STICHTING HET NATIONALE PARK
DE HOGE VELUWE

Evaluation black grouse project 2016

Stichting het Nationaal Park De Hoge Veluwe

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Reintroduction of the black grouse

In 2007, National Park De Hoge Veluwe started with the reintroduction of the black grouse (*Tetrao tetrix*). In the last couple of years we have learned a lot, but we are still not there yet. The black grouse is a very sensitive species. An extensive study from Seiler et al. (2000) already showed a low success rate of a variety of reintroduction projects of different grouse species (black grouse, hazel grouse, capercaillie). Both our own experience and the study of Van Vessem et al. (1990) have shown that predation pressure (northern goshawk and fox) is one of the main obstacles and has a clear negative effect on the success of the first period after release. In 2004, Ziel (2004) proposed a plan to make this reintroduction project a success. In his study he already confirmed that the predation pressure is indeed high, yet with the right amount of introduced black grouse we would overcome this problem. The survival rate of black grouse in the wild is very low, 60% for the males and 40% for the females (Niewold, 1993). These rates are based on wild grouses which know their surroundings. Newly introduced grouse have an even lower survival rate of 5-10% (Ziel, 2004). Unfortunately, we are not allowed to act upon this high predation pressure due to the Dutch Flora and Fauna Act. However, in 2017 the Dutch Flora and Fauna Act will change and maybe new opportunities will arise to act upon this problem. Ziel (2004) suggested that the release of 100 black grouse every year would be high enough to overcome the predation pressure. Unfortunately, the last couple of years the Hoge Veluwe was not yet able to reach these numbers. Another option is to increase the quality of the birds and improve preparation for a life in the wild. Improved preparation can increase adaptability after release. This report will evaluate the bottlenecks and problems faced the last couple of years and come up with suggestions to reach a higher number of black grouse and even more importantly a higher quality and better prepared grouse. Besides predation, other problems faced in the different stages of the project will be discussed. The main goal is the establishment of a healthy population by breeding and releasing high quality and optimally prepared grouse that are able to avoid predators, find their own food and water, find their own nest location, navigate through and use the area, maintain social interaction with conspecifics and reproduce successfully in the wild.

FIGURE 1. PICTURE JUST AFTER THE RELEASE.

Breeding program

At the moment the Hoge Veluwe has 6 breeding cages (10m by 6m), 1 chicken pen (5m by 5m) and 3 soft-release cages (24m by 24m) available. Recently, 7 small cages (previously used to grow the chicks) where rebuilt into an extra breeding cage. Next to the cages situated on location the Hoge Veluwe, a few breeding cages of Mr. Borst are available for the project. Unfortunately, these cages will not be available anymore after 2017. We have to come up with a possible solution to replace these cages and to be able to reintroduce a sufficient amount of animals. Every cage is divided into two smaller cages (5m by 6m) with a small passage which can be blocked to separate the male and the females. All the cages are decorated with small pine trees and natural hiding places to support the right setting for breeding activities. To prevent males to constantly show off towards each other, no visible contact is possible. At the moment one male and three females are housed in each cage. This seems to be the most optimal setting to obtain the best breeding results.

In the first couple of years all the eggs were gathered and put in the incubator and on occasion chickens were used to incubate the eggs. Since 2013 the second clutch of eggs has been left to be incubated by the mother itself. Till 2015, all the chicks were gathered after hatching and placed together below a heat lamp to fully grow into young adults (with the exception of the broods in the soft-release cages). This year a new approach was used, no incubators were used anymore and only the first eggs (mostly abandoned eggs) were incubated by chickens and later introduced by mothers with chicks from the second clutch of eggs. In total 14 females have laid eggs, 6 females raised their chicks by themselves (in total 26 chicks) and 7 chicks incubated by chickens were introduced by the mothers with chicks of roughly the same age. The chicks raised by female black grouse will, in comparison with the chicks raised by hand, learn more natural behaviour. We have to be careful of the fact that tame behaviour could also be imprinted on the chicks. Literature has shown that hatchlings learn important aspects of life from their mothers in the first weeks of their life. In these first weeks they learn predator recognition, nest building, nurturing of chicks, communication, foraging skills and food selection (Hutchins et al., 1995). Looking back at the problems of the last couple of years, these aspects, and mainly predator recognition are important priorities for this project. In multiple studies is shown that chicks raised by their parents or a foster parent are more vigilant (Kreger et al., 2004, Beani and Dessì-Fulgheri, 1998, Valutis and Marzluff, 1999) have higher clutch survival, higher brood survival and higher early survival rate Brittas et al (1992) than chick raised by hand. Next to the increased vigilance and nesting behaviour, the chicks will also be less imprinted on the volunteers and obtain a natural fear towards the large number of visitors in the park. This new approach is definitely a shift into the right direction on which we can built in the coming years. To ensure the high number of new chicks we need to release every year, the use of chickens is a good alternative next to the natural method. These chicks will, just like this year, later be introduced by the mothers with chicks to learn more natural behaviour. More research is needed to increase our knowledge about age, acceptance and difference between the naturally hatched chicks.

A low number of fertilized eggs and a large number of unhatched eggs are two big problems we have had the last years. This year only 44% of the eggs were fertilized and only 74% of these eggs hatched. Multiple reasons can possibly be linked to this problem: low condition parents, irregular breeding (inexperience, disturbance), weather (humidity),

Year	# eggs	# fertilized	# hatched
2011	98	?	38 (39%)
2012	136	?	?
2013	131	63 (48%)	?
2014	194	101 (52%)	64 (33%)
2015	187	94 (50%)	26 (14%)
2016	148	65 (44%)	49 (33%)

TABLE 1. FERTILITY DATA FROM 2011 TILL 2016

high disturbance and stress (humans and male), no connection between male and female (forced mating) and diseases. A great deal of these aspects can be avoided: less human contact, especially in the breeding season (less or no egg inspection, fences, feeding system outside the cage); bringing the birds into perfect condition (start early in autumn to obtain the best result in spring, more natural food throughout the year); separate males and females (in the wild they live solitary except during the breeding season) and female mate choice (mate-choice test, observation). In addition, video observations could be used to monitor the different stages of the breeding season and act upon the drawbacks (new waterproof camera boxes outside the cage should be made to handle the cameras without stress for the birds). Another problem is the number of injuries caused by collision with the roof or the fence. The natural response of a black grouse in danger is to jump. In panic of a nearby volunteer or a predator they jump and hit the roof with great velocity. This results in head and neck injuries and even a few fatalities. Possible solutions are to increase the cover of the sides and increase the height of the cages. A safety net could be placed to decrease impact speed.

Last but not least, the diseases in the different stages of the breeding program. This year a minimum of 9 chicks died due to diseases (in the soft-release cages). After evaluation, the vet diagnosed an outbreak of gapeworm (*Syngamus trachea*) and the presence of an overgrowth of gut bacteria (Enterococcus). The last couple of years the birds were already, as a precaution, treated for Enterococcus. Immediately after hatching they were treated with Ampisol 20%. However, this year we still had a few deceased individuals. After the diagnosed outbreak of gapeworm the birds were treated with Flubendazole 5%. Stress is the main cause of Enterococcus and is mainly relevant in the first weeks after the chicks hatch. One of the symptoms of Enterococcus is collapsing due to weak legs. This has been a common occurrence in the last couple of years and has always been linked to large quantities of proteins. However, proteins are a must in the chicks' diet, in the wild the chicks' diet comprises of 100% insects (Baines et al., 1994). Availability is the main cause of the large quantities of proteins, in nature insects are not available in the quantities we feed our birds. Provisioning the birds with a lower amount of insects and multiple times a day could possibly overcome this problem. Gapeworm is transferred through eggs imbedded in the soil. These eggs are difficult to remove and the vet recommended to excavate the areas were the outbreak took place (mainly Middenzand).
The chicken pen is also a source of diseases which can have large effects on hatching percentages of the eggs and the conditions of the black grouse. I would recommend to move the pen further away from the breeding cages, improve the housing conditions (larger roof, pines and natural hiding places) and decrease the number of chickens. I would not recommend to remove the pen because the chickens are needed to reach the high number of new black grouse. It is important to obtain more knowledge about the re-occurring diseases and their treatment to prevent new outbreaks. By implementing these suggestion we could try to increase our numbers of hatching and surviving black grouse (Due to a variety of circumstances, only 5 mothers and 5 chicks survived until the release this year). Detailed protocols should be designed to cover the different aspects of the breeding program so everyone knows what and when to do.

Summary:

- Using protocols
- Shift more towards hatching and raising by the mothers
- Abandoned and first eggs (not whole clutches) should be incubated by chickens and later introduced by mothers with chicks (more research/knowledge needed)
- Move and improve the chicken pen (source of diseases)

- Less human contact
    - Less egg inspection
    - Fences blocking the view
    - Feeding system outside the cage
- Separate males and females throughout winter (in the wild they live solitary except during the breeding season)
- Mate-choice test (female choice)
- Waterproof camera boxes outside the cage for video observation
- Second passage between the cages
- Place nettings at the roof to decrease impact speed
- Research in occurring diseases and their treatment
- Excavate cages with breakout gapeworm (Middenzand and chicken pen)
- Provisioning of insects/food twice a day
- More natural food throughout the year for a better condition in spring (Rowan berries, mayflower berries, buds, larch, etc.)

FIGURE 2. BLACK GROUSE JUST AFTER RELEASE

Method of release

In 2016 black grouse were released in both April and September. In April 22 black grouse were released with the use of the hard-release system (14 females and 8 males, raised by hand) and in September 36 black grouse were released with the new soft-release system. For the soft-release system two mothers and their chicks (age between 1 and 8 days) were moved to each soft-release cage and released together. First they were housed in the smaller part (12.5m by 6m) of the soft-release cages (5 chicks at Staf, 10 chicks at Middenzand and 4 chicks at Hoog Baarlo). The move towards the soft-release cages at such a young age is a possible explanation for the high death rate in the first week after release (a minimum of 10 chicks died after the move). During the first two weeks of their life chicks are the most sensitive for cold, humidity (Ludwig et al., 2006) and previously mentioned diseases. It is important that the chicks stay underneath their mother for most of the time. Moving them causes a lot of stress for both mother and increases the chance of mothers leaving their chicks. If the soft-release system is used in the coming years, I would recommend to move them at an older age. In some of the soft-release cages chicks incubated by chickens were added (6 at Staf and 1 at Middenzand). As mentioned before, by doing so both the chicks from the chickens and the naturally hatched chicks will be imprinted with useful behaviour in a natural environment.
The black grouse were observed for 4 to 8 weeks after which they were released into the bigger part of the cage (24m by 24m) together with 14 to 20 extra young from an incubator (14 at Staf) and hand raised (20 at Hoog Baarlo). After 1 a 2 weeks they were released into the wild (after some casualties, 9 at Staf, 5 at Middenzand and 19 at Hoog Baarlo). The soft-release cages are used to accustom both mothers and chicks to the natural environment and predators and decreases the change between the breeding cage and the wild. Because the chicks are very sensitive for wet conditions a good preparation of the cages is necessary (lots of dry hiding places, low number of obstacles and low grass). To promote natural foraging behaviour food should be scattered throughout the cage. For next year I would recommend to start earlier with scattering the food maybe even in the breeding cages. From our experience we know that the birds are so habituated to the feeder that even after the release they come back for food. Feeding in a feeder also promotes tame behaviour which we want to avoid. Also the use of natural food items will improve foraging behaviour, accustom them more to the natural food and foraging could serve as enrichment which has a positive effect on the birds stress level. The amount should be increased and provisioned the whole year round and adapted to the availability in nature (Larch, heath, bilberry, rowan berry). Both mothers and chicks showed very tame behaviour and were very much habituated to human presence (especially the young added later to the soft-release cage). The soft release cages did increase their feral behaviour a bit but they still showed tame behaviour at release. Observations should be made throughout the whole process to make small, last-minute changes and learn new things for coming years. Waterproof camera boxes should be made which, to prevent disturbance, should be accessible from the outside.

Furthermore, this year the actual release did not go very well. It involved a lot of stress and even a casualty. Due to the high chance of a predator getting in it is not a possibility to open the hatches and leave. We know from experience that two hatches, and maybe even doors, in each corner is the best way to get the birds out of the cage. Waiting for the birds to leave the cage by themselves is a very time consuming practice and some of the birds come back and enter the cage again. This year, after a couple of hours of waiting, the birds were gently chased out of the cage. At Hoog Baarlo this method worked very well. However, at Staf the birds could not find the exit and became very stressed. One

individual even died due to a broken neck. As mentioned before, side cover or a net could reduce the injuries. Before next year we have to come up with a solution for this problem in order to prevent stress. A possible improvement could be to release them earlier in the morning. Their activity is higher in the morning which increases the chance of finding the exit (Merta et al., 2016). If the project is extended for a couple more years new methods and improvements should be investigated to prevent stress and casualties. We should also investigate more in depth possible solutions to improve the feral state of the birds without causing too much stress. A couple of possible improvements are mentioned below:

- Predator recognition training (Griffin et al., 2000), different studies have had success with this method (Heezik et al., 1999).
- Release chicks with free access to a captive mother (small passages where only the chicks could pass) (Merta et al., 2015).
- Prolong the stay in the soft-release to get them more used to natural environment (autumn, winter). Downside is that predators can learn their location.
- Breeding in the soft-release cages. Tried before but now with more observation and additional food provisioning to overcome food shortage.
- In addition to this project, release individuals caught out of the wild (higher survival rate (Griffith et al., 1989)).
- Focus on at least two generations of birds raised by their mothers in a natural environment (see appendix)

Summary

- Optimize soft-release method (release mothers with own chicks and chicks incubated by chickens at the right age)
- Create more dry hiding spots and improve and increase cover
- Increase the freedom of movement by removing obstacles and grass maintenance
- Scatter food throughout the cage to promote natural foraging behaviour
- Waterproof camera boxes outside the soft-release cage for video observation
- Research to change or optimize release methods
- Increase smaller part of the soft-release cage and additional cage to separate individuals, to catch individuals or to clean the cage.
- Post-release care (drinking water availability and possible feeding options)

FIGURE 3. SOFT-RELEASE CAGE AT LOCATION STAF

Monitoring and analysis

To improve the project, we have to monitor and analyse all the different stages of the project. In the last couple of years only little has been documented. Twice a year a group of volunteers tries to locate black grouse in the park to get an indication of the number of surviving birds. Unfortunately, no black grouse have yet been found on these days. More data could be gathered and different aspects should be monitored more accurately. This year the GPS tracking project has been started (11 birds were successfully tagged with only minor stress). After some adjustments to the harness the procedure is now improved (+/- 5 min handling time) and a study of one of the students confirmed that the tags had no profound effect on the behaviour of the birds and no effect on the moult. The GPS data can give us a nice view of the black grouse after release. Unfortunately, due to casualties and technical problems not a lot of data was gathered this year. Five tags were lost due to technical problems and 6 individuals are predated within 2.5 weeks. One tagged individual died in the cage probably due to collision with the fence.

We should not only follow the black grouse after their release, but also gathering information during the breeding process and during the soft-release stage we can obtain a lot of knowledge. This year students were used to monitor different aspects of the project (tag effect, risk-assessment, mother-chick behaviour, tracking project). These projects produced useful information which we can use in the future of this project. I would recommend to start more of these student projects. If the project will be prolonged for multiple years it is recommended to put a full researcher on the project. He or she can supervise all the volunteers and students and coordinate the whole project. The Hoge Veluwe can also collaborate with an university (for example: Utrecht or Wageningen) or institute (for example: NIOO) to design a PhD project on this subject. This way we can obtain detailed knowledge and learn important aspects about the black grouse and their environment. This knowledge is needed to improve the project and get the best possible results. Below you can find some suggestions of research which could be performed to improve the project:

- Analysis of different release methods, locations, incubation differences, nurturing differences, etc.
- Analysis of data obtained during breeding process (fertility data) expanded with observational data and mortality data. Useful for the formation of better breeding pairs.
- Design and perform mate-choice test (a method to let the female choose her partner)
- Behavioural observations in all stages in combination with faeces analysis.
- Novel object test, to study the response towards new objects which can be linked to feral behaviour and their reaction to new predators.
- Predator recognition training (mentioned before (Heezik et al.,1999; Griffin et al.,2000)).
- Prolong GPS tracking project to study their use of the environment (tags should be tested for their performance and accuracy)
- Predator monitoring and behavioural observations (foxes and northern goshawk).
- Investigate new ways to decrease predation pressure.
- Population viability analysis to study the exact amount of birds needed to obtain a viable population.
- Investigate new ways to localise black grouse in the wild (drones, infrared cameras). Our experience has shown (in cage and with GPS) that it is very difficult to spot black grouse in the

wild. More observation days and more knowledge (experts, literature) how to coordinate these days (number of volunteers, time of days and time of year) are needed.

- Personality tests and their difference in survival

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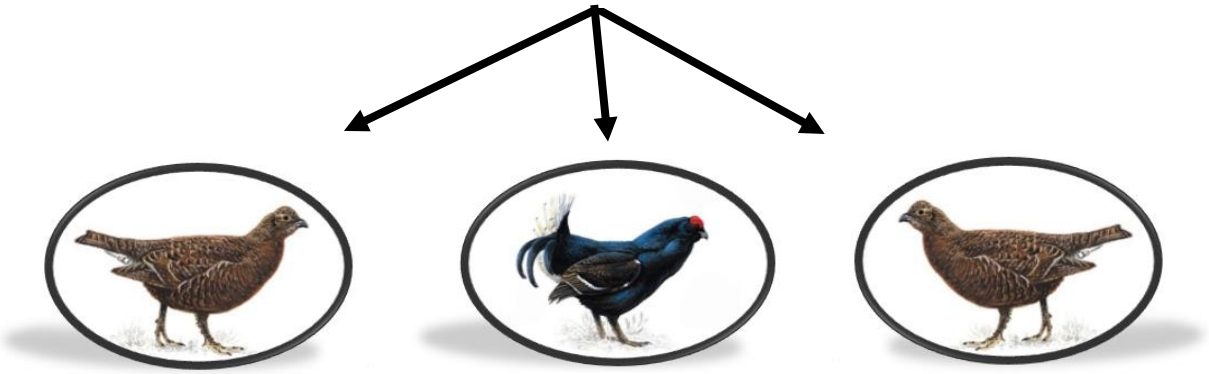
Appendix 1

Selection on good breeding pairs that will stay at the breeding facilities.[1]



Natural bred black grouse raised by its mother

After 3 weeks moved together with its mother to the soft-release cage (smaller part)[1]

Selection will stay throughout the winter. (2 females, 1 male)

Natural bred black grouse raised by its mother in soft-release cage

After 10 weeks released with parents

Natural bred black grouse raised by its mother

After 3 weeks moved to the soft-release cage (introduced by mothers with own chicks)[2]

After 2 weeks moved to the bigger part of the soft-release cage

After 2 weeks in the big cage they will be released

Chicks incubated by chickens.

As soon as possible moved to black grouse with chicks

After 3 weeks moved to the soft-release cage (introduced by mothers with own chicks)[2]

After 2 weeks moved to the bigger part of the soft-release cage

After 2 weeks in the big cage they will be released

Quality

Quantity

[1] Only the first years mothers with chicks will be transported to the soft-release cage. From the second year there will always be mothers in the cage

[2] More research is needed to increase our knowledge about age, acceptance and difference between the naturally hatched chicks.