VKM Report 2022: 32

The release of common pheasants and grey partridges for pointing dog training- consequences for biodiversity, animal welfare and health

Scientific Opinion of the Panel on biodiversity of the Norwegian Scientific Committee for Food and Environment

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Preparation of the opinion

The Norwegian Scientific Committee for Food and Environment (Vitenskapskomiteen for mat og miljø, VKM) appointed a project group to draft the opinion. The project group consisted of 3 VKM members, 2 VKM staff and 2 external experts. Two referees commented on and reviewed the draft opinion. The Committee, by the Panel on Biodiversity, as well as one representative for the Panel on Animal health and welfare, assessed and approved the final opinion.

Authors of the opinion

The authors have contributed to the opinion in a way that fulfils the authorship principles of VKM (VKM, 2019). The principles reflect the collaborative nature of the work, and the authors have contributed as members of the project group and the VKM Panel on Biodiversity/animal health and welfare, appointed specifically for the assignment.

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Acknowledgement

VKM would like to thank the referees Margareta Steen (Swedish University of Agricultural Sciences) and Lucy Mason (The Royal Society for the Protection of Birds) for their valuable comments through critical review of the draft opinion. VKM emphasises that the referees are not responsible for the content of the final opinion. In accordance with VKM's routines for approval of a risk assessment (VKM, 2018), VKM received their comments before evaluation and approval by VKM Panel on Biodiversity and one representative from the Panel on Animal health and Welfare and before the opinion was finalised for publication. VKM would also like Bård G. Stokke and Svein Dale for their valuable comments on table 3.2.1.-1

Competence of VKM experts

Persons working for VKM, either as appointed members of the Committee or as external experts, do this by virtue of their scientific expertise, not as representatives for their employers or third-party interests. The Civil Services Act instructions on legal competence apply for all work prepared by VKM.

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Summary

Key words: VKM, Risk Assessment, Norwegian Scientific Committee for Food and Environment, Norwegian Food Safety Authority, Norwegian Environment Agency, Common Pheasant, Grey partridge, *Perdix perdix*, game-bird, hunting, *Phasianus colchicus*, pointing-dog

Background

Since the late 1800s, an unknown number of common pheasants and grey partridges from captive bred stocks have been released in Norwegian nature. The import, keeping and release of gamebirds, as well as the management of release sites, have been largely unregulated. The consequences to biodiversity, animal health and welfare have not been investigated. The Norwegian Environment Agency (NEA) and the Norwegian Food Safety Authority (NFSA) have jointly requested the Norwegian Scientific Committee for Food and Environment (VKM) for a scientific opinion on the release of common pheasants and grey partridges for pointing dog training regarding consequences for biodiversity, animal welfare of the released birds and health of the released birds as well as wild birds to which pathogens may be transmitted. VKM was further asked to suggest risk reducing measures for biodiversity and animal welfare.

Methods

VKM established a project group with expertise within avian ecology, landscape ecology, population biology, wildlife veterinary medicine and animal welfare. The group conducted systematic literature searches, scrutinized the resulting literature, and supplemented by other relevant articles and reports. In the absence of Norwegian studies, VKM used literature from other countries where common pheasants and grey partridges (and in some cases other gamebirds), are released, as references.

The project group applied observation data of common pheasants and grey partridges in Norway for the period 2000-2022, presented by the Norwegian Biodiversity Information Centre (NBIC). In the assessments, VKM assumed that the release of birds will be in the same order of magnitude as in previous years (a few thousand birds annually on a national level). The number of release sites and the density of released birds per site are unknown. Increasing the number and density of birds would also increase the probability of negative effects and the severity of the consequences. VKM assessed the impacts of released common pheasants and grey partridges on competition, predation, hybridization, transmission of disease, herbivory and indirect impacts through interactions with other species (predator abundance and pathogen-mediated competition). VKM also assessed the impact on biodiversity in a 50-year perspective. Furthermore, VKM discusses how the birds' welfare might be impacted by rearing, transport, release and exposure to pointing dogs. Finally, VKM provides a list of relevant diseases and assessed their potential impact on animal health during transport, rearing and release.

Results and conclusions

VKMs assessment show that there are several risks to biodiversity, animal health, and animal welfare from the release of captive bred common pheasants and grey partridges in Norway.

There is a low (national scale) to moderate (local scale) risk of increased competition for (winter) food with birds with similar niches as common pheasants and grey partridges, in particular with yellowhammer, *Emberiza citronella.* A species categorized as vulnerable on the national red list due to its progressive population decline caused by reduced availability of (winter) food. There is a moderate risk for predation on invertebrates and negative impacts on flora. Indirectly, activities connected to the release of birds may lead to moderate risks of altered predator abundance and disease-mediated competition. VKM concludes that the ecological impacts will be more severe for redlisted species present within the release areas for common pheasants and grey partridges.

Repeated release of common pheasants and grey partridges can lead to high risk of disease transmission to wild birds. For the most virulent diseases and with repeated contact over time, there is a high risk of transmitting pathogens between captive flocks of both common pheasants and grey partridges. VKM concludes that there is a risk of introducing a range of diseases when importing birds from Sweden. Introduction of avian influenza (HPAI) and Newcastle disease (ND) are of special concern since they are highly pathogenic. The risk of introducing new diseases increases with the number of birds imported.

From VKM's assessment of animal welfare it becomes apparent that common pheasants and grey partridges are exposed to several strains, both before and after being released. Growing up in an unnatural environment without parents affects the birds' ability to survive in nature in a negative manner and to be exposed to pointing dogs leads to fear. VKM concludes that the current practice of transport, keeping and release of common pheasants and grey partridges are not compatible with good animal welfare.

While the high mortality rate of common pheasants and grey partridges after release will reduce the risk of negative long-term effects on biodiversity, the causes of mortality, including predation and starvation, are likely to cause suffering to the common pheasants and grey partridges prior to death.

Data gaps and uncertainties

Systematic, peer-reviewed, empirical studies pertaining to all aspects relating to the keeping, transport and release of common pheasants and grey partridges in Norway are missing. The risk assessments are therefore mainly based on extrapolation of information collected in other countries and are accordingly made with low confidence. The negative impacts are expected to be similar to those reported from other countries, but there is uncertainty regarding the magnitude of the consequences. The knowledge relating to game-bird welfare is limited because of the lack of systematic and comprehensive studies outlining the needs of gamebirds. The understanding of the potential impacts of the spread of disease and/or increased levels of pathogens on wild bird populations is limited.

Sammendrag på norsk

Bakgrunn

Siden sent på 1800-tallet har det blitt satt ut et ukjent antall tamme fasaner og rapphøns i norsk natur. Disse fuglene brukes til jakttrening av stående fuglehunder. Import, hold og utsetting av fasaner og rapphøns har i liten grad vært regulert og det er heller ikke utredet hvilke konsekvenser som import, hold og utsetting og jakttrening vil kunne ha for biologisk mangfold, dyrehelse og dyrevelferd. Miljødirektoratet og Mattilsynet har i felleskap bedt VKM om å utarbeide en vitenskapelig vurdering av mulige konsekvenser av utsetting av fasan og rapphøns på biologisk mangfold, dyrehelse og dyrevelferd. VKM ble også bedt om å foreslå eventuelle risikoreduserende tiltak for biologisk mangfold og dyrevelferd.

Metoder

VKM opprettet en prosjektgruppe med ekspertise innenfor blant annet fugleøkologi, landskapsøkologi, populasjonsbiologi, viltmedisin og dyrevelferd. Gruppen utførte systematiske litteratursøk, undersøkte resultatene fra søkene og supplerte med andre relevante studier der det var nødvendig. I mangel av studier fra norske forhold brukte VKM studier fra andre land som setter ut fasaner og rapphøns (og i noen tilfeller andre arter av fuglevilt) som referanse. VKM undersøkte observasjonsdata for fasaner og rapphøns i Norge for perioden 2000 til 2022. I vurderingen av de ulike aspektene som vil kunne påvirkes av utsettingen, la VKM til grunn en årlig utsetting av noen få tusen fugler i Norge. Høyere antall og tetthet av fugler vil øke sannsynligheten for negative effekter og alvorlighetsgraden av konsekvensene. VKM vurderte effekten som utsatte fasaner og rapphøns har på konkurranse med norske fugler, krysning med beslektede arter, sykdomsoverføring, effekter på flora (herbivori), og fauna (predasjon). I tillegg ble indirekte effekter gjennom interaksjon med andre arter vurtdert. VKM vurderte også effekt på biologisk mangfold i et 50-års perspektiv. I tillegg diskuterte VKM hvordan fuglenes velferd vil kunne påvirkes av hold, transport, utsetting, og eksponering for jakthunder. VKM lister også opp relevante sykdommer og vurderer den potensielle effekten av disse på dyrehelse under hold, transport og utsetting. For vurdering av aspekter relatert til import og dyrehelse, la VKM til grunn at fuglene importeres fra Sverige.

Resultater og konklusjoner

VKMs vurderinger viste at utsetting av fasaner og rapphøns i norsk natur medfører risiko for biologisk mangfold, dyrehelse og dyrevelferd. Risiko for økt konkurranse om mat vinterstid med fugler som har lignende økologisk nisje som fasaner og rapphøns, er lav på nasjonal skala og moderat på lokal skala. Det gjelder spesielt gulspurv, *Emberiza citronella.* Denne arten er klassifisert som sårbar på den nasjonale rødlisten grunnet økende nedgang i bestanden, som igjen er forårsaket av redusert tilgjengelighet av mat om vinteren. Det er videre moderat risiko for predasjon på invertebrater (virvelløse dyr) og negative effekter på flora.

Indirekte kan aktiviteter knyttet til utsetting av fasaner og rapphøns føre til moderat risiko for endringer i forekomsten av rovdyr og ved å påvirke konkurranseforhold mellom arter som følge av forhøyet nivå av patogener i miljøet. VKM konkluderer med at risikoen for negative økologiske konsekvenser kan være spesielt stor for sårbare arter som finnes lokalt i områdene der det blir satt ut fasan og rapphøns.

Gjentatt utsetting av fasaner og rapphøns kan gi høy risiko for overføring av sykdom til ville fuglebestander. Det er høy risiko for spredning av patogener mellom besetninger av fasaner og rapphøns for de aller mest smittsomme sykdommene og ved gjentatt kontakt mellom besetningene over tid. VKM konkluderer med at det er risiko for å introdusere en rekke sykdommer til Norge når man innfører fugler fra Sverige. Inkludert for fugleinfluensa (HPAI) og Newcastle Disease (ND). Risikoen for å introdusere nye sykdommer øker med antall fugler som importeres.

I VKMs vurdering av dyrevelferd fremkommer det at fasaner og rapphøns utsettes for en rekke belastninger både før og etter utsetting. Oppvekst i et unaturlig miljø uten foreldre bidrar til å svekke evnen til å klare seg i naturen, og eksponering for jakthunder medfører frykt. VKM konkluderer med at dagens praksis med transport, hold og utsetting av fasaner og rapphøns er lite forenlig med god dyrevelferd.

Selv om høy dødelighet blant de utsatte fuglene vil redusere effektene på biologisk mangold, så vil dødsårsakene mest sannsynlig medføre at utsatte fasaner og rapphøns lider før de dør.

Kunnskapshull og usikkerhet
Det mangler systematiske, fagfellevurderte, empiriske studier av alle aspekter relatert til hold, transport og utsetting av fasan og rapphøns i Norge. Risikovurderingen er derfor hovedsakelig basert på ekstrapoleringer fra andre land og er dermed utført med lav konfidens. De negative effektene er forventet å være tilsvarende effekter rapportert i utenlandske studier, men det er usikkerhet knyttet til styrken av konsekvensene. Det mangler kunnskap om velferd hos viltlevende fugler fordi omfattende, systematiske studier av behovene til slike fugler mangler. Forståelsen av effektene av sykdomsspredning og/eller økt nivå av patogener på ville fuglebestander er også begrenset.

Glossary

Glossary

Animal welfare: Animal welfare is the individual's subjective state in regard to its attempts to cope with its environment (Forskningsbehov dyrevelferd, https://www.forskningsradet.no/siteassets/publikasjoner/1108644079320.pdf). See section 1.9 for details.

Animal-based indicators of animal welfare: observations of the animal itself, such as health or behavioral parameters used as indicators of animal welfare.

Resource-based indicators of animal welfare: observations of environmental conditions and access to resources used as indicators of animal welfare. See section 1.9 for details.

Stress: "Stress is an environmental effect on the individual which overtaxes its control systems and reduces its fitness or appears to do so." (Broom et al., 2019). Stress and strain thus refer to changes that are caused when an animal is exposed to stressors.

Stressor: Stressors are environmental stimuli or conditions that cause stress.

Strain: Strain is is an alteration in the physiological system that is induced by exposure to stressors (Appleby et al., 2018). The Norwegian Animal Welfare act, §3 states that Animals shall be treated well and be protected from danger of unnecessary stress (Norwegian 'påkjenninger') and strains (Norwegian 'belastninger'). Stress and strain are synonyms according to Store Norske Leksikon (https://snl.no/stress 'Stress betyr påkjenning eller belastning.') and are therefore treated as synonyms in the current report.

Note that in this report the word 'strain' is also used in the meaning of different genetic lineages of pathogens and birds.

Stress responses: Behavioural and physiological responses shown by an animal when it is exposed to stressors.

Background as provided by the Norwegian Food Safety Authority/ Norwegian Environment Agency

For several years, farmed pheasants and partridges have been imported to Norway for release into the wild. In addition, there has also been an extensive release of birds farmed in Norway. The purpose of the release has been for hunting and for training and of hunting dogs. The released birds appear to have low survival in the wild, and new releases have therefore been made every year. The Animal Welfare Act states that "animals have intrinsic value regardless of the usefulness they may have for humans" and that "animals must be treated well and be protected against the danger of unnecessary stress and strain" (§ 3).

Prior to 2020, according to the regulations on keeping wildlife in captivity, farming of wildlife, and hunting on released game, pheasants and partridges could be bred without a legal permission. You could also release farmed game in the wild, in areas where the species had wild living populations. As of April 1, 2020, keeping of all wild species requires a permit in accordance with new wildlife regulations. In addition, as of January 1, 2016, a permit is required for the import and release of pheasants and partridges under the Regulation on alien organisms. Animal health requirements for the keeping of pheasants and partridges, and for domestic transfer of these species, are given in Regulations of 18 November 1994 No. 1020 on the certification of poultry holdings.

No permit applications for release of pheasants and partridges were submitted before 2018. Between 2018 and 2020, permissions were granted for the release of approximately 5,000 pheasants and 3,000 partridges annually. The Norwegian Environment Agency granted permits for release in 2018, 2019 and 2020. The decisions were appealed by BirdLife Norway and the animal protection organization NOAH.

In 2021, all applications for release of pheasants and partridges in Norway were rejected. The reasons for rejecting the applications were the risk of negative impacts on biodiversity and violations of the Animal Welfare Act. The decisions were appealed by the applicants. The Ministry of Climate and the Environment (KLD) processed the cases and decided to grant the appeals and issue permits for the release. After assessing the appeals, KLD pointed out that there is a need for additional knowledge about the impacts on biodiversity and animal welfare when releasing pheasants and partridges into the wild.

KLD and the Ministry of Agriculture and Food (LMD), have asked the Norwegian Environment Agency and the Norwegian Food Safety Authority to commission an assessment from the Scientific Committee for Food and Environment (VKM) of the risk of negative consequences for biodiversity, animal health and animal welfare when releasing pheasants and partridges for training and testing of bird dogs, as well as for import and rearing of these species.

In 2019, LMD commissioned the Norwegian Food Safety Authority to prepare a proposal for new regulations to control this activity, possibly through amendments to temporary regulations prohibiting hunting on pen-raised released birds (FOR- 100-08-24-761). The reason for the assignment was that LMD wanted an evaluation of whether the practice of training bird dogs on released pen-raised birds should be regulated based on animal welfare considerations.

Impact on biodiversity after release

Biological diversity, as defined in the Biodiversity Act § 3 letter c, is the diversity of ecosystems, species and genetic variations within the species, and the ecological connections between these components. The risk of negative consequences for biological diversity must be included in the assessment, including potential impact on ecosystems and other species, and risks associated with any hitchhiking species.

Some of the known effects of releasing pen-raised birds in the wild are increased competition, predation and disease, due to occurrence in higher densities than would otherwise occur and thereby altering the ecological factors for survival.

The purpose of the Regulation on alien organisms is to prevent the introduction, release and spread of alien organisms that cause, or may cause, negative consequences for biodiversity in Norway.

Over the past few years, there has been increasing attention directed towards the possible threats to biodiversity posed by alien organisms, and it is therefore necessary to reassess previous practices of releasing birds for hunting and bird dog training. To protect Norwegian flora and fauna, there has been a restrictive policy regarding introduction and release of species, especially those with the potential to survive in Norwegian nature. Climate change may cause more alien organisms to thrive under Norwegian conditions, thus causing an additional threat.

Pheasant is considered an alien species in Norway. It is native in the Caucasus and eastward in large parts of Asia. Since the end of the 19th century, pheasants have been released in Norway for hunting purposes. There are some local populations after releases around the Oslo Fjord, on Jæren, around Lake Mjøsa and a few other scattered areas. These populations coincide with the areas where repeated releases have occurred. They are most likely not self-recruiting, but dependent on repeated releases of birds to persist over time.

Grey partridge occurred naturally in Norway until the 1940s, and did most likely disappear due to climatic reasons and modern agriculture. The species is not defined as an alien species in Norway, but because it no longer occurs naturally, the Regulation on alien organisms apply to its release.

A release permit is required for species with no natural occurrence in a district. The Regulation is in place to prevent negative impacts on biodiversity from the introduction and release of alien organisms, not already present in the district.

When referring to organisms “which do not occur naturally in the district” in the Biodiversity Act, it includes both species, subspecies and populations not found in a district as well as subspecies, species and populations that occur in the district because they have been released there. A release must therefore be justified in accordance with permits granted by a public authority and refer to conditions to prevent damage to biodiversity. The same considerations must be made with regards to both importing and releasing organisms.

There is a need for a scientific assessment of the risk of negative consequences for biological diversity associated with the import and release of pheasants and partridges.

Animal welfare related to release

The association of bird dog clubs has developed guidelines for the release of birds. We are aware that in certain cases, the birds have been fed in the terrain for some time after the release.

The Animal Welfare Act (DVL) § 28 states that "Animals from animal holdings can only be released into the wild given that the animal has good opportunities to adapt and survive in the new environment." This requires that the birds must be of a species able to adapt to a life in the wild, and that they have been prepared for life in the wild prior to the release. There is a ban on releasing animals that are unlikely to be able to adapt a life in the wild.

According to DVL § 14, it is forbidden to leave animals in a helpless state.

The birds must therefore be able to find natural shelter, food and water at the site where they are released. They must be robust and mature enough to have a good chance of surviving in the environment in which they are released. The birds must have access to an acceptable living environment during all seasons after release, not only in the first period. If the birds to a limited degree are able to find food, it will be a prerequisite that they must be fed to comply with § 14. This will, however, be in conflict with the wording of § 28 of the Animal Welfare Act, as they do not have good chances of survival without human intervention.

Animal welfare related to keeping and transporting pheasants and partridges

Our knowledge of how pheasants and partridges are kept is limited and based on inspections of one pheasant farm facility, and one partridge farm facility. These are only two examples of how this activity is carried out. There is also a written statement describing the activity from a breeder of pheasants and partridges. To our knowledge, pheasants and partridges are raised from parent animals in Norway, and some are imported as chickens from Sweden. Fertilized eggs of pheasants and partridges are also imported. Resale of farmed birds to bird dog clubs in other parts of the country does also occur to some extent.

In the pheasant farm inspected by the Norwegian Food Safety Authority, the birds are kept in closed houses in enclosures after hatching, and after a few weeks they are released into the enclosures. A few weeks later, they are released into a large flying aviary with simple mesh walls and mesh roofs. The chicks are kept in the aviary until they are 10 - 12 weeks old, when they are released into the terrain. The birds are released from the end of July and until the end of August at the latest. Using the birds for training of hunting dogs is not allowed until at least 20 days after they have been released. In their guidelines, the association of bird dog clubs have also included transport requirements for the birds.

In the partridge farm inspected by the Norwegian Food Safety Authority, chicks are received when they are 8 weeks old. The birds are put into a barn with free access to a fenced outdoor area. The birds have two weeks to adapt to the new location before the fence is opened out into the terrain. The birds are released in two batches. They are allowed time to settle in the terrain for at least 20 days before the dog training starts. After release, they can seek shelter in bushes and forests in the edge zones around the fence on the property. The birds are released in July and August.

Animal health considerations related to import, keeping, release and national movement of pheasants and partridges

Norway has largely been spared the most serious infectious diseases affecting poultry and other birds. In 2020 and 2021, there were outbreaks of bird flu (H5N1), which led to a curfew for poultry and other captive birds, and a hunting ban in some municipalities. We are also aware that there have been outbreaks of bird flu in pheasant farms in Denmark and the United Kingdom. An outbreak of diseases may have substantial consequences for biodiversity, poultry producers, the egg and poultry industry, and society in general.

Animal health requirements for the keeping of pheasants and partridges, and for the domestic transport of these, are given in The Terrestrial Animal Traceability Regulation and The Terrestrial Animal movement Regulation. These regulations contain provisions intended to limit the risk of spreading diseases in, among other things, poultry stocks during keeping and domestic transport. Provisions on animal health requirements for keeping and domestic transport of pheasants and partridges, will then be found in the Terrestrial Animal Traceability Regulations and the Terrestrial Animal Transfer Regulations. These regulations contain provisions intended to limit the risk of spreading diseases in, among other things, poultry stocks during keeping and domestic transport.

Terms of reference as provided by the Norwegian Food Safety Authority/ Norwegian Environment Agency

Impact on biodiversity after release

We request VKM to:

- Assess the risk of negative consequences for biological diversity from releasing farmed pheasants and partridges.
- Assess whether there are other activities in connection with the release that can have negative effects on biodiversity. For example, extensive feeding.
- Describe the species' possibility of survival in Norwegian fauna without repeated releases.
- Identify which species in Norway have similar ecological niches as pheasants and partridges, and assess whether they can be negatively affected by the release.
- Identify and evaluate possible risk-reducing measures.

We request that the risk of negative consequences for biological diversity be assessed from a 50-year perspective.

Animal welfare related to the release of pheasants and partridges

We request VKM to:

- Describe the natural habitat requirements of pheasants and partridges. To what extent are such habitats present in Norway?
- Describe mortality in a natural habitat without hunting, feeding or other artificial influences.
- Assess differences in mortality for pen-raised pheasants and partridges and wild-born pheasants and partridges.
- Describe possible causes of increased mortality for released pen-raised pheasants and partridges.
- Describe the potential strains the released birds are exposed to.
- Assess the effects of hunting training on the birds’ welfare
- If applicable, describe risk-reducing measures that may increase the degree of survival for the birds.

Animal welfare related to rearing and transport of pheasants and partridges

We request VKM to:

- Describe the welfare needs of pheasants and partridges in the rearing phase.
- Describe which environmental factors that are important for animal welfare in the rearing phase, both indoors and outdoors.
- Describe measures that can improve animal welfare when keeping pheasants and partridges.
- Assess the strain associated with transport of pheasants and partridges.

Animal health related to release, rearing, import and transport of pheasants and partridges

We request VKM to:

- Assess the probability of introduction of infectious agents when importing pheasants and partridges from Sweden into Norway.
- Assess the risk of spreading infection between different captive flocks of pheasants / partridges in Norway, especially related to the transfer of live animals and eggs for hatching between captive flocks.
- Assess the risk of captive flocks of pheasants / partridges spreading disease to wild birds, especially when the animals are released into the wild.

1 Introduction

1.1 Release of wild birds and Norwegian regulations pertaining to biodiversity, animal welfare and animal health

The rearing and release of farmed game birds is practiced in many countries for recreational hunting and restocking of game populations (Alanärä et al., 2021). In Norway today, the main purpose for releasing common pheasants and grey partridges is training and competing with pointing-dogs. The birds are bred in captivity in Norway or other countries and kept enclosed until released. The common pheasant is defined as an alien species in Norway by the Norwegian Biodiversity Information Centre - NBIC and assessed as low risk (LO) (Stokke and Gjershaug, 2018). The grey partridge is considered to be regionally extinct (RE) by NBIC (Stokke et al., 2021c) and, when released into the environment, it is regulated as an alien species by the Norwegian Environment Agency (NEA). According to the Biodiversity Act §3 (e) this means: "an organism that does not belong to a species or population that occurs naturally in an area." Import, breeding, keeping and release of alien organisms require authorization from the Norwegian Environment Agency under the Regulation on alien organisms. This is legally based on the Nature Diversity Act:

- § 1 "The purpose of this Act is to protect biological, geological and landscape diversity and ecological processes through conservation and sustainable use …".

Keeping of wildlife in captivity is, according to the Wildlife Act and its Wildlife Regulation Chapter 4, only allowed in cases described by law or decisions authorized by law. The regulation specifically states that keeping wildlife in captivity is not allowed when the purpose is hunting within enclosed areas, and that training of dogs on wildlife in captivity is not allowed.

Common pheasants and grey partridges hatched and raised in captivity (and their fertilized eggs) are defined as poultry, until they are eventually released and considered wild. In Norway, the welfare of wild animals is protected by the Animal Welfare Act that states:

- § 3 "Animals have an intrinsic value, which is irrespective of the usable value they may have for man. Animals shall be treated well and be protected from danger of unnecessary stress and strains".

In addition, the Animal Welfare Act § 14 a) and c) are of particular relevance, stating the following:

- It is forbidden to:

  a) Abandon animals in a helpless condition,

  c) Use live animals for food or bait.

The Nature Diversity Act states:

§ 15 "... Unnecessary harm and suffering caused to animals occurring in the wild and their nests, lairs and burrows shall be avoided".

Furthermore, in the Act relative to food production and food safety (Food Act) it is stated that:

§ 19 "Live animals shall not be placed on the market, brought into a holding, moved or released if there is reason to suspect the presence of a serious transmissible animal disease that may have substantial social impacts."

VKM has written the report under the assumption that handling of captive common pheasants and grey partridges and management of release sites in Norway are performed according to the appropriate laws and regulations.

1.2 Contradiction between environmental and animal welfare concerns

As addressed in a previous VKM report on release of farmed mallards (*Anas platyrhynchos*) (VKM, 2017), there exists an inherent contradiction between the concerns for environmental impacts and animal welfare. The Norwegian Environment Agency has allowed the release of common pheasants and grey partridges assuming that the winter survival is too low for establishment of reproducing populations. High mortality of birds in the wild will reduce the risk of negative environmental effects. This contrasts with the requirements of the Norwegian Food Safety Authority, regarding the following paragraphs of the Animal Welfare Act:

- § 14 b) "It is forbidden to abandon animals in a helpless condition"

- § 28 "An animal can only be released from captivity into nature to live wild if the animal has a good possibility to adapt to and survive in its new environment".

The relative weighting of the various concerns pertaining to the release of common pheasants and grey partridges in Norway has been discussed by the Parliamentary Ombud (https://www.sivilombudet.no/uttalelser/tillatelse-til-utsetting-av-fasan-og-rapphons-for-hundetrening/).

1.3 No legal release of common pheasants and grey partridges in 2022

In 2021, applications to release 5,280 common pheasants and 2,710 grey partridges were submitted to the Norwegian Environment Agency (NEA). The applications were rejected by the NEA. The rejection was later overruled by the Ministry of Climate and Environment (KLD) after an appeal made by Fuglehundklubbenes Forbund (FKF) and birds were legally released in 2021. In 2022, NEA received applications to release 5,700 common pheasants and 4,425 grey partridges (Pers. Comm Ole Roar Daviden, NEA, 10.11.22). These applications were also rejected by the NEA, appealed by FKF, and once again the rejection was overruled by KLD. However, in August 2022, the animal rights organization NOAH brought the case to Oslo District Court. The court concluded on August 26th that the Ministry's decision to allow this release is a violation of §28 of the Animal Welfare Act and that the decision hence was invalid (Oslo Tingrett saksnummer: 22-116161TVI-TOSL/08). There was no appeal in this case by FKF or KLD (the last date for release of birds would have been August 31st), and thus no birds were legally released in 2022.

1.4 Common pheasant - biology and distribution

The common pheasant (ring-necked pheasant) was originally found in large parts of Asia and south-eastern Russia, eastwards from the Caucasus and Caspian Sea. Following introduction to England and France around a thousand years ago, pheasants have spread throughout Europe and have also been introduced to New Zealand, North America (including the Hawaiian Islands), Chile and other locations (Giudice et al., 2022). The birds bred in captivity for release are mainly hybrids between the subspecies *Phasianus c. colchicus* and *P. c. torquatus*, but *P. c. mongolicus* and *P. c. karpowi* are also being used in the breeding stock (Bevanger, 2005).

Pheasants were among the earliest game-bird species known to be intentionally introduced to Norway, the first release taking place in Bærum in 1875-76. In 2018, approximately 2,300 pheasants were released in Norway according to Fuglehundklubbenes Forbund (FKF). This was at a relatively small scale compared to neighbouring countries. In 2005, approximately 130,000 pheasants were raised and released in Sweden (Wiberg and Gunnarsson, 2009). In Denmark during 2018-2021, an average of 845,000 pheasants and 7,700 partridges were released annually for hunting purposes (Miljøstyrelsen, 2017). In the UK, the number of pheasants released annually is estimated to 31.5 million pheasants (range 29.8-33.7) (Madden, 2021).

In Norway, the distribution of common pheasants seems to be limited by the winter climate and available suitable habitat, with the best conditions for their survival being in low-snowfall coastal areas. Scattered presence of common pheasants can be found in the areas where birds have been released, mainly in south-eastern Norway and Rogaland and also in the areas around Trondheimsfjorden. The most stable populations occur in the areas around the Oslo Fjord and Mjøsa. The geographical spread of species observations for the period 2000-2022 is shown in Figure 1.4-1. The total population size is estimated by the Norwegian Biodiversity Information Centre (NBIC) to be 750 individuals (Stokke and Gjershaug, 2018). Hunting is permitted from October 1st to December 31st. No hunting statistics are recorded in Norway for common pheasants.

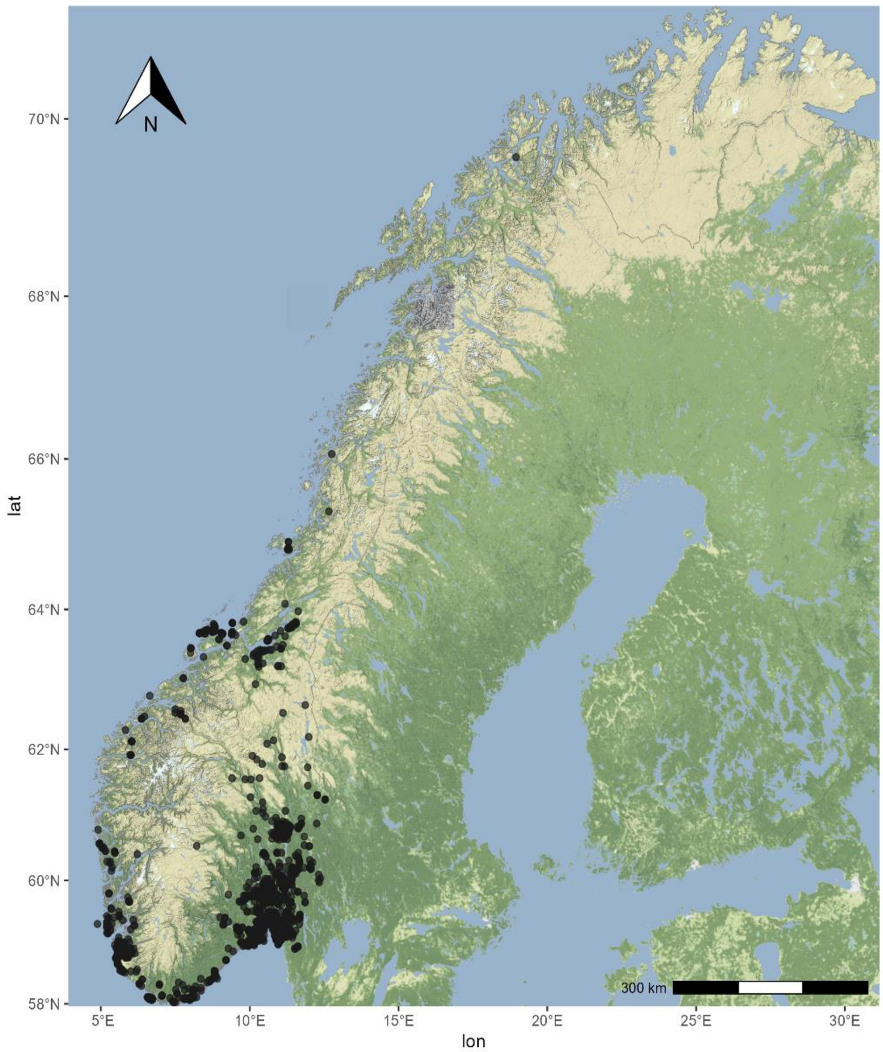

Figure 1.4-1 Common pheasant observations in Norway 2000-2022 (based on data from artsdatabanken.no). The observations were made throughout the year (see Table 3.1.1-1 for observations made per month for the same period).

The common pheasant is associated with cultivated land and is also found in natural semi-cultivated landscapes where hedges, shrubs and smaller trees break up large tracts of land, as well as in denser wooded areas where it may find shelter and roosting sites. Adult pheasants feed mainly on plant matter, such as grain, wild seeds, fruits, buds and leaves, though their diet also includes tubers, nuts and acorns, plus a variety of invertebrates and earthworms. The chicks feed almost exclusively on insects for the first six weeks of life, before graduating to plant foods, similar to the diet of adults. To increase winter survival prospects, feeding with grain has been practised in some areas with pheasant releases (Pedersen, 1991).

If surviving the winter, males establish their territories in spring, defending the same area from year to year. The territory size varies with the density of the population, supply of food and type of landscape. In the wild, the pheasant is normally polygamous and each male may mate with 2-5 hens. The nest is a simple scrape on the ground in dense grass or under a bush. The hen lays 10-12 eggs in April-June, and the incubation lasts for 23-25 days. Pheasants normally produce one brood annually, but may re-lay up to twice if the clutch is taken or destroyed. The hen broods and defends the chicks, which grow fast and are able to fly short distances already at 12-14 days old and even spend the night in trees just 3-4 weeks after hatching. At this point, the poults can find their own food and fly but they may remain with the hen for another 7-8 weeks (Pedersen, 1991).

1.5 Grey partridge – biology and distribution

The grey partridge inhabits farmland across most of Europe and the western Palearctic to south-western Siberia. It has been widely introduced into North America, South Africa, Australia and New Zealand. The grey partridge is a popular game-bird across its distribution area. In Norway, approximately 1,100 grey partridges were released in 2018 according to Fuglehundklubbenes Forbund (FKF). In 2005 the number of grey partridges raised and released in Sweden was 30,000 (Alanärä et al., 2021). In the UK, 180,000 to 200,000 grey partridges and 6.3 to 10 million red-legged partridges (*Alectoris rufa* - rødhøne) were released each year in 2004, 2012, and 2016 (Aebischer, 2019).

The European population of grey partridge has declined by about 50 to 90% in several countries within its range since the early 1990s (Ewald et al., 2020; Potts, 1980).

Timing of the decline coincides with increased use of chemical pesticides in agriculture. Herbicides significantly reducing weed content (Birkan et al., 1990; Potts, 1986) and as a consequence of insecticide use, both pest insects and insects in general were dramatically reduced. Thus, much of the food, especially for chicks, was lost. Landscape changes due to modern agricultural practices also resulted in less access to shelter and nesting sites. Combined these factors are believed to be the main drivers of the dramatic reduction of the partridge population in Europe (Panek, 1992).

Fennoscandia represents the northern limit of grey partridge distribution. Norway has never hosted a large population of the species, but has had influxes from Sweden in 1733 and 1811.The grey partridge population fluctuated extensively and severe winter conditions have been suggested to have caused high mortality in Fennoscandia. For example, during the winter of 1941-42, almost 90% of the population in Skåne, South Sweden, died (Holt, 1948).

In Norway, scattered observations of grey partridge have been reported annually since the mid-1950s. Gjershaug et al. (1994) suggested that, although not certain, the last natural breeding-attempt possibly occurred in the late 1980s. Later observations are most likely of birds released from captivity. Grey partridges are not legally hunted in Norway. The geographic spread of observations for the period 2000-2022 is shown in Figure 1.5-1.

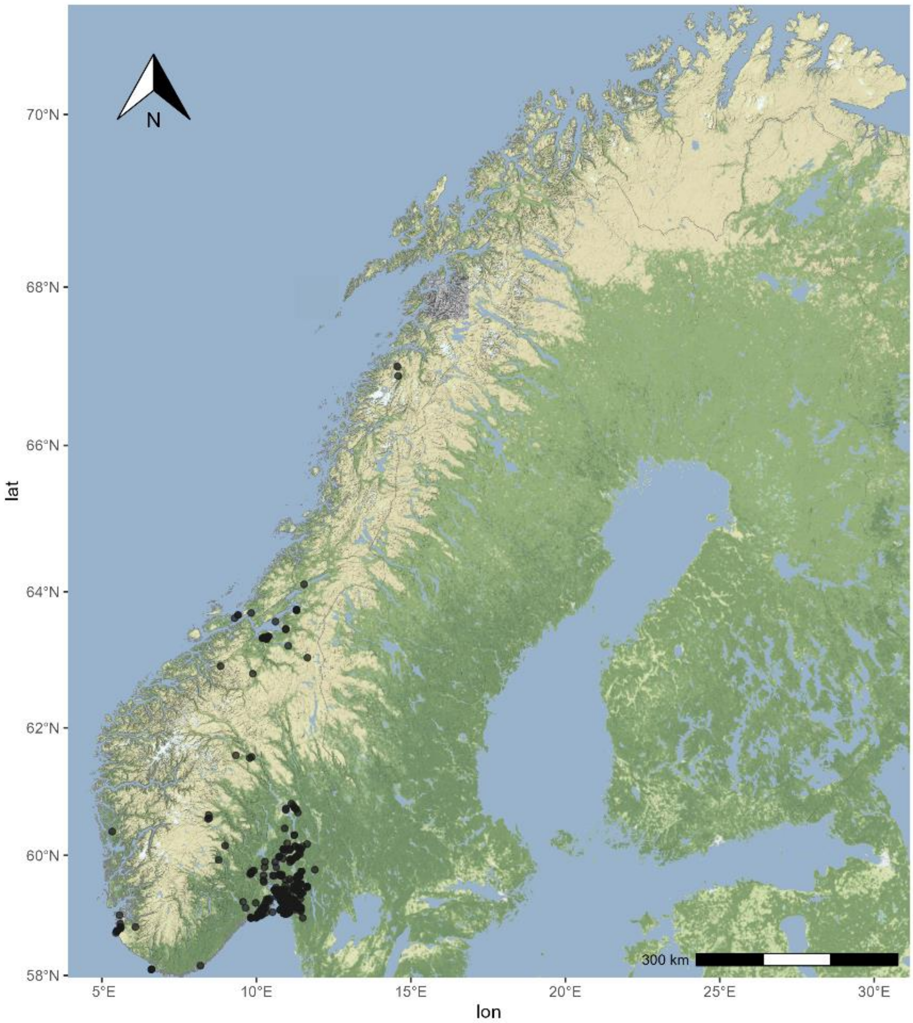

Figure 1.5-1 Partridge observations in Norway 2000-2022 (based on data from artsdatabanken.no). The observations were made throughout the year (see Table 3.1.2-1 for observations made per month for the same period).

Grey partridges are associated with cultural landscapes and often found where cultivated fields and meadows alternate with pastures, woodlands and shrub- and heath lands. Ditch edges and stone walls that fragment fields are important elements of suitable partridge habitat. Removal of stone walls and fences to create for modern agricultural-machinery, has resulted in an unfortunate impact on the partridges losing shelter from predators and suitable nesting spots (Pedersen, 1991; Potts, 2012).

The diet of adult grey partridges consists of a variety of cereal grain, wild seeds, green plant matter, insects and other invertebrates. Weed seeds are especially important. Grey partridges are ground feeders, thus the maximum depth of snow in winter is limiting their distribution. Finnish studies have shown that the critical maximum snow-depth is 15 cm (Pulliainen, 1965). To help partridges through the winter, barley or oats have generally been provided at permanent feeding stations.

During the first two weeks after hatching, insects make up more than half of the chicks' food. The presence of insects is of great importance for their growth and general health (Benton et al., 2002; Holland et al., 2006). If insects are scarce the chicks spend more time searching for food and are thus more exposed to bad weather and predation (Pedersen 1991; Potts 2012). For adult hens, an insect-rich diet increases the clutch size (Potts, 2012).

Grey partridges lay 15-20 eggs during May-June. Normally, just one clutch is produced, but if the eggs are depredated or destroyed a new slightly smaller clutch may be laid. Incubation lasts 23-25 days. If food is plentiful and the chicks grow fast, they will be able to fly short distances already after 10-11 days (Pedersen 1991; Potts 2012). The broods stay together until late autumn and form coveys (flocks) during wintertime (Potts, 2012).

1.6 The status of semi-natural habitats in Norway

The preferred habitat types of common pheasants and grey partridges are on the Norwegian Red List of Nature Types, and are categorized as threatened (Hovstad et al., 2018). Semi-natural grassland (hayfields) is categorized as critically endangered (CR) and semi-natural grassland (meadow) is categorized as endangered (EN) due to a large contraction in area during the last 50-year period, coupled with reduced ecological condition in the habitats that still remain (Hovstad et al., 2018). It was assessed that over 80% of the current area of semi-natural grassland (hayfields) in Norway has seen a sharp degradation in ecological condition over the past fifty years. It has also been estimated that the total area of semi-natural meadows decreased by 50 % over the period from 1950 to 2015 (Aune et al., 2018). It is expected that the decrease will continue, but limited data exist.

1.7 Description of pointing dog training on live birds

Lowland field trial competitions are arranged by local dog clubs in Eastern, South-Western and Central parts of Norway. Areas where captive-bred common pheasants and grey partridges are released are the areas where established birds are also regularly observed (see Figures 1.4-1 and 1.5-1). Field trials with pointing dogs in Norway includes breeds such as continental pointing dogs as well as British and Irish pointers and setters.

The field trial competition should emulate common hunting practice, and is carried out on stubble fields, field margins and pockets of woodland between fields. The size of the area used per group of dogs may vary, about two to four km^2 per group being the norm. Both grey partridges and common pheasants are present in the terrain. During the trial the judges should first and foremost score the dog's ability to quickly and safely locate birds, and flushing it for the shot. The dogs should also quickly and correctly retrieve shot or wounded birds. Not all field trials demand the shooting of birds and judging of a dogs' retrieving skills. Where dogs have to show correct retrieving skills, previously shot (dead) birds or decoys are used as objects for retrieval.

A common antipredator strategy to avoid detection used by many ground-dwelling birds, including all Galliformes, is to sit tight (trykke, in Norwegian) as a predator approaches (Caro, 2005). A variant of this is the so-called "playing dead" behaviour. Pointing dogs function as predators, but instead of attacking the bird when detected, the dog goes 'on point', showing more or less precisely where the bird is crouched. On command, the dog 'runs-in' the crouched bird, which is flushed and thereby flies beyond reach of the dog/predator.

Under natural conditions, flushed birds will fly out of sight. One field-trial judge reported his impression that the vast majority of birds are probably flushed just once during the day of a field trial, and that it is rare that they are flushed twice or more. Birds that are flushed more than once usually sit quite tight. It is also the case that pheasants in particular, habitually run quite a distance before flushing and taking flight. Field trials are never arranged in heavy rain, since experience shows that the flying ability of the birds under such conditions, especially partridges, is negatively affected (Oddgeir Andersen pers.com 31.08.22).

The trials are carried out mostly in October, each lasting for three days. The trials often involve several hundred dogs. For example, in autumn 2021 during five field-trial events, 297 Winning-class dogs (adult dogs qualified for Winning class) took part (https://www.fuglehundklubbenesforbund.no/). The total number of dogs participating in lowland field training with live birds annually in Norway, is unknown.

1.8 Environmental impact of game bird release

The release of non-native game-birds may impact a range of taxa and the environment both inside and outside the area of release (Martin-Albarracin et al., 2015). The released birds may disperse, such that the environmental effects they cause and pathogens they may carry, have the potential to spread. Introduction of a species can alter the disease dynamics in a location by 1) introduction of new pathogens and 2) providing increased density of potential pathogen hosts and thereby population growth of pathogens already present in the environment. The risk of negative impacts will increase proportionally with the number of birds released per unit area. For example, VKM (2017) concluded that increasing the number and density of hand-reared mallards increases the probability of negative effects on biodiversity, as well as the severity of the consequences.

Management of farmland and woodland habitat related to game-bird release, including supplementary feeding and legal control of predatory mammals and scavengers, may further increase the environmental impact of the gamebird release (Arroyo and Beja, 2002; Madden and Sage, 2020; Mason et al., 2020; Sage et al., 2020). In the UK, illegal persecution of protected species (birds of prey) has been documented (e.g., Mason et al. 2020). Furthermore, lowland dog-training may in itself contribute to environmental impact, because of disturbance to native wildlife by free-running dogs (training sites are exempted from the national leash mandate April 1st to August 20th).

1.9 Animal welfare aspects

Animal welfare is the individual's subjective state in regard to its attempts to cope with its environment (Forskningsbehov dyrevelferd, se https://www.forskningsradet.no/siteassets/publikasjoner/1108644079320.pdf).

The term animal welfare thus refers to the degree to which an animal is healthy and happy (Dawkins, 2021). It describes the quality of an animals' life as it is experienced by an individual animal (Bracke et al., 1999).

Welfare is commonly evaluated by answering questions related to 1) emotions: is the animal happy or is it displaying signs of undesirable emotions?, 2) biological function: is the animal healthy and well-functioning from a biological perspective?, and 3) natural behaviour: is the animal able to behave normally and live a reasonably natural life? The preceding questions are typically answered by recording behavioural and physiological measures referred to as animal-based welfare indicators. Environmental factors that impact animals, referred to as resource-based animal welfare indicators (see glossary for definition) outside of a specific range may also be used as indicators of poor welfare in themselves. For example, exposure to predators (including dogs), extreme cold or heat, pathogens and gun-shot sounds (unpredictable, sudden and extreme stimuli) or wounds (pain and debilitation) in themselves constitute indicators of poor welfare from a resource-based perspective.

To define the needs of gamebirds, it is relevant to mention a few considerations related to the comparison between gamebirds and domesticated fowl. Firstly, game-birds are not intentionally selected for domestication (Matheson et al., 2015). Instead, birds used as breeding stock are, typically, free-living individuals that have survived a shooting season. This contrasts with other livestock, including chicken, which have experienced long periods of selection for traits consistent with husbandry and productivity including docility, tameness and gregariousness (Fraser and Broom, 1997). Such selection may lead to co-evolved traits that improve welfare outcomes for captive individuals, because they are better suited to live in captivity. Therefore, when game-birds are held in captivity, they may respond to stressors in different ways to those of domesticated chickens. Furthermore, many generations of breeding wild stock birds in captivity may reduce their ability to express adaptive antipredator responses following reintroduction (Carrete and Tella, 2015). Systematic and comprehensive studies outlining the specific needs of gamebirds are, however, lacking. This means that a description of the needs of game-birds must be based on a general understanding of their natural biology, ecology and behaviour, combined with a general theoretical understanding of what defines a need.

1.10 Animal health aspects

In the following assessment of animal health risks, VKM assumes that the common pheasants and grey partridges to be released are bred in Norway or imported from Sweden. These two countries have a similar zoo-sanitary status for gallinaceous birds. The more easterly and southwards geographic-location of Southern Sweden nevertheless implies that Swedish common pheasants and grey partridges may have a higher degree of contact with migratory birds in the eastern Mediterranean/Black Sea and East Asia/East Africa flyways compared to their Norwegian counterparts that mostly use the East Atlantic Flyway (BirdLife, 2010). As a consequence, importing birds from Sweden may therefore increase the number of bird populations and the geographic area, that a given common pheasant, or grey partridge farm, is in indirect contact with. It should be mentioned that the origin of the Swedish birds is unknown.

In a general wildlife disease context, the epidemiological significance of release of game-birds from captivity to the wild, may be that the conditions they are kept under can facilitate efficient transmission and build-up of pathogens (Gortázar et al., 2006), thereby boosting the occurrence of transmissible diseases. High stocking-density and high numbers of birds, poor hygiene and inadequate disease transmission barriers between different game bird facilities and between game bird facilities and wild bird populations constitute risk factors for this. Adequate feeding, and removal of birds that perform poorly, may prevent or mask outbreaks of disease as long as the birds are kept in captivity. When the birds are released, they may carry with them a high pathogen burden. This can cause disease in the pheasants and partridges themselves when they are exposed to stressors during transport. After release and subsequent adaptation to the new circumstances the result can be spread of disease to the environment and native bird populations.

1.10.1Categories of disease

The World Organization for Animal Health (WOAH) categorizes infectious diseases as listed and non-listed (WOAH, 2022). The listed diseases are compulsorily notifiable, meaning that the veterinary authorities of WOAH member states are obliged to report any new occurrence to WOAH within 24 hours. The purpose of this being to "minimise spread of important animal diseases, and their pathogenic agents, and to assist in achieving better worldwide control of these diseases" (WOAH, 2022). The know about the occurrence of listed diseases within a country (or other kind of epidemiological compartment) is important for the establishment of animal health measures related to international trade. Inclusion in the list requires that international spread of a pathogen has been proven and that measures to identify the disease are present. In addition, the disease must either have a severe impact on human health, health of domestic animals, health of wildlife, or threaten the viability of a wildlife population.

In veterinary matters, the European Economic Area (EEA) Agreement specifies that Norway follows the regulations of the European Union. EU Regulation 2016/429 and 2018/1882 divides diseases in categories A to E according to which management measures the diseases require for control and prevention (Table 1.9.1-1). This is based on the diseases potential impact on public or animal health, economy, society and the environment.

Table 1.10.1-1 Modified from REGULATION (EU) 2018/1882 of 3 December 2018 and the Norwegian regulation on animal health (Forskrift om dyrehelse – FOR-2022-04-06-631)

EU disease Category	Definition
Category A	Does not normally occur in the Union - immediate eradication measures must be taken as soon as it is detected.
Category B	Must be controlled in all Member States with the goal of eradicating it throughout the Union.
Category C	Is of relevance to some Member States and measures are needed to prevent it from spreading to parts of the Union that are officially disease-free or that have eradication programmes for the disease.
Category D	For which measures are needed to prevent it from spreading on account of its entry into the Union or movements between Member States.
Category E	For which there is a need for surveillance within the Union.

In addition, the Norwegian Animal Health Regulation (dyrehelseforskriften) has three national lists of notifiable diseases that includes several diseases that not are listed by EU or WOAH. According to the regulation, when diseases listed in List 1 or 2 are suspected or diagnosed, any juridicial person is obliged to immediately report to the Norwegian Food Safety Authority (NFSA). When List 3 diseases are suspected or diagnosed, any juridicial person should report this to NFSA or to a veterinarian as soon as practically feasible. Veterinarians shall report List 3 diseases to the authority within seven days.

1.10.2Epidemic Diseases

Epidemic (also called epizootic and epiornithic) diseases have the ability to cause outbreaks of clinical disease involving several birds. Virulent and highly contagious diseases that can cause widespread outbreaks involving many animals are a challenge in poultry production around the world, especially where high densities of birds kept in captivity are allowed contact with wild bird populations. The frequency of such outbreaks seems to be slightly higher in Sweden than in Norway, with Sweden experiencing more cases of for example

Newcastle Disease, Infectious Bronchitis, Infectious Laryngotracheitis and salmonellosis (see section 3.6). However, both countries have experienced outbreaks of Newcastle Disease and Avian Influenza in 2021-22.

1.10.3 Endemic diseases

Endemic (also called enzootic or enornithic) diseases are more or less continuously present in a population. These diseases seldom cause large and widespread outbreaks as many animals have been exposed to these pathogens and some degree of herd immunity is present, or that the pathogen is so well adapted to the host that only mild disease is the general rule. These diseases will often have a sporadic occurrence, and severe disease will usually only occur when several disease-promoting factors are present at the same time. A typical situation will be when many birds are kept closely together, perhaps under circumstances where it is difficult to maintain biosecurity and hygiene, and where the birds are exposed to stressors and consequently are immunosuppressed. Then the birds are expected to suffer from higher prevalence of infection with ubiquitous pathogens, and higher infection or infestation intensity of common parasites than if they lived in their natural habitat at normal densities. If the birds are provided with housing having access to natural substrates such as soil and litter accessible to rodents, insects and wild birds, and where the maintenance of good measures of biosecurity and hygiene routines is difficult, the prevalence of infection and the infection/infestation intensity are likely to increase. In the UK, this is described as a general problem for the game-bird rearing industry (Brookes et al., 2022). The cumulative load of several diseases may cause ill-thrift, morbidity and/or mortality during rearing. The impact of this burden will often increase when the birds are exposed to stressors, for example during and right after release. This may have major implications for animal welfare and can also play a role for the potential for transmission of disease to wild bird populations. The cumulative burden of disease, and its impact on survival, production and welfare of game-birds released to the wild, is difficult to entangle, but several authors suggest that this is a major issue in game-bird production (see for example Draycott et al., 2006).

2 Methodology and Data

2.1 Risk Assessment of impact on biodiversity and animal health

For the questions outlined in the Terms of Reference, the hazards were identified and assessed independently using the IUCN guidelines of Environmental Impact Classification for Alien Taxa (EICAT; Blackburn et al., 2014). VKM assesses each potential hazard in four standardized steps: 1) hazard identification, 2) hazard characterization, 3) likelihood, and 4) risk characterization. For animal welfare, VKM was requested to provide descriptions of various aspects related to keeping, transport and release of common pheasants and grey partridges. The animal welfare aspects have therefore not been risk assessed in this report.

Potential negative impacts of release of grey partridges and common pheasants on native species are expected to increase with the number of birds released. VKM has assumed that the release of birds will be in the same order of magnitude as in previous years (i.e. a few thousand birds annually, see sections 1.4 and 1.5).

1) "**Hazard identification**" provides a description of the specific hazard and why this hazard is considered in the current assessment. The known effects of the hazard are presented and referenced examples of the known impacts from other countries are included when relevant.

In the IUCN-EICAT approach (Blackburn et al., 2014), 12 mechanisms in which alien species may impact on local biodiversity are described. For the assessment of the impact of common pheasants and grey partridges in Norway, VKM deemed parasitism (with the exception of endoparasitism, which is discussed under animal health issues) poisoning and bio-fouling irrelevant for further assessment. VKM considers that the release of common pheasants and grey partridges in Norway will potentially affect the environment through the following mechanisms (potential hazards):

Competition – the alien taxon competes with native taxa for resources (e.g., food, water, space), leading to deleterious impact on native taxa.

Predation – the alien taxon depredates native taxa, leading to deleterious impact on native taxa.

Hybridization – the alien taxon hybridizes with native taxa, leading to deleterious impact on native taxa.

Transmission of disease – the alien taxon transmits diseases to native taxa, leading to deleterious impact on native taxa.

Grazing/herbivory/browsing – grazing, herbivory or browsing by the alien taxon leads to deleterious impact on native taxa.

Chemical impact on ecosystem – the alien taxon causes changes to the chemical characteristics of the native environment (e.g., pH; nutrient and/or water cycling), leading to deleterious impact on native taxa.

Indirect impacts through interactions with other species – the alien taxon interacts with other native or alien taxa (e.g., through any mechanism, including pollination, seed dispersal, apparent competition, mesopredator release), facilitating indirect deleterious impact on native taxa.

If the landscape of the lowland game sites is being managed through modifications, two more of the IUCN-EICAT mechanisms may be added:

Physical impact on ecosystem - the alien taxon causes changes to the physical characteristics of the native environment (e.g., disturbance or light regimes), leading to deleterious impact on native taxa.

Structural impact on ecosystem - the alien taxon causes changes to the habitat structure (e.g., changes in architecture or complexity), leading to deleterious impact on native taxa.

2) "**Hazard characterization**" describes the potential effects of the specific hazard under Norwegian conditions. The potential magnitude of the specific hazard is characterized on a scale from "Minimal" to "Massive".

The following impact category definitions are also based on the IUCN – EICAT methodology and were used to assess both impact on biodiversity and animal health.

Minimal Concern (MC)

A taxon is considered to have impacts of "Minimal Concern" when it causes negligible levels of impacts, but no reduction in performance of individuals in the native biota. Note that all alien taxa have impacts on the recipient environment at some level, for example by altering species diversity or community similarity (e.g., biotic homogenisation), and for this reason there is no category equating to "no impact". Only taxa for which changes in the individual performance of native species have been studied but not detected are assigned an MC category. Taxa that have been evaluated under the EICAT process but for which impacts have not been assessed in any study should not be classified in this category, but should rather be classified as Data Deficient.

Minor (MN)

A taxon is considered to have "Minor" impacts when it causes reductions in the performance of individuals in the native biota, but no declines in native population sizes, and has no impacts that would cause it to be classified in a higher impact category.

Moderate (MO)

A taxon is considered to have "Moderate" impacts when it causes declines in the population size of at least one native taxon but has not been observed to lead to the local extirpation of a native taxon.

Major (MR)

A taxon is considered to have "Major" impacts when it causes community changes through the local or sub-population extinction (or presumed extinction) of at least one native taxon, that would be naturally reversible if the alien taxon was no longer present. Its impacts do not lead to naturally irreversible local population, sub-population or global taxon extinctions.

Massive (MV)

A taxon is considered to have "Massive" impacts when it causes naturally irreversible community changes through local, sub-population or global extinction (or presumed extinction) of at least one native taxon.

3) "**Likelihood**" is an assessment of how likely it is for characterized hazard to occur. Likelihood intervals range from "Very unlikely" to "Very likely" (as described in Table 2.1-1).

Table 2.1-1 Likelihood

Rating	Descriptors
Very unlikely	Negative consequences would be expected to occur with a likelihood of 0-5%
Unlikely	Negative consequences would be expected to occur with a likelihood of 5>-10%
Moderately likely	Negative consequences would be expected to occur with a likelihood of 10-50%
Likely	Negative consequences would be expected to occur with a likelihood of 50-75%

Rating	Descriptors
Very likely	Negative consequences would be expected to occur with a likelihood of 75-100%

4) "**Risk characterization**" is an assessment of the risk to biodiversity in Norway posed by the specific hazard. The risk is characterized as "Low", "Medium" or "High", based on the magnitude of the impact of the potential hazard and the overall likelihood of this occurring.

Table 2.1-2 Assessment of confidence

Rating	Descriptors
Low	There is limited information on the subject, in particular from comparable environmental settings. Subjective expert judgements may be introduced without supporting evidence. Little peer reviewed literature is available and there are limited empirical and quantitative data to support the assessment.
Medium	Relevant information on the subject is available, but only limited information from comparable environmental settings. Some subjective expert judgements are introduced. Both grey literature and peer reviewed literature are used and there are some empirical and quantitative data to support the assessment.
High	There is extensive information on the subject, also from comparable environmental settings. Little or no subjective expert judgements are introduced. Primarily peer reviewed literature is used and there are empirical and quantitative data to support the assessment.

2.1.1 Summary of risk assessment

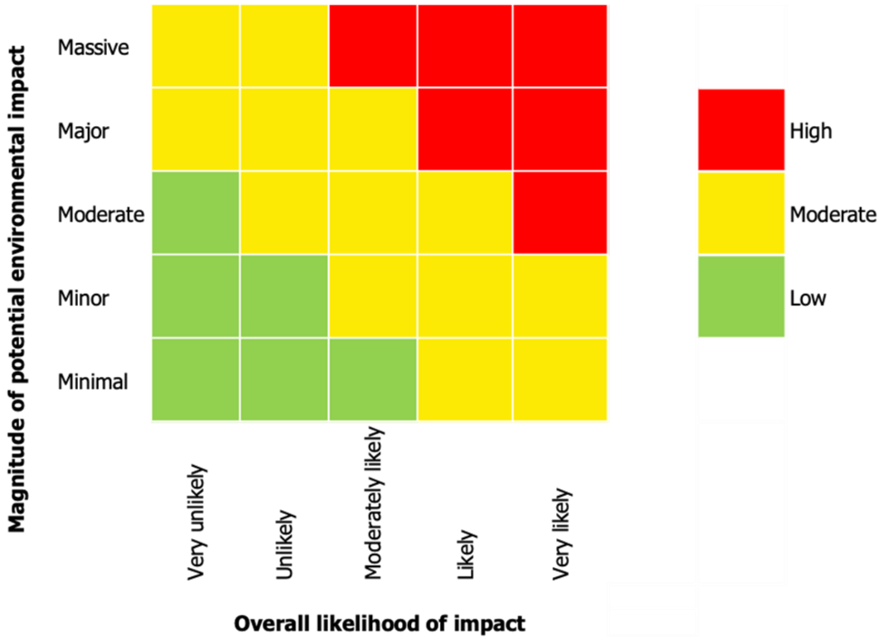

Figure 2.1.1-1 Risk matrix illustrating the results of the risk characterization of the various factors impacting biodiversity

2.2 Selection of diseases

Diseases that may be relevant for rearing and release of pheasants and grey partridge under Swedish and Norwegian circumstances were selected based on the lists of notifiable diseases from WOAH, EU and national regulations, expert knowledge about occurrence of poultry and wild bird diseases in the Nordic countries, information available on the web pages of the Swedish (www.sva.se), and the Norwegian (www.vetinst.no) National veterinary institutes and surveillance reports available on these web pages, the game-bird web pages of the National Animal Disease Information Service (https://nadis.org.uk/disease-a-z/game-birds/), and the web pages of St. Davis Game Bird Services (https://stdavids-game-birds.co.uk/resources/diseases/pheasant-partridge/). Some issues concerning the occurrence of diseases in the Nordic countries were also discussed with staff at the Norwegian Veterinary Institute, mainly Dr. Silje Granstad. Information from these sources was compared with knowledge available in authoritative text books, mainly the 14th edition of Diseases of Poultry (Swayne, 2019), references therein and published papers found during the literature screening mentioned above.

2.3 Literature search strategy

The project group decided on relevant search words. Literature searches were conducted in May, 2022 in Web of Science, through the Advanced Search Builder across all categories.

Searching for ALL=(Common Pheasant OR *Phasianus colchicus*) yielded 870 hits. Initial screening resulted in 263 abstracts of relevance, which were retained for further evaluation. Searching for ALL=(Grey Partridge OR *Perdix perdix*) yielded 566 hits. Initial screening resulted in 214 abstracts of relevance, which were retained for further evaluation.
All members of the project group also conducted their own targeted searches based on their own expertise of the topic. Literature searches were performed separately for each species, without any restrictions to language or date of publication, and imported to Endnote. All titles and abstracts were screened for relevance pertaining to the terms of reference twice. Studies addressing the following topics were excluded: antimicrobial resistance, ecotoxicology, pesticides, zoonotic diseases (transferrable to humans), phylogeny, human medicine, sexual dimorphism, ethics or socio-economic aspects or marking methods. The remaining abstracts/full papers were retained for further screening of relevance. Furthermore, searches were made in the alien invasive species database (https://www.cabi.org/isc/datasheet/70470#tosummaryOfInvasiveness), and the Conservation Evidence database (https://www.conservationevidence.com/). In addition, the project group members conducted individual searches when supplements to the articles found in the initial searches was needed.

2.4 Species observation data

Species observation data presented by the Norwegian Biodiversity Information Center (NBIC) and SLU Swedish Species Information Centre in Sweden are registered by public observers in the websites artsdatabanken.no and artportalen.se. In Norway, most of the data on birds are validated by experts from BirdLife Norway. Since the data are not collected systematically, multiple observations of the same individual could be reported. There is also likely to be bias in the number of observations in space and time due to differences in the level of activity of observers geographically and throughout the year. Moreover, the likelihood of observing a species may vary from month to month depending on both the behaviour of the birds and the degree of visibility in the landscape.

3 Hazard and risk assessment

3.1 Common pheasants and grey partridges in Norway: possibility of survival and habitat requirements

The common pheasants and grey partridges that have been released in Norway originate from captive-bred strains of birds, the common pheasant often being mixes between subspecies (see section 1.4). Generally, released captive-reared animals have lower survival and reproduction rates than their wild conspecifics (a phenomenon referred to as the 'burden of captivity' (Champagnon et al., 2012). This has also been demonstrated to be the case for galliform birds (Sokos et al., 2008).

The causes of death for released birds will largely be the same as for wild birds, but particularly in the first weeks after release the captive bred birds seem to be less able to cope with their environment (see for example Alanärä et al., 2021 and references therein; Madden et al., 2018; Whiteside et al., 2016b). In the UK it has been estimated that only 40% of the released pheasants are killed through shooting (for which they are released) and that the majority are dead within 15 months (Madden et al., 2018). For grey partridges, Parish and Sotherton (2007) reported that 10% of the pen-raised birds released in autumn survived until spring. However, it is worth noting that this relates to survival of pen-raised partridges monitored by radio-tagging and that other studies (e.g., Homberger et al., 2021) have shown radio-tagging to negatively affect survival. Most birds are being killed by predators, such as red foxes (*Vulpes vulpes* - rødrev) and raptors that are attracted by the high density of birds after release (Madden et al., 2018; Mason et al., 2020). Captive bred birds are lacking predator evasion skills normally gained from parental influence or experience from the wild (Mason et al., 2020). They are also less able to find suitable nesting sites the following spring if they survive the hunting season (Madden et al., 2018).

In Finland, lower survival of released common pheasants was demonstrated in sites with a higher density of foxes (Kallioniemi et al., 2015). Starvation is also a common cause of increased mortality, particularly in harsh winters (e.g. Alanärä et al., 2021 and references therein; Madden et al., 2018). Noteworthy, breeding populations of both common pheasants and grey partridges are found in areas of North America where winter temperatures can be as low as in Scandinavia, for example Canada and North Dakota (https://mnbirdatlas.org/species/ring-necked-pheasant/; https://mnbirdatlas.org/species/gray-partridge/). Diseases, as for example high burdens of parasites, have been suggested to be a cause of high mortality (Draycott et al., 2002; Turner, 2008) both by reducing condition (Gethings et al., 2016) and by increasing the risk of predation by foxes (Millian et al., 2002). Another significant cause of death is caused by road vehicles (Madden and Perkins, 2017; Roos et al., 2018; Turner and Sage, 2003; Turner, 2008).

The animal welfare aspects pertaining to the various causes of mortality are covered in section 3.4.

3.1.1 Common pheasants

The common pheasant is not native to Norway, and it is therefore not feasible to compare survival between wild and released birds. In other parts of the world where pheasants have been introduced, e.g., Sweden (Brittas et al., 1992), the UK (Sage et al., 2002), and USA (Musil and Connelly, 2009), comparative studies have been done between more or less 'wild' captive strains of birds, concluding that the wilder strains cope better in a natural environment (see also Madden et al. 2020 and references therein). In a Norwegian project, Kleverud (2006) radio-tracked 25 common pheasants of which 23 died within the study period of about six months. Of these, 14 were the confirmed kills of red fox, northern goshawk (*Accipiter gentilis* - hønsehauk) and domestic cat (*Felis catus* - katt). Information on the number of common pheasants that have been released in Norway is lacking as the pheasant population have not been monitored. However, some data have been collected through species observations (see methods for description) by the NCBI. In the period 2000-2022 a total of 14,128 observations of common pheasant in Norway were reported to NBIC The annual number varied between 191 in 2001 and 1,210 in 2017 (Figure 3.1.1-1). The geographical distribution of these observations is shown in Figure 1.4-1.

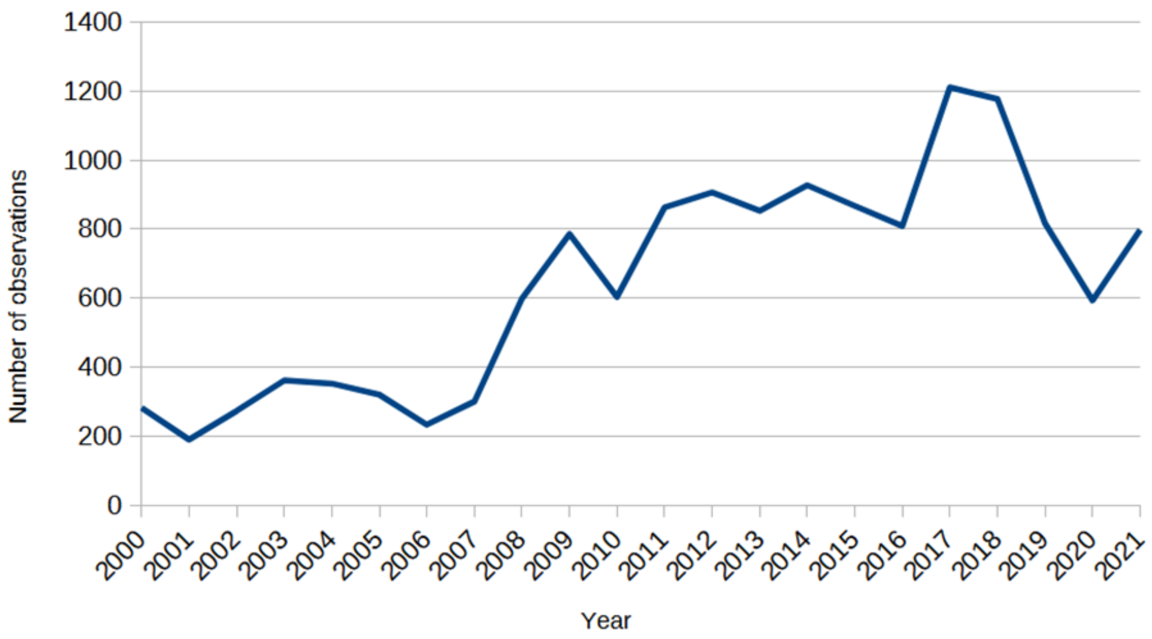

Figure 3.1.2-1 Number of observations (X-axis) of common pheasant in Norway per year (Y-axis) for the period 2000-2022 (data from artsdatabanken.no).

The NBIC has categorized the common pheasant as being of Low Risk (LO) on the list of Alien Species in Norway (Stokke and Gjershaug, 2018). In the alien species report, it is stated that data on the pheasant's speed of dispersal is lacking, however, a dispersal rate of less than 50 m/year was assumed. The authors also assumed winter temperature to be the limiting factor for the species distribution and that its survival depends on supplementary feeding during winters. With warmer winters caused by climate change, NBIC expects an increase in the distribution range with potential for reproduction as far North as in Troms and Finnmark. Observations of common pheasants over the year suggest that some birds survive Norwegian winters. (Table 3.1.1-1). In fact, most observations were made in the months April (19%) and May (16%). This could possibly be partly be explained by territorial males being particularly conspicuous in spring (see section 2.1.1 for description of species observations).

Table 3.1.2-1 Number of common pheasants observed per month in Norway during 2000-2022 and % of the yearly observations made per month (data from artsdatabanken.no).

Month	# Observations	% Observations
January	1365	9.7
February	659	4.7
March	1432	10.1
April	2658	18.8
May	2316	16.4
June	980	6.9
July	627	4.4

August	729	5.2
September	839	5.9
October	1022	7.2
November	867	6.1
December	634	4.5

The main activity registered for the observed birds was foraging (20%), followed by being stationary (13%) and possible copulation (6%). Forty-six of the observations (0.3%) were recorded as reproduction. Of the reproductions, one was on the island Frøya in Trøndelag (63.7°N, in 2014). The rest were in the Oslo Fjord area and in the county of Rogaland, where also most of the species' observations were made (see Figure1.4-1). This proves that reproduction occurs in Norway, but should not be interpreted as the proportion of birds reproducing. Females on nests or with broods are expected to be more difficult to detect than other individuals and reproduction may thus be underreported.

The common pheasant is considered to be resident-breeding species in Sweden, but because it is introduced, it is listed as Not Applicable (NA) on the Swedish Red List (Andersson et al., 2020). In the period 2000-2022, 191,636 observational records of common pheasants were collected in Sweden (artfakta.se). The peak year was 2021 with 16,061 observations, following a steady increase since 2000 (908 observations). The northernmost breeding attempt was registered close to Luleå in northern Sweden (65.6°N).
and reproduction may thus be underreported.

3.1.1.1 Dispersal capacity of common pheasants

In a study of dispersal of radio-collared common pheasant males in South Dakota (US), Leif (2005) demonstrated an average dispersal of an average of 3.2 (0.3) km from wintering sites to spring breeding sites. The breeding territories of males varied, being larger in open than in wooded landscapes. In the UK, a study showed that 6% of the birds were shot at a different estate than where they were released (Turner, 2008). It was concluded that competition (for food, water, roosting and nesting sites) due to high density of birds at the release sites stimulated dispersal in some males. Pheasants typically remain within a few kilometers of their release point, according to a review by Madden et al., (2018). This was also the finding by Kleverud (2006) in his study of radio-collared common pheasants in Norway. It is suggested that a post-release environment that reduces competition for food, water, shelter and refuge will prevent dispersal (Madden et al., 2018). This will also reduce the birds' risk of being killed in traffic (Madden and Perkins, 2017).

3.1.2 Grey partridges

The grey partridge population has, after its decline throughout Europe (see section 1.5), been subjected to attempted reintroduction- or reinforcement in several countries (e.g. Buner et al., 2011; Ewald et al., 2020; Putaala and Hissa, 1998). As with the common pheasant, the general experience has been that captive-bred birds are less likely to survive and reproduce than wild conspecifics. Following a study in Finland, the authors concluded that released birds would be of little value in reintroduction/reinforcement programs for the species (Putaala and Hissa, 1998). A review of failed attempts to reintroduce populations of galliform birds is presented by Sokos et al. (2008). No such attempt has been made for re-establishment of the Norwegian grey partridge population.

Information on the number of grey partridges that have been released in Norway is lacking and the population of released birds has not been monitored. However, some data has been collected through species observations (see methods for description) by the NCBI. In the period 2000-2022 a total of 302 observations of grey partridge in Norway were reported to NBIC (Figure 3.1.2-1). The annual number varied between two in 2007 and 28 in 2019. The geographical distribution of the observations is shown in Figure 1.5-1.

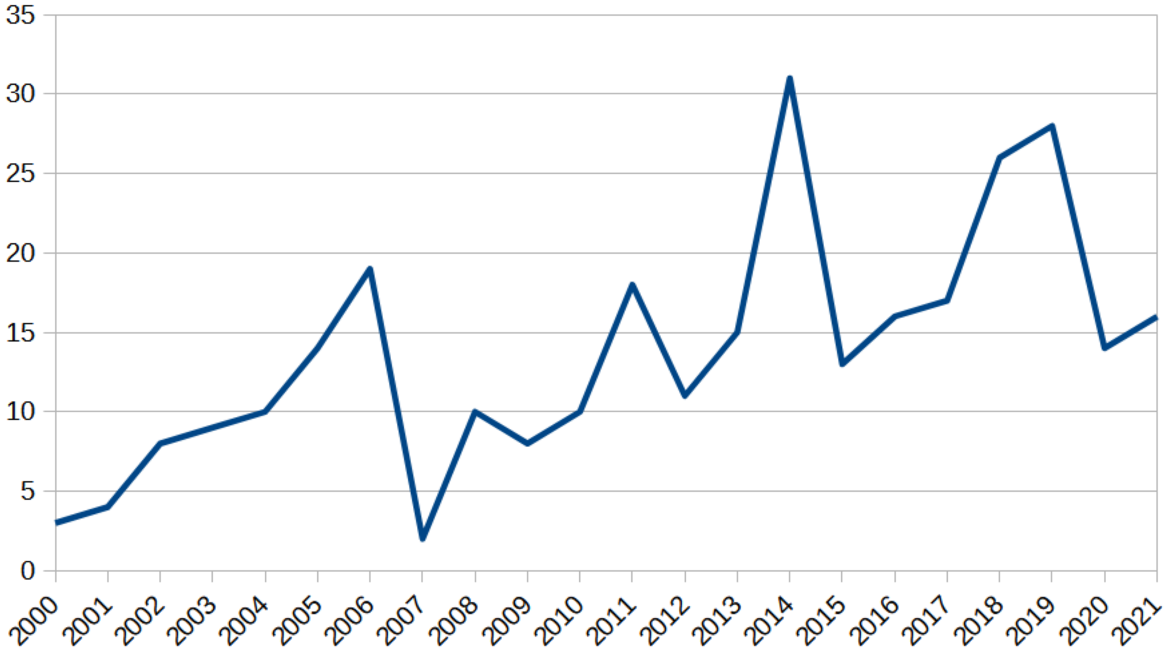

Figure 3.1.3-1 Number of observations (X-axis) of grey partridge in Norway per year (Y-axis) for the period 2000-2022 (data from artsdatabanken.no).

Observations of grey partridges over the year (Table 3.1.-1) suggest that some birds survive Norwegian winters. As for the common pheasant (Table 3.1.1-1), most observations were made in the months April (12%) and May (11%), see Table 3.1.2-1. The main activity registered for the observed birds was foraging (18%) followed by being stationary (19%) and possible copulation (6%). Seven of the observations (2.2%) were recorded as reproduction. This proves that reproduction occurs in Norway, but should not be interpreted as the proportion of birds reproducing. Females on nests or with broods are expected to be more difficult to detect than other individuals and reproduction may thus be underreported.

Table 3.1.2-1 Number of grey partridges observed per month in Norway for the years 2000-2022 and % of the yearly observations made per month (data from artsdatabanken.no).

Month	# Observations	% Observations
January	30	9.9
February	9	3.0
March	29	10.0
April	37	12.3
May	34	11.3
June	25	8.3
July	24	8.0
August	16	5.3
September	30	9.9
October	33	10.9
November	23	7.6
December	12	4.0

3.1.3 Possible survival of common pheasants and grey partridges in Norway in a 50-year perspective

Over the next 50 years, the climate in Norway is expected to warm and cause range shifts of numerous wildlife species (see e.g., VKM, 2021:15). The snow cover (extent and depth) has been reduced for decades (Rizzi et al., 2017) and is expected to continue to decrease in the future (Saloranta and Andersen, 2018). The warming is likely to lead to increased winter survival for common pheasants and grey partridges in Norway (less birds dying from starvation), but the majority of birds will still die from predation, disease and other causes (see section 3.1). Without continued release, the populations of both common pheasants and grey partridges can be expected to decline relatively rapidly. For both species there is potential for some augmentation through immigration from Sweden, where the populations are considerably larger. For the grey partridge, the historic decline seems to mainly reflect factors other than climate (see section 1.5), indicating that a stable population is not very likely to establish in Norway over the next 50 years, with or without releases. For the common pheasant it is considered likely that with increased winter survival and more suitable habitat available, the reproducing population could persist over the next 50 years even without additional releases. The high mortality and lowered reproduction of birds originating from captive-bred stock can be expected to be reduced in a few generations as birds hatched in the wild will learn survival skills from their parents. The potential for dispersal seems to be higher than the dispersal rate assumed by NBIC (<50m/year) in the Alien Species List assessment (Stokke and Gjershaug, 2018) for the common pheasant.

3.2 Impact on biodiversity from release of common pheasants and grey partridges in Norway

The assessment of impact of released common pheasants and grey partridges in Norway follows the IUCN guidelines of Environmental impact Classification for Alien Taxa (EICAT) (see section 2.4). In sections 1.5, 1.6, 3.1.1, 3.1.2, it is described how common pheasants and grey partridges differ from each other, also in regard to their history in Norwegian nature. However, their impact on biodiversity falls within the same categories, and thus the subsequent risk assessments of the two species have been combined. This is in line with relevant reviews of ecological impact where the collective term 'game-bird' is used for several species (e.g. (Bicknell et al., 2010; Mason et al., 2020). In cases where VKM expects that there could be differences in the impact of common pheasants and grey partridges this is described in the relevant text.

3.2.1 Competition

Hazard identification

Competition between species can define ecological niches (Diamond, 1978; Martin and Martin, 2001) and its intensity will depend on the degree of niche overlap between species in a landscape. Species sharing a habitat will compete over limited resources such as food and foraging spots, nesting sites and shelter from predators (Wiens, 1992). Competition can occur directly through agonistic interactions (Persson, 1985; Wiens, 1992) or indirectly through resource depletion (Dhondt, 2012; Schoener, 1983). Released grey partridges and common pheasants may compete with native species, in particular other farmland birds. Like the grey partridge (see section 1.4), other farmland birds have declined dramatically in Europe since the 1960s (Donald et al., 2001; Voříšek et al., 2010). Habitat loss, use of pesticides and increasingly efficient machinery, have caused reduced food availability throughout the year (Bowler et al., 2019; Heggøy and Eggen, 2020; Pedersen, 2020) Increased management and harvesting frequencies have exacerbated nest-failure rates and adult mortality, particularly among ground-nesting species (Kragten and de Snoo, 2007; Müller et al., 2005). These birds are among the avian groups with the most pronounced negative population trends in Europe (Guerrero et al., 2012; McMahon et al., 2020) and Norway (Heggøy and Eggen, 2020). The preferred habitats of grey partridges and common pheasants in Norway are classified as threatened (see section 1.6).

Hazard characterization

The impact of competition from released common pheasants and grey partridges on native fauna has not been studied in Norway. Peer-reviewed empirical studies of competitive interactions and niche partitioning, between released common pheasants and grey partridges, and native wild bird species, are also scarce from other countries (Mason et al., 2020). Studies from North America have shown that pheasants usually use different habitats than native gamebirds, but can impact their reproductive success negatively by interspecific nest parasitism (Hagen et al., 2007; Westemeier et al., 1998). Given the limited empirical evidence, this hazard characterization and risk assessment is founded on expert opinion based on ecological knowledge concerning native bird species of Norway. Assessment of native birds with expected niche overlap, and direct and indirect competitive interactions with released grey partridges or common pheasants, are presented in Table 3.2.1-1.

In the assessment of niche overlap (Table 3.2.1-1), it is considered that most ground-nesting bird species listed in the table build their nests in open habitats, while common pheasants and grey partridges are more dependent on edge zones and shrubby cover. This means that competition between native species and common pheasant or grey partridge is low for many of the native species. However, interspecific nest parasitism by pheasants could be a source of disturbance and reproductive losses for ground-nesting native birds (Westemeier et al., 1998).

Immediately after release and in the short term (weeks to months), one could expect that the released birds will have agonistic interactions with native birds in the area. Native birds may be subject to increased disturbance and consequent strain, and also direct competition for resources (invertebrate food and shelter), as for example in the case of threatened species including northern lapwings (CR), Eurasian curlews (EN) and corn crakes (CR).

Table 3.2.1-1 Native ground-nesting bird species associated with agricultural landscapes in Norway, short description of their ecological niches and assessment of potential niche overlap (competition) with released game-birds (grey partridge or common pheasant). Unless a species specifically noted to be resident or partly resident, the species is migratory and (mainly) overwinter outside the country. CR = critically threatened, EN = endangered, VU = vulnerable, NT = near threatened, LC = least concern, RE= regionally extinct, NE = not evaluated. LO = alien species with low risk. Only species that are assumed to have some degree of ecological niche overlap with released grey partridges or common pheasants are listed. The relative extent of potential niche overlap with released grey partridges or common pheasants is based on expert opinion. Sources: Norwegian Red List of Species 2021 (Artsdatabanken, 2021) and Norwegian List of Alien Species (Artsdatabanken, 2018). *The grey partridge established in Norway towards the end of the 19th century and was for a period abundant in southeast Norway and north to Trøndelag. The grey partridge no longer breeds regularly in Norway and is assessed as red list category regionally extinct RE.

Scientific name	**Species**	**Distribution**	**Red list/ Alien species list status**	**Ecological niche**		**Potential niche overlap (competition)**	
				Breeding habitat	**Diet**	**Nest site**	**Diet**
Perdix perdix	grey partridge (rapphøne)	north to Trøndelag*	RE	open cultural landscape and steppe areas, often with some scattered shrubs	grain, seeds and green plant parts, some invertebrates	medium	medium

Scientific name	Species	Distribution	Red list/ Alien species list status	Ecological niche Breeding habitat	Diet	Potential niche overlap (competition) Nest site	Diet
Phasianus colchicus	common pheasant (fasan)	north to Trøndelag	NE (LO)	relatively open areas such as meadows, but also along forest edges and ditches, in heathland and areas with bushes/trees	grain, seeds, fruits, buds and leaves, invertebrates	medium	medium
Anthus pratensis	meadow pipit (heipiplerke)	all of Norway	LC	most abundant in open mountain areas from the *Salix* shrubs region up into the alpine zone, and in the treeless coastal landscape, but also found on open bogs in boreal forests	mainly small invertebrates	low	Low
Alauda arvensis	Eurasian skylark (sanglerke) Partly resident	all of Norway	NT	open cultural landscape with short-growing vegetation: pasture, meadows, cropland	insects and seeds	low	Low/medium
Coturnix coturnix	common quail (vaktel)	north to Trøndelag	VU°	agricultural landscape, usually nests in arable land (grass or grain cropland)	plant materials, also some invertebrates	low	Medium
Crex crex	corn crake (åkerrikse)	north to Trøndelag	CR	lush cultivated land such as meadows and fields, also moist meadows near water and fallow areas near cultivated land	invertebrates, some plant material	low	Low

Scientific name	Species	Distribution	Red list/ Alien species list status	Ecological niche Breeding habitat	Diet	Potential niche overlap (competition) Nest site	Diet
Emberiza citrinella	Yellowhammer (gulspurv) **Resident**	all of Norway	VU	agricultural landscape, associated with edge zones and areas with alternating open ground for foraging, and dense vegetation for nesting and shelter	seeds, grain, and insects in breeding season, seeds in autumn and winter	medium	High (in winter)
Limosa limosa	black-tailed godwit (svarthalespove)	Rogaland North Norway	CR	nominate subspecies *limosa* most often nests on cultivated land. Nordand and Troms: subspecies *islandica*	mainly invertebrates	low	low
Numenius arquata	Eurasian curlew (storspove)	all of Norway	EN	open landscape, both on cultivated land and cultivated land; heathers, marshes and salt meadows; c. 65% of the population lives in, or adjacent to, agricultural landscapes	annelids, arthropods, crustaceans, molluscs, plant materials	low	low
Saxicola rubetra	Whinchat (buskskvett)	all of Norway	LC	moist meadows and marshy areas with shrubs and tall herbaceous vegetation, also occurs on clearcuts and by roadsides and ditches	invertebrates	medium	low

Scientific name	Species	Distribution	Red list/ Alien species list status	Ecological niche		Potential niche overlap (competition)	
				Breeding habitat	Diet	Nest site	Diet
Vanellus vanellus	northern lapwing (vipe)	all of Norway	CR	original breeding habitat is marshes and salt marshes, but today strongly linked to the agricultural landscape	mainly invertebrates, especially earthworms and large insects	low	low

If the released birds survive through the autumn, competition for food in the winter may have a negative impact on winter survival, of yellowhammers in particular. The yellowhammer is a resident species that is categorized as threatened (VU) due to substantial population decline caused by habitat loss/degradation and reduced availability of winter food (grain left after harvest) (Stokke et al., 2021a). This is in line with findings from the UK (Mason et al., 2020; Madden and Sage, 2020, and reference therein), who report some evidence that small seed-eating farmland birds, i.e., yellowhammers, corn bunting (*Emberiza calandra* – kornspurv) (RE in Norway) and sympatric galliform species (grey partridge), may be negatively impacted by food competition from common pheasants. It should be pointed out, however, that the densities of common pheasants in the studies from the UK are much higher than in Norway.

During early spring, competition for food may have a negative impact on migratory birds, like the vulnerable (VU) common quail or the near threatened (NT) Eurasian skylark (Stokke et al., 2021b), which need to replenish physical condition before entering the energy-demanding reproductive stage.

Since pheasants thrive in edge zones, there is potential for other field/woodland-edge species to be affected by their release, e.g., columbiformes, corvids, starling (*Sturnus vulgaris* (NT), stær), Eurasian tree sparrow (*Passer montanus* - pilfink) and possibly thrushes. However, most of these species place their nests well above the ground and competition for nest sites is unlikely.

Summary hazard assessment

VKM has identified two main competitive impacts from common pheasants/grey partridges:

- immediately after release and during the autumn/winter there will likely be competition for food (mostly granivorous and insectivorous species)
- if released birds survive the winter, there may be competition for nest sites with some ground-nesting species

Assuming that the number of released birds per year will not exceed previous levels, it is expected that the most serious impact of competition will be from (winter) food competition by released common pheasants and grey partridges on native birds (particularly yellowhammers). VKM assesses this impact to be **"Minimal"** (on a national scale) to **"Minor"** (on a local scale). This assessment is made with **"Medium"** confidence.

Likelihood

VKM assesses that released common pheasants and grey partridges are **"Moderately Likely"** to impact native ground-breeding birds in Norway though direct and indirect competition. This assessment is made with **"Medium"** confidence.

Risk characterization

The risk to avifauna in Norway, from competition by released common pheasants and grey partridges, is assessed to be **"Moderate"** on a local level and **"Low"** on a national level (see figure 3.2.1-1).

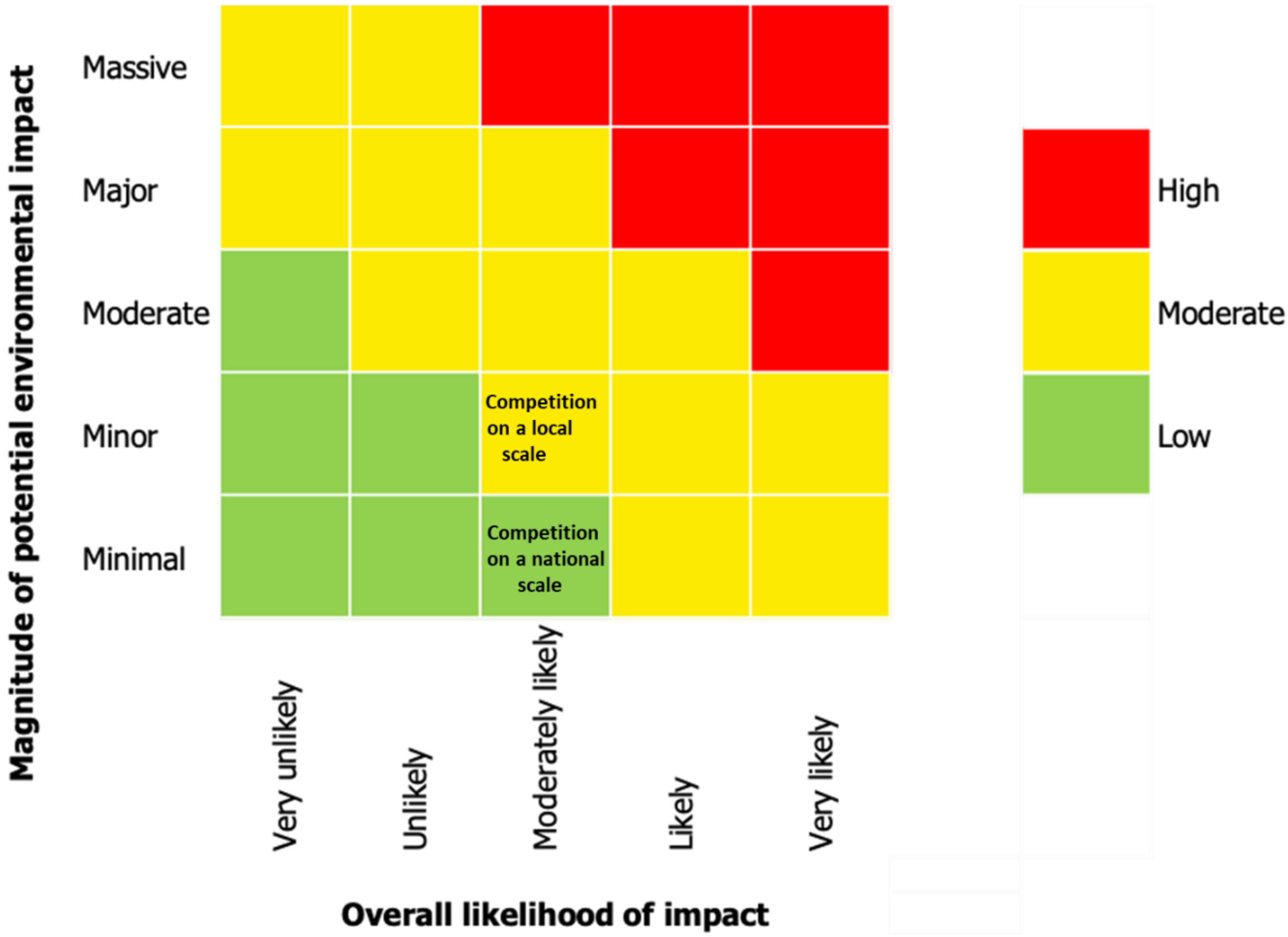

Figure 3.2.1-1 Risk characterization of competition for food by released common pheasants and grey partridges on native birds (primarily yellowhammers), which is assumed to be the strongest type of competition with native birds. Data to assess whether the impacts of competition from introduced common pheasants will differ from the impacts of competition from introduced grey partridges is missing.

3.2.2 Predation

Hazard identification

Both common pheasants and grey partridges are omnivores and with diets consisting partly of invertebrates (see sections 1.4 and 1.5). Chicks and breeding females in particular rely on protein derived from insects (Hall et al., 2021; Madden and Sage, 2020). Changes to invertebrate communities, especially within pheasant release pens, have been documented in the UK (Neumann et al., 2015). Mason et al., (2020) point out that, during spring, the predation risk on invertebrate populations is high and may affect other birds whose chicks also require invertebrate prey.

In the UK, it has been suggested by the Amphibian and Reptile Conservation Trust that pheasant predation could cause local declines in reptile populations (see also Hand, 2020; Madden and Sage, 2020; Mason et al., 2020). Negative impact on local populations of reptiles and amphibians has also been suggested to occur as a consequence of massive release of pheasants in Denmark (Miljøstyrelsen, 2017; https://mst.dk/media/121599/fasan.pdf). Also in Belgium, negative impact on reptile populations is suspected, as no reptiles were found at pheasant release-sites (Graitson and Taymans, 2022). Moreover, the return of viviparous lizards (*Zootoca vivipara* - nordfirfisle) was observed in areas from which pheasants had disappeared.

Hazard characterization

The impact of predation on reptiles, amphibians and invertebrates by released common pheasants and grey partridges has not been studied in Norway. As in the UK, local effects on invertebrate communities within aviaries and at release sites could be expected, particularly in the case of the larger common pheasants.

VKM found no documentation of predation on herptiles by common pheasants in Norway. However, among those reptile species to be negatively impacted, as mentioned by both Mason et al., 2020 (UK) and Graitson and Taymans, 2022 (Belgium), slow-worm (*Anguis fragilis* – stålorm), adder (*Vipera berus* – hoggorm), grass snake (*Natrix natrix* – buorm) and common lizard (*Zootoca vivipara* – nordfirfisle) are native to Norway. The native smooth snake (*Coronella austriaca* - slettsnok) is rare in the UK, however, pheasants are commonly listed among its predators.

The number of birds released in Norway is low compared to that in the UK, Belgium and Denmark, such that impact on herptiles inhabiting the immediate release area is all that may be expected in Norway.

Summary hazard assessment

The impact of predation by released common pheasants and grey partridges on Norwegian invertebrates and herptiles is only expected to be local and thus **"Minor"**. This assessment is made with **"Low"** confidence.

Likelihood

VKM assesses that released common pheasants and grey partridges are **"Unlikely"** to impact herptiles but are **"Likely"** to impact invertebrates in Norway though predation. This assessment is made with **"Low"** confidence.

Risk characterization

The risk to invertebrates or herptiles in Norway, from predation by released common pheasants and grey partridges is assessed to be **"Low"** to **"Moderate"** (see figure 3.2.2-1).

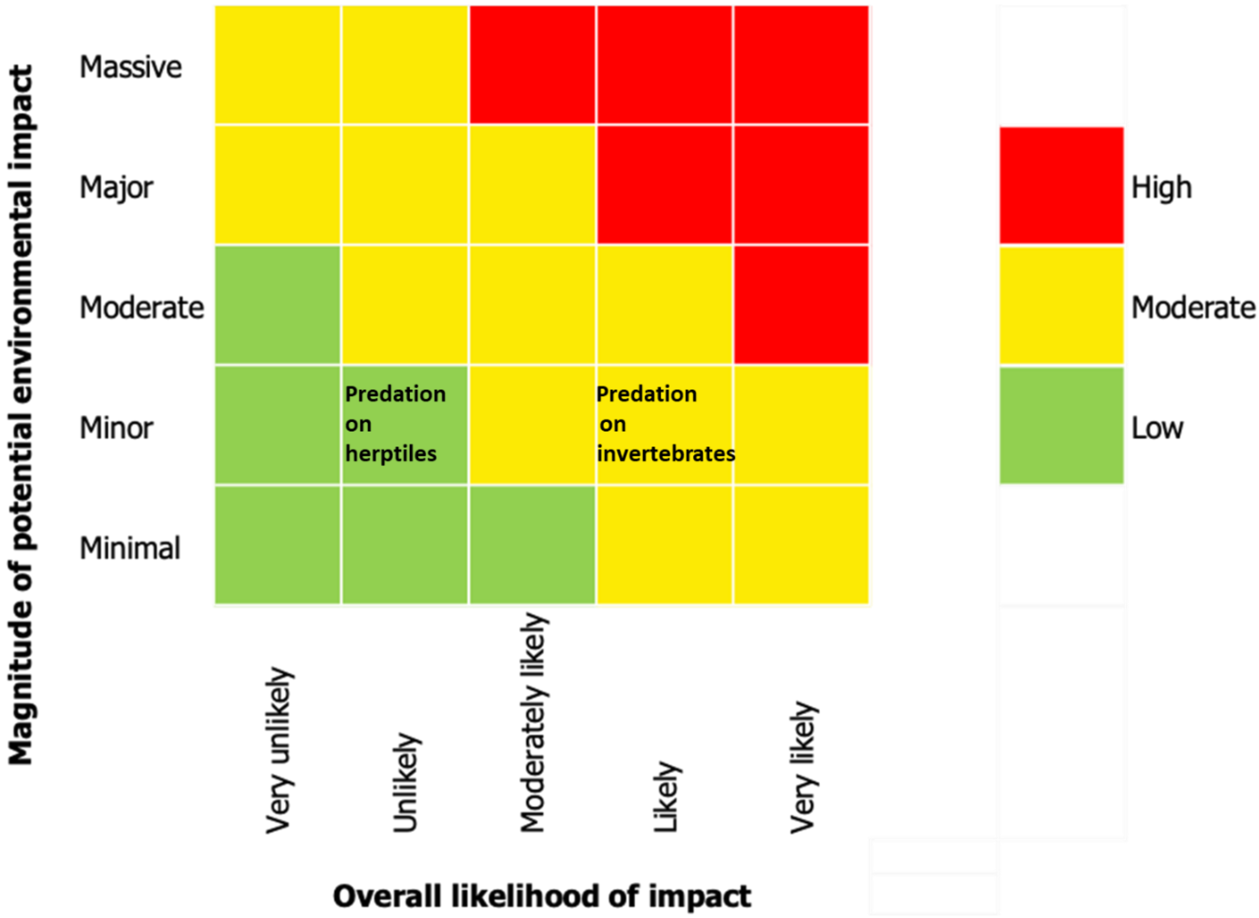

Figure 3.2.2-1 Risk characterization of predation on invertebrates and herptiles from common pheasants and grey partridges released in Norway.

3.2.3 Hybridization

The frequency of hybridization across species boundaries, or between domestic and wild subspecies, may increase due to human activities such as release of alien species or modification of natural habitats (e.g. Quilodrán et al., 2020). The common pheasant bred for release is often a hybrid between various subspecies (Braasch et al., 2011).

Hazard identification

The common pheasant in particular (Ottenburghs, 2019), but also the grey partridge, have the potential to interbreed with other galliform birds. The documented cases are numerous both in captivity and in the wild (http://www.bird-hybrids.com). Common pheasants and grey partridges can also hybridize with each other, and with domestic hens (*Gallus gallus*). In Sweden, where captive-bred quail are used for lowland training of pointing dogs (Alanärä et al., 2021), introgression of genes from a domesticated strain of Japanese quail (*Coturnix c. japonicus)* has been detected in the native quail population (Sanchez-Donoso et al., 2012; Sánchez Donoso et al., 2014)

Hazard characterization

No hybrids between common pheasants or grey partridges with wild bird species have been recorded in Norway. However, several species that could potentially be involved are native to Norway. Galliform birds related to pheasants and partridge include hazel grouse (*Bonasa bonasia* - jerpe), willow ptarmigan, (*Lagopus lagopus* - lirype), rock ptarmigan (*Lagopus muta* - fjellrype), western capercaillie (*Tetrao urogallus* - storfugl), black grouse (*Lyrurus tetrix* - orrfugl), and common quail (*Coturnix coturnix* - vaktel). For the grey partridge, hybridization with willow ptarmigan has been documented in nature (McCarthy, 2006 and references therein).

If relict populations of wild grey partridges should exist in Norway, hybridization with released captive bred grey partridges could lead to introgression of genetic material into the wild stock. Introgression of genes from captive birds would be regarded as a negative impact on the native population.

Summary of hazard characterization

Hybridization by released common pheasants and grey partridges with Norwegian wild birds is expected to have **"Minor"** impact on the population level. This assessment is made with **"Low"** confidence.

Likelihood

Artificially reared galliform birds have lowered reproductive success compared to wild conspecifics (Sokos et al., 2008), which reduces the probability of interbreeding. The likelihood of hybridization between released and wild birds will depend on location of release and the degree of habitat overlap. According to the NCBI, none of the species mentioned in the hazard characterization above inhabits semi-natural habitat types in Norway. The release of common pheasants and grey partridges takes place after the breeding season of native galliforms and any events of hybridization would have to involve released birds that have survived until next spring.

VKM assess that released common pheasants and grey partridges are **"Unlikely"** to impact wild birds in Norway through hybridization. This assessment is made with **"Low"** confidence.

Risk characterization

The risk to wild birds in Norway of hybridization with released common pheasants and grey partridges is assessed to be **"Low"** (see figure 3.2.3-1).

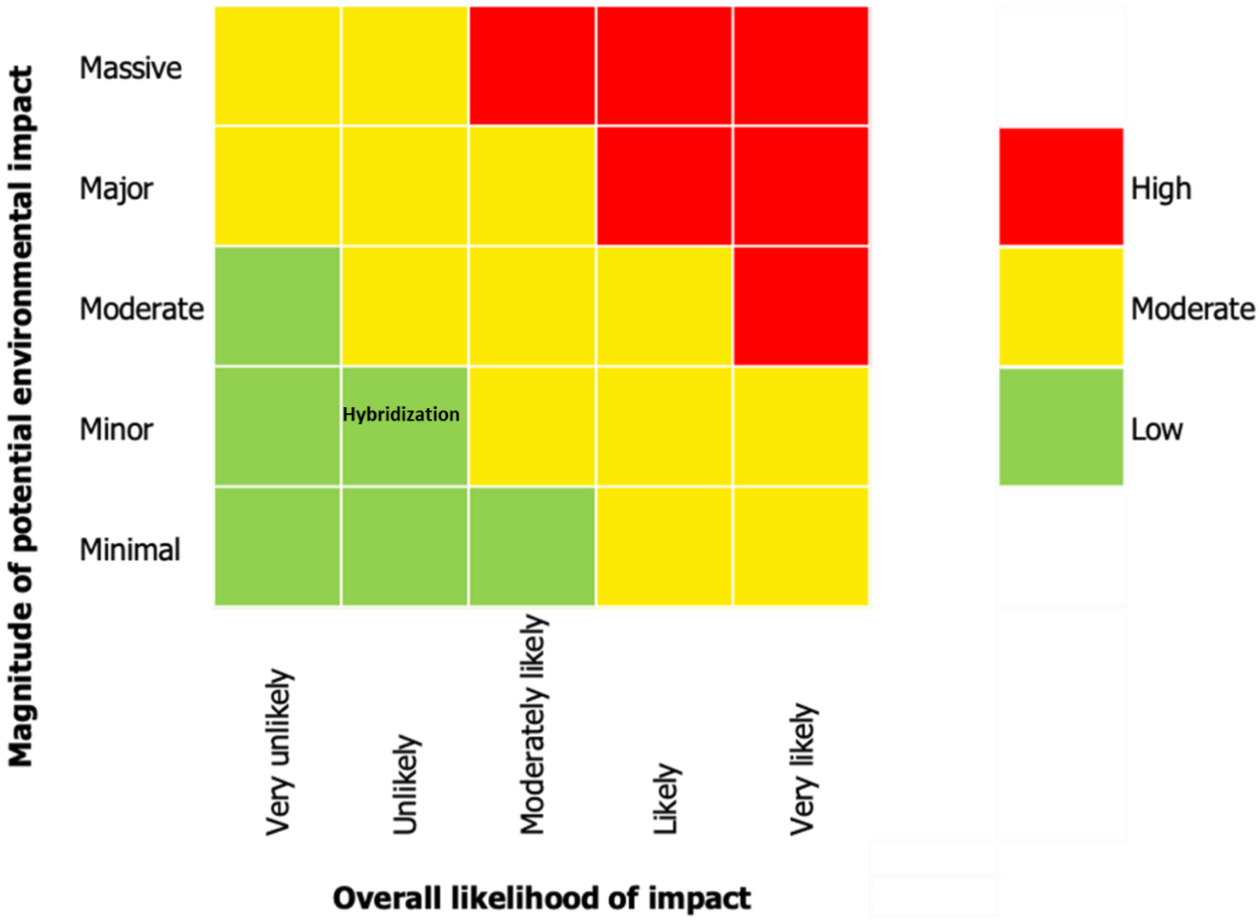

Figure 3.2.3-1 Risk characterization of hybridization between released common pheasants and grey partridges and wild galliform birds in Norway.

3.2.4 Transmission of disease

Hazard identification

If virulent and highly contagious pathogens are allowed to spread within and between captive flocks of common pheasant and grey partridges, and these flocks are released into the wild, this would constitute a massive pathogen exposure for native bird populations, overcoming natural obstacles for transmission of virulent pathogens in the wild. If the pathogen in question is highly contagious and/or persists in the environment, or if pheasants and/or partridges only experience mild disease but still shed considerable amounts of pathogens and infection, the infection may cause high mortality in other species. If diseased individuals and carcasses are prone to predation and scavenging, raptors and scavengers will also be exposed to increased amounts of pathogens, causing a potential impact in these populations too. Such a scenario could occur, for example, if a rearing facility was infected with a virulent pathogen, such as Newcastle Disease/avian paramyxovirus 1 or high pathogenicity avian influenza virus before game-birds are released. The disease could then spread into local populations of passerines, anatids and other birds through common use of feeding stations, or other points of contact subsequent to release.

Hazard characterization

There are no reports describing the impact of any disease transmitted from common pheasants and grey partridges to wild birds in Norway. Many of the pathogens described in section 3.6 are, nevertheless, capable of causing infection and disease in wild birds. The impact of transmission of disease from released common pheasants and grey partridges on Norwegian wild birds will vary with pathogen, pathogen strain and degree of contact between released gamebirds and wild birds, as well as the susceptibility of these species. In most cases, the impact is expected to be local, but highly virulent pathogens, as for example avian influenza, can theoretically spread from a gamebird release site to large areas, especially during migration of native birds. Small populations of threatened species could become extinct from a serious disease outbreak, thus resulting in major impact. In contrast, a more abundant and widespread species would experience minor, and often local, impact (even if the local morbidity and mortality is high). It is noteworthy that there are on-going outbreaks of Newcastle disease and avian influenza in wild bird populations in Norway.

A list of diseases that may be relevant for common pheasants and grey partridges under Norwegian circumstances, are found in section 3.6. Examples of diseases for which outbreaks in wild birds have been documented are Newcastle disease (Aldous and Alexander, 2008; Alexander, 2009), avian influenza (Capua and Alexander, 2009), avian metapneumovirus (van Boheemen et al., 2012) and avian tuberculosis (Kock et al., 1999).

Summary of hazard characterization

The impact of a spread of disease is assessed to vary from **"Minor"** to **"Major"** depending on the pathogen and species of wild bird affected. The spread of a virulent, highly contagious pathogen to a dense population of a threatened species during the breeding season would be a worst-case scenario, with potential for major impact on biodiversity. This assessment is made with **"Medium"** confidence.

Likelihood

For a single release of captive common pheasants and/or grey partridges it is assessed as **"Unlikely"** that transmission of disease to wild birds will occur. However, if the release of captive-bred gamebirds occurs at a high frequency over a prolonged period, it is **"Likely"** that an outbreak will occur at some point. This assessment is made with **"Medium"** confidence.

Risk characterization

The risk of negative consequences to biodiversity in Norway from transmission of disease from released common pheasants or grey partridges to wild species, is assessed to vary from **low to high**, depending on the frequency of the release and the pathogen in question (see figure 3.2.4-1).

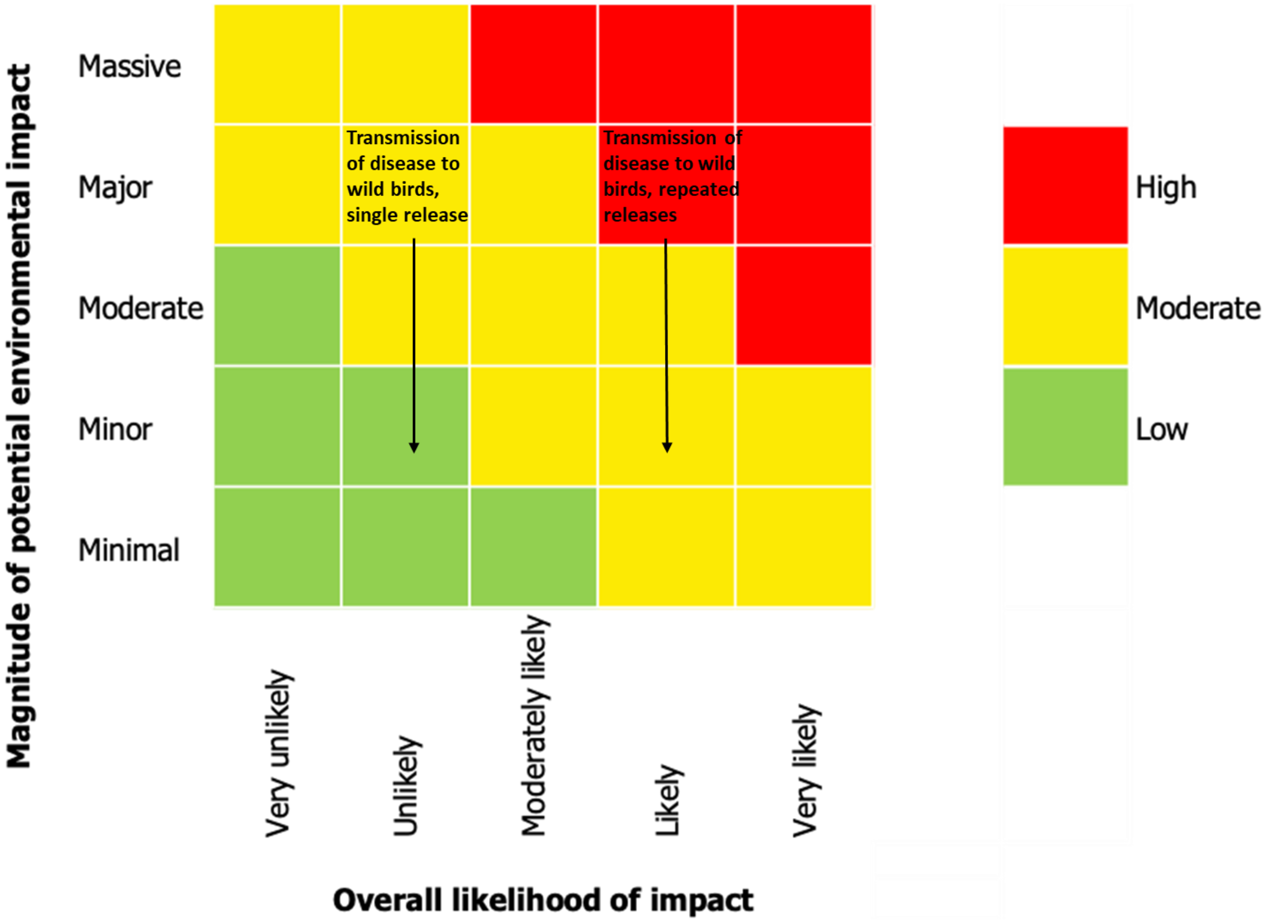

Figure 3.2.4-1 Risk characterization of transmission of disease to wild birds from released common pheasants and grey partridges in Norway. Arrows indicate the range of potential environmental impact that caused by transmission of disease, with the spread of a virulent, highly contagious pathogen potentially causing a major impact, whereas a less contagious pathogen is likely to result in a more moderate or even minor impact.

3.2.5 Grazing/herbivory/browsing

Hazard identification

The diet of common pheasants and grey partridges after release consists predominantly of seeds and other plant material (Hall et al., 2021). A review of the direct effects (pecking and trampling) of released common pheasants and red-legged partridges on the native ground flora in the UK, suggests that the impact was restricted to occur within the release pens and the area around the release site (Sage et al., 2020 and references therein). In addition, the flora of the release area may be significantly affected by landscape management. It is noteworthy that all the semi-natural habitat types on the Norwegian Red List of Nature Types are categorized as threatened (see section 1.6).

Hazard characterization

Most studies of the impact of game-birds on ground flora from the UK are from within release pens (e.g., Mason et al., 2020). There are no studies of the impact of released common pheasants and grey partridges on the flora of release pens or sites in Norway and the usual density of birds per pen is unknown. However, as only local effects were observed from released birds in the UK (Sage et al., 2020), the same can be expected in Norway. The flora at the release site could thus be negatively affected. Information on the extent of landscape management on release sites in Norway is lacking.

Summary hazard assessment

The impact of browsing/herbivory/grazing by released common pheasants and grey partridges on Norwegian flora is only expected to be local and thus **"Minor"**. This assessment is made with **"Low**" confidence.

Likelihood

VKM assesses that released common pheasants and grey partridges are **"Moderately likely"** to impact flora in Norway though browsing/herbivory/grazing. This assessment is made with "**Low"** confidence.

Risk characterization

The risk to flora in Norway, from browsing/herbivory/grazing by released common pheasants and grey partridges is assessed to be **"Moderate"** (see figure 3.2.5-1).

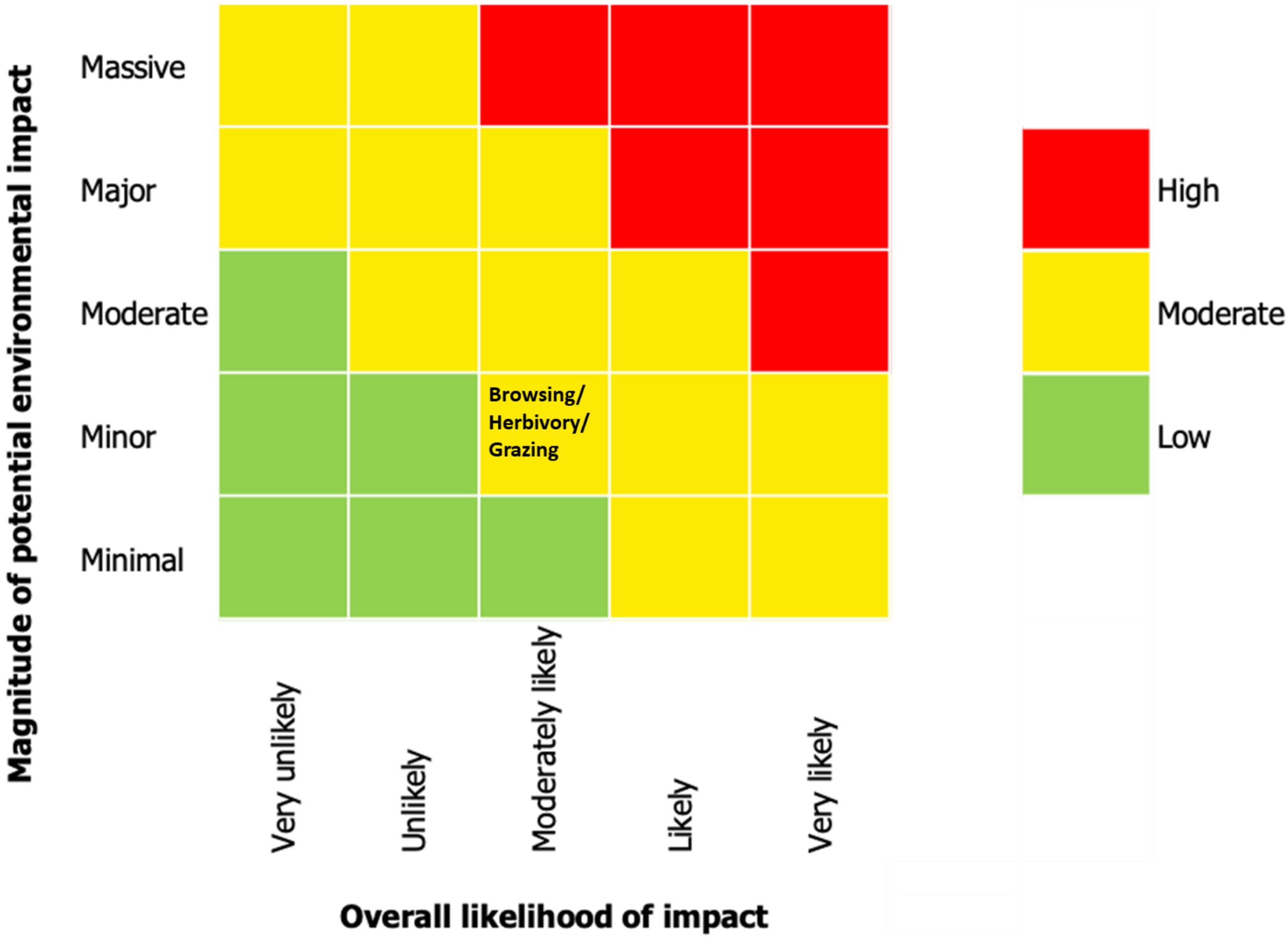

Figure 3.2.5-1 Risk characterization of browsing/herbivory/grazing on flora in the release sites by common pheasants and grey partridges in Norway.

3.2.6 Chemical impact on ecosystem

Hazard identification

Defecation by released birds may lead to soil fertilization through increased levels of potassium and phosphorus, as documented in the UK after pheasant release (Madden and Sage, 2020). Changes to soil chemistry can influence the composition of the woodland ground flora (Sage et al., 2005). Increase in detritivores, such as earthworms, snails and slugs has been observed around pheasant release sites in the UK (Hall et al., 2021).

Due to lack of information, it is not possible to assess if the release of common pheasants and grey partridges at the scale practiced in Norway may have any chemical impact on ecosystems. For chemical effects (lead pollution) of activities related to the release see section 3.3.

3.2.7 Indirect impacts through interactions with other species

VKM has chosen to focus on two separate aspects of indirect impacts through interactions with other species. These are predator abundance and pathogen-mediated competition.

Predator abundance

Hazard identification

In their review of impacts of the non-native gamebird release in the UK, Mason et al. (2020) suggest three mechanisms by which gamebird release may affect predator and scavenger abundance and predation rates:

1) Released gamebirds may be a supplementary food source for predators and scavengers and thereby lead to increased predator abundance.
2) Management of semi-natural habitats where gamebirds are released may enhance predator populations by increasing the availability of suitable habitat and natural prey.
3) Lethal predator control in areas where gamebirds are released may reduce the population size of predators.

It has been shown that particularly generalist predators may increase in numbers as a response to increased abundance of prey resulting from game bird release (Mustin et al., 2018).

The intensity of predator control varies, and estates that rely on high density of released gamebirds are more likely to control predators during the gamebird rearing, releasing and shooting season only, rather than throughout the year (McDonald and Harris, 1999).

Intensive lethal predator control carried out in addition to other game-bird habitat management, and over several years, increases the abundance and/or nest survival of a number of passerine bird species and some mammalian prey species (see references in Mason et al., 2020). Lethal predator control is known to occur at Norwegian release sites, but the extent is unknown.

Hazard characterization

There are no studies of effects of released common pheasants and grey partridges on predation patterns, predator control or availability of released birds as an additional prey source for predators and scavengers in Norway. As in the UK, the release of gamebirds may alter predation pressure on native species, including many threatened farmland-bird species. In addition to the immediate attraction of predators to the area, release of common pheasants and grey partridge, functioning as prey, can support increased populations of predators, especially if the released birds survive and establish in the wild (Mustin et al., 2018). When the pheasants and partridges eventually die, for example due to harsh winter conditions, this may cause even higher predation pressure on resident species.

Summary of hazard characterization

The impact of release of common pheasants and grey partridges on predator abundance is assessed to be **'Minor'** as only local effects are expected. The local population of predators could increase or decrease depending on management regimes. This assessment is made with **'Medium**' confidence.

Likelihood

It is assessed to be '**Moderately likely'** that the local predator populations are directly or indirectly impacted by released common pheasants and grey partridges.

Risk characterization

The risk of impact on local predator abundance is assessed to be '**Moderate**' (see figure 3.2.7-1).

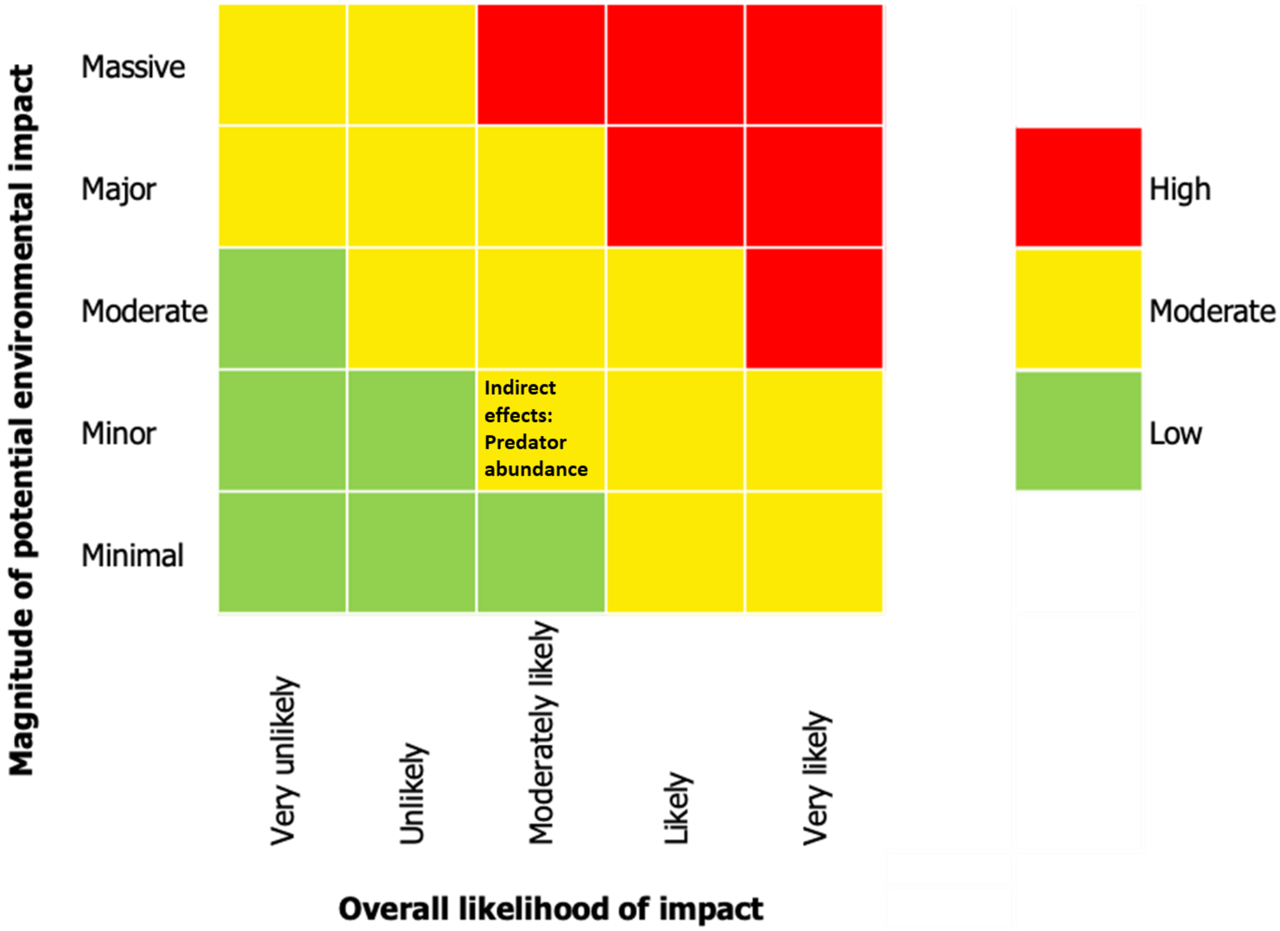

Figure 3.2.7-1 Risk characterization of indirect effects of the release of common pheasants and grey partridges: predator abundance.

3.2.8 Pathogen-mediated competition

Hazard identification

Common pheasants and grey partridges reared in captivity are prone to a number of infections and often suffer from high infestation/infection loads of enzootic pathogens (see section 3.6.4). Release of these birds may imply a major increase in the local pathogen population. In addition, the birds represent an abundance of susceptible hosts for pathogens already present in the environment, facilitating transmission and pathogen population growth. In cases where the pheasants and partridges aggregate in certain areas, for example around feeders, this may additionally ease pathogen transmission and cause a local increase in pathogen population. If these hot-spots also attract other birds, as for example a feeding station most likely would, these birds will experience higher probability of exposure to the pathogens. In situations where the pathogens, native or introduced, are less virulent (cause less disease) in the introduced birds than any native bird species, this species will be exposed to pathogen-mediated apparent competition (Price et al., 1988).

A well-known, but disputed, example is infection with *Heterakis gallinarum* in common pheasants and grey partridges. Tompkins et al. (2001) established a model where *H. gallinarum* is thought to be shed in large amounts from relatively unaffected pheasants, but cause poor performance in infected partridges, while the latter species is unable to maintain sufficient populations of the parasite to cause a considerable infection pressure. Hence, Tompkins et al. (2001) suggested that overlapping area use between pheasants and grey partridges would cause decline of the latter. This theory has, however, been disputed by several other studies (see Mason et al. (2020) for a review). See section 3.6 for further information on relevant pathogens.

Hazard characterization

There are no studies demonstrating pathogen-mediated competition between common pheasants and grey partridges, and other bird species in Norway.

Summary of hazard characterization

An increase in pathogen populations, and thereby increased infection pressure for wild bird species, will have local and hence "**Minor"** impacts on the biodiversity of wild birds, unless this happens at a location hosting very vulnerable populations of susceptible birds. This assessment is made with "**Medium**" confidence.

Likelihood

The probability of increased exposure and load for sympatric species of common pathogens with sporadic occurrence after a release of captive pheasants or partridges, is assessed to be **"Likely**". This assessment is made with **"Medium"** confidence.

Risk characterization

The risk of impact by an increased pathogen load on the performance of wild, native bird-species has been assessed as **"Moderate"** (see figure 3.2.8-1).

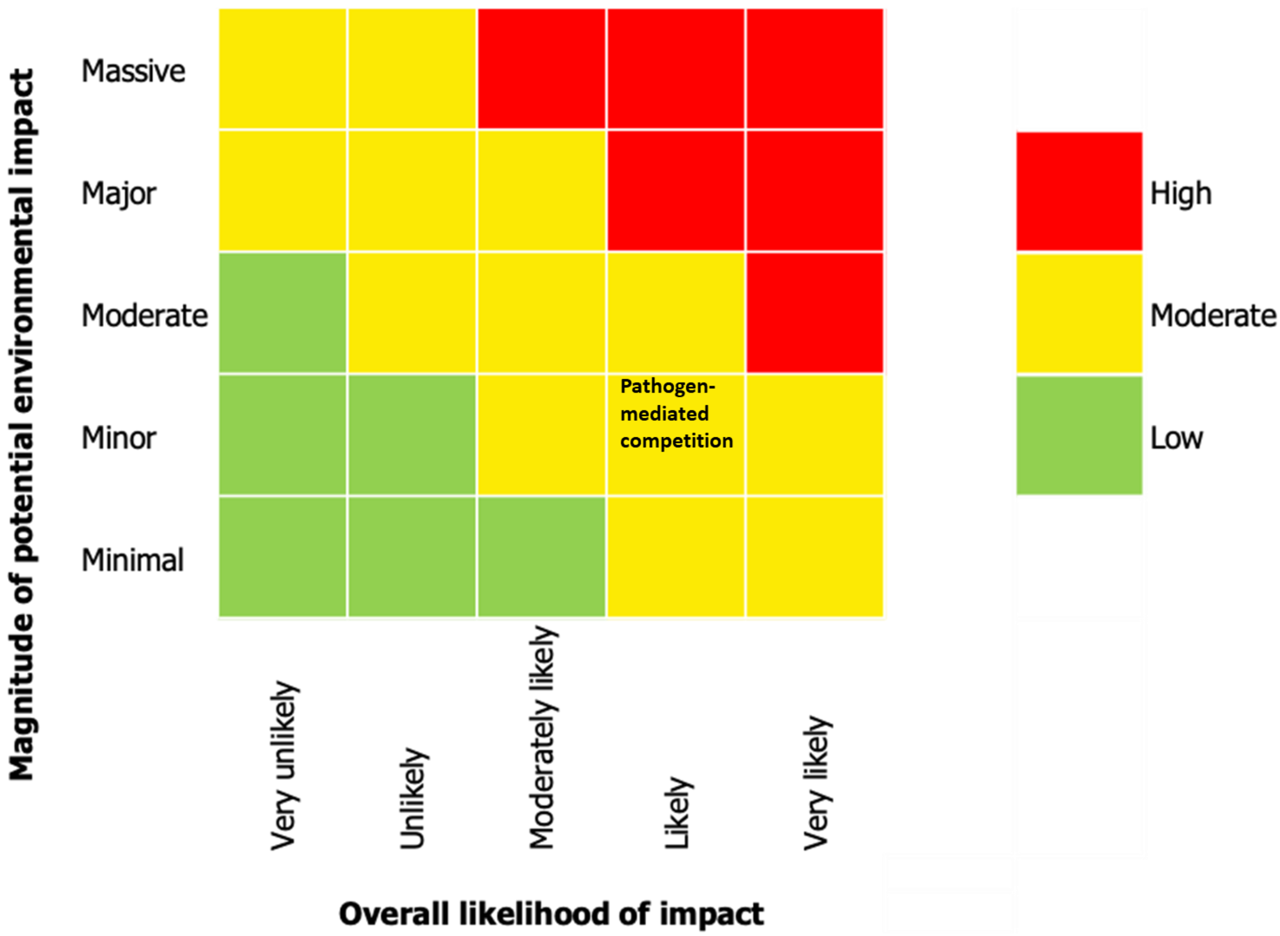

Figure 3.2.8-1 Risk characterization of indirect effects from the release of common pheasants and grey partridges- pathogen-mediated competition

3.3 Activities related to the release that may have a negative impact on local biodiversity

Pheasants are hunted in Norway from October 1 to December 23, conceivably impacting the environment negatively by lead pollution from ammunition. Decimation of predators and scavengers at the release sites by shooting will also contribute to lead pollution. The extent of such activities in Norway is unknown.

Feeding released gamebirds may support other small vertebrates and attract predators (e.g., Madden and Sage, 2020 and references therein).

In the UK, increased abundance of farmland and woodland passerines, such as blackbird, robin (*Erithacus rubecula* - rødstrupe), wren (*Troglodytes troglodytes* - gjerdesmett), nuthatch (*Sitta europaea* – spettmeis) and blue tit (*Cyanistes caeruleus* – blåmeis), was observed at sites with a higher density of gamebird feeders in the UK (Davey, 2008). In woodlands, by contrast, the density of song thrush (*Turdus philomelos* – måltrost) and willow warbler (*Phylloscopus trochilus* – løvsanger) decreased with increased feeder density (Davey, 2008).

In the UK, many mammals are also attracted by feeders provided for non-native game-birds, including the following species native to Norway: yellow-necked mouse (*Apodemus flavicollis* – storskogmus), wood mouse (*Apodemus sylvaticus* - småskogmus), bank vole (*Myodes glareolus* - klatremus), brown rats (*Rattus norvegicus* – brunrotte), red squirrels (*Sciurus vulgaris* -ekorn) hedgehog (*Erinaceus europaeus* – piggsvin), badger (*Meles meles* – grevling), roe deer (*Capreolus capreolus* - rådyr), red fox (Vulpes vulpes - rødrev) tand toat (*Mustela ermina* - røyskatt). Some of these may predate the eggs and chicks of ground-nesting and woodland birds (Sánchez-García et al. 2015). In Norway, it is also possible that wild boar (*Sus scrofa* - villsvin), an alien species expanding its range (VKM, 2018:14), will be attracted to feeding sites.

3.3.1 Physical and structural impacts from landscape modification.

Landscape modification at release sites (low land field-trial sites) will alter microhabitats and, consequently, the nest site suitability for farmland birds (Mason et al., 2020). See table 3.2.1-1 for description of breeding habitats for native ground-nesting birds that could be impacted by release of common pheasants and grey partridges in Norway. The extent of landscape modifications at game-bird release sites in Norway is unknown.

3.3.2 Impact on biodiversity in a 50-year perspective

An evaluation of the potential for survival and establishment of common pheasants and grey partridges in Norway, in a 50-year perspective, is given in section 3.1.3. The negative impact on biodiversity will increase with repeated releases of birds, the number of birds released and the number of and geographic range of the release sites. If the survival of birds increases, as is expected with warming climate over the next 50 years, the negative impact will be greater per unit of birds released. The negative impact on biodiversity will also be greater if farmed game-birds are released into habitats where vulnerable native species that may be subjected to niche competition (ground feeding/nesting birds), predation (invertebrates, herptiles), hybridization and/or disease transmission are found.

3.4 Animal health aspects related to transport, rearing and release

Hazard identification

The following hazard identification focuses on diseases for which there is evidence for occurrence in game-bird facilities raising pheasants or grey partridges (and/or released birds of these species) in Northern Europe, and wich have the potential to affect health and welfare of the game birds and/or spread to wild native birds and/or domestic poultry. A list of diseases that may be relevant under Norwegian circumstances is presented below. For explanation about the lists of notifiable diseases from WOAH, EU and the Norwegian Animal Health Regulation and the different categories, see section 1.10.1.

Epidemic diseases

3.4.1 Newcastle disease and other avian paramyxovirus 1s

Newcastle disease (ND) is one of the most contagious viral diseases known, listed by WOAH and a notifiable disease according to the Norwegian Animal Health Regulation (List 1) and EU-regulations (Category A). It is caused by highly virulent strains of avian paramyxovirus 1. Less virulent strains circulate among wild birds and can cause disease outbreaks among pigeons. Infections with less virulent strains are categorized as notifiable disease in the Norwegian List 2.6, but not listed in EU regulations. Most bird species seem to be susceptible. There is a requirement for vaccination for homing pigeons that participate in shows, races or dog training, while the Norwegian Animal Health Regulation prohibits vaccination of other bird species (to enable detection of infection with serological studies).

Pheasants are regarded as highly susceptible to ND at all ages, but may show variable degrees of disease and mortality (Aldous and Alexander, 2008). Outbreaks have been recorded both in captivity and in the wild. For example, an outbreak was described among 12,000 pheasants released on an island of 3.9 km^2 in Denmark, where mortality reached 56%. There were few people and no domestic birds on the island, suggesting a wild bird source, but no disease among wild birds was observed (Jørgensen et al., 1999).

There are also reports of outbreaks with high mortality in partridges, for example an outbreak with pigeon paramyxovirus 1 at a farm in Scotland, where the source of infection was believed to be feral pigeons living in a loft beside the partridge cages (Irvine et al., 2009).

Avian paramyxovirus is efficiently spread from bird to bird via the respiratory route. The importance of vertical transmission (from hen to egg) is uncertain (Alexander, 2009).

Virus shedding has been confirmed from vaccinated pheasants (Capua et al., 1994), and imported pheasant poults from a flock with just mild clinical signs of respiratory disease, resulted in an outbreak in Great Britain (Aldous et al., 2007).

With the exception of outbreaks in cormorant *(Phalacrocoracidae*) colonies, there are few reports of ND epidemics in wild birds (Alexander, 2009). However, this does not necessarily exclude the possibility that such outbreaks could occur, or that ND associated mortality cannot affect the ecology of a given bird species. An outbreak of paramyxovirus 1 was observed among feral pigeons (*Colombo livia*) in Oslo in August 2022 (https://www.vetinst.no/nyheter/smittsomt-virus-pavist-blant-duer-i-oslo, accessed 7th of September 2022). To VKM's knowledge, disease was not observed in other species. An outbreak of Newcastle Disease was reported in a flock of egg-laying hens in Kristianstad, in southern Sweden, in April 2022. There is currently (September, 2022) an outbreak of Newcastle Disease in a flock of egg-laying hens in the county of Rogaland, Norway (https://kommunikasjon.ntb.no/pressemelding/pavisning-av-newcastle-disease-i-fjorfebesetning-i-rogaland?publisherId=10773547&releaseId=17941582&lang=no)

3.4.2 Avian influenza

Avian influenza (AI) is caused by the influenza A virus. Strains that are highly virulent to poultry (H5 and H7) are classified as highly pathogenicity avian influenza (HPAI) and considered as a notifiable disease, irrespective of which species they are detected in. Subtypes that are are virulent in poultry are classified as low pathogenicity avian influenza" (LPAI). Among these, H5 and H7 LPAI are still notifiable when detected in poultry, and LPAI viruses "having proven natural transmission to humans associated with severe consequences" are still notifiable when detected in domestic and captive wild birds. (https://www.woah.org/en/what-we-do/standards/codes-and-manuals/terrestrial-code-online-access/?id=169&L=1&htmfile=chapitre_oie_listed_disease.htm)

According to the Norwegian Animal Health Regulation, HPAI in all species, and H5 and H7 LPAI in domestic poultry are notifiable (List 1), while EU-regulations list HPAI in birds in Category A.

The main reservoir of AI is aquatic birds of several orders, in particular gulls, waders, ducks and geese (Capua and Alexander, 2009). Highly pathogenic avian influenza appears to emerge when LPAI H5 and H7 viruses are introduced to poultry and subsequent mutations lead to higher virulence in these orders. Most species of birds are susceptible, but clinical signs and severity of disease may vary considerably depending on the bird species in question, individual characteristics, environmental factors and virus strain. Before the H5N1 outbreak (that started in China in 2005, spread to most of the world and caused significant mortality among wild birds) only one outbreak with considerable mortality among wild birds had been reported: in common terns in South Africa in 1961 (Becker, 1966). Since 2005, several epidemics have caused mortality in wild birds, in particular ducks, swans and raptors. Today, many outbreaks in domestic poultry are thought to be initiated by transmission from wild migratory birds.

In captivity, pheasants may show severe disease with high mortality (Brookes et al., 2022), but some individuals often show only mild disease. VKM has not found any reports referring to outbreaks in partridges.

Transmission of avian influenza seems to require close contact between birds, though infected birds shed large amounts of virus, which can persist in the environment. Vertical transmission is not regarded to be of significance.

HPAI was diagnosed for the first time in Norway in 2020 (H5N8). Since then, HPAI H5N8, H5N1 and H5N5 have been isolated from both diseased wild and domestic birds all over the country, including several white-tailed eagles (*Haliaëtus albicilla*). The virus isolates have been closely related to isolates found in birds from other parts of Europe, in Russia and North America, and the cases in Norway are a part of an unprecedented large and widespread epidemic in both poultry and wild birds all over Europe (EFSA, 2022). In contrast to previous years, the current epidemic has been characterized by major die-offs in sea bird breeding colonies in North Western Europe. In 2022, avian influenza was observed in seabirds in areas of Northern Norway and even the Arctic islands of Jan Mayen and Svalbard, far from any poultry farms (see https://www.vetinst.no/fugleinfluensa-i-norge for updated information). European Food Safety Authority (EFSA) and co-authors (2022) suggests that the risk of HPAI virus infection may be increased for the years to come, as the virus seems to persist and circulate among wild birds in Europe.

3.4.3 Infectious laryngotracheitis (ILT)

Infectious laryngotracheitis (ILT) is caused by Gallid herpesvirus 1. It is highly contagious, listed by WHOA, and notifiable according to the Norwegian Animal Health Regulation (List 2.6), but not according to EU regulations. Infectious laryngotracheitis is an economically important disease in domestic poultry globally. Infection causes an upper respiratory disease with high morbidity, but moderate mortality (5-20%). Disease has been observed in domestic hens, pheasants, peafowls and turkeys, while several passerines are regarded as refractory to infection. The virus is antigenically relatively stable, and vaccination is common in the poultry industry in many parts of the world. Transmission occurs directly with respiratory discharges or indirectly via fomites or spread of poultry litter over fields. Infected birds that recover are often asymptomatically infected and virus shedding can be reactivated when the birds are exposed to stressors. ILT occurs sporadically in backyard domestic poultry in Sweden (Jonare, 2020) and Norway.

3.4.4 Infectious bronchitis (IB) and related coronavirus-associated diseases

Infectious bronchitis (IB) is caused by an avian gammacoronavirus. It is a highly contagious, WHOA-listed disease and notifiable according to the Norwegian Animal Health Regulation (List 2.6), but not according to EU regulations. IBV is found worldwide in domestic hens, but closely related gammacoronaviruses are found in pheasants, partridges and other galliform birds, pigeons, geese, ducks and waders (Hughes et al., 2009). Infection causes an acute upper respiratory disease, enteritis, reduced egg quality and/or nephritis. In young hens, the infection causes chronic lesions in the oviduct resulting in reproduction problems later in life. IB-related coronavirus disease has only been observed in the domestic hen, turkey, guinea fowl and pheasant. As typical for corona viruses, recombination events often occur and the mutation rate is high, multiple antigenic types exist, and new types continuously emerge. Morbidity is close to 100%, but mortality varies with status of the birds, environmental factors, and viral strain. Secondary infections are common and can contribute to mortality. The virus is transmitted by direct contact between birds and indirectly through aerosols, faeces or contaminated fomites, infecting a new host via respiration or ingestion. The virus is, however, not regarded as persistent in the environment. Persistent, asymptomatic infection is common, while vertical transmission does not seem to occur. Backyard domestic poultry constitute a reservoir, but wild birds are also regarded to play a key role in the spread of IBV, and it is feared that infection in wild birds may predispose for recombination events, creating new and virulent strains, but disease outbreaks in wild birds have hitherto not been reported (Miłek and Blicharz-Domańska, 2018).

3.4.5 Avian encephalomyelitis

Avian encephalomyelitis is caused by a picornavirus called tremovirus A and is not listed by WOAH or EU. In the Norwegian Animal Health Regulation, it is listed under List 3.5. The virus can infect poultry, pheasants, partridges and probably other birds, but antibodies have not been found in field surveys of passerines. Infection in pheasants is characterized by central nervous disease, causing shivering, weakness and problems with walking and standing (Welchman et al., 2009). Morbidity and mortality may be high in outbreaks in captivity. Both horizontal and vertical transmission (i.e. transmission with eggs) occur. Faecal-oral transmission is important. The virus is relatively persistent in the environment. Antibodies combatting the virus were common in a Finnish survey of backyard poultry (Pohjola et al., 2017). Little is known about virus occurrence and potential for disease in wild birds in Scandinavia.

3.4.6 Avian metapneumovirus

Avian metapneumovirus is a paramyxovirus. Infection may lead to respiratory disease and reproductive disorders and predispose to secondary infections. Avian metapnemovirus-associated disease has been described under labels such as "turkey rhinotracheitis", "swollen head syndrome" and "avian rhinotracheitis". Turkey rhinotracheitis is listed by WOAH and listed in the Norwegian Animal Health Regulation (List 2.6), but not categorized in EU regulations. Several species may be affected by metapneumovirus infection, among them pheasants (Gough et al., 1988; Ogawa et al., 2001). Transmission seems to occur through direct contact. There are no reports of vertical transmission or long-term persistent infection.

The subtype associated with disease in pheasants, has been detected in mallards, greylag geese and common gulls in the Netherlands (van Boheemen et al., 2012). Little is known about virus occurrence and potential for disease in wild birds in Scandinavia but, based on presence in water-birds in the Netherlands, it should be expected that this virus may also be present among migratory birds in Norway.

3.4.7 Marble spleen disease

Marble spleen disease in pheasants is caused by an adenovirus closely related to turkey adenovirus 3, the etiological agent of hemorrhagic enteritis in turkeys. The disease is not notifiable, but widespread in areas where pheasants are common. Clinical infection typically affects 3-8 month-old birds and is regarded as an acute respiratory disease with high morbidity and moderate mortality. A mottled, enlarged spleen is a typical finding at necropsy. Asymptomatic, persistent infection with fecal virus shedding is common. Survivors often suffer from secondary infections. Transmission is believed to be mainly fecal-oral, but aerosol transmission cannot be excluded. Vertical transmission is not regarded to occur. The virus is persistent in the environment. Serologic surveys have not revealed infections in non-galliform birds.

3.4.8 Salmonellosis (Fowl typhoid, pullorum disease and paratyphoid salmonellae)

Salmonellosis of warm-blooded animals is caused by one of above 2,500 serovars of the bacterium subspecies *Salmonella enterica* subsp. *enterica.* In birds, the host-specific *S. enterica* subsp. *enterica* serovar Gallinarum causes fowl typhoid in mature individuals, while *S. enterica* subsp. *enterica* serovar Pullorum causes pullorum disease in chicks. Both these diseases are listed by WOAH. Other serovars, often called paratyphoid salmonellae, mostly cause low-grade disease and persistent infection in immunocompetent individuals, but may lead to foodborne disease in, for example, humans consuming infected birds, eggs or contaminated bird products. Infection with paratyphoid serovars is not listed by WOAH, but all types of salmonellosis are notifiable according to the Norwegian Animal Health Regulation (List 2.1) and listed as Category D in EU regulations when found in chicken, turkey, guinea fowl, quail, pheasant, partridge or domestic ducks.

Salmonellosis is common in poultry production around the world, but Norway, Sweden and Finland represent exceptions, having low occurrence (SVA, 2022). According to continuous surveillance programs, including all breeding and commercial-production poultry flocks, estimated prevalence in food-producing fowl in Norway has been below 0,5% every year since 1996 (Heier et al., 2022). Sporadic cases of pullorum disease have, however, been observed in backyard domestic-poultry flocks in Sweden from time to time, last reported in

2017. Pullorum disease and fowl typhoid are also uncommon in other countries of Western Europe, but highly prevalent in other parts of the world. Poultry production in other countries may consequently be regarded as the main potential reservoir for fowl typhoid, pullorum disease and most paratyphoid serovars. Transmission is, thus, most likely to occur through importation of contaminated food. Outbreaks with *S.* Typhimurium - involving small passerines or hedgehogs - are, however, sporadically observed also in the Nordic countries and are believed to arise from these two wildlife reservoirs (Heir et al., 2002). These outbreaks may spill over to carnivores such as foxes and domestic cats, also to production animals. The *Salmonella* status in backyard poultry and game-bird rearing facilities is not surveyed on a regular basis.

Different *Salmonella* strains vary greatly in virulence in different host species, from causing acute generalized disease with diarrhoea and septicemia to only just diarrhoea, or absence of clinical signs of disease. Environmental factors such as housing of birds of different ages together, large flock size, high rodent density, old housing facilities and outdoor access, predispose for infection. Pullorum disease was a major cause of mortality of chicks in the pheasant rearing industry in certain parts of England in the 1990s (Pennycott and Duncan, 1999). "Wild bird strains" of *Salmonella* are more commonly isolated from game-bird facilities than from poultry farms in Great Britain (Pennycott et al., 2006), presumably as a consequence of the closer contact between game-birds and wild birds.

Salmonella is shed in large amounts with faeces from infected birds and survives for months in humid environments, for example in bird litter, making environmental transmission plausible. *Salmonella* can also be transmitted from the ovaries to the eggs from infected birds, causing both vertical transmission from hen to offspring and potential for spillover to egg-consuming species.

The potential impact of *Salmonella* transmission from pheasants and partridges to wild birds is not known.

3.4.9 Infectious sinusitis – avian mycoplasmoses

Mycoplasmosis in birds is a range of diseases caused by different, relatively host-specific species of small bacteria without a cell wall. Several *Mycoplasma* spp. cause diseases in poultry, the most important being *M. gallisepticum,* which causes chronic respiratory disease in domestic hens and infectious sinusitis in turkeys, and *M. meleagridis* causing airsacculitis in turkeys. Avian mycoplasmoses are listed as notifiable according to WOAH, Norwegian (List 2.6) and EU-regulation (Categories D and E). The diseases are common in many countries, also in Europe, especially in backyard domestic poultry. Both *M. gallisepticum, M. meleagridis* and *M. synoviae* are surveyed in Sweden, and regarded to be present in backyard domestic poultry. In Norway, *M. gallisepticum* is surveyed in egg-and-meat production, in domestic hen and turkey-breeding flocks, while *M. meleagridis* is surveyed in turkey-breeding flocks, both as a part of the Certification program for poultry. No antibodies were found in 2021, or in 2022 thus far (Pers. comm. Silje Granstad, Norwegian Veterinary Institute, 25.08.2022).

In pheasants and partridges, infection with *M. gallisepticum* leads to “bulgy eye” disorder, i.e. infectious sinusitis. In addition, *M. synoviae* is suspected to cause disease. *Mycoplasma melagridis* is regarded to be host-specific to turkeys.

Infectious sinusitis in pheasants is a severe disease with high mortality. It is characterized by swollen, pus-filled sinuses, sometimes causing the bird’s eyes to close and making them functionally blind, and respiratory tract infection including airsacculitis. Horizontal transmission occurs both indirectly and directly, and during outbreaks aerosol transmission is of significance. Subclinically infected birds are epidemiologically important. The pathogen is also transmitted vertically with eggs. *Mycoplasma synovia* is considered to cause milder clinical signs, but may in addition to respiratory disease cause synovitis in joints and tendon sheaths.

The role of wild birds in transmission of *M. gallisepticum* and *M. synoviae* to galliform birds is uncertain. *Mycoplasma gallisepticum* and *M. synoviae* are found only at low prevalence levels in wild birds in Europe (Michiels et al., 2016). In North America, *M. gallisepticum* is regarded as the etiological agent of an epidemic of transmissible conjunctivitis in house finches (*Carpodacus mexicanus*) and other passerines. The epidemic emerged in 1994 and has spread over large parts of the USA and Canada, causing rapid declines of affected populations (Dhondt et al., 2005). It is suspected to be the result of dispersal from a single point of origin (Cherry et al., 2006), possibly a result of spill-over from domestic poultry (Dhondt et al., 2005). Such emergences of infectious diseases novel to a wild species rarely occur. The occurrence is expected to be more frequent when the captive and wild bird populations are in close proximity.

3.4.10Avian pasteurellosis and Fowl Cholera

Fowl cholera is caused by the bacterium *Pasteurella multocida.* The disease is notifiable to WOAH and listed under Norwegian regulation (List 2.6), but is not listed by the EU.

Infection may cause rapid septicemia and death, but some birds survive and develop chronic disease. It is suspected that asymptomatic carriers can be the source of outbreaks, both in wild and captive birds. Fowl cholera is defined as infection with *P. multocida*, causing acute disease and high mortality. Infections with less virulent strains of the same bacterium are consequently defined as avian pasteurellosis. Avian pasteurellosis occurs sporadically in poultry in the Nordic countries.The last case of fowl cholera in Norway was diagnosed in 2006. Transmission can be both directly and indirectly horizontal, while vertical transmission does not seem to occur. The pathogen survives long periods in the environment. All bird species are regarded as susceptible, but different strains may cause different diseases in different species. Large outbreaks with high mortality have been recorded among pheasants. Similarly, large outbreaks with thousands of dead birds are occasionally observed in wild birds, waterbirds in particular. Outbreaks involving nesting eider ducks (*Somateria molissima*) and gulls with *Pasteurella* strains, similar to those found in backyard domestic poultry, were reported from Denmark in 2001 (Pedersen et al., 2003).

Endemic diseases

3.4.11Rotavirus enteritis

Rotavirus infection is a common cause of enteritis and diarrhoea in young birds (3-14 days old) in captivity. The virus is easily transmitted, and mortality can be high. In addition, infected chicks are susceptible to secondary enteric infections, and will often experience severe setbacks in growth. Viral enteritis is often related to suboptimal management and can be minimized or prevented by good hygiene and biosecurity. Rotaviruses are often regarded as species-specific, but some research indicates that the species barrier, for example between galliform species, is not complete. Rotaviruses are often isolated from healthy birds, and have even been found in healthy wild pheasants (Ursu et al., 2011), indicating that the virus is ubiquitous. Transmission is faecal-oral, though isolation of virus from three-day-old chicks has raised suspicion of vertical transmission. In the current context, rotavirus infection may first and foremost be regarded as a welfare problem for pheasants and partridges.

3.4.12Necrotic enteritis

Necrotic enteritis is caused by toxin-producing strains of the ubiquitous bacteria *Clostridium perfringens*. This disease was a major problem when captive breeding of capercaillie (black grouse and ptarmigan) was explored in Norway during the 1980s (Stuve, 1995; Stuve et al., 1992). The bacterium is found in soil and is common in the intestinal tract of healthy birds and mammals. It is spore-forming and consequently environmentally resistant. Sudden dietary changes, carbohydrate or protein-rich food, exposure to stressors and intestinal parasitism, in particular coccidiosis (see below), may predispose to clostridial growth and/or toxin production in the intestines, causing damage to mucosa and further invasion, for example into the liver. Exposure to stressors, poor hygiene and access to old litter or soil will promote disease. The disease typically manifests by way of acute mortality in juvenile birds, or a more protracted disease with diarrhea leading to death after approximately a week. Chronic disease is characterized by wasting and growth stagnation. In the current context, necrotic enteritis may first and foremost be regarded as a welfare problem for captive pheasants and partridges during rearing and release.

3.4.13Avian tuberculosis

Avian tuberculosis is caused by the mycobacterium *Mycobacterium avium* subsp. *avium.* The bacterium is ubiquitous in the environment and can survive several years in soil. The disease is notifiable to WOAH and is listed in the Norwegian regulation (List 2.6), but not listed by the EU. Pheasants and partridges are regarded as highly susceptible to this disease (Hejlicek and Treml, 1993), though the disease has been described in a wide range of bird and mammal species. Water-birds, birds associated with agriculture, gregarious birds, raptors and scavengers seem to be most at risk in the wild (Cromie, 2012). Infection may cause debilitating and long-lasting disease, affected individuals typically being older birds in very poor condition. Infected individuals with lesions in the gastrointestinal track can shed bacteria and contaminate their environment. If avian tuberculosis spread in a rearing facility is followed by release of the flock, these birds may shed mycobacteria in the environment and their carcasses later act as a source of infection for raptors and scavengers. Outbreaks of the disease in wild birds are rarely reported, though an event with mass mortality among lesser flamingos (*Phoeniconaias minor*) was associated with avian tuberculosis (Kock et al., 1999). Nevertheless, it should not be dismissed that, given a game-bird population with high prevalence, this type of infection has the potential to cause a hidden increase in morbidity and mortality in sympatric bird populations. In the current context, this infection is of importance, both as a welfare problem and as a pathogen that has the potential to affect biodiversity if it spreads from a rearing facility.

3.4.14Aspergillosis

Aspergillosis is caused by mould fungi of the genus *Aspergillus,* mainly *A. fumigatus.* The most common disease manifestation is infection of the lungs and air sacs, but this opportunistic pathogen may invade other tissues too. Acute disease is most commonly seen in young birds and may cause high mortality, while adult birds develop chronic and debilitating disease. An alternating wet and dry environment, high temperature, poor air circulation and mouldy litter or grain, predispose to formation of massive amounts of spores that are inhaled by the birds. High livestock density, and poor immune status, facilitate infection and disease. Aspergillosis is not a contagious disease *per se*, and the importance of the disease in this context is as a welfare threat among captive birds.

3.4.15Ascaris *spp.*

Infections with roundworms in the genus *Ascaris* are common in gallinaceous birds. They invade the mucosa of small intestines in young birds. Heavy infections may cause decreased weight gain and sporadic cases of intestinal obstruction. *Ascaris compar* is present in wild gallinaceous birds in Norway.

3.4.16Caecal worms

Caecal worms (*Heterakis gallinarum*) are nematodes that are very common in birds housed on a soil base or litter. They are not very virulent and must be present in large amounts to cause clinical signs of disease, which are reduced growth, wasting and poor reproduction. However, the nematode may function as a vector for the protozoan parasite *Histomonas meleagridis*, which is the causative agent of blackhead (see below). Caecal worms have a direct lifecycle, but may be ingested by and survive within earthworms for several years. Some studies indicate that the spread of caecal worms, from relatively unaffected pheasants to grey partridges, may cause a situation of apparent competition between the species (see section 3.2.8).

3.4.17Gapeworm

Gapeworm (*Syngamus trachea*) is commonly found in the trachea of a wide range of bird species, and is very common in captive pheasants and partridges. The parasite has an indirect lifecycle with earthworms as intermediate hosts. Pheasant poults are regarded as highly susceptible. Clinical disease manifests as respiratory distress with coughing and sneezing. However, even mild infections with gapeworm have been reported to cause reduction in body condition of released pheasants, and is proposed as an explanation of poor breeding performance and high mortality after release (Gethings et al., 2016).

3.4.18Capillaria spp. including Eucoleus contortus

Several species in the nematode genus *Capillaria* and the nematode *Eucoleus contortus* (syn. Capillaria contorta) may infect the mucosa of the crop, oesophagus or small intestines of gallinaceous birds. Heavy infection may cause disease. The parasites have an indirect life cycle with earthworms as intermediate host, necessitating access to soil for infection to occur. Millan et al., (2002) found that released pheasants that shed *E. contortus* eggs were more frequently taken by foxes than birds that did not, though no difference in condition was observed between the two groups.

3.4.19Histomoniasis – Blackhead Disease

Blackhead disease is caused by the protozoan *Histomonas meleagridis.* All gallinaceous birds are susceptible, but turkeys are regarded to be the most vulnerable. The disease may cause severe losses both in turkey and game-bird production. Outbreaks are common in Europe and mortality can be very high. Sporadic outbreaks are also seen in Norway (Gjerde, 2011). The protozoan has an indirect lifecycle within a nematode, *Heterakis gallinarum*. The nematode is the intermediate host of *H. meleagridis* and earthworms serve as the transport host of the nematode. After release from the nematode in the intestinal tract, tthe protozoan invades the mucosa of the caecum and subsequently the portal blood, ending up in the liver. The severity of disease relies on interaction between *Histomonas meleagridis* and intestinal bacteria. The clinical disease is characterized by yellowish diarrhoea and liver failure. Ducks and domestic hens can become infected and act as asymptomatic carriers, functioning as a disease reservoir. Transmission can be direct, but the protozoan may survive for several years within its nematode host or eggs, and the nematode may survive for several years in earthworms. The birds do not develop efficient immunity, such that disease can strike both young and adult individuals.

3.4.20 Coccidiosis

Coccidiosis is caused by protozoans of the genus *Eimeria.* These are parasites with a direct life cycle that infect and multiply the cells of the intestinal tract, thereby causing tissue damage and disease. Coccidiosis is a very common disease of captive pheasants (see for example Fulton, 2021) as it is contained in other poultry productions after the ban of commonly used coccidiostatics. Most *Eimeria* spp. are not transmitted between host species. It should be noted, however, that an *Eimeria* isolated from capercaillie and black grouse, seems to be very similar to *Eimeria* isolated from pheasants (Stenzel et al., 2019). Several different *Eimeria* spp. may cause infection and disease in pheasants and partridges, and co-infections occur. Signs of disease and mortality vary, but is typically characterized by watery or whitish diarrhoea. In severe cases a large proportion of the birds may die, and the survivors will show low growth and ill-thrift. Infected individuals shed large amounts of oocytes that survive well in the environment.

3.4.21 Ectoparasites

Multiple ectoparasites can infest pheasants and partridges. Infestation loads will typically be highest in dense populations and debilitated individuals. Mites are typical parasites of pheasants, including the very common red poultry mite (*Dermanyssus gallinae*), northern fowl mite (*Ornithonyssus sylvarium*), scaly leg mite (*Knemidocoptes mutans),* feather mites (fe.g. *Megninia* spp., *Pseudolichus phasiani* and *Syringophiloidus* sp.) and chewing lice (e.g. *Goniocotes chrysocephalus, Goniodes colchici, Lagopoecus colchicus, Amyrsidea megalosoma, Amyrsidea perdicis, Lipeurus maculosus, Cuclotogaster heterographa*) (Dik and Uslu, 2006; Gassal, 2004; Goldová et al., 2006). Grey partridges can also be infested with red poultry mite and northern fowl mite, in addition to multiple species of the more species-specific chewing lice (Oncel, 2011). Red poultry mites and northern fowl mites are hematophagous (suck blood) and can cause anaemia, while the other ectoparasites may to varying degree cause pruritus and irritation. In Norway, the mites are common in both industrial poultry production and backyard domestic flocks, and should be expected to be common in reared game-bird flocks in Norway. The darkling beetle (*Alphitobius diaperinus*) may be found in large numbers in poultry houses. The beetle is omnivorousand may food on dying birds, but their main role in this context is that they may maintain circulation of pathogens such as *Eimeria* and *Salmonella.*

The probability of introduction of infectious agents may be low in each case of import, but high in a longer time perspective and with repeated imports.

The risk of transmission of disease between captive flocks of common pheasants or grey partridges in Norway

Hazard characterization

There are no studies describing the probability or impact of transmission of infectious disease between game bird facilities in Norway. Case studies of outbreaks of infectious disease in facilities in UK highlight that contact between facilities is a risk factor. This is also a well-known phenomenon from general knowledge of veterinary epidemiology. As described with regards to probability of introduction of pathogens with import, several important diseases can be transmitted with asymptomatic carriers, i.e., live birds that are infected but not show obvious clinical signs of disease. Some pathogens can also be transmitted vertically, i.e., with eggs and newly hatched chicks. As described in section 3.4.1, many pathogens are environmentally persistent and can be transmitted between facilities with animals, people, vehicles, clothes, transport boxes, equipment and utensils.

Poor biosecurity measurements, high bird density and outdoor facilities that enable contact with wild bird populations in the facility of origin constitute hazards for transmission of disease from one facility to another. Such circumstances have been described as typical for the game bird industry in UK (Brookes et al., 2022). There has not been any systematic investigation of Norwegian game bird facilities.

If a new pathogen or a new strain of a pathogen is introduced to an immunologically naïve herd, this may cause high morbidity and mortality. The high bird density, and the suboptimal building design and management procedures in many facilities (Brookes et al., 2022), will facilitate transmission between birds within a flock. This may augment the occurrence of pathogens in the environment, facilitating further spread in wild bird populations and to domestic poultry. Likewise, high burdens of parasites and other non-listed pathogens, may constitute a hazard for the welfare of the birds during both rearing and release (3.1.1), also for local impact on biodiversity through disease transmission to native species (section 3.2.4) and pathogen-mediated competition (section 3.2.8).

Summary of hazard characterization

The impact of spread of infections among captive flocks will most probably only be local and hence **"Minor"**, but in the case of a highly contagious and virulent pathogen the impact on animal health in the flock may be **"Moderate"** to **"Major"**, depending on the pathogen and the affected flock and facility (individual characteristics as immune status and condition and management factors). High burdens of disease in a flock may have major impact on animal welfare and increase the probability of spread to wild birds and pathogen-mediated competition, both from the facility and after release.

Likelihood

The likelihood of spreading disease between captive flocks of common pheasants and grey partridges will be lowest for fertilized eggs, greater but still low for recently hatched chicks, then increasing with advancing age as maternal immunity diminishes and days of potential hazards increases. The likelihood also increases with an increasing number of birds and repeated moving of birds over time. The likelihood of spread of a highly contagious and virulent pathogen is assessed to be **"Unlikely"** for each event of contact between facilities, but **"Likely"** in a longer time perspective. This assessment is made with **"Medium"** confidence. It is important to note that the occurrence of high pathogen loads among common pheasants and grey partridges kept in large flocks in captivity will further affect the likelihood of spread.

Risk characterization

The risk of spreading infection between different captive flocks of pheasants/partridges in Norway, especially relating to the transfer of live animals, and eggs for hatching between captive flocks, is assessed to be from **"Low"** to **"High"** (see Figure 3.4-1).

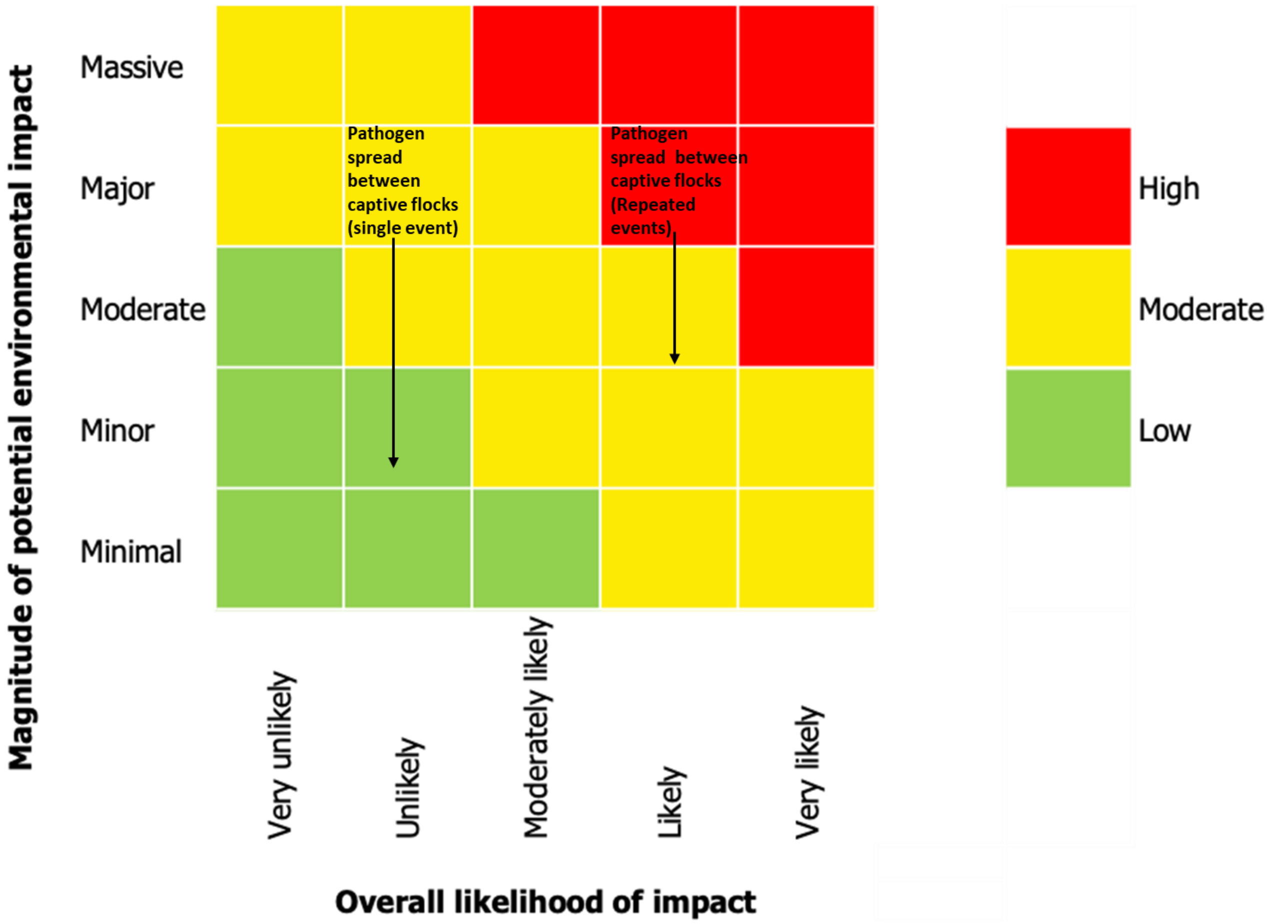

Figure 3.4-1 Risk characterization matrix of the spread of pathogens between captive flocks of birds in Norway. Arrows indicate the range of potential impact that caused by the spread of pathogens between captive flocks, with the spread of a highly contagious pathogen potentially causing a major impact, whereas a less contagius pathoghen is likely to result in a more moderate or even minor impact.

3.5 Probability of introduction of infectious agents with import of pheasants and partridges

There are no studies specifically describing the probability of introduction of infectious agents with import of game birds from Sweden to Norway. Based on data describing occurrence of infectious disease in the two countries, knowledge about the transmission and epidemiology of these diseases and environmental factors present in Norway and Sweden, import of common pheasants and grey partridges from Sweden to Norway may imply increased probability of introduction of pathogens to the receiving facility/facilities (compared to transport from facilities within Norway). Particularly if the Swedish facilities the birds originate from are located in southern and eastern parts of the country and in vicinity of locations visited by many migratory birds (see section 1.10). The presence of free-living populations of common pheasant and grey partridges around the facility of origin will also increase the probability of infection in the transported birds and thereby the probability of introduction.

Failure of detection of disease and subsequent import of asymptomatic carriers can occur with many of the listed diseases, for example Newcastle disease, avian influenza, infectious laryngotracheitis, infectious bronchitis, marble spleen disease, salmonellosis, mycoplasmosis, pasteurellosis and avian tuberculosis. Vertical transmission with eggs is known to occur with for example, avian encephalomyelitis, salmonellosis and mycoplasmosis. Notably, when less than 20 birds/eggs are moved, they can also be bought from non-approved establishments that are not under continuous surveillance (see Appendix 1), which furthermore will increase the uncertainty about the disease status of the birds and the probability of introduction of infectious agents.

3.6 Animal welfare aspects related to rearing, transport and release of pheasants and partridges

3.6.1 Transport

Putative stressors related to transport are exposure to handling, novelty, variable temperatures, and food and water deprivation. More specific descriptions of stressors would have to be based on specific knowledge relating to the various handling routines that are used for transporting pheasants and partridges in Norway.

3.6.2 Rearing conditions

Although there are many studies on how rearing conditions influence welfare of laying hens, there are few studies focusing specifically on the pre-release welfare of game-birds. One study showed that the mortality of reared pheasants during the first six weeks after hatching was 5% (Djordjević et al., 2010). Another study conducted in Sweden (Groth, 2001) reported mortality between 3 and 35 % for pheasants and partridges during the period before release. The lower estimates of mortality are about the same level of mortality typically observed for the whole production cycle in domestic laying hens between about 16 and 76 weeks of age. Mortality itself is, however, an indirect measure of animal welfare as it does not reliably indicate the state of the bird during life, but does suggest problems from a view of animal welfare emphasizing biological function.

Regarding the physical environment, pheasants and partridges normally nest and brood in complex habitats (see section 3.1.4 (Haensly et al., 1987; Rands, 1988). Mean home ranges are rather large for both grey partridges [first 20 days of life]: 315 [± 41] m^2 and pheasants [for first 10 days of life]: 4.5 [± 4] ha (Green, 1984; Robertson, 1988). The birds also show high dispersal distances (daily movement: grey partridges: 108 [± 19] m; and pheasants: 75 [± 13] m (Green, 1984; Robertson, 1988) under natural conditions. This means that poults living in the wild experience a high degree of environmental complexity (e.g., woods, fields, fences and buildings) both in the area where they leave the nest, and the area into which they disperse with their mothers during the subsequent weeks (Madden et al., 2020). During rearing, captivity in a barren environment is likely to contribute to the development of feather pecking, aggression between poults and increased competition, in addition to deprivation of opportunity to perform natural exploratory behaviour in a complex environment.

Feather pecking in birds reared in an inappropriate environment is an example of abnormal behaviour. Several studies of feather pecking, have reported the plucking and eating of the feathers from the bodies of other birds (see review by Blokhuis, 1998 and references therein). Feather pecking is a consequence of life in a sterile environment that does not provide adequate stimulation, such that exploratory behaviour is redirected towards the feathers of other birds. Feather picking has negative consequences for later welfare through increased food uptake necessary for maintenance of body temperature under cold conditions. Typically, it is also associated with damage to the skin, inspiring aggressive attention from other birds. Mechanical anti pecking devices (bits) can be used in Norway, but only on a temporary basis as a last resort when other approaches fail. They prevent birds from expressing pecking behaviour without addressing the causes of the abnormal behaviour and they cause sores. They are therefore not considered a viable method for improving bird welfare.

Life in a barren environment may be associated with apathy, boredom and frustration. For pheasants, access to perches during rearing promotes increased and more prolonged perching behaviour, which is beneficial to fully-grown birds after release into the wild (Santilli and Bagliacca, 2017; Whiteside et al., 2016a). This culminates in a greater chance of survival the first eight months after release (Whiteside et al., 2016). In laying hens, access to perches during rearing is also associated with increased bone mineralization (Hughes and Appleby, 1989; Reichmann and Connor, 1977), bone mass (Shipov et al., 2010), bone volume (Hughes et al., 1993) and bone strength (Fleming et al., 1994). Pheasant poults raised with access to perches have thicker tarsal bones compared to those denied perching facilities (Whiteside et al., 2016).

Pheasants hatched in the wild remain with their parents for up to 70-80 days and even longer for red-legged partridges (Johnsgards, 1999). Madden et al. (2020) states that the absence of adult birds during rearing is likely to have wide-ranging and profound effects on the welfare of young birds following release into the wild. Through interactions with their parents, game-birds learn appropriate feeding behaviour (dietary preferences), social behaviour (social cohesion and interactions) and antipredator responses (which stimuli trigger a reaction and how to react). As an example, captive-reared grey partridges express lower levels of vigilance compared to parent-reared partridges (Dowell, 1990).

3.6.3 Post-release

Because early-life experience within a complex environment influences cognitive ability in adulthood, being raised in a barren artificial environment is likely to adversely affect the ability to locate resources, such as food and shelter, and avoid predation after release.

A review of welfare in game-birds released into the wild from 2020 indicated that there were no studies specifically documenting the welfare status of birds following release (Madden et al., 2020). However, based on animal welfare considerations, incorporating resource-based measures, the conditions to which birds are exposed provide information regarding welfare status. A number of rearing-related factors may be especially important for the welfare of birds following release. These include exposure to adult birds during rearing, appropriate bird densities, appropriate group sizes, naturalistic diets and naturalistic physical environments (reviewed by Madden et al., 2020). Post release, the birds may be subject to hunger, thirst, and associated malnutrition if they are not provided with supplementary food, especially during those times they are simultaneously exposed to low temperatures. Exposure of birds to low temperatures during winter is likely to cause considerable stress during periods, leading to their eventual deaths. Exposure to wild predators is an additional stressor, exacerbated by the exercise of dog training as outlined below.

At group sizes and bird densities larger than those observed under natural conditions (see sections in intro), birds may experience social stress, develop abnormal aggressive behaviour and be forced to compete for access to resources such as food, heat sources and perches. Although it has not been studied specifically, the unnatural competition caused by high bird densities during early life, is likely to produce an adult phenotype less adapted to an adult environment in which these behaviours are not required. Indeed, a reduction in pheasant density from 4 to 0.7 chicks per m^2 had a beneficial effect on plumage condition (Kjaer, 2004).

Availability of insects (as a source of proteins) is not only important to young birds in the growing phase, but also for adult pheasants and partridges, particularly hens prior to egg laying (Hall et al., 2021; Madden and Sage, 2020). In all Galliformes, fast growth of wing-feathers at an early age is important for their ability to fly and survive (Dial et al., 2006). Slower body growth also leads to a delay in the poult's. ability to regulate body temperature (Marjoniemi et al., 1995). This increases vulnerability to predation and to bad weather.

Several studies indicate high mortality for pheasants and partridges released into the wild following rearing in captivity. Although mortality in itself tells us little about the welfare status of birds, it does suggest birds have suffered exposure to a variety of stressors prior to death. A Spanish study on commercially reared 5-6 month-old red-legged partridges released in the fall over two seasons found that none of the 36 birds that were released survived until the following spring (Alonso et al., 2005). The survival period was estimated to be nine days in the first season and seven days in the second season. The cause of mortality was reported to be related to predation (72%), hunting (11%), and malnutrition/accidents/unknown cause of death (17%). From a Scottish study, it was reported that only 10% of 520 partridges survived until the next spring (Parish and Sotherton, 2007). The cause of death was reported to be related to predation by red foxes and birds of prey (82% and 55%, respectively, for two different locations). A study from Idaho, USA (Musil and Connelly, 2009) reported that pheasants that grew up in the wild had a seven times greater likelihood of survival from March to October and a ten times greater likelihood of surviving through the nesting season compared to birds reared in captivity. Causes of death were predation (unknown predator) 54 %, predation by mammals 26 %, predation by birds of prey 12 %, natural causes of death 4 %, and death caused by humans 4 %. Similar findings were reported from studies in Finland and indicate high mortality especially immediately following release into the wild for partridges reared in captivity compared to wild partridges (Putaala and Hissa, 1998).

3.7 Animal welfare related to hunting-dog training

Exposure to the pointing dogs induces fear, anxiety and pain (if birds are pursued, caught or shot), also disrupting behaviours such as foraging, social interactions and resting, in addition to a lack of responsiveness to wild predators.

Fear, anxiety and stress caused by exposure to wild (for example foxes and birds of prey) and domesticated predators (dogs), as well as the physical exertion required for flight responses, is associated with poor welfare and suffering. Classical stressors, such as intermittent exposure to predators, inhibit normal behaviour. Corticosterone secreted during and after exposure stressors inhibits anabolic and reproductive function, plus and inhibits activity in the immune system (see review by Sapolsky et al., 2000). If this is combined with an increased exposure to parasites and pathogens, the welfare of birds will deteriorate further. If birds are shot at or wounded this causes additional stress.

3.7.1 Measures that may increase the degree of survival for the birds.

To marginally improve a captive environment for pheasants and game-birds, food and water should be located at different locations in a large arena equipped with dustbathing substrates, barriers, perches and natural sources of green roughage as foraging materials (Madden et al., 2020).

A continuous, as opposed to an intermittent light cycle, was found to be associated with reduced feather pecking as well as an improved food conversion and body weight (Slaugh et al., 1990). Feather pecking in commercially-reared game-birds is typically prevented in the UK by fitting anti-pecking devices, but this causes head-shaking, scratching, nostril inflammation and bill deformities (Butler and Davis, 2010). Rearing with foster parents compared to artificial rearing reduced the tonic immobility responses of game-birds (Santilli and Bagliacca, 2019) indicating that rearing with older birds reduces fearfulness. It was also shown that early-life access to dustbathing substrates increases their use once adulthood is reached (Vestergaard and Bildsoe, 1999). Dustbathing is relevant because it is internally-motivated and is positively associated with improved welfare (Olsson and Keeling, 2005). Birds should be provided with food similar to that eaten in the wild, to ensure adaptation of their feeding behaviour to their living environment after release. Ideally, they should be intermittently exposed to simulated predator attacks, in an environment allowing them to develop adaptive predator responses (hiding places and space for flight) crucial for survival as adults.

Specific measures, relating to the effects of rearing on survival in fully-grown birds post release, are as suggested by Madden et al. (2020). These include exposure to adult birds during rearing, appropriate bird densities and group sizes, naturalistic physical environments and naturalistic diets (Madden et al., 2020). The rearing environment should be sufficiently complex to facilitate the development of physical fitness and cognitive abilities required during adulthood for the ability to escape predators, find hiding places, locate and use perches and locate food. In some cases, it may be necessary to find a compromise between promoting good welfare during rearing and adulthood. As an example, intermittent exposure to stressful stimuli during early life (such as simulated predator attack) may at least temporarily reduce welfare in young birds, but promote adaptation to the adult environment, thereby improving the welfare of adult birds at a cost to welfare in younger birds.

Recommendations for adult birds would include to avoid transportation, not exposing the birds to dogs in connection with training, and not releasing birds raised in artificial environments, that differ greatly from naturalistic conditions, into the wild. In addition, winter feeding should improve the survival of birds in the wild, but is likely to have a number of detrimental consequences. These relate to an increased density of birds in a small area, the spread of disease, predation on native wildlife, and increased susceptibility to local predation (see sections 3.2.4, 3.2.2, 3.2.7).

Uncertainties

Limited knowledge exists from Norway on the impact of the release of farmed common pheasants and grey partridges into a wild environment. Impacts are expected to be similar to those reported in studies from other countries, but there is uncertainty regarding the magnitude of the consequences.

There is limited information about how the captive populations of common pheasants and grey partridges are kept in Norway, and therefore uncertainty regarding the animal welfare of captive birds.

There is limited knowledge on how pheasants and partridges are reared in Sweden and Norway.

The understanding of the epidemiology of many diseases affecting common pheasants and grey partridges and the potential impacts of the spread of epidemic disease and/or increased levels of enzootic pathogens on wild bird populations is limited.

4 Conclusions (with answers to the terms of reference)

4.1 Impact on biodiversity after release

- **Assess the risk of negative consequences for biological diversity from releasing farmed common pheasants and partridges.**

There are, potentially, several negative consequences for biological diversity from the release of farmed common pheasants and grey partridges in Norway. The magnitude of impact depends upon the extent of the releases in numbers of birds, in geographic range and over time. VKM has assessed that the risk of transmission of disease to native species will vary from low to high risk (Figure 3.2.4-1), depending on the frequency of releases and the severity of the pathogen. Competition with farmland birds (many of which are in decline, Figure 3.2.1-1 and table 3.2.1), predation on invertebrates (Figure 3.2.2-1), impact on flora (Figure 3.2.5-1) will be of moderate risk. The risk of hybridization with native galliform birds (Figure 3.2.3-1) and predation on herptiles (Figure 3.2.2-1) by the released birds is assessed to be low. The risk of negative consequences will increase if birds disperse widely from the area where they are released. VKM finds it likely that the dispersal capacity of common pheasants exceeds that assumed in the Alien Species List assessment of 2018 (see section 3.1.1.1).

- **Assess whether there are other activities in connection with the release that can have negative effects on biodiversity. For example, extensive feeding.**

Feeding at the release sites will potentially attract predators, scavengers and other ground feeding birds, leading to increased abundance of pathogens that may spread to native species (see section 3.3). The extent of both feeding and predator control in Norway is not known. The risks of altered predator abundance (Figure 3.2.7-1) and disease-mediated competition (Figure 3.2.8-1) are both assessed to be moderate. Hunting in the release area (of both common pheasants, predators and scavengers) will inevitably result in lead pollution, but the extent is unknown.

- **Describe the species' possibility of survival in Norwegian fauna without repeated releases.**

The populations of both common pheasants and grey partridges are expected to decrease rapidly if the releases are discontinued, due to high mortality of the farmed birds in the wild (sections 3.1.1 and 3.1.2). For both species, there is a potential of immigration from Sweden, where the number of released birds is considerably higher (sections 1,.3, 1.4 and 3.1.3). Climate warming is expected to increase winter survival and distribution range and thus small populations of common pheasants and grey partridges will presumably have the potential to survive even without further release.

- **Identify which species in Norway have similar ecological niches as pheasants and partridges, and assess whether they can be negatively affected by the release.**

Native species having niche overlap with common pheasants and grey partridges are listed in Table 3.2.1-1. Yellowhammers in particularly can be expected to be negatively affected by competition for food in the winter. The yellowhammer is the only species presented in Table 3.2.1-1 that is also a resident species like common pheasants and grey partridge, and it is listed as vulnerable in the national red list due to progressive population decline caused by reduced availability of (winter) food. Other threatened ground-nesting species, including northern lapwings (CR), Eurasian curlews (EN) and corn crakes (CR), could be negatively impacted by direct and indirect competition (disturbance, interspecific nest parasitism) during the period after release (see section 3.2.1).

- **Identify and evaluate possible risk-reducing measures.**

Reducing the extent of the releases of farmed common pheasants and grey partridges in numbers, frequency and geographic range would also reduce the negative consequences on biodiversity.

The fewer released birds that survive, the less negative consequences on biodiversity will be expected, hence, from a biodiversity perspective removal of all released birds after the period of dog training would be preferable.

Feeding will increase the survival of birds and increase the risk of spreading pathogens and impact other species. Feeding should therefore be avoided to minimize the impact on biodiversity.

Lower density of birds at release sites may prevent dispersal and thereby the geographic extent of negative impact on biodiversity and potential spread of disease to wild birds.

- **We request that the risk of negative consequences for biological diversity be assessed from a 50-year perspective.**

The more common pheasants and grey partridges that are released over time, the greater the risk of negative impact on biodiversity (see section 3.3.2). The risk of dispersal to new areas (and potential negative impact on ecosystems outside the release areas) will intensify with increased density of birds at the release sites, and also over time because of the warming winter climate.

4.2 Animal welfare related to the release of pheasants and partridges

- **Describe the natural habitat requirements of pheasants and partridges. To what extent are such habitats present in Norway?**

Both common pheasants and grey partridges prefer semi-natural habitats, which are on the Red List of nature types in Norway, and peripheral zones between semi-natural habitats and forest. Semi-natural meadows are found throughout Norway. However, this, and other semi-natural nature types, are threatened from both abandonment and agricultural intensification. It has been estimated that the total area of semi-natural meadows decreased by at least 50 % over the last 50 years and the decrease is expected to continue.

- **Describe mortality in a natural habitat without hunting, feeding or other artificial influences.**

The common pheasants and grey partridges that are released in Norway are from captive populations, thus assessment of their mortality in a "natural" habitat is not feasible. It is, however, well known that the released captive birds have higher mortality than wild birds (see section 3.1) and that Norwegian winters are challenging to the released common pheasants and grey partridges, particularly without feeding and predator control (3.6.3, 3.7.1)

- **Assess differences in mortality for pen-raised pheasants and partridges and wild-born pheasants and partridges.**

Numerous empirical studies have assessed that the mortality of captive-bred gamebirds is significantly higher than that of wild conspecifics (see section 3.1). The mortality is particularly high in the first period after release (see point below for details).

- **Describe possible causes of increased mortality for released pen-raised pheasants and partridges.**

Released pen-raised common pheasants and grey partridges will suffer higher mortality because of several factors related to a lack of experience with the natural environment during early life (see section 3.6.2). Furthermore, high pathogen loads as a consequence of being kept at high densities may affect the welfare of these birds (see section 3.2.8).

The main challenges for the birds are difficulty in locating, identifying and ingesting appropriate food and water and perching in suitable elevated locations during the night (section 3.6.3).

Furthermore, a lack of appropriate antipredator responses including both early detection of, and flight from predators, is likely exacerbated by inappropriate social behaviour and responses to social signals (see section 3.6.2).

- **Describe the potential strains the released birds are exposed to**

The most important strains released birds are exposed to include difficulty in locating food and water, resulting in hunger, thirst, and associated malnutrition (section 3.6.3). Exposure to low temperatures during winter is likely to cause considerable stress and snow cover above 15cm makes it difficult to access food on the ground (section 1.5). Exposure to wild predators is an additional stressor, exacerbated by the exercise of dog training (section 3.7).

- **Assess the effects of dog hunting training on the birds' welfare**

Exposure to pointing dogs causes fear, anxiety and pain to the gamebirds used in training (see section 3.7). Their normal ongoing behaviour, such as foraging, social interactions and rest, and antipredator responses to wild predators, will be disrupted. If caught, the birds may suffer from injuries. In addition, the physical exertion required for flight responses when subjected to dog training, is likely to exhaust birds and cause depletion of resources necessary for maintenance and coping with other challenges.

- **If applicable, describe risk-reducing measures that may increase the degree of survival for the birds.**

Provide birds with a naturalistic environment during rearing to ensure maximal adaptation to life in the wild (see section 3.7.1) This involves exposure to adult birds during rearing, low bird densities, small group sizes, naturalistic physical environments and naturalistic diets. Recommendations for adult bird welfare involve not subjecting them to transportation, not releasing birds bred in artificial environments that differ greatly from naturalistic conditions into the wild and no exposure to dogs (section 3.7.1). Winter feeding could improve the survival of birds in the wild (see section 3.7.1)

4.3 Animal welfare related to rearing and transport of pheasants and partridges

- **Describe which environmental factors that are important for animal welfare in the rearing phase, both indoors and outdoors.**

Gamebirds need access to appropriate lighting and temperatures, clean air, good quality food and fresh water. They have internally motivated needs for foraging, locomotion, flight and exploration, resting when tired, drinking when thirsty and dustbathing at certain times of the day. In addition, birds have externally motivated behavioural needs, such as fleeing from approaching predators. Birds have a need to experience a balance between positive and negative emotions associated with access to appropriate resources and the ability to express natural behaviour. They have the need to predict and control their environments, as this will contribute to an experience of positive emotions (see section 1.9).

- **Describe measures that can improve animal welfare when keeping pheasants and partridges.**

This question directly overlaps with previous sections as welfare improvements could be made by not exposing birds to stress, including hunting-dogs, providing them with conditions that increase their survival, and covering their welfare needs both during rearing and after release into the wild. These aspects are thoroughly described and discussed in section 3.6 of this report.

- **Assess the strain associated with transport of pheasants and partridges.**

Putative stressors associated with transport are subjecting to handling, novel environments, variable temperatures, and food and water deprivation (section 3.6.1). Specific descriptions would have to be based on specific knowledge about the variety of routines that are used in Norway.

4.4 Animal health related to release, rearing, import and transport of pheasants and partridges

- **Assess the probability of introduction of infectious agents when importing pheasants and partridges from Sweden into Norway**

The probability of introducing infectious agents is higher when importing common pheasants and grey partridges from Sweden, than when transferring eggs or birds between facilities in Norway (see section 3.5). Clinical inspection will not necessarily reveal whether or not the birds carry pathogens that are able to establish silent infections (e.g., Newcastle disease, avian influenza, infectious laryngotracheitis, infectious bronchitis, marble spleen disease, salmonellosis, mycoplasmosis, pasteurellosis and avian tuberculosis). The probability of introducing infectious agents is lower for fertilized eggs, with the exception of diseases with vertical transmission (e.g., avian encephalomyelitis, salmonellosis and mycoplasmosis). The probability will increase with age of the chicks imported, and will depend on circumstances at the rearing facilities and under transport (e.g. density of birds, hygiene, contact with birds from other facilities, contact with wildlife, wild bird species and populations present at the location). Repeated imports will increase the probability for introduction of pathogens. See also Appendix I for a thorough description of the regulations concerning movement of animals.

- **Assess the risk of spreading infection between different captive flocks of pheasants / partridges in Norway, especially related to the transfer of live animals and eggs for hatching between captive flocks.**

There is a low to moderate risk of spreading infection between different captive flocks of pheasants/partridges in Norway (Figure 3.4-1). Spread of certain listed diseases (see section 3.4) may, however, cause major impacts on both game bird flocks, poultry production and vulnerable wildlife populations, and as such constitute a high risk if considered individually (Figure 3.4-1). The likelihood of spreading disease between captive flocks of common pheasants and grey partridges will be lowest for fertilized eggs, greater but still low for recently hatched chicks, and increasing with advance of the birds' age as maternal immunity diminishes and days of potential exposure increases. The likelihood also increases with an increasing number of birds and repeated moving of birds over time.

- **Assess the risk of captive flocks of pheasants / partridges spreading disease to wild birds, especially when the animals are released into the wild.**

The keeping of large groups of birds at relatively high densities outdoors enabling contact between captive birds and wild birds, increases the risk of exchanging pathogens. Contact at feeding stations or drinking facilities will further facilitate disease transmission. The risk of spreading pathogens from captive common pheasants and grey partridges to wild birds in Norway varies from low to high (see Figure 3.2.4-1). The consequences of such a spread will depend on the type of pathogen (see section 3.4). Highly virulent pathogens (e.g., avian influenza and Newcastle disease), have the greatest potential for spreading over large areas and may cause high mortality. The greatest impact can be expected if threatened native-species should become infected with such viruses. Some diseases may cause pathogen mediated competition between wild species and the released game birds, and many of the described diseases can have a negative impact on animal welfare of pheasants and grey partridges, both in captivity and after release.

Data gaps

- Very limited or no systematically gathered information exists on the practises concerning farmed gamebirds in Norway. This pertains to all aspects of acquiring, keeping, releasing and post release treatment/management of the birds.

- Peer-reviewed, empirical studies on the impacts of released common pheasants and grey partridges, relating to antagonistic interactions and competition for space and resources with native species, are lacking.

- There are limits to the knowledge relating to game-bird welfare because of the lack of systematic and comprehensive studies outlining the needs of game-birds

- No studies of impact on biodiversity from released common pheasants and grey partridges have been carried out in Norway, or under comparable conditions elsewhere in Fennoscandia.

- Limited knowledge exists about the occurrence (distribution, prevalence) of most of the pathogens and diseases described above, both in captive gamebirds, backyard poultry and wild birds. There is also limited knowledge about the host preferences and potential impact in different host species of the different pathogens.

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Appendix I

Regulations concerning movement of animals

The following section is meant to provide a background on how movement of animals is regulated with regard to preventive measures against introduction of disease. The text does not provide a full picture of an operator's obligations with respect to this, and the reader is referred to the mentioned regulations and the respective authorities to retrieve sufficient information.

In Norway, import (and keeping and release) of common pheasants and grey partridges is regulated by "regulation on alien species" (forskrift om fremmede organismer, FOR-2015-06-19-716). The regulation is authorized in the Nature Diversity Act (naturmangfoldloven, LOV-2009-06-19-100, https://www.regjeringen.no/en/dokumenter/nature-diversity-act/id570549/), which is a part of the environmental regulations and consequently not included in EEA. In addition, keeping of game-birds is regulated in the game regulation (viltforskriften, FOR-2020-04-01-565) stating that keeping of wild animals in captivity only is allowed when authorized by law or competent decisions authorized by law.

The regulation specifies which species that are allowed to be imported to Norway without a specific permit granted by the Environment Agency. Pheasants and partridges are not included in these lists, and anybody who want to import (keep and release) these game-birds have to apply for a permit (§ 6, 10). The Nature Diversity Act (§ 29 and 30) states that no permits may be granted if there is reason to believe that the import/release/trade will have substantial adverse impacts on biological diversity." According to § 24 in the regulation, the person responsible for import, trade, dissemination or release of alien species, is obliged to perform investigations to discover and install measurements that prevent spread of associated organisms that may cause harm to biodiversity. The application shall contain a description of which preventive measurements the operators plan in order to avoid potential risk of harm to biodiversity. On the animal health area, movement of game-birds and eggs within the EEA is regulated EEA-regulations and national regulations. The basis act is the Animal Health Regulation (dyrehelseforskriften, FOR-2022-04-06-631, implementing Regulation (EU) 2016/429). This act is supplemented by the Animal Movement Regulation (landdyrforflytningsforskriften, FOR-2022-04-07-636, implementing Regulation (EU) 2020/688) giving provisions on movement of terrestrial animals within the EEA and the Animal Traceability Regulation (landdyrsporbarhetsforskriften, FOR-2022-04-07-637, implementing Regulation (EU) 2019/2035) giving provisions on registration and approval of establishments keeping terrestrial animals as well as provisions on traceability of terrestrial animals. In addition, there are supplementing provisions concerning animal health surveillance in the Animal Health Surveillance Regulation (dyrehelseovervåkingsforskriften, FOR-2022-04-06-632, implementing Regulation (EU) 2020/689).

An important requirement is that operators only are allowed to move or receive kept terrestrial animals from another EEA-state if they come from establishments that are approved by the competent authority at the origin, namely the Swedish Board of Agriculture (Jordbruksverket) in Sweden and the Norwegian Food Authority (Mattilsynet) in Norway (Regulation (EU) 2016/429, articles 94(1)d) and 124(2)). The regulations emphasize the operators' obligation to take appropriate and necessary preventive measures to avoid spread of listed diseases.

On a general basis, movement between states is only allowed when the animals show no disease symptoms, when there have been no abnormal mortalities of undetermined cause, when no introductions of new individuals have been made for an appropriate time and when the establishment or any contact animals are not under any restrictions due to animal health issues (Regulation (EU) 2016/429, article 126 and 130). A shipping of poultry, including game-birds, is required to be accompanied by an animal health certificate issued by the competent authority at the origin that contains information that demonstrate that the birds fulfil relevant animal health requirements (Regulation (EU) 2016/429, article 143). Before signing such a certificate, the official veterinarian shall check health documents and production records kept at the establishment, check the identity of the birds and inspect the flock for signs of listed diseases. (Regulation (EU) 2020/688, article 91). This shall occur within the last 48 hours before departure of breeding birds, 24 hours before departure for day-old chicks and 72 hours for hatching eggs (within 31 days if monthly health inspections are carried out).

Approved game-bird establishments have a microbiological control programme for hygienic control and are under surveillance for *Salmonella* Pullorum and *S.* Gallinarum (Regulation (EU) 2019/2035, article 7-8 and Annex II, part 1-2) and avian influenza (Regulation (EU) 2020/689, Annex II, Part 1, Section 7.3d).

Participation in a health program is obligatory for all Swedish poultry breeding farms that shall export live birds or eggs (https://jordbruksverket.se/djur/lantbruksdjur-och-hastar/fjaderfan/sjukdomar-hygienregler-och-antibiotikaresistens).

Regulation (EU) 2020/688, article 34-40 describes specific requirements for movement of breeding poultry, day-old chicken and eggs between EEA member states. If the movement includes less than 20 individuals or eggs, it is allowed to move/receive birds also from establishments that not are approved. Movements of 20 and more birds or eggs is only allowed from approved game-bird establishments. The following criteria has, however, to be fulfilled in any case (shortened from the original text):

- the birds come from flocks which have been continuously resident in a single registered/approved (see above) establishment since hatching or for at least 21 days prior to departure;
- the birds come from flocks which show no clinical signs of listed diseases relevant for the species or where there is suspicion of such infections;
- surveillance has not detected infection with low pathogenic avian influenza viruses in the flock of origin of the birds during the last 21 days prior to departure;
- the birds have had no contact with newly-arrived poultry or with birds of lower health status during the last 21 days prior to departure;

- the exported birds or, in case of export of hatching eggs, the flock have been subjected to tests for infection with *Salmonella pullorum*, *S. gallinarum* and *S. arizonae* and for avian mycoplasmosis (*Mycoplasma gallisepticum* and *M. meleagridis*) within 21 days before transport with negative results.

Operators receiving animals from abroad are obliged to check the state of the animals, identification documents and animal health certificates and report irregularities to Mattilsynet (Regulation (EU) 2016/429, article 127).

A national provision in the Animal Movement Regulation (§ 22) regulates movements of game-birds and hatching eggs thereof within Norway. In this provision it is specified that (our translation): "Hatching eggs for the production of poultry to be released as game-birds and poultry to be released as game-birds must come from an approved or certified establishment or from a registered establishment where at least the following biosecurity measures are taken:

a) The birds are fed and watered under roof.
b) Visitors wear coveralls and staff wear suitable work clothes and act in accordance with hygiene rules drawn up by the operator.
c) The birds are kept in rooms or enclosures that prevent the birds from coming into direct contact with wild animals and are emptied of birds at least once a year. During the empty period, the rooms or enclosures, as well as equipment used there, must be cleaned and disinfected."

Consequently, there are no obligatory requirements for testing for infectious disease or for a health certificate from an official veterinarian when birds or hatching eggs are moved within Norway.