NATIONAL VETERINARY INSTITUTE

SVA report 73:2022

LARGE CARNIVORES 2021

ONE HEALTH: HEALTHY ANIMALS, SAFE HUMANS, SUSTAINABLE FUTURE

The National Veterinary Institute (SVA) is an expert authority with the overall mission to work for the health of animals and humans, as well as for good practice, management, and environment for animals. With healthy animals, good animal practice, and a sustainable use of our resources, human health and a healthy ecosystem can be promoted. This is also called "One Health". To work with a holistic view where all species and habitats are managed as interlinked entities is not a new concept but has become increasingly important with accelerating interactions between humans, animals, plants, and the environment.

The human population is increasing in numbers and geographic spread, and more humans come in contact with animals. This contact can be positive in many ways, but increased contact also means more opportunities for disease to spread between animals and humans. Climate change, loss of biodiversity and large-scale land usage creates new conditions and possibilities for diseases to spread. The possibility of humans, animals, and products to move fast in contemporary society also contributes to the rapid and far-reaching spread of diseases.

Authors: Minerva Löwgren, Erik Ågren, Linda Thelin

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NATIONAL VETERINARY INSTITUTE

address: ulls väg 2 B **address**. 751 89 Uppsala **telephone**. +46 18 67 40 00
e-mail. sva@sva.se **web**. www.sva.se

Content

Introduction

Handling carcasses and samples from dead specimens of the four large carnivores brown bear, wolverine, lynx, and wolf is part of the assignment from the Swedish Environmental Protection Agency (NV-08983-19) to SVA. This annual report presents results from the activities carried out under this assignment in 2021. The Wildlife section of the Department of Pathology and Wildlife Diseases at SVA is responsible for handling and compiling samples and data from dead large carnivores. This report summarizes the work and presents results from each species separately.

The report contains information on specific findings made when examining the dead carnivores. The individuals are referred to by a mortality ID, M-number, "M" followed by a unique six-digit serial number. This ID is used for the identification of dead carnivores in the carnivore database *Rovbase* used by the responsible authorities. In the public domain of the website www.rovbase.se, you can find public information about the carnivores, with entries made by the County Administrative Boards, SVA, the Swedish Museum of Natural History, and others.

The results of this report refer to all carnivores submitted to and registered at SVA during 2021 – not necessarily all animals that died during the calendar year. This is relevant to keep in mind when reading, as, for example, some organ samples from the bear hunt in 2021 were received in 2022 and are thus registered for 2022. Similarly, fallen wildlife or skeletal parts found in the wild are recorded the year they were received by SVA, which is not necessarily the same year they died.

When monitoring mortality in wildlife, it is known that many dead animals are never found. Therefore, it is not possible to accurately say what percentage of a population dies from different causes. However, with a similar monitoring system and effort over several years, variations in mortality for specific reasons can be compared over time. All mortality figures in this report are thus based on the animals recovered and submitted to SVA for examination, and not as a proportion of the entire population.

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Minerva Löwgren, Veterinary Officer
Erik Ågren, Head of Section of Wildlife, Veterinary Officer
Linda Thelin, Coordinator Large carnivores, M.Sc. Biologist

Summary

THE FOUR LARGE CARNIVORES

In 2022, SVA registered 837 entire carcasses, or parts, of large carnivores.

Brown bear (*Ursus arctos*)

In 2021, 596 whole carcasses or parts of bears were received by SVA. The majority were received as a result of management-related measures, such as license hunt or culling. Four were shot in self-defence. For fallen wildlife, traffic accident was the most common cause of death. For one bear, the cause of death could not be determined. Five bears were admitted as forensic cases. Necropsy findings in bears were mainly fresh or older traumatic injuries. Other minor findings, such as a malformation, parasites, and dental health issues, were also made. Based on the examined material, the bear population is considered to have a good health status.

Wolverine (*Gulo gulo*)

In 2021, 16 wolverines were received, of which thirteen were from protective culling and two from traffic accidents. One animal was received as a forensic case. Necropsy findings were minor old traumatic injuries or remarks on dental health. Too few animals have been examined to assess the overall health of the wolverine population.

Lynx (*Lynx lynx*)

168 lynx were received by SVA in 2021. Most were skinned carcasses from the license hunt or protective culling. In the fallen wildlife category, traffic accident was the most common cause of death. There were also deaths from starvation or predation. In one lynx, the cause of death could not be determined. Minor malformations as well as fresh and old lesions of natural or human origin were seen. In addition, dental lesions and several species of parasites were found. The health of the lynx population is considered good, except that sarcoptic mange occurs regularly.

Wolf (Canis lupus)

In all, 57 wolves were admitted to SVA 2021, the majority of which were from the license hunt and protective culling. Of fallen wildlife cases, traffic accidents were the most frequent. In three wolves, the cause of death could not be determined. Two wolves were admitted as forensic cases. Findings of malformations, disease, old natural and human-caused injuries as well as the presence of parasites were in most cases minor necropsy findings. Based on these cases, the wolf population is considered to have a good health status, but notable is a high prevalence of cryptorchidism.

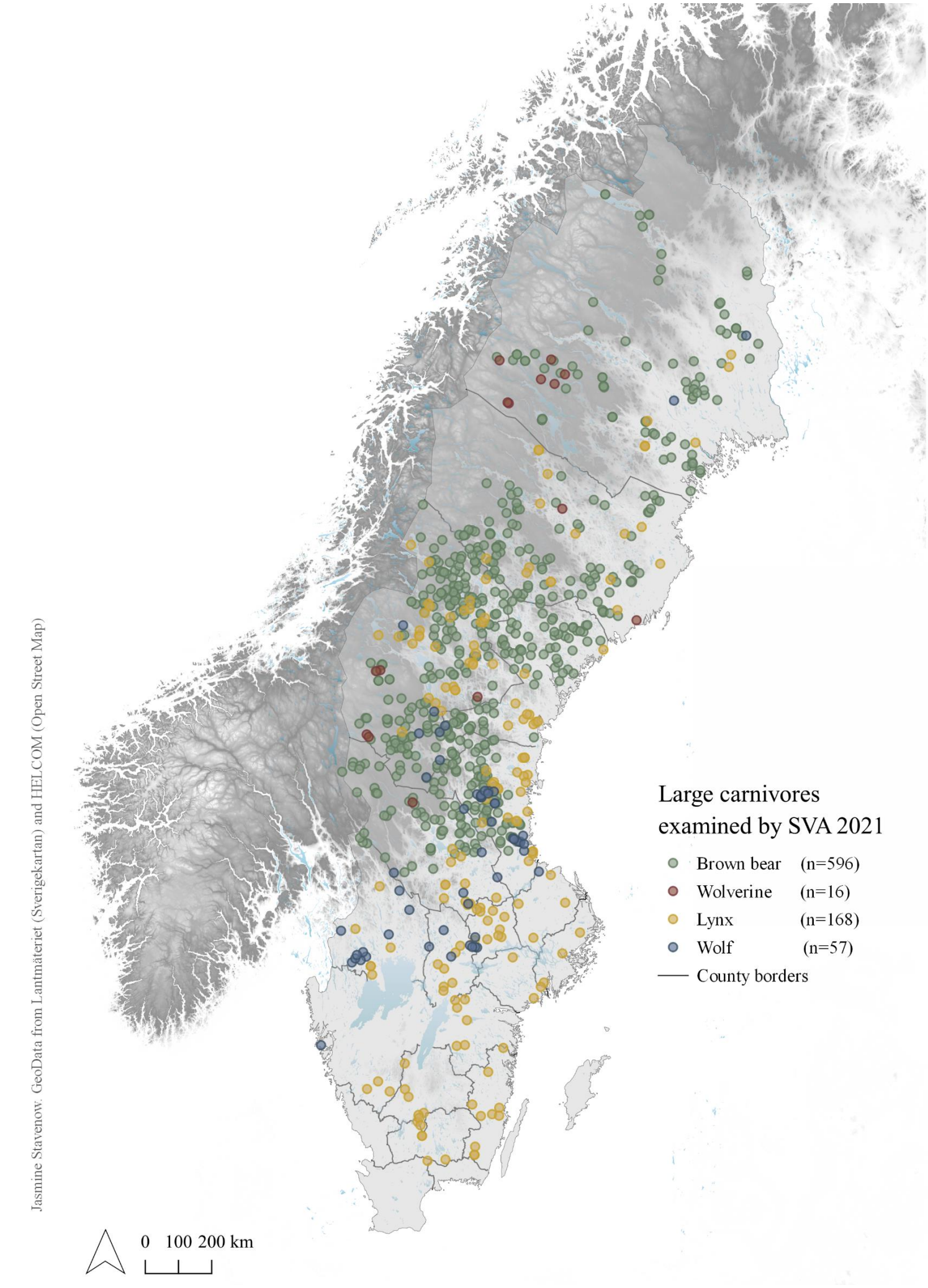

Figure 1. Map of Sweden with locations of dead and hunter harvested large carnivores submitted to SVA in 2021.

Analyses at SVA

SVA monitors health, causes of death, and diseases in large carnivores by sampling and collecting data on all dead large carnivores. Several samples and data are important for the management of these populations. Collected material and data are also used in ongoing research and saved for future research on various topics, as well as being added to national scientific museum collections. Routines for sampling and data collection are similar for all carnivore species, with only some differences. The overall framework for SVA's monitoring and collection is described below.

ESTABLISHING CAUSES OF DEATH

Fallen wildlife, except traffic

Carnivores that die of natural causes are called fallen wildlife. These include infectious or spontaneously arising diseases, emaciation, accidents, and predation. Since some of the fallen wildlife is never found, it is not possible to say with accuracy what proportion of an entire populations actually dies from the various causes of death.

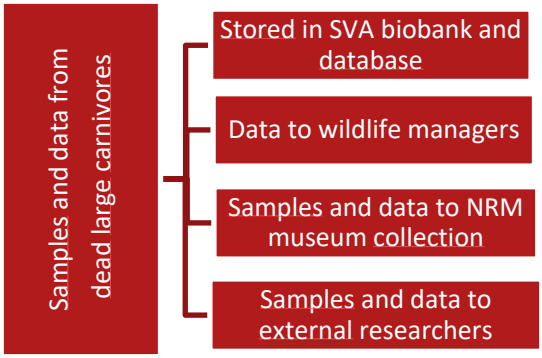

Figure 2. Schematics of what is done with samples taken at SVA. Illustration: SVA

However, with continuous and similar monitoring running over many years, it is possible to see trends in mortality from specific causes.

In some cases, it is not possible to determine a cause of death. This is especially the case if the carcass is too autolysed or only parts of the body have been submitted. Although the cause of death remains unknown, the submitted animal or animal parts nevertheless contribute with material and information that is important for disease surveillance, research, and management.

License and protective hunts, traffic

Animals that are culled due to management decisions or die of other human-related causes, such as traffic accidents, are equally important to investigate as these carcasses usually represent animals that are healthy and in good body condition. The necropsies contribute with knowledge on normal variations in the population and changes in trends can therefore indicate shifts in the environment or health status. These carcasses also contribute with important material and data for carnivore management and research.

MINOR FINDINGS

At necropsy, in addition to the cause of death, minor changes and incidental findings not involved in the cause of death are also noted. These may be minor malformations, fresh or old lesions or injuries, signs of other disease, parasites, or other findings. In the licensed bear hunt, only a set of tissue samples are received per bear and therefore not all lesions or changes can be detected. However, the County Administrative Board inspectors document obvious lesions on the carcass after a bear has been culled. It is not possible to establish what exact proportion of the population is affected by various ailments but the incidence of a disease or diagnose can be compared over time.

SAMPLING

For all large carnivores received at SVA, a range of tissue samples are taken when possible: spleen, liver, kidney, lung, muscle, intestine, blood, urine, reproductive organs, skin, fat and a tooth. Other samples are taken for some of the species, or for verifying any

suspected diagnosis. The samples are stored in the SVA biobank for further studies or sent to various research projects and to the Swedish Museum of Natural History. Some samples are used to provide data for the large carnivore management. For example, a muscle sample is sent for genetic analysis to identify each individual and a tooth is sent to age the animals.

In licensed hunting of bears (and in some cases in protective hunting since 2021), the animal is not received by SVA as a complete carcass, but as a set of tissue samples. A comprehensive disease surveillance of these individuals can therefore not be done. The samples are taken locally by an inspector from the County Administrative Board and submitted to SVA. The types and number of samples taken during license hunting may vary. In 2021, the sampling routines were revised. A minimum sampling was done for all bears and a more extensive sampling only in one out of every three culled bears. Read more under "License hunting" on page 6.

AGING

At necropsy, the carnivores are aged as cub-of-the-year, yearling, or adult by assessing body size, genitals, dentition, skeletal growth plates, and presence of thymus (which atrophies at sexual maturity). The exact age in years cannot be determined at necropsy. A section of a tooth root from each carnivore is therefore sent to a laboratory specializing in age determinations of wildlife in the United States: Matson's Laboratory. By counting the number of annulations in the tooth cement layer, a more exact age can be assessed, as the cement layer is denser after a winter season compared to the summer cement layer. The age results are used for population management and research.

REPRODUCTION

Uterus, ovaries, testicles, and vas deferens are used for reproduction studies and as an indication of the reproductive history of the females by noting placental scars in the uterus. If clear scars are present, it is an indication that she recently has been pregnant.

The presence and appearance of cysts on the vas deferens is checked on sampled testicles. The placement and size of testicles to diagnose cryptorchism is also noted. Different sized testicles, or underdeveloped testicles, as well as cryptorchism can be signs of reproductive disorders.

MEASUREMENTS

All animals are measured and weighed. The data makes it possible to sum up the hunting results and gives a proxy for the quality of the carnivore populations. Measurements and weights are also basic data that are used in most research studies, as it is important to know the body condition and measurements in relation to body weight. Measurements are also used to describe the species in national museum collections, as well as being parameters that can be used to determine the age of the animal.

FORENSIC INVESTIGATIONS

Approximately, 10 to 20 carnivore cases are received as part of forensic investigations, where there is a suspicion of felony. Ongoing preliminary investigation cases are confidential.

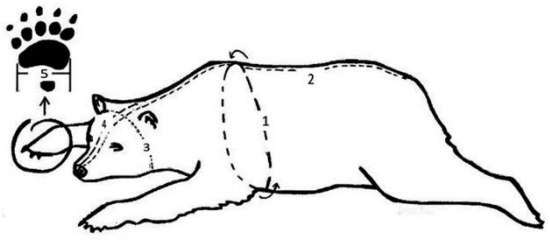

Figure 3. Graphics showing the measurements taken on a bear carcass. Illustration: SVA

BROWN BEAR

SUMMARY

In 2021, entire carcasses or parts of 596 bears were sent to SVA. The majority of these came from license hunting (78%) and protective hunting (19%). Other causes of death were traffic accidents (2%) and self-defence shooting incidents (>1%). In one bear, the cause of death could not be determined. Five bears were filed as classified cases. The health status of the bear population, based on the surveys of whole-body bears, is considered good.

MANAGEMENT HUNTING

Licensed hunt

The number of bears received from licensed hunting in 2021 was 463. The number refers to the number of bears whose bodies and organ samples were submitted to SVA during 2021 – which is not necessarily the same number of culled bears this year. This is because samples may be submitted to SVA after the turn of the year and are then registered in the following year.

From the licensed bear hunt, only tissue samples, not whole carcasses, are sent to SVA for analysis. The samples are taken by the county administrative board inspectors, who also note any obvious findings on the animal. For the 2021 bear hunt, sampling instructions were revised to optimize available resources, as the quota increased from around 300 to nearly 500 bears that could be harvested. All culled bears were subject to a minimum sampling protocol. An extended sampling protocol was carried out on approximately one in three culled bears, as well as in all bears tagged by the Scandinavian brown bear project. The minimum sampling protocol includes a number of body measurements, weight, two small teeth for age determination and research, muscle sample for genetic analysis, a hair sample, and a strip of skin as a reference sample. In the extended sampling protocol, additional tissue samples are also taken (genitals, mammary gland from females, colon, blood, lung). In addition, the presence of skin and intestinal parasites, injuries, and presence of fluid in teats in females is also noted. Some counties also had inspectors note gastric contents, to control for use of baiting stations in the hunt.

More details about bears culled in the license hunt can be found in the report *License bear hunting 2021* on SVA's website (in Swedish).

Protective hunting

During 2021, 111 bears were received as entire carcasses or as tissue samples sets from protective hunting. Of these, 63 bears were culled in Norrbotten County, 28 in Jämtland County, 12 in Västerbotten County, and 2 in Dalarna County.

Self-defence

During 2021, SVA received four bears shot in self-defence.

FALLEN WILDLIFE

Traffic accidents

Ten bears were received as traffic-related mortality. Of these, six had been killed by train and four by road traffic.

The difference in traffic mortality between years can depend on factors such as variations in bear population size or weather conditions. In snowy winters, more wildlife use railway tracks, resulting in train accidents and presence of carcasses of different species along the railroad. When bears emerge from hibernation, these carcasses are a readily available food resource, and more bears are killed by trains. However, variation between years is also probably coincidental.

Natural and other causes of death

Other causes of death in bears may be predation or disease. In 2021, no admitted bears had such causes of death. However, for one bear, the cause of death could not be determined. It was male bear cub (M526258) where neither sign of disease or trauma could be detected despite both detailed necropsy and histopathology.

NECROPSY FINDINGS

Acute and old lesions

Among the bears harvested in the license hunt, fresh or old injuries were documented by county administrative board inspectors in twelve bears. These injuries were mostly traumatic injuries, such as bites and lacerations likely from clashes with other bears, and wear and tear on the paw pads.

In other bears, old injuries or signs of old injuries were noted in two individuals. One was an adult female (M526088) with two severed claws that had regrown. The other was an adult male (M525981) with adhesions between the chest wall and lungs, most likely from an older injury.

Malformation

In an adult female bear (M526417) culled in the license hunt, a minor umbilical hernia was documented by the official inspector. This malformation had not affected her health.

Dental health

In total, seven bears had remarks on dentition. Tooth injuries and dental attrition often occur with old age. Five individuals had dental attrition. One of these (M526105), had such thin enamel that the teeth were red-coloured. Three bears had dental tartar, one in moderate amounts (M525907).

Parasites

Intestinal parasites are found in bears in certain geographical areas. In smaller amounts, they do not normally cause disease or lesions. The roundworm *Baylisacaris transfuga* is a nematode that has the brown bear as its main host. Eggs in bear faeces become larvae that can live several years outside the animal carcass. If the bear ingests something with larvae in or on it, the parasites develop in the bear intestine, mature, mate, and females secrete thousands of eggs.

Tapeworms (cestodes) in bears, unlike the roundworm, have an intermediate host in their life cycle. The eggs excreted with the faeces are eaten by an intermediate host, develop to a larval stage and when a bear eats the intermediate host, the larvae develop into adult tapeworms in the intestinal tract where new eggs are produced.

In 2021, intestinal parasites were noted in 26 individuals, either by the official inspectors at the licensed hunt or at necropsy at SVA. *Bayslisascaris* was noted in several bears from known infected regions, and four bears had tapeworms.

Other findings

In an adult male culled in protective hunting (M525967), a small loose piece of bone or cartilage was seen in a joint. In addition, in the previously mentioned male with thoracic adhesions (M525981), cholesterol crystals were seen in the heart muscle. However, this was a minor finding and probably did not have an impact on the health of the bear.

SEX-, WEIGHT-, AND AGE DISTRIBUTION

Of documented bears, 292 (49%) were females and 291 (49%) males. The remaining eight bears lacked gender documentation.

The body weight of registered bears varied widely. The smallest bear was a young-of-the-year weighing 2.5 kg, with undetermined cause of death (M526258). The largest was an adult male weighing 223 kg. The average weight of adult bears was 76 kg. Of examined whole carcase bears, 90 were assessed as adults and 36 as young-of-the-year cubs or yearlings.

WOLVERINE

SUMMARY

The least numerous large carnivore examined at SVA is the wolverine. In 2021, sixteen wolverines were admitted, most as entire carcasses. Thirteen were culled in protective hunting, two died in traffic accidents and one was a forensic case. Old injuries, parasites and minor findings were detected. The necropsied wolverines were in good health, but the number examined is too low to assess the overall health status of the Swedish wolverine population.

MANAGEMENT HUNTING

Protective hunting

In 2021, thirteen wolverines were received from protective hunts, decided by the county administrative boards. Seven were from Norrbotten County, five from Jämtland County and one from Västerbotten County.

FALLEN WILDLIFE

Road accidents

In 2021, two wolverines died in traffic accidents, one was an adult male from Västerbotten (M97362). The number of traffic-killed wolverines per year is usually very few, no more than two per year since 2009.

NECROPSY FINDINGS

Old injuries

One wolverine (M525527) had an old fracture that was not considered to be related to the cause of death. It was an adult female culled in protective hunting in Norrbotten County.

Dental health

Two female wolverines culled in protective hunting in Norrbotten county had remarks on dental health: (M525407) had a root tip abscess and (M525331) had dental attrition. Both were in good body condition.

Parasites

Wolverines usually do not carry parasites to the same extent as the other large predators. This year, tapeworms were found in one male culled in protective hunting in Jämtland County (M525521).

Other findings

Wolverines that are examined at SVA are generally healthy and this year no other notable findings were found in the animals that were examined.

GENDER DISTRIBUTION, SIZE, AND AGE

Five (31%) of the wolverines were females, ten (62%) were males. The smallest wolverine was an adult female from Norrbotten, weighing 6.7 kg (M5253301). The heaviest was a male from Västerbotten, weighing 16.2 kg (M525601). Both were culled in protective hunting. The average weight of wolverines was 12.4 kg. All wolverines were categorized as adults.

Figure 4. Wolverine. Photo: NTNU, Faculty of Natural Sciences, CC BY 2.0. Trimmed photo.

LYNX

SUMMARY

In 2021, 168 lynx were submitted to SVA. The majority of these were from management decisions, such as licensed hunting (47%) and protective hunting (17%). Traffic accidents were common (24%), where road traffic accidents were more common than train accidents. Other causes of death were predator-caused trauma and emaciation. One lynx was received without documentation, and the origin could not be traced back or confirmed. The health status of the received lynx was generally good, with the exception that sarcoptic mange is not uncommon.

FÖRVALTNINGSBESLUT

Licensed hunt

Eighty-one lynx were culled in the 2021 licensed hunt. Decisions on licensed hunting were made by the county administrative boards of Jämtland, Jönköping, Kalmar, Stockholm, Västerbotten, Västernorrland, Västmanland, Västra Götaland, Värmland, and Örebro.

In lynx hunts, the person with hunting rights in the area where the animal is culled is allowed to keep the lynx pelt and may have the cranium returned after examination at SVA. The skinned bodies are sent to SVA for necropsy. If signs of mange are noted, the whole skin or samples from affected skin are to be sent to SVA for analysis. Any fresh damages to claws or paws are to be documented by official inspectors. See the report "Licensed hunt of Lynx 2021" (in Swedish) on SVA's website for more details of the culled lynx.

Protective hunting

Twenty-six lynx were submitted from protective hunting in 2021. Of these, thirteen were from Jämtland County, eight from Norrbotten County, three from Västerbotten County, and one from Västmanland and Västernorrland Counties, respectively.

FALLEN WILDLIFE

Road accidents

After management-related culling, traffic accidents were the most common cause of death. In 2021, 42 lynx were killed in traffic - 29 in road traffic, 4 in rail traffic and 9 by unspecified traffic injury.

Other causes of death

Twelve necropsied lynx had starved to death, four of them from effects of sarcoptic mange. Several other lynx had died of emaciation as a result of traumatic injuries that likely made it difficult for them to hunt efficiently. One lynx (M526908) had starved to death as a result of a severe infection, see below.

One lynx had been bitten to death (M526147). The suspicion was that it could have been bitten to death by a dog, which was supported by findings at necropsy.

A lynx cub (M526916) was euthanized when her mother was killed in a traffic accident. For one lynx, the cause of death could not be determined as the body was very autolysed.

NECROPSY FINDINGS

Old injuries

Some old injuries were noted, mostly fractures or injuries to the extremities. One lynx had a healed fracture in a front leg that resulted in a shortened leg (M526931). Another (M525482) lacked the right front leg paw. In M526141, the left hind leg was deformed below the knee, see Figure 3. The misaligned leg may have been the result of a bone injury early in life that healed incorrectly, or possibly a congenital defect. The thigh muscles of this leg were also atrophied, suggesting an old lesion.

The lynx M526908 with a severe generalized infection due to a bite wound in the lumbar region with spread to several joints, died of starvation.

Figure 5. Abnormally bent left tibia and fibula in lynx M526141. Photo: SVA

One lynx carcass from the licensed hunt had an old shotgun wound. A shotgun pellet was found in the body, but the lynx had been killed with a rifle bullet.

Malformations

One lynx had both testicles in the groin (M526249), a condition called cryptorchism, when one or both testicles have not migrated down the scrotum as expected. Another lynx (M525566) had an underdeveloped testicle. Both testicles were in the scrotum, but one was abnormally small. Histological examination of the testicle indicated that the lynx was infertile.

Dental health

Twenty-six of the lynx had remarks on dentition, most notably broken teeth or missing teeth. Dental tartar and gingivitis also occurred in a few lynx.

Parasites

In 2021, tapeworms were found in 78 lynx (46%) and roundworms in 55 (33%). In healthy animals, intestinal parasites are not expected to have any great impact on the general health of the animal.

Sarcoptic mange (*Sarcoptes scabiei*) is an important ectoparasite that affects lynx. The scabies mite, unlike the intestinal parasites, have a clear negative impact on health, and infection can lead to starvation and death. Mange was found in seven lynx in 2021. In addition, mange was suspected by official inspectors in three lynx culled in the licensed hunt. For one of these lynx, mange infection was determined by detecting antibodies to *Sarcoptes* in blood. Three lynx from the license hunt had ear mites (*Otodectes cynotis*).

In six out of 111 lynx analyzed, Trichinella (*Trichinella* spp.*)*, a muscle parasite, was detected. This type of parasite does not notably affect the health of the lynx.

Other findings

Minor changes were found in skeleton or joints: bone deposits in a jaw joint, an immobile hock joint, and a knee lesion.

GENDER DISTRIBUTION, SIZE, AND AGE

In all, 73 females (43%) and 91 males (54%) were examined. Four carcasses were too degraded to be sexed visually.

The smallest lynx was a 2 kg cub found emaciated next to a private residence in Örebro (M526931). The heaviest weighed 17.8 kg, an adult female culled in protective hunting in Jämtland (M525619). Adult lynx had an average weight of 13.5 kg.

To age lynx - in addition to the criteria on p. 5 – adult males have small penile skin tags, which are formed at sexual maturity. 101 lynx were adult and 59 were juvenile. In eight lynx from 2021, the age was not specified or assessable.

WOLF

SUMMARY

Fifty-seven wolves, entire carcasses, or parts of wolves were admitted to SVA during the year. Most were submitted from county administrative board decisions regarding licensed hunt (47%) and protective hunt (32%), the latter also including two wolves shot to protect domestic animals (JF 28§). Wolves were also killed in traffic (10%), all by road vehicles. Four wolves, two of them following traffic accident injuries, were euthanized due to illness or injury (JF 40c§). The cause of death could not be assessed for three wolves. Two wolves were received as forensic cases.

The health status of the wolf population is considered good, but it is noteworthy that a large proportion of males (28%) of the total number of male animals admitted to SVA in 2021 were cryptorchid.

MANAGEMENT DECISIONS

Licensed hunt

Twenty-seven wolves were received from the licensed hunt in 2021. Decisions on licensed hunting were made by the county administrative boards in Jämtland, Gävleborg, Västmanland, and Örebro.

In licensed hunting, the carcass is inspected when it is culled. During the inspection, several measurements and the body weight are noted in a form by a county administrative board inspector. The hunter is allowed to keep the skin and therefore the skinned bodies are sent to SVA for necropsy. If signs of mange are detected, the pelt or samples from the skin should also be sent to the SVA for analysis. See the report "Licensed hunting of wolf 2021" (in Swedish) on the SVA website for more details about the wolves examined.

Protective hunting

Sixteen wolves were received after protective hunting. Of these, six were from Jämtland county, three from Gävleborg county, two from Dalarna and Norrbotten counties, and one from Västra Götaland, Västernorrland, and Örebro counties.

In addition, two wolves were killed in protective hunting to protect domestic animals (JF 28§). These (M526198 and M526755) came from Värmland county.

FALLEN WILDLIFE

Road accidents

Four wolves had been killed in traffic, all in road-bound traffic. In addition, two wolves were also euthanized after injuries caused by road traffic.

Other causes of death

An old male wolf was euthanized due to an emaciated appearance and showing altered behaviour (M526871), see Necropsy Findings below.

A 1-day-old female puppy (M526196), found alone and weak, was euthanized and submitted to SVA for species determination and examination. No sign of disease was found, but the pup had not suckled, which was considered to be a possible cause for the general weakness.

In three wolves (M525562, M526143, and M526191) found dead, the cause of death could not be determined. The submitted material was incomplete or so autolysed that no conclusions could be made.

NECROPSY FINDINGS

Fresh and old injuries

Aside from lesion from euthanasia, no other fresh lesions were seen in the wolves received during the year. Old injuries, such as healed fractures, were found in six wolves - including the above-mentioned male wolf euthanized due to altered behaviour (M526871). One wolf (M525293) had an old gunshot wound from a protective hunting

attempt the previous year. The wolf could probably not hunt effectively with the injured The leg musculature had begun to atrophy, and the wolf was thin.

Malformations

The main congenital defects that affect wolves in Sweden are cryptorchism and dentition defects. In 2021, ten males (28%) were cryptorchid and two wolves (>1%) had dentition defects. Cryptorchism means that one or both testicles have not wandered down to the scrotum as they should but remain in the abdomen or groin. Cryptorchism is a genetic defect, but details on heredity and underlying cause is not known in detail. The Swedish wolf population genetics regarding cryptorchism is being studied by researchers at the Swedish University of Agricultural Sciences (SLU) and SVA. The bite defects are usually mild defects, and can be crossbite, underbite or overbite, or misaligned teeth.

An individual (M525413) with a bite defect also had a minor incidental congenital malformation of the trachea, where two cartilage rings were partially fused.

Dental health

The dental status of the wolves was good overall. Three wolves had remarks, in addition to bite defects. In two old individuals with several other findings (M525536, M526755), significant attrition was seen on all teeth. In addition, a broken tooth was seen in M526198.

Parasites

Sarcoptic mange was noted in one wolf (M525293). Mange infection usually results in starvation and death. In wolves, mange can be particularly serious for family groups, as their social behaviour increases the risk of spreading infection.

Trichinella was detected in one of 46 examined wolves (>1%).

Dwarf tapeworm of *Echinoccocus* spp. (*E. granulosus s.l.* and *E. multilocularis*) were not found in any of the 52 wolves examined.

Other findings

In one female (M526104), a mild, chronic joint inflammation was seen in several joints. Joint inflammation was also seen in the previously mentioned older male (M526871) euthanized due to being thin and with altered behaviour. The main finding in this wolf was a malignant bone tumour (osteosarcoma) in the right shoulder joint, see Figure 3. This type of tumour is very rare in wolves but is found in old dogs of large breeds.

An old wolf that was euthanized in protective hunting (M525536) had, in addition to several old and healed fractures of the extremities and ribs, also an old focal kidney lesion.

GENDER DISTRIBUTION, SIZE, AND AGE

The sex ratio was 21 (37%) females and 36 (63%) males.

The heaviest wolf was a 49 kg male from the licensed hunt (M525305) in Gävleborg county. The smallest wolf was a female puppy found alone and weak, weighing 340 g (M526196). The average full body weight of adult wolves was 38 kg.

The age distribution in 2021 was 35 adult wolves, 19 young-of-the-year.

Figure 6. Radiograph image of osteosarcoma of the right shoulder joint in an old male wolf (M526871). Photo: SVA

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