

= Gray wolf =

The gray wolf or grey wolf (*Canis lupus*), also known as the timber wolf or western wolf , is a canid native to the wilderness and remote areas of Eurasia and North America . It is the largest extant member of its family , with males averaging 43 ? 45 kg (95 ? 99 lb) , and females 36 ? 38 @. @ 5 kg (79 ? 85 lb) . Like the red wolf , it is distinguished from other *Canis* species by its larger size and less pointed features , particularly on the ears and muzzle . Its winter fur is long and bushy , and predominantly a mottled gray in color , although nearly pure white , red , or brown to black also occur . As of 2005 , 37 subspecies of *C. lupus* are recognised by MSW3 .

The gray wolf is the second most specialised member of the genus *Canis* , after the Ethiopian wolf , as demonstrated by its morphological adaptations to hunting large prey , its more gregarious nature , and its highly advanced expressive behavior . It is nonetheless closely related enough to smaller *Canis* species , such as the eastern wolf , coyote , and golden jackal to produce fertile hybrids . It is the only species of *Canis* to have a range encompassing both the Old and New Worlds , and originated in Eurasia during the Pleistocene , colonizing North America on at least three separate occasions during the Rancholabrean . It is a social animal , travelling in nuclear families consisting of a mated pair , accompanied by the pair 's adult offspring . The gray wolf is typically an apex predator throughout its range , with only humans and tigers posing a serious threat to it . It feeds primarily on large ungulates , though it also eats smaller animals , livestock , carrion , and garbage .

The gray wolf is one of the world 's best known and well researched animals , with probably more books written about it than any other wildlife species . It has a long history of association with humans , having been despised and hunted in most pastoral communities because of its attacks on livestock , while conversely being respected in some agrarian and hunter @-@ gatherer societies . Although the fear of wolves is pervasive in many human societies , the majority of recorded attacks on people have been attributed to animals suffering from rabies . Non @-@ rabid wolves have attacked and killed people , mainly children , but this is rare , as wolves are relatively few , live away from people , and have developed a fear of humans from hunters and shepherds .

= = Etymology = =

The English ' wolf ' stems from the Old English *wulf* , which is itself thought to be derived from the Proto @-@ Germanic * *wulfaz* . The Latin *lupus* is a Sabine loanword . Both derive from the Proto @-@ Indo @-@ European root * *wlqws* / * *lukws* .

= = Taxonomy and evolution = =

= = = Taxonomy = = =

Canis lupus was recorded by Carl Linnaeus in his publication *Systema Naturae* in 1758 . The Latin classification translates into English as " dog wolf " . The subspecies of *Canis lupus* are listed in *Mammal Species of the World* . The nominate subspecies is the Eurasian wolf (*Canis lupus lupus*) , also known as the common wolf . As of 2005 37 subspecies of *C. lupus* are recognised by MSW3 , however the classification of several as either species or subspecies has recently been challenged .

= = = Evolution and relationship with the dog = = =

The evolution of the wolf occurred over a geologic time scale of 800 thousand years , transforming the first Middle Pleistocene wolf specimen that is recognized as being morphologically similar to *Canis lupus* into today 's dog , dingo and gray wolf . Ecological factors including habitat type , climate , prey specialization and predatory competition will greatly influence the wolf 's genetic population structure and cranio @-@ dental plasticity . Wolves went through a population bottleneck 20 @, @ 000 years before present (YBP) , which indicates that many wolf populations had gone

extinct at a time that coincided with the Last Glacial Maximum and the expansion of modern humans worldwide with their technology for capturing large game . The domestic dog is the most widely abundant large carnivore and a descendant from one of those now @-@ extinct wolf populations . Today , the wolf is represented by the many extant subspecies of *Canis lupus* , which includes the dog and dingo .

= = = Subspecies = = =

Globally , *C. lupus* taxonomy has been subject to numerous revisions , particularly in North America . As of 2005 , 37 subspecies of *C. lupus* are recognised by MSW3 . Its list includes the domestic dog , dingo , eastern wolf and red wolf , but lists *C. l. italicus* and *C. l. communis* as synonyms of *C. l. lupus* .

= = = Hybridization with other *Canis* = = =

Dogs and gray wolves do not voluntarily interbreed in the wild , though they can produce fertile wolf @-@ dog offspring . In North America , black colored wolves acquired their coloration from wolf @-@ dog hybridization , which occurred 10 @,@ 000 ? 15 @,@ 000 years ago . Like pure wolves , hybrids breed once annually , though their mating season occurs three months earlier , with pups mostly being born in the winter period , thus lessening their chances of survival . However , one genetic study undertaken in the Caucasus Mountains showed that as many as 10 % of dogs in the area , including livestock guardian dogs , are first generation hybrids . The captive breeding of wolf @-@ dog hybrids has proliferated in the USA , with 300 @,@ 000 such animals being present there .

The gray wolf has interbred extensively with the eastern wolf producing a hybrid population termed Great Lakes boreal wolves . Unlike the red and eastern wolf , the gray wolf does not readily interbreed with coyotes . Nevertheless , coyote genetic markers have been found in some wild isolated gray wolf populations in the southern United States . Gray wolf Y @-@ chromosomes have also been found in Texan coyote haplotypes . In tests performed on a putative chupacabra carcass , mtDNA analysis showed that it was a coyote , though subsequent tests revealed that it was a coyote ? gray wolf hybrid sired by a male Mexican gray wolf . In 2013 , a captive breeding experiment in Utah between gray wolves and western coyotes produced six hybrids through artificial insemination , making this the very first hybridization case between pure coyotes and northwestern gray wolves . At six months of age , the hybrids were closely monitored and were shown to display both physical and behavioral characteristics from both species . Although hybridization between wolves and golden jackals has never been observed , evidence of such occurrences was discovered through mtDNA analysis on jackals in Bulgaria . Although there is no genetic evidence of gray wolf @-@ jackal hybridization in the Caucasus Mountains , there have been cases where otherwise genetically pure golden jackals have displayed remarkably gray wolf @-@ like phenotypes , to the point of being mistaken for wolves by trained biologists .

= = Physical description = =

= = = Anatomy and dimensions = = =

Compared to its closest wild cousins (the coyote and golden jackal) , the gray wolf is larger and heavier , with a broader snout , shorter ears , a shorter torso and longer tail . It is a slender , powerfully built animal with a large , deeply descending ribcage , a sloping back and a heavily muscled neck . The wolf 's legs are moderately longer than those of other canids , which enables the animal to move swiftly , and allows it to overcome the deep snow that covers most of its geographical range . Females tend to have narrower muzzles and foreheads , thinner necks , slightly shorter legs and less massive shoulders than males .

The gray wolf's head is large and heavy, with a wide forehead, strong jaws and a long, blunt muzzle. The ears are relatively small and triangular. The teeth are heavy and large, being better suited to crushing bone than those of other extant canids, though not as specialised as those found in hyenas. Its molars have a flat chewing surface, but not to the same extent as the coyote, whose diet contains more vegetable matter. The gray wolf's jaws can exert a crushing pressure of perhaps 10 @, @ 340 kPa (1 @, @ 500 psi) compared to 5 @, @ 200 kPa (750 psi) for a German shepherd. This force is sufficient to break open most bones. A study of the estimated bite force at the canine teeth of a large sample of living and fossil mammalian predators when adjusted for the body mass found that for placental mammals, the bite force at the canines (in Newtons / kilogram of body weight) was greatest in the extinct dire wolf (163), then followed among the extant canids by the four hypercarnivores that often prey on animals larger than themselves : the African hunting dog (142), the gray wolf (136), the dhole (112), and the dingo (108).

The gray wolf usually carries its head at the same level as the back, raising it only when alert. It usually travels at a loping pace, placing its paws one directly in front of the other. This gait can be maintained for hours at a rate of 8 ? 9 km / h, and allows the wolf to cover great distances. On bare paths, a wolf can quickly achieve speeds of 50 ? 60 km / h. The gray wolf has a running gait of 55 to 70 km / h, can leap 5 metres horizontally in a single bound, and can maintain rapid pursuit for at least 20 minutes.

The gray wolf is the largest extant member of the Canidae, excepting certain large breeds of domestic dog. Gray wolf weight and size can vary greatly worldwide, tending to increase proportionally with latitude as predicted by Bergmann's Rule, with the large wolves of Alaska and Canada sometimes weighing 3 ? 6 times more than their Middle Eastern and South Asian cousins. On average, adult wolves measure 105 ? 160 cm (41 ? 63 in) in length and 80 ? 85 cm (32 ? 34 in) in shoulder height. The tail measures 29 ? 50 cm (11 ? 20 in) in length. The ears are 90 ? 110 millimetres (3 @. @ 5 ? 4 @. @ 3 in) in height, and the hind feet are 220 ? 250 millimetres (8 @. @ 7 ? 9 @. @ 8 in). The skull averages 9 ? 11 inches in length, and 5 ? 6 inches wide. The mean body mass of the extant gray wolf is 40 kg (88 lb), with the smallest specimen recorded at 12 kg (26 lb) and the largest at 80 kg (176 lb). Gray wolf weight varies geographically; on average, European wolves may weigh 38 @. @ 5 kilograms (85 lb), North American wolves 36 kilograms (79 lb) and Indian and Arabian wolves 25 kilograms (55 lb). Females in any given wolf population typically weigh 5 ? 10 lbs less than males. Wolves weighing over 54 kg (120 lbs) are uncommon, though exceptionally large individuals have been recorded in Alaska, Canada, and the forests of western Russia. The heaviest recorded gray wolf in North America was killed on 70 Mile River in east @-@ central Alaska on July 12, 1939 and weighed 79 @. @ 4 kilograms (175 lb).

= = = Fur = = =

The gray wolf has very dense and fluffy winter fur, with short underfur and long, coarse guard hairs. Most of the underfur and some of the guard hairs are shed in the spring and grow back in the autumn period. The longest hairs occur on the back, particularly on the front quarters and neck. Especially long hairs are on the shoulders, and almost form a crest on the upper part of the neck. The hairs on the cheeks are elongated and form tufts. The ears are covered in short hairs, which strongly project from the fur. Short, elastic and closely adjacent hairs are present on the limbs from the elbows down to the calcaneal tendons. The winter fur is highly resistant to cold; wolves in northern climates can rest comfortably in open areas at ? 40 ° by placing their muzzles between the rear legs and covering their faces with their tail. Wolf fur provides better insulation than dog fur, and does not collect ice when warm breath is condensed against it. In warm climates, the fur is coarser and scarcer than in northern wolves. Female wolves tend to have smoother furred limbs than males, and generally develop the smoothest overall coats as they age. Older wolves generally have more white hairs in the tip of the tail, along the nose and on the forehead. The winter fur is retained longest in lactating females, though with some hair loss around their nipples. Hair length on the middle of the back is 60 ? 70 mm. Hair length of the guard hairs on the shoulders generally does not exceed 90 mm, but can reach 110 ? 130 mm.

Coat color ranges from almost pure white through various shades of blond , cream , and ochre to grays , browns , and blacks , with variation in fur color tending to increase in higher latitudes . Differences in coat color between sexes are largely absent , though females may have redder tones . Black colored wolves in North America inherited the Kb allele responsible for melanism from past interbreeding with dogs , while the mutation was found to be naturally occurring in wolves from Iran . Black specimens are more common in North America than in Eurasia , with about half the wolves in Yellowstone National Park being black .

= = Behavior = =

= = = Social and territorial behaviors = = =

The gray wolf is a social animal , whose basic social unit consists of a mated pair , accompanied by the pair 's adult offspring . The average pack consists of a family of 5 ? 11 animals (1 ? 2 adults , 3 ? 6 juveniles and 1 ? 3 yearlings) , or sometimes two or three such families , with exceptionally large packs consisting of 42 wolves being known . In ideal conditions , the mated pair produces pups every year , with such offspring typically staying in the pack for 10 ? 54 months before dispersing . Triggers for dispersal include the onset of sexual maturity and competition within the pack for food . The distance travelled by dispersing wolves varies widely ; some stay in the vicinity of the parental group , while other individuals may travel great distances of 390 km , 206 km , and 670 km from their natal packs . A new pack is usually founded by an unrelated dispersing male and female , travelling together in search of an area devoid of other hostile packs . Wolf packs rarely adopt other wolves into their fold , and typically kill them . In the rare cases where other wolves are adopted , the adoptee is almost invariably an immature animal (1 ? 3 years of age) unlikely to compete for breeding rights with the mated pair . In some cases , a lone wolf is adopted into a pack to replace a deceased breeder . During times of ungulate abundance (migration , calving etc .) , different wolf packs may temporarily join forces .

Wolves are highly territorial animals , and generally establish territories far larger than they require to survive in order to assure a steady supply of prey . Territory size depends largely on the amount of prey available and the age of the pack 's pups , tending to increase in size in areas with low prey populations or when the pups reach the age of 6 months , thus having the same nutritional needs as adults . Wolf packs travel constantly in search of prey , covering roughly 9 % of their territory per day (average 25 km / d or 15 mi / d) . The core of their territory is on average 35 km² (14 sq mi) , in which they spend 50 % of their time . Prey density tends to be much higher in the territory 's surrounding areas , though wolves tend to avoid hunting in the fringes of their range unless desperate , because of the possibility of fatal encounters with neighboring packs . The smallest territory on record was held by a pack of six wolves in northeastern Minnesota , which occupied an estimated 33 km² (13 sq mi) , while the largest was held by an Alaskan pack of ten wolves encompassing a 6 @, @ 272 km² (2 @, @ 422 sq mi) area . Wolf packs are typically settled , and usually only leave their accustomed ranges during severe food shortages .

Wolves defend their territories from other packs through a combination of scent marking , direct attacks and howling (see Communication) . Scent marking is used for territorial advertisement , and involves urination , defecation and ground scratching . Scent marks are generally left every 240 metres throughout the territory on regular travelways and junctions . Such markers can last for 2 ? 3 weeks , and are typically placed near rocks , boulders , trees or the skeletons of large animals . Territorial fights are among the principal causes of wolf mortality , with one study concluding that 14 ? 65 % of wolf deaths in Minnesota and the Denali National Park and Preserve were due to predation by other wolves .

= = = Reproduction and development = = =

The gray wolf is generally monogamous , with mated pairs usually remaining together for life ,

unless one of the pair dies . Upon the death of one mated wolf , pairs are quickly re-established . Since males often predominate in any given wolf population , unpaired females are a rarity . If a dispersing male gray wolf is unable to establish a territory or find a mate , he mates with the daughters of already established breeding pairs from other packs . Such gray wolves are termed " Casanova wolves " and , unlike males from established packs , they do not form pair bonds with the females they mate with . Some gray wolf packs may have multiple breeding females this way , as is the case in Yellowstone National Park . Gray wolves also practice alloparental care , in which a wolf pair may adopt the pup or pups of another . This might take place if the original parents die or are for some reason separated from them . In addition to heterosexual behavior , homosexual behavior has been observed in gray wolves . Male gray wolves often mount each other when the highest ranking female in the pack comes into heat .

The age of first breeding in gray wolves depends largely on environmental factors : when food is plentiful , or when wolf populations are heavily managed , wolves can rear pups at younger ages in order to better exploit abundant resources . This is further demonstrated by the fact that captive wolves have been known to breed as soon as they reach 9 ? 10 months , while the youngest recorded breeding wolves in the wild were 2 years old . Females are capable of producing pups every year , with one litter annually being the average . Unlike the coyote , the gray wolf never reaches reproductive senescence . Estrus typically occurs in late winter , with older , multiparous females entering estrus 2 ? 3 weeks earlier than younger females . During pregnancy , female wolves remain in a den located away from the peripheral zone of their territories , where violent encounters with other packs are more likely . Old females usually whelp in the den of their previous litter , while younger females typically den near their birthplace . The gestation period lasts 62 ? 75 days , with pups usually being born in the summer period .

Wolves bear relatively large pups in small litters compared to other canid species . The average litter consists of 5 ? 6 pups , with litter sizes tending to increase in areas where prey is abundant , though exceptionally large litters of 14 ? 17 pups occur only 1 % of the time . Pups are usually born in spring , coinciding with a corresponding increase in prey populations . Pups are born blind and deaf , and are covered in short soft grayish @-@ brown fur . They weigh 300 ? 500 grams at birth , and begin to see after 9 ? 12 days . The milk canines erupt after one month . Pups first leave the den after 3 weeks . At 1 @.@ 5 months of age , they are agile enough to flee from danger . Mother wolves do not leave the den for the first few weeks , relying on the fathers to provide food for them and their young . Pups begin to eat solid food at the age of 3 ? 4 weeks . Pups have a fast growth rate during their first four months of life : during this period , a pup 's weight can increase nearly 30 times . Wolf pups begin play fighting at the age of 3 weeks , though unlike young foxes and coyotes , their bites are inhibited . Actual fights to establish hierarchy usually occur at 5 ? 8 weeks of age . This is in contrast to young foxes and coyotes , which may begin fighting even before the onset of play behavior . By autumn , the pups are mature enough to accompany adults on hunts for large prey .

= = = Hunting and feeding behaviors = = =

Although social animals , single wolves or mated pairs typically have higher success rates in hunting than do large packs , with single wolves having occasionally been observed to kill large prey such as moose , bison and muskoxen unaided . The gray wolf 's sense of smell is relatively weakly developed when compared to that of some hunting dog breeds , being able to detect carrion upwind no farther than 2 ? 3 km . Because of this , it rarely manages to capture hidden hares or birds , though it can easily follow fresh tracks . Its auditory perception is acute enough to be able to hear up to a frequency of 26 kHz , which is sufficient to register the fall of leaves in the autumn period . A gray wolf hunt can be divided into five stages :

Locating prey : The wolves travel in search of prey through their power of scent , chance encounter , and tracking . Wolves typically locate their prey by scent , though they must usually be directly downwind of it . When a breeze carrying the prey 's scent is located , the wolves stand alert , and point their eyes , ears and nose towards their target . In open areas , wolves may precede the hunt

with group ceremonies involving standing nose @-@ to @-@ nose and wagging their tails . Once concluded , the wolves head towards their prey .

The stalk : The wolves attempt to conceal themselves as they approach . As the gap between the wolves and their prey closes , the wolves quicken their pace , wag their tails , and peer intently , getting as close to their quarry as possible without making it flee .

The encounter : Once the prey detects the wolves , it can either approach the wolves , stand its ground , or flee . Large prey , such as moose , elk , and muskoxen , usually stand their ground . Should this occur , the wolves hold back , as they require the stimulus of a running animal to proceed with an attack . If the targeted animal stands its ground , the wolves either ignore it , or try to intimidate it into running .

The rush : If the prey attempts to flee , the wolves immediately pursue it . This is the most critical stage of the hunt , as wolves may never catch up with prey running at top speed . If their prey is travelling in a group , the wolves either attempt to break up the herd , or isolate one or two animals from it .

The chase : A continuation of the rush , the wolves attempt to catch up with their prey and kill it . When chasing small prey , wolves attempt to catch up with their prey as soon as possible , while with larger animals , the chase is prolonged , in order to wear the selected prey out . Wolves usually give up chases after 1 ? 2 km (0 @.@ 62 ? 1 @.@ 3 mi) , though one wolf was recorded to chase a deer for 21 km (13 mi) . Both Russian and North American wolves have been observed to drive prey onto crusted ice , precipices , ravines , slopes and steep banks to slow them down .

The actual killing method varies according to prey species . With large prey , mature wolves usually avoid attacking frontally , instead focusing on the rear and sides of the animal . Large prey , such as moose , is killed by biting large chunks of flesh from the soft perineum area , causing massive blood loss . Such bites can cause wounds 10 ? 15 cm in length , with three such bites to the perineum usually being sufficient to bring down a large deer in optimum health . With medium @-@ sized prey such as roe deer or sheep , wolves kill by biting the throat , severing nerve tracks and the carotid artery , thus causing the animal to die within a few seconds to a minute . With small , mouse @-@ like prey , wolves leap in a high arc and immobilize it with their forepaws . When prey is vulnerable and abundant , wolves may occasionally surplus kill . Such instances are common in domestic animals , but rare in the wild . In the wild , surplus killing primarily occurs during late winter or spring , when snow is unusually deep (thus impeding the movements of prey) or during the denning period , when wolves require a ready supply of meat when denbound . Medium @-@ sized prey are especially vulnerable to surplus killing , as the swift throat @-@ biting method by which they are killed allows wolves to quickly kill one animal and move on to another .

Once prey is brought down , wolves begin to feed excitedly , ripping and tugging at the carcass in all directions , and bolting down large chunks of it . The breeding pair typically monopolizes food in order to continue producing pups . When food is scarce , this is done at the expense of other family members , especially non @-@ pups . The breeding pair typically eats first , though as it is they who usually work the hardest in killing prey , they may rest after a long hunt and allow the rest of the family to eat unmolested . Once the breeding pair has finished eating , the rest of the family tears off pieces of the carcass and transport them to secluded areas where they can eat in peace . Wolves typically commence feeding by consuming the larger internal organs of their prey , such as the heart , liver , lungs and stomach lining . The kidneys and spleen are eaten once they are exposed , followed by the muscles . A single wolf can eat 15 ? 19 % of its body weight in a single feeding .

= = Communication = =

= = = Visual = = =

The gray wolf 's expressive behavior is more complex than that of the coyote and golden jackal , as necessitated by its group living and hunting habits . While less gregarious canids generally possess simple repertoires of visual signals , wolves have more varied signals that subtly inter grade in

intensity . When neutral , the legs are not stiffened , the tail hangs down loosely , the face is smooth , the lips untensed , and the ears point in no particular direction . Postural communication in wolves consists of a variety of facial expressions , tail positions and piloerection . Aggressive , or self @-@ assertive wolves are characterized by their slow and deliberate movements , high body posture and raised hackles , while submissive ones carry their bodies low , sleeken their fur and lower their ears and tail . When a breeding male encounters a subordinate family member , it may stare at it , standing erect and still with the tails horizontal to its spine . Two forms of submissive behavior are recognized : passive and active . Passive submission usually occurs as a reaction to the approach of a dominant animal , and consists of the submissive wolf lying partly on its back and allowing the dominant wolf to sniff its anogenital area . Active submission occurs often as a form of greeting , and involves the submissive wolf approaching another in a low posture , and licking the other wolf 's face . When wolves are together , they commonly indulge in behaviors such as nose pushing , jaw wrestling , cheek rubbing and facial licking . The mouthing of each other 's muzzles is a friendly gesture , while clamping on the muzzle with bared teeth is a dominance display .

Similar to humans , gray wolves have facial color patterns in which the gaze direction can be easily identified , although this is often not the case in other canid species . In 2014 , a study compared the facial color pattern across 25 canid species . The results suggested that that the facial color pattern of canid species is related to their gaze communication , and that especially gray wolves use the gaze signal in conspecific communication .

= = = Auditory = = =

Gray wolves howl to assemble the pack (usually before and after hunts) , to pass on an alarm (particularly at a den site) , to locate each other during a storm or unfamiliar territory and to communicate across great distances . Wolf howls can under certain conditions be heard over areas of up to 130 km² (50 sq mi) . Wolf howls are generally indistinguishable from those of large dogs . Male wolves give voice through an octave , passing to a deep bass with a stress on " O " , while females produce a modulated nasal baritone with stress on " U " . Pups almost never howl , while yearling wolves produce howls ending in a series of dog @-@ like yelps . Howling consists of a fundamental frequency that may lie between 150 and 780 Hz , and consists of up to 12 harmonically related overtones . The pitch usually remains constant or varies smoothly , and may change direction as many as four or five times . Howls used for calling pack mates to a kill are long , smooth sounds similar to the beginning of the cry of a horned owl . When pursuing prey , they emit a higher pitched howl , vibrating on two notes . When closing in on their prey , they emit a combination of a short bark and a howl . When howling together , wolves harmonize rather than chorus on the same note , thus creating the illusion of there being more wolves than there actually are . Lone wolves typically avoid howling in areas where other packs are present . Wolves from different geographic locations may howl in different fashions : the howls of European wolves are much more protracted and melodious than those of North American wolves , whose howls are louder and have a stronger emphasis on the first syllable . The two are however mutually intelligible , as North American wolves have been recorded to respond to European @-@ style howls made by biologists .

Other vocalisations of wolves are usually divided into three categories : growls , barks and whines . Barking has a fundamental frequency between 320 ? 904 Hz , and is usually emitted by startled wolves . Wolves do not bark as loudly or continuously as dogs do , but bark a few times and retreat from perceived danger . Growling has a fundamental frequency of 380 ? 450 Hz , and is usually emitted during food challenges . Pups commonly growl when playing . One variation of the howl is accompanied by a high pitched whine , which precedes a lunging attack . Whining is associated with situations of anxiety , curiosity , inquiry and intimacy such as greeting , feeding pups and playing .

= = = Olfactory = = =

Olfaction is probably the wolf 's most acute sense , and plays a fundamental role in communication . The wolf has a large number of apocrine sweat glands on the face , lips , back , and between the

toes . The odor produced by these glands varies according to the individual wolf 's microflora and diet , giving each a distinct " odor fingerprint " . A combination of apocrine and eccrine sweat glands on the feet allows the wolf to deposit its scent whilst scratching the ground , which usually occurs after urine marking and defecation during the breeding season . The follicles present on the guard hairs from the wolf 's back have clusters of apocrine and sebaceous glands at their bases . As the skin on the back is usually folded , this provides a microclimate for bacterial propagation around the glands . During piloerection , the guard hairs on the back are raised and the skin folds spread , thus releasing scent . The pre @-@ caudal scent glands may play a role in expressing aggression , as combative wolves raise the base of their tails whilst drooping the tip , thus positioning the scent glands at the highest point . The wolf possesses a pair of anal sacs beneath the rectum , which contain both apocrine and sebaceous glands . The components of anal sac secretions vary according to season and gender , thus indicating that the secretions provide information related to gender and reproductive state . The secretions of the preputial glands may advertise hormonal condition or social position , as dominant wolves have been observed to stand over subordinates , apparently presenting the genital area for investigation , which may include genital licking . During the breeding season , female wolves secrete substances from the vagina , which communicate the females ' reproductive state , and can be detected by males from long distances . Urine marking is the best @-@ studied means of olfactory communication in wolves . Its exact function is debated , though most researchers agree that its primary purpose is to establish boundaries . Wolves urine mark more frequently and vigorously in unfamiliar areas , or areas of intrusion , where the scent of other wolves or canids is present . So @-@ called raised leg urination (RLU) is more common in male wolves than in females , and may serve the purpose of maximizing the possibility of detection by conspecifics , as well as reflect the height of the marking wolf . Only dominant wolves typically use RLU , with subordinate males continuing to use the juvenile standing posture throughout adulthood . RLU is considered to be one of the most important forms of scent communication in the wolf , making up 60 ? 80 % of all scent marks observed .

= = Ecology = =

= = = Habitat = = =

The gray wolf is a habitat generalist , and can occur in deserts , grasslands , forests and arctic tundras . Habitat use by gray wolves is strongly correlated with the abundance of prey , snow conditions , absence or low livestock densities , road densities , human presence and topography . In cold climates , the gray wolf can reduce the flow of blood near its skin to conserve body heat . The warmth of the footpads is regulated independently of the rest of the body , and is maintained at just above tissue @-@ freezing point where the pads come in contact with ice and snow . Gray wolves use different places for their diurnal rest : places with cover are preferred during cold , damp and windy weather , while wolves in dry , calm and warm weather readily rest in the open . During the autumn @-@ spring period , when wolves are more active , they willingly lie out in the open , whatever their location . Actual dens are usually constructed for pups during the summer period . When building dens , females make use of natural shelters such as fissures in rocks , cliffs overhanging riverbanks and holes thickly covered by vegetation . Sometimes , the den is the appropriated burrow of smaller animals such as foxes , badgers or marmots . An appropriated den is often widened and partly remade . On rare occasions , female wolves dig burrows themselves , which are usually small and short with 1 ? 3 openings . The den is usually constructed not more than 500 metres away from a water source , and typically faces southwards , thus ensuring enough sunlight exposure , keeping the denning area relatively snow free . Resting places , play areas for the pups and food remains are commonly found around wolf dens . The odour of urine and rotting food emanating from the denning area often attracts scavenging birds such as magpies and ravens . As there are few convenient places for burrows , wolf dens are usually occupied by animals of the same family . Though they mostly avoid areas within human sight , wolves have been known to nest

near domiciles , paved roads and railways .

= = = Diet = = =

All social terrestrial mammalian predators feed mostly on terrestrial herbivorous mammals with a body mass similar to the combined mass of the social group members attacking the prey animal , and a pack of timber wolves can bring down a 500 kg moose as their preferred prey . The gray wolf generally specializes in vulnerable individuals of large prey . In Eurasia , many gray wolf populations are forced to subsist largely on livestock and garbage in areas with dense human activity , though wild ungulates such as moose , red deer , roe deer and wild boar are still the most important food sources in Russia and the more mountainous regions of Eastern Europe . Other prey species include reindeer , argali , mouflon , wisent , saiga , ibex , chamois , wild goats , fallow deer and musk deer . The prey animals of North American wolves have largely continued to occupy suitable habitats with low human density , and cases of wolves subsisting largely on garbage or livestock are exceptional . Animals preferred as prey by North American wolves include moose , white @-@ tailed deer , elk , mule deer , bighorn sheep , Dall 's sheep , American bison , muskox and caribou .

Although wolves primarily feed on medium to large sized ungulates , they are not fussy eaters . Smaller sized animals that may supplement the diet of wolves include marmots , hares , badgers , foxes , weasels , ground squirrels , mice , hamsters , voles and other rodents , as well as insectivores . They frequently eat waterfowl and their eggs . When such foods are insufficient , they prey on lizards , snakes , frogs , rarely toads and large insects as available . In times of scarcity , wolves readily eat carrion , visiting cattle burial grounds and slaughter houses . Cannibalism is not uncommon in wolves : during harsh winters , packs often attack weak or injured wolves , and may eat the bodies of dead pack members . Wolf packs in Astrakhan hunt Caspian seals on the Caspian Sea coastline and some wolf packs in Alaska and Western Canada have been observed to feed on salmon . Humans are rarely , but occasionally preyed upon . Other primates occasionally taken by wolves include grey langurs in Nepal and hamadryas baboons in Saudi Arabia .

Wolves supplement their diet with fruit and vegetable matter . They willingly eat the berries of mountain ash , lily of the valley , bilberries , blueberries and cowberry . Other fruits include nightshade , apples and pears . They readily visit melon fields during the summer months . A well @-@ fed wolf stores fat under the skin , around the heart , intestines , kidneys , and bone marrow , particularly during the autumn and winter . Digestion only takes a few hours , thus wolves can feed several times in one day , making quick use of large quantities of meat .

= = = Enemies and competitors = = =

Gray wolves typically dominate other canid species in areas where they both occur . In North America , incidents of gray wolves killing coyotes are common , particularly in winter , when coyotes feed on wolf kills . Wolves may attack coyote den sites , digging out and killing their pups , though rarely eating them . There are no records of coyotes killing wolves , though coyotes may chase wolves if they outnumber them . Near identical interactions have been observed in Eurasia between gray wolves and golden jackals , with the latter 's numbers being comparatively small in areas with high wolf densities . Gray wolves are the most important predator of raccoon dogs , killing large numbers of them in the spring and summer periods . Wolves also kill red , arctic and corsac foxes , usually in disputes over carcasses , sometimes eating them . In Asia , they may compete with dholes , though there is at least one record of a lone wolf associating with a pair of dholes in Debrigarh Wildlife Sanctuary .

Brown bears typically dominate wolf packs in disputes over carcasses , while wolf packs mostly prevail against bears when defending their den sites . Both species kill each other 's young . Wolves eat the brown bears they kill , while brown bears seem to only eat young wolves . Wolf interactions with American black bears are much rarer than with brown bears , because of differences in habitat preferences . The majority of black bear encounters with wolves occur in the species ' northern range , with no interactions being recorded in Mexico . Wolves have been recorded on numerous

occasions to actively seek out black bears in their dens and kill them without eating them . Unlike brown bears , black bears frequently lose against wolves in disputes over kills . While encounters with brown and black bears appear to be common , polar bears are rarely encountered by wolves , though there are two records of wolf packs killing polar bear cubs . Wolves also kill the cubs of Asian black bears .

Wolves may encounter striped hyenas in Israel , Central Asia and India , usually in disputes over carcasses . Striped hyenas feed extensively on wolf @-@ killed carcasses in areas where the two species interact . One @-@ to @-@ one , hyenas dominate wolves , but wolf packs can drive off single or outnumbered hyenas . However , there was a case of a female striped hyena dominating 12 Arabian wolves . Two cases are known however from southern Israel , where wolves and striped hyenas associated closely with each other in an apparently amicable way .

Large wolf populations limit the numbers of small to medium @-@ sized felines . Wolves encounter cougars along portions of the Rocky Mountains and adjacent mountain ranges . Wolves and cougars typically avoid encountering each other by hunting on different elevations . In winter , however , when snow accumulation forces their prey into valleys , interactions between the two species become more likely . Wolves in packs usually dominate cougars and can steal kills . They have been reported killing mothers and their kittens . Wolves hunt steppe cats , and may scavenge from snow leopard kills . Wolves may also reduce Eurasian lynx populations . Wolves may kill lynxes by running them down , or killing them before they can escape into trees . Similar reports of encounters between wolves and bobcats have been documented .

Leftovers of wolf kills are sometimes scavenged by wolverines . Wolverines usually wait until the wolves are done feeding , but have been known to drive away wolves from kills . However , there have been confirmed reports of wolf packs killing wolverines .

Other than humans , tigers appear to be the only serious predators of wolves . Wolf and tiger interactions are well documented in Sikhote @-@ Alin , where tigers depress wolf numbers , either to the point of localized extinction or to such low numbers as to make them a functionally insignificant component of the ecosystem . Wolves appear capable of escaping competitive exclusion from tigers only when human persecution decreases tiger numbers . Proven cases of tigers killing wolves are rare and attacks appear to be competitive rather than predatory in nature , with at least four proven records of tigers killing wolves without consuming them .

= = Range and conservation = =

The gray wolf was once one of the world 's most widely distributed mammals , living throughout the northern hemisphere north of 15 ° N latitude in North America and 12 ° N in India . However , deliberate human persecution has reduced the species ' range to about one third , because of livestock predation and fear over attacks on humans . The species is now extinct in much of Western Europe , in Mexico and much of the United States . In modern times , the gray wolf occurs mostly in wilderness and remote areas , particularly in Canada , Alaska and northern USA , Europe , and Asia from about 75 ° N to 12 ° N. Wolf population declines have been arrested since the 1970s , and have fostered recolonization and reintroduction in parts of its former range , due to legal protection , changes in land @-@ use and rural human population shifts to cities . Competition with humans for livestock and game species , concerns over the danger posed by wolves to people , and habitat fragmentation pose a continued threat to the species . Despite these threats , because of the gray wolf 's relatively widespread range and stable population , it is classified as least concern by the IUCN .

= = = Europe = = =

= = = = Decline = = = =

Although wolf @-@ dog hybridization in Europe has raised concern among conservation groups

fearing for the gray wolf 's purity , genetic tests show that introgression of dog genes into European gray wolf populations does not pose a significant threat . Also , as wolf and dog mating seasons do not fully coincide , the likelihood of wild wolves and dogs mating and producing surviving offspring is small .

The extermination of Northern Europe 's wolves first became an organized effort during the Middle Ages , and continued until the late 1800s . In England , wolf persecution was enforced by legislation , and the last wolf was killed in the early sixteenth century during the reign of Henry VII . Wolves lasted longer in Scotland , where they sheltered in vast tracts of forest , which were subsequently burned down . Wolves managed to survive in the forests of Braemar and Sutherland until 1684 . The extirpation of wolves in Ireland followed a similar course , with the last wolf believed to have been killed in 1786 . A wolf bounty was introduced in Sweden in 1647 , after the extermination of moose and reindeer forced wolves to feed on livestock . The Sami extirpated wolves in northern Sweden in organized drives . By 1960 , few wolves remained in Sweden , because of the use of snowmobiles in hunting them , with the last specimen being killed in 1966 . The gray wolf was exterminated in Denmark in 1772 and Norway 's last wolf was killed in 1973 . The species was decimated in 20th century Finland , despite regular dispersals from Russia . The gray wolf was only present in the eastern and northern parts of Finland by 1900 , though its numbers increased after World War II .

In Central Europe , wolves were dramatically reduced in number during the early nineteenth century , because of organized hunts and reductions in ungulate populations . In Bavaria , the last wolf was killed in 1847 , and had disappeared from the Rhine regions by 1899 and largely disappeared in Switzerland before the end of the nineteenth century . In 1934 , Nazi Germany became the first state in modern history to place the wolf under protection , though the species was already extirpated in Germany at this point . The last free @-@ living wolf to be killed on the soil of present @-@ day Germany before 1945 was the so @-@ called " Tiger of Sabrodt " , which was shot near Hoyerswerda , Lusatia (then Lower Silesia) in 1904 . Today , wolves have returned to the area . Wolf hunting in France was first institutionalized by Charlemagne between 800 ? 813 , when he established the *louveterie* , a special corps of wolf hunters . The *louveterie* was abolished after the French Revolution in 1789 , but was re @-@ established in 1814 . In 1883 , up to 1 @,@ 386 wolves were killed , with many more by poison .

In Eastern Europe , wolves were never fully exterminated , because of the area 's contiguity with Asia and its large forested areas . However , Eastern European wolf populations were reduced to very low numbers by the late nineteenth century . Wolves were extirpated in Slovakia during the first decade of the twentieth century and , by the mid @-@ twentieth century , could only be found in a few forested areas in eastern Poland . Wolves in the eastern Balkans benefitted from the region 's contiguity with the former Soviet Union and large areas of plains , mountains and farmlands . Wolves in Hungary occurred in only half the country around the start of the 20th century , and were largely restricted to the Carpathian Basin . Wolf populations in Romania remained largely substantial , with an average of 2 @,@ 800 wolves being killed annually out of a population of 4 @,@ 600 from 1955 ? 1965 . An all @-@ time low was reached in 1967 , when the population was reduced to 1 @,@ 550 animals . The extermination of wolves in Bulgaria was relatively recent , as a previous population of about 1 @,@ 000 animals in 1955 was reduced to about 100 ? 200 in 1964 . In Greece , the species disappeared from the southern Peloponnese in 1930 . Despite periods of intense hunting during the eighteenth century , wolves never disappeared in the western Balkans , from Albania to the former Yugoslavia . Organized persecution of wolves began in Yugoslavia in 1923 , with the setting up of the Wolf Extermination Committee (WEC) in Kocevje , Slovenia . The WEC was successful in reducing wolf numbers in the Dinaric Alps .

In Southern Europe , wolf extermination was not as complete as in Northern Europe , because of greater cultural tolerance of the species . Wolf populations only began declining in the Iberian Peninsula in the early 19th @-@ century , and was reduced by a half of its original size by 1900 . Wolf bounties were regularly paid in Italy as late as 1950 . Wolves were exterminated in the alps by 1800 , and numbered only 100 by 1973 , inhabiting only 3 ? 5 % of their former Italian range .

== == Recovery == ==

The recovery of European wolf populations began after the 1950s , when traditional pastoral and rural economies declined and thus removed the need to heavily persecute wolves . By the 1980s , small and isolated wolf populations expanded in the wake of decreased human density in rural areas and the recovery of wild prey populations .

The gray wolf has been fully protected in Italy since 1976 , and now holds a population of over 1 @, @ 269 @-@ 1 @, @ 800 . Italian wolves entered France 's Mercantour National Park in 1993 , and at least fifty wolves were discovered in the western Alps in 2000 . By 2013 the 250 wolves in the Western Alps imposed a significant burden on traditional sheep and goat husbandry with a loss of over 5 @, @ 000 animals in 2012 . There are approximately 2 @, @ 000 wolves inhabiting the Iberian Peninsula , of which 150 reside in northeastern Portugal . In Spain , the species occurs in Galicia , Leon , and Asturias . Although hundreds of Iberian wolves are illegally killed annually , the population has expanded south across the river Duero and east to the Asturias and Pyrenees Mountains .

In 1978 , wolves began recolonising central Sweden after a twelve @-@ year absence , and have since expanded into southern Norway . As of 2005 , the total number of Swedish and Norwegian wolves is estimated to be at least one hundred , including eleven breeding pairs . The gray wolf is fully protected in Sweden and partially controlled in Norway . The Scandinavian wolf populations owe their continued existence to neighbouring Finland 's contiguity with the Republic of Karelia , which houses a large population of wolves . Wolves in Finland are protected only in the southern third of the country , and can be hunted in other areas during specific seasons , though poaching remains common , with 90 % of young wolf deaths being due to human predation , and the number of wolves killed exceeds the number of hunting licenses , in some areas by a factor of two . Furthermore , the decline in the moose populations has reduced the wolf 's food supply . Since 2011 , Netherlands , Belgium and Denmark have also reported wolf sightings presumably by natural migration from adjacent countries .

Wolf populations in Poland have increased to about 800 ? 900 individuals since being classified as a game species in 1976 . Poland plays a fundamental role in providing routes of expansion into neighbouring Central European countries . In the east , its range overlaps with populations in Lithuania , Belorussia , Ukraine , and Slovakia . A population in western Poland expanded into eastern Germany and in 2000 the first pups were born on German territory . In 2012 , an estimated 14 wolf packs were living in Germany (mostly in the east) and a pack with pups has been sighted within 15 miles of Berlin . The gray wolf is protected in Slovakia , though an exception is made for wolves killing livestock . A few Slovakian wolves disperse into the Czech Republic , where they are afforded full protection . Wolves in Slovakia , Ukraine and Croatia may disperse into Hungary , where the lack of cover hinders the buildup of an autonomous population . Although wolves have special status in Hungary , they may be hunted with a year @-@ round permit if they cause problems .

Romania has a large population of wolves , numbering 2 @, @ 500 animals . The wolf has been a protected animal in Romania since 1996 , although the law is not enforced . The number of wolves in Albania and Macedonia is largely unknown , despite the importance the two countries have in linking wolf populations from Greece to those of Bosnia and Herzegovina and Croatia . Although protected , sometimes wolves are still illegally killed in Greece , and their future is uncertain . Wolf numbers have declined in Bosnia and Herzegovina since 1986 , while the species is fully protected in neighbouring Croatia and Slovenia .

= = = Asia = = =

= = = = Historical range and decline = = = =

During the 19th century , gray wolves were widespread in many parts of the Holy Land east and west of the Jordan River . However , they decreased considerably in number between 1964 and

1980 , largely because of persecution by farmers . The species was not considered common in northern and central Saudi Arabia during the 19th century , with most early publications involving animals either from southwestern Asir , northern rocky areas bordering Jordan , or areas surrounding Riyadh .

The gray wolf 's range in the Soviet Union encompassed nearly the entire territory of the country , being absent only on the Solovetsky Islands , Franz @-@ Josef Land , Severnaya Zemlya , and the Karagin , Commander and Shantar Islands . The species was exterminated twice in Crimea , once after the Russian Civil War , and again after World War II . Following the two world wars , Soviet wolf populations peaked twice . 30 @,@ 000 wolves were harvested annually out of a population of 200 @,@ 000 during the 1940s , with 40 @,@ 000 ? 50 @,@ 000 harvested during peak years . Soviet wolf populations reached a low around 1970 , disappearing over much of European Russia . The population increased again by 1980 to about 75 @,@ 000 , with 32 @,@ 000 being killed in 1979 . Wolf populations in northern inner Mongolia declined during the 1940s , primarily because of poaching of gazelles , the wolf 's main prey . In British @-@ ruled India , wolves were heavily persecuted because of their attacks on sheep , goats and children . In 1876 , 2 @,@ 825 wolves were bountied in the North @-@ Western Provinces (NWP) and Bihar . By the 1920s , wolf extermination remained a priority in the NWP and Awadh . Overall , over 100 @,@ 000 wolves were killed for bounties in British India between 1871 and 1916 .

Wolves in Japan became extinct during the Meiji restoration period , an extermination known as ?kami no kujo . The wolf was deemed a threat to ranching , which the Meiji government promoted at the time , and targeted via a bounty system and a direct chemical extermination campaign inspired by the similar contemporary American campaign . The last Japanese wolf was a male killed on January 23 , 1905 near Washikaguchi (now called Higashi Yoshiro) . The now extinct Japanese wolves were descended from large Siberian wolves , which colonized the Korean Peninsula and Japan , before it separated from mainland Asia , 20 @,@ 000 years ago during the Pleistocene . During the Holocene , the Tsugaru Strait widened and isolated Honshu from Hokkaid? , thus causing climatic changes leading to the extinction of most large bodied ungulates inhabiting the archipelago . Japanese wolves likely underwent a process of island dwarfism 7 @,@ 000 ? 13 @,@ 000 years ago in response to these climatological and ecological pressures . *C. l. hattai* (formerly native to Hokkaid?) was significantly larger than its southern cousin *C. l. hodophilax* , as it inhabited higher elevations and had access to larger prey , as well as a continuing genetic interaction with dispersing wolves from Siberia .

== == Modern range == ==

There is little reliable data on the status of wolves in the Middle East , save for those in Israel and Saudi Arabia , though their numbers appear to be stable , and are likely to remain so . Israel 's conservation policies and effective law enforcement maintain a moderately sized wolf population , which radiates into neighbouring countries , while Saudi Arabia has vast tracts of desert , where about 300 ? 600 wolves live undisturbed . The wolf survives throughout most of its historical range in Saudi Arabia , probably because of a lack of pastoralism and abundant human waste . Turkey may play an important role in maintaining wolves in the region , because of its contiguity with Central Asia . The mountains of Turkey have served as a refuge for the few wolves remaining in Syria . A small wolf population occurs in the Golan Heights , and is well protected by the military activities there . Wolves living in the southern Negev desert are contiguous with populations living in the Egyptian Sinai and Jordan . Throughout the Middle East , the species is only protected in Israel . Elsewhere , it can be hunted year @-@ round by Bedouins .

Little is known of current wolf populations in Iran , which once occurred throughout the country in low densities during the mid @-@ 1970s . The northern regions of Afghanistan and Pakistan are important strongholds for the wolf . It has been estimated that there are about 300 wolves in approximately 60 @,@ 000 km² (23 @,@ 000 sq mi) of Jammu and Kashmir in northern India , and 50 more in Himachal Pradesh . Overall , India supports about 800 @-@ 3 @,@ 000 wolves , scattered among several remnant populations . Although protected since 1972 , Indian wolves are

classed as endangered , with many populations lingering in low numbers or living in areas increasingly used by humans . Although present in Nepal and Bhutan , there is no information of wolves occurring there .

Wolf populations throughout Northern and Central Asia are largely unknown , but are estimated in the hundreds of thousands based on annual harvests . Since the fall of the Soviet Union , continent-wide extermination of wolves has ceased , and wolf populations have increased to about 25 000 ? 30 000 animals throughout the former Soviet Union . In China and Mongolia , wolves are only protected in reserves . Mongolian populations have been estimated at 10 000 ? 30 000 , while the status of wolves in China is more fragmentary . The north has a declining population of an estimated 400 wolves , while Xinjiang and Tibet hold about 10 000 and 2 000 respectively .

== North America ==

==== Historical range and decline ====

Originally , the gray wolf occupied all of North America north of about 20 ° N. It occurred all over the mainland , save for the southeastern United States , California west of the Sierra Nevada , and the tropical and subtropical areas of Mexico . Large continental islands occupied by wolves included Newfoundland , Vancouver Island , southeastern Alaskan islands , and throughout the Arctic Archipelago and Greenland . While Lohr and Ballard postulated that the gray wolf had never been present on Prince Edward Island , analysis of references to the Island 's native fauna in unpublished and published historical records has found that gray wolves were resident there at the time of the first French settlement in 1720 . In his 6 November 1721 letter to the French Minister of the Marine , Louis Denys de La Ronde reported that the Island was home to wolves ' of a prodigious size ' , and sent a wolf pelt back to France to substantiate his claim . As the Island was cleared for settlement , the gray wolf population may have been extirpated , or relocated to the mainland across the winter ice : the few subsequent wolf reports date from the mid -19th century and describe the creatures as transient visitors from across the Northumberland Strait .

The decline of North American wolf populations coincided with increasing human populations and the expansion of agriculture . By the start of the 20th century , the species had almost disappeared from the eastern USA , excepting some areas of the Appalachians and the northwestern Great Lakes Region . In Canada , the gray wolf was extirpated in New Brunswick and Nova Scotia between 1870 and 1921 , and in Newfoundland around 1911 . It vanished from the southern regions of Quebec and Ontario between 1850 and 1900 . The gray wolf 's decline in the prairies began with the extermination of the American bison and other ungulates in the 1860s ? 70s . From 1900 ? 1930 , the gray wolf was virtually eliminated from the western USA and adjoining parts of Canada , because of intensive predator control programs aimed at eradicating the species . The gray wolf was exterminated by federal and state governments from all of the USA by 1960 , except in Alaska and northern Minnesota . The decline in North American wolf populations was reversed from the 1930s to the early 1950s , particularly in southwestern Canada , because of expanding ungulate populations resulting from improved regulation of big game hunting . This increase triggered a resumption of wolf control in western and northern Canada . Thousands of wolves were killed from the early 1950s to the early 1960s , mostly because of poisoning . This campaign was halted and wolf populations increased again by the mid -1970s .

==== Modern range ====

The species ' modern range in North America is mostly confined to Alaska and Canada , with populations also occurring in northern Minnesota , northern Wisconsin and Michigan 's Upper Peninsula , and portions of Washington , Idaho , northern Oregon , and Montana . A functional wolf population should exist in California by 2024 according to estimates by state wildlife officials .

Canadian wolves began to naturally recolonize northern Montana around Glacier National Park in 1979, and the first wolf den in the western U.S. in over half a century was documented there in 1986. The wolf population in northwest Montana initially grew as a result of natural reproduction and dispersal to about 48 wolves by the end of 1994. From 1995 to 1996, wolves from Alberta and British Columbia were relocated to Yellowstone National Park and Idaho. In addition, the Mexican wolf (*Canis lupus baileyi*) was reintroduced to Arizona and New Mexico in 1998. The gray wolf is found in approximately 80 % of its historical range in Canada, thus making it an important stronghold for the species.

Canada is home to about 52,000 to 60,000 wolves, whose legal status varies according to province and territory. First Nations residents may hunt wolves without restriction, and some provinces require licenses for residents to hunt wolves while others do not. In Alberta, wolves on private land may be baited and hunted by the landowner without requiring a license, and in some areas, wolf hunting bounty programs exist. Large scale wolf population control through poisoning, trapping and aerial hunting is also presently conducted by government mandated programs in order to support populations of endangered prey species such as woodland caribou.

In Alaska, the gray wolf population is estimated at 6,000 to 7,000, and can be legally harvested during hunting and trapping seasons, with bag limits and other restrictions. As of 2002, there are 250 wolves in 28 packs in Yellowstone, and 260 wolves in 25 packs in Idaho. The gray wolf received Endangered Species Act (ESA) protection in Minnesota, Wisconsin, and Michigan in 1974, and was reclassified from endangered to threatened in 2003. Reintroduced Mexican wolves in Arizona and New Mexico are protected under the ESA and, as of late 2002, number 28 individuals in eight packs. A female wolf shot in 2013 in Hart County, Kentucky by a hunter was the first gray wolf seen in Kentucky in modern times. DNA analysis by Fish and Wildlife laboratories showed genetic characteristics similar to those of wolves in the Great Lakes Region.

== Diseases and parasites ==

== Viral and bacterial infections ==

Viral diseases carried by wolves include rabies, canine distemper, canine parvovirus, infectious canine hepatitis, papillomatosis, and canine coronavirus. Wolves are a major host for rabies in Russia, Iran, Afghanistan, Iraq and India. In wolves, the incubation period is 8 to 21 days, and results in the host becoming agitated, deserting its pack, and travelling up to 80 km a day, thus increasing the risk of infecting other wolves. Infected wolves do not show any fear of humans, with most documented wolf attacks on people being attributed to rabid animals. Although canine distemper is lethal in dogs, it has not been recorded to kill wolves, except in Canada and Alaska. The canine parvovirus, which causes death by dehydration, electrolyte imbalance, and endotoxic shock or sepsis, is largely survivable in wolves, but can be lethal to pups. Wolves may catch infectious canine hepatitis from dogs, though there are no records of wolves dying from it. Papillomatosis has been recorded only once in wolves, and likely doesn't cause serious illness or death, though it may alter feeding behaviors. The canine coronavirus has been recorded in Alaskan wolves, with infections being most prevalent in winter months.

Bacterial diseases carried by wolves include brucellosis, Lyme disease, leptospirosis, tularemia, bovine tuberculosis, listeriosis, anthrax and foot and mouth disease. Wolves can catch *Brucella suis* from wild and domestic reindeer. While adult wolves tend not to show any clinical signs, it can severely weaken the pups of infected females. Although Lyme disease can debilitate individual wolves, it does not appear to have any significant effect on wolf populations. Leptospirosis can be contracted through contact with infected prey or urine, and can cause fever, anorexia, vomiting, anemia, hematuria, icterus, and death. Wolves living near farms are more vulnerable to the disease than those living in the wilderness, probably because of prolonged contact with infected domestic animal waste. Wolves may catch tularemia from lagomorph prey, though its effect on wolves is unknown. Although bovine tuberculosis is not considered a major threat to wolves, it has

been recorded to have once killed two wolf pups in Canada .

== Parasitic infections ==

Wolves carry ectoparasites and endoparasites , with wolves in the former Soviet Union having been recorded to carry at least 50 species . Most of these parasites infect wolves without adverse effects , though the effects may become more serious in sick or malnourished specimens . Parasitic infection in wolves is of particular concern to people , as wolves can spread them to dogs , which in turn can carry the parasites to humans . In areas where wolves inhabit pastoral areas , the parasites can be spread to livestock .

Wolves are often infested with a variety of arthropod exoparasites , including fleas , ticks , lice , and mites . The most harmful to wolves , particularly pups , is *Sarcoptes scabiei* (or mange mite) , though they rarely develop full blown mange , unlike foxes . Lice , such as *Trichodectes canis* , may cause sickness in wolves , but rarely death . Ticks of the genus *Ixodes* can infect wolves with Lyme disease and Rocky Mountain spotted fever . The tick *Dermacentor pictus* also infests wolves . Other ectoparasites include biting lice , sucking lice and the fleas *Pulex irritans* and *Ctenocephalides canis* .

Endoparasites known to infect wolves include protozoans and helminths (flukes , tapeworms , roundworms and thorny @-@ headed worms) . Of 30 @,@ 000 protozoan species , only a few have been recorded to infect wolves : *Isospora* , *Toxoplasma* , *Sarcocystis* , *Babesia* , and *Giardia* . Wolves may carry *Neospora caninum* , which is of particular concern to farmers , as the disease can be spread to livestock , with infected animals being 3 ? 13 times more likely to miscarry than those not infected . Among flukes , the most common in North American wolves is *Alaria* , which infects small rodents and amphibians that are eaten by wolves . Upon reaching maturity , *Alaria* migrates to the wolf 's intestine , but harms it little . *Metorchis conjunctus* , which enters wolves through eating fish , infects the wolf 's liver or gall bladder , causing liver disease , inflammation of the pancreas , and emaciation . Most other fluke species reside in the wolf 's intestine , though *Paragonimus westermani* lives in the lungs . Tapeworms are commonly found in wolves , as their primary hosts are ungulates , small mammals , and fish , which wolves feed upon . Tapeworms generally cause little harm in wolves , though this depends on the number and size of the parasites , and the sensitivity of the host . Symptoms often include constipation , toxic and allergic reactions , irritation of the intestinal mucosa , and malnutrition . Infections by the tapeworm *Echinococcus granulosus* in ungulate populations tend to increase in areas with high wolf densities , as wolves can shed *Echinococcus* eggs in their feces onto grazing areas . Wolves can carry over 30 roundworm species , though most roundworm infections appear benign , depending on the number of worms and the age of the host . *Ancylostoma caninum* attaches itself on the intestinal wall to feed on the host 's blood , and can cause hyperchromic anemia , emaciation , diarrhea , and possibly death . *Toxocara canis* , a hookworm known to infect wolf pups in utero , can cause intestinal irritation , bloating , vomiting , and diarrhea . Wolves may catch *Diocotophyma renale* from minks , which infects the kidneys , and can grow to lengths of 100 cm . *D. renale* causes the complete destruction of the kidney 's functional tissue , and can be fatal if both kidneys are infected . Wolves can tolerate low levels of *Dirofilaria immitis* for many years without showing any ill effects , though high levels can kill wolves through cardiac enlargement and congestive hepatopathy . Wolves probably become infected with *Trichinella spiralis* by eating infected ungulates . Although *T. spiralis* isn 't known to produce clinical signs in wolves , it can cause emaciation , salivation , and crippling muscle pains in dogs . Thorny @-@ headed worms rarely infect wolves , though three species have been identified in Russian wolves : *Nicolla skrjabini* , *Macrocantorhynchus catulinus* , and *Moniliformis moniliformis* .

== Relationships with humans ==

== In culture ==

=== In personal names ===

Old English literature contains several instances of Anglo-Saxon kings and warriors taking on wulf as a prefix or suffix in their names . Examples include Wulfhere , Cynewulf , Ceonwulf , Wulfheard , Earnwulf , Wulfm?r , Wulfst?n and Æthelwulf . Wolf-related names were also common among pre-Christian Germanic warriors : Wolfhroc (Wolf-Frock) , Wolfhetan (Wolf Hide) , Isangrim (Grey Mask) , Scrutolf (Garb Wolf) , Wolfgang (Wolf Gait) and Wolfdregil (Wolf Runner) .

Ancient Greek literature is similar : Autolycus (" the wolf itself ") , Lycurgus (" wolf-work ") .

The Latin for " female prostitute " is lupa , and the most famous brothel in Pompeii was the Lupanar .

=== In folklore , religion and mythology ===

The wolf is a common motif in the foundational mythologies and cosmologies of peoples throughout Eurasia and North America (corresponding to the historical extent of the habitat of the gray wolf) . The obvious attribute of the wolf is its nature of a predator , and correspondingly it is strongly associated with danger and destruction , making it the symbol of the warrior on one hand , and that of the devil on the other . The modern trope of the Big Bad Wolf is a development of this . The wolf holds great importance in the cultures and religions of the nomadic peoples , both of the Eurasian steppe and of the North American Plains . In many cultures , the identification of the warrior with the wolf (totemism) gave rise to the notion of Lycanthropy , the mythical or ritual identification of man and wolf .

=== In fable and literature ===

Aesop featured wolves in several of his fables , playing on the concerns of Ancient Greece's settled , sheep-herding world . His most famous is the fable of The Boy Who Cried Wolf , which is directed at those who knowingly raise false alarms , and from which the idiomatic phrase " to cry wolf " is derived . Some of his other fables concentrate on maintaining the trust between shepherds and guard dogs in their vigilance against wolves , as well as anxieties over the close relationship between wolves and dogs . Although Aesop used wolves to warn , criticize and moralize about human behavior , his portrayals added to the wolf's image as a deceitful and dangerous animal . Isengrim the wolf , a character first appearing in the 12th-century Latin poem Ysengrimus , is a major character in the Reynard Cycle , where he stands for the low nobility , whilst his adversary , Reynard the fox , represents the peasant hero . Although portrayed as loyal , honest and moral , Isengrim is forever the victim of Reynard's wit and cruelty , often dying at the end of each story . The tale of Little Red Riding Hood , first written in 1697 by Charles Perrault , is largely considered to have had more influence than any other source of literature in forging the wolf's negative reputation in the western world . The wolf in this story is portrayed as a potential rapist , capable of imitating human speech . The hunting of wolves , and their attacks on humans and livestock feature prominently in Russian literature , and are included in the works of Tolstoy , Chekhov , Nekrasov , Bunin , Sabaneyev , and others . Tolstoy's War and Peace and Chekhov's Peasants both feature scenes in which wolves are hunted with hounds and borzois . Farley Mowat's largely fictional 1963 memoir Never Cry Wolf was the first positive portrayal of wolves in popular literature , and is largely considered to be the most popular book on wolves , having been adapted into a Hollywood film and taught in several schools decades after its publication . Although credited with having changed popular perceptions on wolves by portraying them as loving , cooperative and noble , it has been criticized for its idealization of wolves and its factual inaccuracies .

=== In heraldry and symbolism ===

The wolf is a frequent charge in English armory . It is illustrated as a supporter on the shields of Lord Welby , Rendel , and Viscount Wolseley , and can be found on the coat of arms of Lovett and the vast majority of the Wilsons and Lows . The demi @-@ wolf is a common crest , appearing in the arms and crests of members of many families , including that of the Wolfes , whose crest depicts a demi @-@ wolf holding a crown in its paws , in reference to the assistance the family gave to Charles II during the battle of Worcester . Wolf heads are common in Scottish heraldry , particularly in the coats of Clan Robertson and Skene . The wolf is the most common animal in Spanish heraldry , and is often depicted as carrying a lamb in its mouth , or across its back . The wolf is featured on the flags of the Confederated Tribes of the Colville Reservation , the Oneida Nation of Wisconsin and the Pawnee . In modern times , the wolf is widely used as an emblem for military and paramilitary groups . It is the unofficial symbol of the spetsnaz , and serves as the logo of the Turkish Grey Wolves . During the Yugoslav Wars , several Serb paramilitary units adopted the wolf as their symbol , including the White Wolves and the Wolves of Vučjak .

== = Conflicts == =

== = = Wolf predation on livestock == = =

Livestock depredation has been one of the primary reasons for hunting wolves , and can pose a severe problem for wolf conservation : as well as causing economic losses , the threat of wolf predation causes great stress on livestock producers , and no foolproof solution of preventing such attacks short of exterminating wolves has been found . Some nations help offset economic losses to wolves through compensation programmes or state insurance . Domesticated animals are easy prey for wolves , as they have evolved under constant human protection , and are thus unable to defend themselves very well . Wolves typically resort to attacking livestock when wild prey is depleted : in Eurasia , a large part of the diet of some wolf populations consists of livestock , while such incidences are rare in North America , where healthy populations of wild prey have been largely restored . The majority of losses occur during the summer grazing period , with untended livestock in remote pastures being the most vulnerable to wolf predation . The most frequently targeted livestock species are sheep (Europe) , domestic reindeer (northern Scandinavia) , goats (India) , horses (Mongolia) , cattle and turkeys (North America) . The number of animals killed in single attacks varies according to species : most attacks on cattle and horses result in one death , while turkeys , sheep and domestic reindeer may be killed in surplus . Wolves mainly attack livestock when the animals are grazing , though they occasionally break into fenced enclosures . In some cases , wolves do not need to physically attack livestock to negatively affect it : the stress livestock experiences in being vigilant for wolves may result in miscarriages , weight loss and a decrease in meat quality .

== = = Conflicts with dogs == = =

Being the most abundant carnivores , feral and free @-@ ranging dogs have the greatest potential to compete with wolves . A review of the studies in the competitive effects of dogs on sympatric carnivores did not mention any research on competition between dogs and wolves . Competition would favor the wolf , which is known to kill dogs , however wolves tend to live in pairs or in small packs in areas where they are highly persecuted , giving them a disadvantage facing large groups of dogs .

Wolves kill dogs on occasion , with some wolf populations relying on dogs as an important food source . In Croatia , wolves kill more dogs than sheep , and wolves in Russia appear to limit stray dog populations . Wolves may display unusually bold behavior when attacking dogs accompanied by people , sometimes ignoring nearby humans . Wolf attacks on dogs may occur both in house yards and in forests . Wolf attacks on hunting dogs are considered a major problem in Scandinavia

and Wisconsin . The most frequently killed hunting breeds in Scandinavia are harriers , with older animals being most at risk , likely because they are less timid than younger animals , and react to the presence of wolves differently . Large hunting dogs such as Swedish elkhounds are more likely to survive wolf attacks because of their better ability to defend themselves .

Although the numbers of dogs killed each year are relatively low , it induces a fear of wolves entering villages and farmyards to take dogs . In many cultures , there are strong social and emotional bonds between humans and their dogs that can be seen as family members or working team members . The loss of a dog can lead to strong emotional responses with demands for more liberal wolf hunting regulations .

Dogs that are employed to guard sheep help to mitigate human ? wolf conflicts , and are often proposed as one of the non @-@ lethal tools in the conservation of wolves . Shepherd dogs are not particularly aggressive , but they can disrupt potential wolf predation by displaying what is to the wolf ambiguous behaviors , such as barking , social greeting , invitation to play or aggression . The historical use of shepherd dogs across Eurasia has been effective against wolf predation , especially when confining sheep in the presence of several livestock @-@ guarding dogs . However , shepherd dogs are sometimes killed by wolves .

= = = = Wolf predation on humans = = = =

The fear of wolves has been pervasive in many societies , though humans are not part of the wolf 's natural prey . How wolves react to humans depends largely on their prior experience with people : wolves lacking any negative experience of humans , or which are food conditioned , may show little fear of people . Although wolves may react aggressively under provocation , such attacks are mostly limited to quick bites on extremities , and the attacks are not pressed . Predatory attacks (attacks by wolves treating humans as food) may be preceded by a long period of habituation , in which wolves gradually lose their fear of humans . The victims are repeatedly bitten on the head and face , and are then dragged off and consumed , unless the wolves are driven off . Such attacks typically occur only locally , and do not stop until the wolves involved are eliminated . Predatory attacks can occur at any time of the year , with a peak in the June ? August period , when the chances of people entering forested areas (for livestock grazing or berry and mushroom picking) increase , though cases of non @-@ rabid wolf attacks in winter have been recorded in Belarus , Kirov and Irkutsk oblasts , Karelia and Ukraine . Also , wolves with pups experience greater food stresses during this period . The majority of victims of predatory wolf attacks are children under the age of 18 and , in the rare cases where adults are killed , the victims are almost always women . Cases of rabid wolves are low when compared to other species , as wolves do not serve as primary reservoirs of the disease , but can be infected by animals such as dogs , jackals and foxes . Incidents of rabies in wolves are very rare in North America , though numerous in the eastern Mediterranean , Middle East and Central Asia . Wolves apparently develop the " furious " phase of rabies to a very high degree which , coupled with their size and strength , makes rabid wolves perhaps the most dangerous of rabid animals , with bites from rabid wolves being 15 times more dangerous than those of rabid dogs . Rabid wolves usually act alone , travelling large distances and often biting large numbers of people and domestic animals . Most rabid wolf attacks occur in the spring and autumn periods . Unlike with predatory attacks , the victims of rabid wolves are not eaten , and the attacks generally only occur on a single day . Also , the victims are chosen at random , though the majority of cases involve adult men . In the half @-@ century up to 2002 , there were eight fatal attacks in Europe and Russia , and more than 200 in south Asia . Between 2005 @-@ 2010 , two people were killed in North America .

= = = = Human predation on wolves = = = =

Wolves are notoriously difficult to hunt because of their elusiveness , their sharp senses , their high endurance in the chase and ability to quickly incapacitate and kill hunting dogs . Historically , many methods have been devised to hunt wolves , including the killing of spring @-@ born litters in their

dens , coursing with dogs (usually combinations of sighthounds , bloodhounds and fox terriers) , poisoning with strychnine , and foothold and deadfall traps . A popular method of wolf hunting in Russia involves trapping a pack within a small area by encircling it with fladry poles carrying a human scent . This method relies heavily on the wolf 's fear of human scents , though it can lose its effectiveness when wolves become accustomed to the smell . Some hunters are able to lure wolves by imitating their calls . In Kazakhstan and Mongolia , wolves are traditionally hunted with eagles and falcons , though this practise is declining , as experienced falconers are becoming few in number . Shooting wolves from aircraft is highly effective , as it allows greater visibility of wolves than hunting on the ground , though this method is controversial , as it allows wolves little chance to escape or defend themselves . Some dog breeds like the Borzoi wolfhound , the Irish wolfhound , or the Kyrgyz Tajgan have been specifically selected for wolf hunting .

= = = As pets and working animals = = =

Wild wolves are sometimes kept as exotic pets , and in some rarer occasions , as working animals . Although closely related to domesticated dogs , wolves do not show the same tractability as dogs in living alongside humans , and generally , much more work is required in order to obtain the same amount of reliability . Wolves also need much more space than dogs , about 10 to 15 square miles so they can exercise .