

Bold wolf behaviour: definitions and analysis of reported past cases across Europe



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1. Background

Large carnivores, including wolves (*Canis lupus*), have experienced a recovery in Europe in recent decades (Chapron et al. 2014a, Linnell & Cretois 2018, Boitani et al. 2022, Kaczensky et al. 2024). Apart from their ecological plasticity, several factors have been highlighted driving their recovery, including strict conservation policies and political commitments, law enforcement, institutional arrangements, context-specific management practices (e.g., use of damage prevention measures, combating illegal use of poison), land abandonment and shifts in land uses, or changes in public acceptance to their presence (e.g., Chapron et al. 2014a, Dressel et al. 2015, Eklund et al. 2017, Van Eeden et al. 2018, Cimatti et al. 2021).

Conflict drivers in landscapes of coexistence between large carnivores and people can be diverse, including depredation on livestock, competition with hunters for game, or real/perceived risks posed by large carnivores to human safety (Carter & Linnell 2016, Chapron & López-Bao 2016, Lute et al. 2018). In the case of wolves, for example, while some issues, such as of livestock depredation and competition for game have been widely addressed, either in the scientific literature or from a management point of view (e.g., Bisi et al. 2010, Singer et al. 2023, Kutal et al. 2024, Treves 2009, Trump et al. 2022), there is relatively little focus on behaviours (including behaviours that are considered unwanted from an anthropocentric viewpoint) or risky situations that might pose a real or perceived threat to human safety, and the management of such cases (Linnell et al. 2002, Behdarvand et al. 2014, Penteriani et al. 2016, Nowak et al. 2021). So far, main research attention around real or perceived threats of wolves to human safety has been focused on attacks on humans, which are extremely rare events (e.g., Linnell et al. 2002, McNay et al. 2002, Behdarvand et al. 2015, Penteriani et al. 2016, Iliopoulos et al. 2022, Linnell et al. 2021); although they are often overplayed by the media and are highly vulnerable to fake news (Arbieu et al. 2021; Iliopoulos et al. 2022). Additionally, human fear and stereotypes towards wolves, including understanding factors governing human fear, has also attracted some research attention in recent times (e.g., Johansson et al. 2012, 2016, 2016b; Mohammadi et al. 2021; Sevillano-Triguero et al. 2023).

Wolves are usually reported to avoid close encounters with humans (e.g., Karlsson et al. 2007, Reinhardt et al. 2020). In 34 experimental approaches to radio-collared wolves, Karlsson et al. (2007) described how wolves moved away when the approaching human was between 17 and 310 m away, with a mean distance of 106 m. Wam et al. (2014) repeatedly approached wild wolves to test their individual response and habituation to human encounters. The wolves

reacted and moved away at a mean distance of 248 m (range 35–488 m), with none of the animals visually or vocally exposing themselves. Versluijs et al. (2022) found that, over 21 approach trials on 7 GPS-collared wolves, they predominantly showed a flight response ($n = 18$), and no wolves were seen or heard during trials, even when the observer passed the wolf at < 50 m. Similarly, wolves persisting in human-dominated landscapes avoid human infrastructures and activities (e.g., Ahmadi et al. 2014, Sazatornil et al. 2016, Ronnenberg et al. 2017, Rio-Maior et al. 2019, Carricondo-Sánchez et al. 2020, Barker et al. 2023, Zanni et al. 2023); or have adapted to use some infrastructures (e.g. roads) in a cryptic way to avoid human encounters and modulating their behaviour to minimize risks (e.g., Zimmermann et al. 2014, Llaneza et al. 2016, Smith et al. 2022, Martínez-Abraín et al. 2023).

Nonetheless, given their vast spatial requirements (with home ranges from a few hundred square kilometers to more than a thousand square kilometers in Europe and dispersion over considerable distances; e.g., Ciucci et al. 2009, Jędrzejewski et al. 2007; Mattisson et al. 2013, Ražen et al. 2016, Silva et al. 2018, Vorel et al. 2024), it is impossible for European wolves to entirely avoid human settlements, infrastructure, or even people, and like other wildlife, they can be also observed during daylight hours (Bombieri et al. 2021, Kojola et al. 2016, Martínez-Abraín et al. 2023, Reinhardt et al. 2020; Ferreira-Arias et al. 2024). The recovery of the wolf population in today's Europe inevitably leads to increasing likelihoods of human-wolf encounters. For example, in expanding wolf populations in human-dominated landscapes, young, dispersing wolves are increasingly seen close to human infrastructures as they navigate through unfamiliar areas during dispersal. Wolves dispersing into more densely populated and more fragmented areas may show less avoidance of human infrastructure than before, even after their dispersal (Barry et al. 2020).

Increasing public concern across Europe on the potential outcomes from close interactions between wolves and people demands a better understanding of what type of wolf behaviours or situations are necessary to identify as an early warning sign that could lead to a potentially risky situation. Along these lines, preventing human–wildlife conflict over such perceived or real risks requires understanding when unproblematic habituation in wolves can escalate into wolves showing strong habituation to the close presence of humans or, ultimately, bold behaviour. This is fundamental for the implementation of proper preemptive interventions in each case. The most challenging situations may be expected in areas where wolves were historically exterminated, leading to the disappearance of human awareness to the presence of wolves and adaptations for coexistence (Chapron et al. 2014a, Chapron & López-Bao 2016, Kuijper et al. 2019). In this scenario, when large carnivores return, fear and resentment can emerge (López-Bao et al. 2017). An illustrative example is the fear of wolves recolonizing

areas near settlements, because of the perception that wolves should be shy, and they are supposed to inhabit wild and remote areas (Figari & Skogen 2011). People living in these areas may be uncertain in how to interpret wolf behaviour, which can reinforce concerns in sharing the landscape with this species.

There are two types of situations in which people may be worried and motivated to report a wolf observation assuming an unwanted or threatening behaviour or risky situation (Karlsson et al. 2007):

- 1) Situations in which human expectations of what is normal wolf behaviour (may be driven by the perception that wolves should be shy and stay in remote or natural areas) do not correspond to how wolves actually behave in a particular situation, for example, when wolves allow people to approach at close distances or are sighted near human settlements..
- 2) Situations in which wolves really act in a bold manner, that is, the animal intentionally approaches humans.

Addressing this emerging public concern is further complicated by inconsistent terminology used to describe the behaviour of wolves along a gradient of habituation, which can cause confusion and exacerbate tensions when dealing with the management of these situations. Establishing consistent terminology is particularly challenging given the complexity of wolf behaviours, which is influenced by numerous factors and can vary significantly, for example, with the presence of a person walking with a dog (Karlsson et al. 2007). Furthermore, wolf behaviour has been traditionally studied in remote and natural environments, where human presence is usually rare (Mech & Boitani 2010). Translating these behavioural patterns to anthropogenic environments might not always be appropriate, also considering the adaptability of wolves to different scenarios. Finally, the perception of what is normal behaviour might be influenced by highly contextual cultural understandings and social representations of the species (Peterson et al. 2008; Lescureux 2011). It is also important to note that approaching humans are recognisable to wolves as humans; that is to say, people in a car, a forestry truck or in a building may not provoke a reaction from wolves that would occur if people were simply walking. Notwithstanding such difficulties, clear and authoritative guidance to identify wolf behaviour that might cause risky situations is crucial for the public and authorities to prevent unnecessary fear, and enable prompt action if needed (Reinhardt et al. 2020). One example among many is the inconsistency around the term "habituation" which, as discussed above, does not inherently equal problematic behaviour unless further specified.

2. Strong habituation and bold behaviour

It is expected that wolves recovering, and persisting, in human-dominated landscapes are more used to the presence of humans and their activities (Lowry et al. 2012) compared to their conspecifics in remote and more natural areas, as they become habituated to human-related elements. In fact, this is important in today's human-dominated landscapes, as a certain degree of habituation toward humans and their activities is a necessary precondition for wolf persistence and survival, as well as for all other wildlife, in these landscapes. From the point of view of the real or perceived threat of wolves to human safety, habituated wolves do not necessarily mean a threat, as habituation covers a wide behavioural spectrum, ranging from natural and unproblematic behaviours to other behaviours that may lead to risky situations under some circumstances, such as in close human-wolf encounters (Baker & Timm 2017, Linnell et al. 2021).

Habituation is commonly defined as the “*loss of natural reaction of alert after being repeatedly exposed to the same stimulus*” (Rankin et al. 2009), which is considered *neutral* (Whittaker & Knight, 1998) when not associated with meaningful events (Enquist et al. 2016). In our case, the stimulus that wolves become habituated to is human presence and activities, for which they seem to have no positive or negative reaction, and which they ignore. Although habituation *per se* is not threatening (Uchida et al. 2019), along the gradient of habituation, strong habituation could potentially lead to risky behaviours. Habituation is an adaptive process, and humans could, deliberately or not, get wolves used to humans approaching at close distances (Knight 2009). Positive conditioning is a form of associative learning process whereby animals associate the presence of humans or human-related features (e.g., urban environments to an advantage, either for play, food sources or refuge, Bateman & Fleming 2012). That can occur more easily in young wolves than adults due to their natural curiosity and naivety. Strongly habituated wolves, such as in the case of food-conditioned wolves, may deliberately seek the vicinity of humans for the advantages they associate with them (Reinhardt et al. 2020). Although, again, they might not be *per se* a threat, they could potentially lead to close encounters that can lead to risky situations for people (LCIE 2019). At the extreme of habituation, strongly habituated wolves may intentionally and repeatedly approach humans, an activity often referred to as bold behaviour.

To gain insights into how bold behaviour toward humans is defined in the literature, we conducted a systematic review using the Scopus database (www.scopus.com). In addition to wolves, we extended our search to other canid species, specifically coyote (*Canis latrans*), red fox (*Vulpes vulpes*), golden jackal (*Canis aureus*), dhole (*Cuon alpinus*), and dingo (*Canis lupus dingo*). No results were found for dhole, dingo or jackal, while four relevant articles were identified for foxes, two for coyotes, and one for wolves (see details of the systematic review in Appendix I).

Like in the case of habituation, boldness or bold behaviour are used inconsistently in the literature; although it seems there is a general agreement that boldness is a trait that belongs to a behavioural continuum associated with the willingness to take risks (Lazzaroni et al. 2024). Breck et al. (2019) define boldness in coyotes as a response to a risky situation, such as encountering a predator or a human in an urban setting. Some authors associate boldness with reduced neophobia and responses to unfamiliar situations (Bridge & Harris 2020, Padovani et al. 2021, Morton et al. 2023). However, this behaviour is considered by other researchers to fall under the concept of exploratory behaviour (Breck et al. 2019, Lazzaroni et al. 2024), even describing it as exploratory boldness in the case of dispersing wolves (Barry et al. 2019). The link between a level of habituation and boldness is also suggested by Lazzaroni et al. (2024), where they define boldness in urban foxes as a propensity to take risks in non-novel situations, i.e., after habituation. At the extreme stage of boldness, some authors discuss aggressive behaviour (e.g., Farr et al. 2023). Aggressive behaviour is defined by Breck et al. (2019) for coyotes, as an agonistic reaction towards conspecifics, with its extreme form being a coyote attacking dogs on leash.

The progression of boldness to its most extreme form (i.e., biting incidents or attacks) is illustrated by Farr et al. (2023), who propose a four-levels scale of coyote behaviour: 1) Avoidance. The individual runs or moves away from people; 2) Indifferent behaviour. The individual appears not to notice or care about the presence of people, even watching them, or vocalizing at them; 3) Bold behaviour. The individual follows or stalks people or approaches pets or people; and 4) Aggressive behaviour. The individual attacks pets (in the immediate vicinity of people) or people.

Bold behaviour manifested repeatedly characterises a bold individual, thus the frequency and repeated nature of bold behaviour is key to identify a bold individual. Boldness is an individual propensity and may manifest differently among individuals.

Acknowledging the need to provide a coherent classification of some wolf behaviours for management purposes, we propose an operative definition for strong habituation and bold wolves. Although the manifestation of a given behaviour can be context-dependent and each case of close encounter between wolves and humans ought to be analysed separately, considering the individual variability and environmental conditions, we believe that definitions able to guide the overall judgement are needed for ensuring adequate management of eventually risky situations.

Along these lines, we define **strong habituation as a situation whereby a wolf allows people** (being recognizable as people) to **repeatedly approach at short distances without moving away** (the wolf appears to not care about the presence of people). An adult wolf that repeatedly tolerates humans at a distance of less than 30 m is an indication of strong habituation, as most wolves have a much longer flight distance (e.g. Wam 2002, Karlsson et al. 2007). In addition, technical deterrents such as rubber bullet or paintball shooting can only be realistically implemented if the wolf can be approached within 30 m of the human. Bold behaviour does not usually emerge without a preceding strong habituation, which should be also recorded and monitored for an overall evaluation and the implementation of early interventions.

On the other hand, considering two critical aspects for a proper definition of a bold wolf: distance to people and frequency of the bold behaviour, **we define a bold wolf as one that repeatedly approaches people** (being recognizable as people) **at a short distance** (30 m or less). Wolves that approach humans at a short distance once might exhibit bold behaviour but are not to be classified as bold wolves, as the reiteration of bold behaviour is key for such classification.

Considering that most cases of bold wolf behaviour reported in the literature involved wolves that were previously strongly habituated to the presence of humans (McNay 2002, Reinhardt et al. 2020, Nowak et al. 2021), the development of a strong habituation might need to be discouraged to prevent further development into more risky behaviours (i.e., bold behaviours). For example, in the six reported cases where non-rabid wolves have bitten humans in Europe between 2002 and 2020, all the incidents were preceded by unusual behaviours from each individual repeated over time, indicating a stage of strong habituation, being frequently in close proximity to humans or relying on anthropogenic food sources (i.e., food-conditioned wolves) (Linnell et al. 2021; Nowak et al. 2021).

The threshold for an encounter between wolves and humans at a short distance is set arbitrarily at 30 m. Most wolves have a much longer flight distance (Karlsson et al. 2007, Wam et al. 2014). Such a limit is in addition supported by ballistic tests and experience-based information in the use of rubber bullets for aversive conditioning (e.g., Reinhardt et al. 2020). Ballistics tests undertaken using Benelli Gun M3 model with Fiocchi “Rubber Baton” and “15 Rubber Buckshot” ammunitions caliber 12 suggest that the energy of rubber bullets shot at 20 m with long or short guns does not decrease during the trajectory, while it significantly decreases at a distance up to 30 m. At higher distances the trajectory might also be compromised due to the loss of energy and speed (CUFA, 2024).

3. Collection of cases of strongly habituated and bold wolves

The systematic collection of details on each close human-wolf encounter, which may end up in identifying cases of strongly habituated and bold wolves, is crucial for a proper assessment of the wolf behaviour and the adoption of adequate management actions. However, so far, our understanding of strongly habituated and bold wolves is based primarily on anecdotal evidence (e.g., Reinhardt et al. 2020, Nowak et al. 2021, Linnell et al. 2021).

In this regard, the goal of task 2.1 of the LIFE WILD WOLF project was to collect detailed information on cases of human-wolf close encounters that matched with our definitions of strongly habituated and bold wolves, from 2012 to 2022. Our data collection was made from project countries (eight project countries - Croatia, Czech Republic, Germany, Greece, Italy, Portugal, Slovenia and Sweden) and beyond across Europe (e.g. The Netherlands). We additionally contacted experts from across EU Member States (members of the project scientific committee and the IUCN Large Carnivore Initiative for Europe - LCIE) for contributing to the data collection of cases reported to local authorities or responsible institutions. We also included cases from Poland reported in the literature (Nowak et al. 2021), the media and social networks. In cases where reliable and detailed descriptions were not recorded, information was gathered from various sources, including interviews with people directly involved in the case, and compiled into an overview form for each case, whenever possible. Cases that were still ongoing at the end of 2022 were not included in this report.

A dataset for all cases was created following the approach developed in Germany within the frame of the DBBW project (www.dbb-wolf.de/) as a starting point and modified including categorical options and additional fields (see details in Appendix II). All observations concerning the same animal, wolf pack or location were filed in a “case file”. A case file keeps track of every reported event of a wolf exhibiting strong habituation and bold behaviour according to the definitions proposed above. Observations might be sightings (with or without photographic documentation), camera trap pictures / videos or any other type of wolf signs that can be linked to the case in question. The final form prompts for the collection of detailed descriptions of the single observations, encouraging the input of data in a systematic manner, as much as possible. Data collection included the environment and circumstances of the observation, the closest distance between the wolf and the human, behaviour of the wolf, human behaviour, the presence of attractants like dogs, and any interventions carried out (Appendix II).

For the analyses of wolf behaviour, only documented first-hand information was used (Reinhardt et al. 2020) to avoid uncertainty. For the sake of an objective interpretation of past cases, we used only observations with high degrees of reliability, adopting the classification used for Eurasian Lynx monitoring in Switzerland (SCALP; Molinari-Jobin et al. 2012), further adapted to wolf monitoring (Kaczensky et al. 2009, Wolf Alpine Group 2022). The SCALP criteria categorise evidence based on its verifiability and includes a range that goes from highly reliable (i.e., C1, which indicates the availability of hard evidence, such as photographs, video footage with identifiable location, or genetically verified samples) to impossible to verify (i.e., C3, unconfirmed observation, which include all indirect signs such as reported sightings without pictures or signs of presence too old or incomplete, that are impossible to be verified). Once further observations are no longer reported for a particular case, the case file is closed (after one year, according to Reinhardt et al., 2020). This might happen for different reasons, such as the disappearance of the wolf involved or the implementation of intervention actions. Every closed case file is associated with a summary compiled using a dedicated form (Appendix III) that summarises what happened overall, i.e. the behaviour of wolves and people, the presence of attractants, the duration in time of the case, and the eventual management interventions implemented. Due to the intrinsic nature of historical data, most cases were available only as summaries without detailed descriptions of individual observations. Consequently, essential information for understanding and evaluating these cases could be lacking. As a result, five cases and case summaries could not be included in further analyses, as information was missing that would, for example, allow determining whether the wolf was approaching recognizable humans (not in a car or a building).

4. An overview of reported cases

Although we did not explicitly ask contacts to report individual close encounters, we received a total of 371 records including 312 records of single close encounters between wolves and humans from the period 2012 to 2022. These 312 records did not meet the criteria for bold or strongly habituated wolves (not a repeated behaviour, 75 % of single close encounters were classified as non-C1 reports according to the SCALP criteria and, in most instances, the behaviour was not even considered as conspicuous, or the report did not meet a minimum quality for assessing the behaviour of the wolf properly). A further 5 cases (with multiple individual events) and 6 case summaries, were not included in the analyses as well, as they did not meet the criteria or lacked sufficient information. Finally, a total of 20 cases matched our criteria of strongly habituated and/or bold wolves, involving 6 countries (Table 2, Appendix III). In 7 of these 20 cases we obtained not only the case summaries we requested, but also the individual events belonging to these cases (between 3 and 9 per case)..

Among the 20 analyzed cases, one case was classified as strong habituation (wolf allows people to approach) and 19 cases as bold wolves (wolf approaches people; note that, usually, a previous condition for a bold wolf is strong habituation). See Appendix III for case summaries. Available information in the reports of the case involving a strongly habituated wolf (IT_03) did not allow us to assess if this individual could also meet the criteria for a bold wolf .

Three cases from Germany are interlinked and involve a single litter of wolf pups, whose behaviour suggested they were positively conditioned by people (DE_01). Two of these offspring later became separate cases—one after dispersing (DE_02) and the other after being the only one from the pack to resume bold behaviour following intervention (DE_03).

In 75% of cases (n = 15), a single wolf was involved in human-wolf encounters. An exceptional case was the one from Tolve (Italy, IT_04), where up to five pack members were frequenting the city, including both adults and yearlings.

When the age of the wolf was known (80% of cases, n = 16), in 14 cases (87%) the individuals were yearlings, or in three cases even pups. Only in the DE_05 case was the individual an

adult, whose bold behaviour was likely influenced by its physical handicap, as mentioned below. In cases where the sex was known, the ratio was five males to five females, in line with previous findings by Kojola et al. (2016) that risk-taking behaviour toward human infrastructure is not sex dependent.

In two cases, the behaviour of the wolves was likely influenced by their physical condition. The wolf from the case DE_05 was confirmed to have mange, canine distemper, parvoviruses and a spinal injury, which severely impacted its ability to hunt. The female wolf from the case PL_02 had a spleen abnormality which likely negatively influenced her fitness and may have favoured her becoming food-conditioned (Nowak et al. 2021).

Two other wolves identified as bold likely originated from captivity. The wolf in the case IT_02 had signs of a collar around its neck, suggesting prior confinement. The female wolf in the Czech Republic (CZ_01) was found to have rabies antibodies, but since rabies was not detected, it is assumed that the wolf had been vaccinated in captivity. There were speculations that the bold wolf case from Bieszczady Mountains (PL_01) might have also been raised in captivity due to some indices, but it was never confirmed (Nowak et al. 2021).

In terms of spatial coverage, six cases were from Italy, six from Germany, three from Greece, two from Poland, and one each from the Czech Republic and the Netherlands, respectively (Fig. 1). Most cases (n=17; 85%) occurred in areas re-colonized by wolves since 2012 (Kaczensky et al. 2021, 2024). Only three cases fall within the wolf range at their lowest extent estimated for the period 1950-1970s (Chapron et al. 2014b). Overall, 30% of cases were recorded on the Italian Peninsula, 45% were from the Central European population, and the remaining cases (25%) were reported from Greece and the Polish Carpathians, regions where, unlike in the aforementioned areas, wolf populations have remained relatively stable in recent decades (Chapron et al. 2014a, b, Kaczensky et al. 2024).

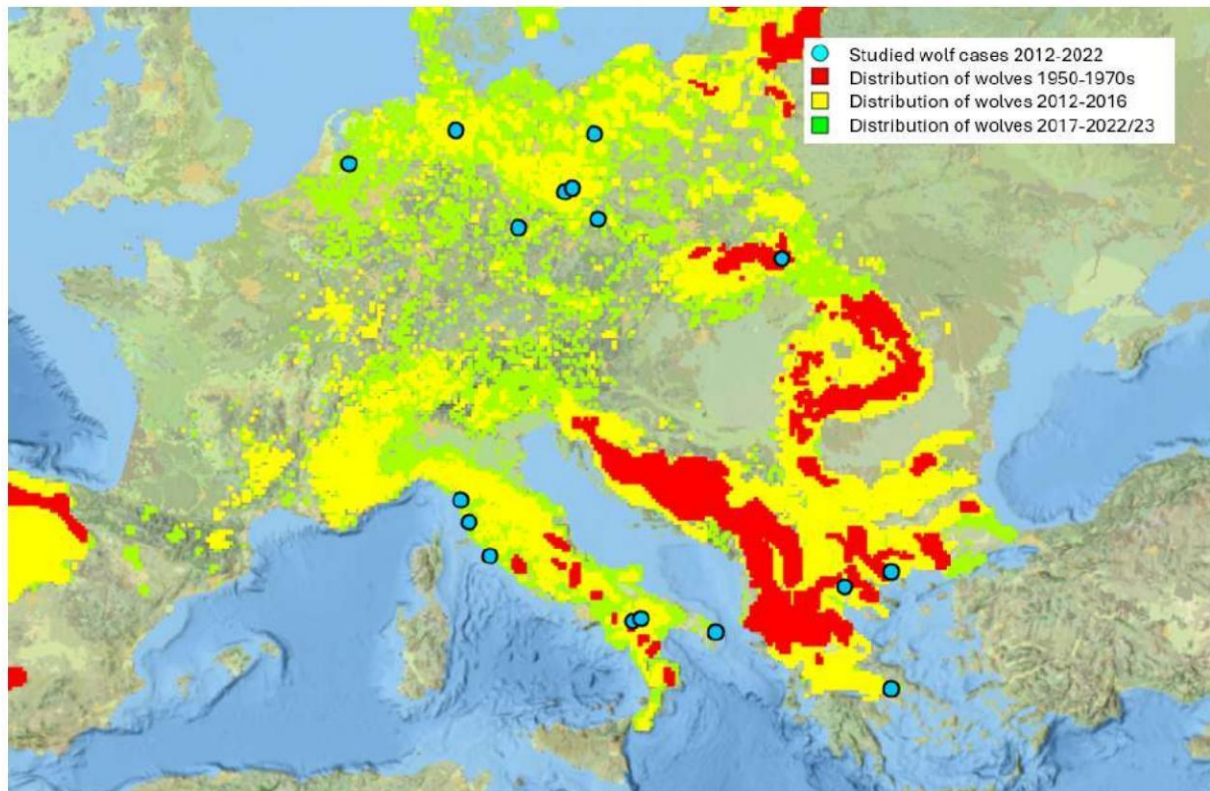


Figure 1: Distribution of documented cases of wolves showing strong habituation or bold behaviour, in relation to wolf distribution dynamics over the years (Chapron et al. 2014b, Kaczensky et al. 2021, Kaczensky et al. 2024).

The number of cases fluctuated over time without showing a clear Increasing trend (Table 1). Cases were reported throughout the entire year and had a remarkable duration.

Table 1: Number of documented cases of wolves showing strongly habituated or bold behaviour initiated per year over a ten-year period

Year	Number of cases
2012-2013	0
2014	1
2015	2
2016	0
2017	3
2018	5
2019	0
2020	3
2021	5
2022	1

On average, the duration of the cases that matched our criteria was approximately 5.3 months (3–401 days). For two cases from Greece (GR_01, 02), the duration was unclear, but it was likely between several weeks and a few months. The case GR_04 was not included in the calculation of the average duration of cases, as new individuals exhibiting bold behaviour continue to appear, likely with new litters of pups, until the summer of 2024. It seems that most cases (90%, $n = 18$) included encounters and sightings at various times of the day, primarily during daylight hours; except for one case in Greece (GR_01) and one in Germany (DE_06), where observations and encounters occurred exclusively during night.

In all cases of bold individuals, wolves actively approached people to <30 m (Table 2); although in three cases (DE_05, GR_03, IT_05), wolves approached people themselves, but they did not allow people to approach them. In 75% of cases ($n = 15$), wolves entered several times or stayed in settlements or near inhabited houses during daylight.

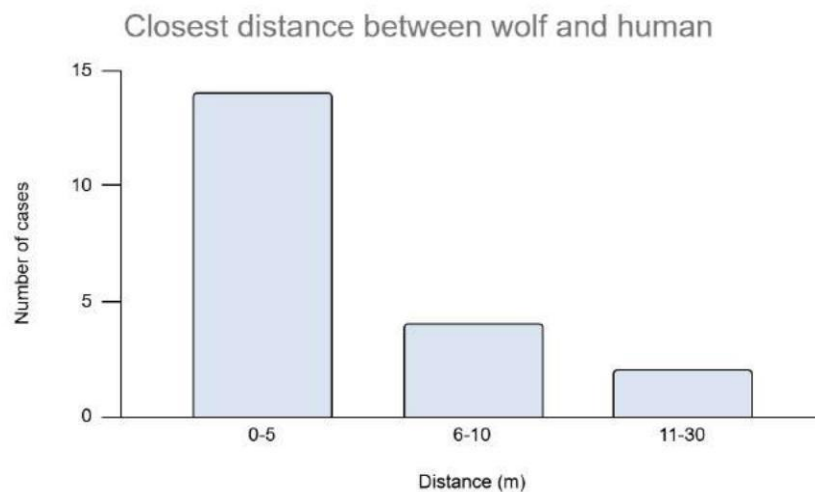


Figure 2: Frequency of minimum distance during human-wolf encounters reported in the documented cases of wolves showing strongly habituated or bold behaviour

Only in five cases did wolves approach cars with clear interest. One case involved pups investigating forest worker's equipment (DE_04), while the other four (DE_01, 02, 03, NL_01) involved wolves that were likely food-conditioned from or near cars. It should be recalled that the three cases from Germany are interconnected, with the interest in cars observed in cases DE_02 and DE_03 originating from case DE_01. The minimum distance registered in reported cases ranged from 0 to 5 m in 70% of all cases ($n = 14$, Fig. 2), with four of these encounters resulting in physical contact with humans (20% of all cases, Table 2).

It is important to note that physical contact occurred in cases involving wolves that were likely captive (CZ_01, IT_02, PL_01) and/or highly food conditioned over a long period (PL_01, 02). The case CZ_01 did not result in any human injury, and contact occurred when the dog owner pulled the dog out of the wolf's mouth. In the remaining cases, people were bitten (see Appendix III).

Attractants were at least partly known in 85% of cases (n = 17). Three types of attractants were identified: food sources (n = 12, e.g. garbage, pet food, kitchen leftovers), dogs (n = 11) and human tools (n = 1). In one case (IT_06) the attractants (garbage) were identified and removed, and wolf behaviour was no longer reported. Various food sources were recorded in 12 cases. However, in only 5 of these cases (29% of cases with known attractants) the food was the sole known attractant. In 7 cases, wolves were also interested in dogs, and their interactions almost always resulted in injury or death of the dog, similar to the other two cases where dogs were identified as one of the possible attractants. In contrast, dogs were the main attractant for two female wolves (IT_03, DE_06) likely for mating purposes. Only in one case (DE_04) the attractants were neither food or dogs, but rather forest workers' equipment, which the pups were interested in.

Table 2: Type of wolf behaviour, presence of attractants and dog involvement across documented cases of wolves showing strongly habituated or bold behaviour. "NA" (Not Applicable) indicates that the specific condition is irrelevant to the case because the prerequisite circumstances were not present.

Country	Case	Wolf approaches people < 30 m	Wolf allows people to approach < 30 m	Wolf approaches or follows cars with interest	Wolf repeatedly in built-up areas during daylight	Closest distance	Physical contact to people	Attractants were known	Type of attractant	Dogs involved	Dog as the main object of interest	Physical contact to dog	Attractants removed
Italy	IT_01	repeatedly	one time	no	yes	11 - 30m	no	no	NA	no	NA	NA	NA
	IT_02	repeatedly	repeatedly	no	yes	0 - 5m	yes, with injury	yes	food source	not clear	NA	no	unknown
	IT_03	unknown	repeatedly	no	yes	6 - 10m	no	yes	dogs - mating	yes	yes	yes	no
	IT_04	repeatedly	unknown	unknown	yes	11 - 30m	no	partly	food sources/dogs	yes	partly	yes	partly
	IT_05	repeatedly	no	no	yes	0 - 5m	no	no	NA	yes	no	no	NA
	IT_06	repeatedly	repeatedly	no	yes	6 - 10m	no	yes	food source	yes	no	no	yes
Greece	GR_01	repeatedly	repeatedly	no	yes	6 - 10m	no	yes	food source	no	NA	NA	unknown
	GR_02	repeatedly	repeatedly	no	no	0 - 5m	no	unknown	NA	no	NA	NA	NA
	GR_03	repeatedly	repeatedly	no	no	6 - 10m	no	partly	food sources/dogs	yes	partly	yes	NA
	GR_04	repeatedly	one time	no	no	0 - 5m	no	partly	food sources/dogs	yes	partly	no	NA
Germany	DE_01	repeatedly	repeatedly	repeatedly	yes	0 - 5m	no	partly	food source	yes	no	no	no
	DE_02	repeatedly	repeatedly	repeatedly	yes	0 - 5m	no	partly	dogs	yes	yes	yes	partly
	DE_03	repeatedly	repeatedly	repeatedly	yes	0 - 5m	no	partly	dogs	yes	partly	yes	partly
	DE_04	repeatedly	repeatedly	repeatedly	no	0 - 5m	no	partly	tools	no	NA	NA	partly
	DE_05	repeatedly	no	no	yes	0 - 5m	no	yes	food sources/dogs	yes	partly	yes	partly
	DE_06	repeatedly	repeatedly	no	unknown	0 - 5m	no	yes	dogs - mating	yes	yes	yes	partly
Poland	PL_01	repeatedly	repeatedly	no	yes	0 - 5m	yes, with injury	yes	food sources/dogs	yes	partly	yes	no
	PL_02	repeatedly	repeatedly	no	yes	0 - 5m	yes, with injury	yes	food sources/dogs	yes	partly	yes	no
Czechia	CZ_01	repeatedly	repeatedly	no	yes	0 - 5m	yes, without injury	yes	food sources/dogs	yes	partly	yes	no
The Netherlands	NL_01	repeatedly	repeatedly	repeatedly	no	0 - 5m	no	partly	food sources	no	NA	NA	no

5. Discussion

In this report we propose definitions for strongly habituated and bold wolves. We acknowledge these definitions are provided from a purely anthropocentric perspective, and privilege human safety. Although some aspects of our definitions might be questionable (e.g., the distance threshold selected which depends on the type of guns and bullets used for aversive treatments), our focus is to provide a practical contribution in terms of management of risky situations, with a secondary aim of discouraging wolf behaviours that might cause concerns and put wolf safety at stake. Our definitions assume a recurrence of unwanted behaviours over time. In fact, we observed a long average duration of the selected cases of strong habituation and bold wolves (5.3 months). The observation of a single episode of bold behaviour or strong habituation does not necessarily mean that it is a case demanding immediate intervention but it demands an appropriate level of monitoring over time. We acknowledge that a more precise definition of “repeatedly” might be needed and we aim to provide one with future data collection.

Between 2008 and 2011, ca. 12,000 wolves were estimated to occur in Europe (Chapron et al. 2014a); whereas this figure reached up to ca. 23,000 wolves in the period 2017-2022/23 (Kaczensky et al. 2024). During the similar period (2012-2022), we compiled 20 cases of wolves whose behaviour matched with our definitions of strongly habituated and bold wolves (1 strongly habituated, i.e. allowing people to approach, and 19 bold wolves, i.e. approaching humans). Remarkably, most reported cases occurred in areas re-colonized by wolves in the last decade. Although the number of cases in the past is low (on average, 2 cases per year in Europe during the study period), we acknowledge that the lack of homogenous definitions for strong habituation and bold wolves across Europe, together with different scenarios of coexistence with the species, lack of systematic monitoring of potential cases, and lack of awareness and motivations to report cases, among other factors, may influence the observed number of cases. On the other hand, a large number of records of allegedly bold behaviour were discarded from our analysis because the criteria for strong habituation or bold behaviour were not met, and many observations recorded behaviour that was not problematic. Thus, we recommend the adoption of homogeneous definitions, standardised data collection and protocols across Europe to monitor the occurrence of potential cases of strong habituation and bold wolves in the human-dominated landscapes. Increasing efforts in monitoring reported cases, and informing the public about different wolf behaviours, are two crucial initial steps in addressing these unwanted behaviours (LCIE 2019, Reinhardt et al. 2020). In this regard, our

proposed definitions and template used to compile information on these close human-wolf encounters— which can potentially lead to strong habituation and bold wolf behaviour— may be useful to get a better idea of the dimension of these unwanted wolf behaviours at European scale.

Still, from the 20 cases compiled, some preliminary patterns emerged that may be useful for an early identification of potential cases. Most cases involved a single wolf and, when the wolf's age was known, the majority (87%) were young (yearlings or pups). This aligns with studies indicating that young and dispersing wolves are more likely to develop bold behaviour than adults (Smith and Stahler 2003, Kojola et al. 2016, Barry et al. 2020). Moreover, most cases (90%) included encounters and sightings mainly during daylight hours, when humans are more active.

On the other hand, the detailed analysis of the cases revealed that strongly habituated and bold wolves are often the result of human actions in origin. At least two of the cases involved wolves that were likely held in captivity before (for a third one in Poland this is also a likely explanation, Nowak et al. 2021). In 55% of the reported cases food as an attractant was involved. In the majority of reported cases (70%) dogs were involved. Situations in which a wolf is primarily interested in dogs may be more complex and more difficult to prevent and solve than situations involving food conditioning (Mugnari et al. 2025).

Accessible food or direct feeding by humans is the most common factor when wolves are losing their shy / cautious behaviour toward humans (Smith et al. 2020, Reinhardt et al. 2020). Thus, we call for an increased focus on prevention of unwanted behaviours of wolves and humans. This includes an immediate intervention to avoid boldness as soon as conditions facilitating the development of strong habituation are reported according to our definitions. Removal of attractants is one of the first recommended steps in managing wolves showing strong habituation and/or bold behaviour (LCIE 2019, Reinhardt et al. 2020, Linnell et al. 2021). However, it is not always possible to identify and remove all attractants, especially when dogs are involved. Efficient removal of attractants was recorded only in one of the collected cases (IT_06). Our study provided valuable insights on a phenomenon that has received less attention so far. In particular, we provide objective definitions of unwanted wolf behaviour toward humans and a specific protocol for data collection, with possible interventions for both strong habituation and bold wolves, which all together is strongly needed for ensuring an adequate, appropriate, and prompt management of eventually risky situations.

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Appendix I. Systematic review on bold behaviour in canids.

To gain insights into how bold behaviour toward humans is defined in the literature, we conducted a systematic review using the Scopus database (www.scopus.com). The search was conducted within the Article Title, Abstract, and Keywords fields, with the following search string:

("canid species" OR "Latin name of the species") AND (human* OR people OR public OR man OR men OR woman OR women OR child OR children OR victim*) AND (bold*) AND (behavio* OR individual* OR habituation).*

In addition to wolves, we extended our search to other canid species, specifically coyote (*Canis latrans*), red fox (*Vulpes vulpes*), golden jackal (*Canis aureus*), dhole (*Cuon alpinus*), and dingo (*Canis lupus dingo*).

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Appendix II. Proposed template for data collection of strongly habituated and bold wolves

Concrete actions for maintaining wolves wild in anthropogenic landscapes of Europe LIFE21-NAT-IT-4417 WILD WOLF



T.2.1-T2.3 - Collection of current and past cases of bold behaviour of wolves toward humans

Please fill in one row for each event/case. Only cases where humans were present and are recognizable for a wolf as human beings should be presented. PLEASE PLACE CURSOR ON "SELECT ONE" CELL TO SEE DROP DOWN OPTIONS. Please fill the last columns "Accompanying actions" when the case is closed or ended.

ID	Case file name	Type of observation	Observer	Date	Time	SCALP	First hand?	Length of time	Coordinates (Latitude - Longitude)	Country	Region (country, federal state)	Province	Location (next village / city)	More detailed description of the location
		Please select				Please select	Please select	Please select						

Circumstances	Terrain	In settlement environment? If yes, which	Evident attractant present?	Notes on attractants (describe if possible)	Number of wolves	N. indeterminate	N. adults	N. pups	N. yearling	Identity of wolf (i.e. genetic / telemetry)	Wolf(ves) handicapped /with evident disease	Dogs involved?
Please select	Please select	Please select	Please select									Please select

Was there physical contact to dog?	Info about the dog	Shortest distance to people(m)	What happened? Describe	Behavior wolf/wolves - describe	Behavior of people - describe	Wolf perceives humans?(for cars = unclear)	If yes, what does wolf do to show it perceived humans?	Wolf deliberately approached human?(Human is to be recognized as such)
	Please select	Please select				Please select	Please select	Please select

Person deliberately approached wolf?	Wolf purposefully approached vehicle?	Scare away attempt: How? Describe	Scare away attempt: Reaction wolf - describe	Photo / Video?	Recorded by	Internal comment / remark	Assessment of behavior(will be filled in by authority)	Comment on the final assessment(will be filled in by authority)	Final assessment of (name of employee that made final assessment)
Please select	Please select			Please select			Please select		

DROPDOWN OPTIONS

Type of observation	SCALP	First hand?	Length of time	Circumstances	Terrain	In settlement environment?	Evident attractant present?
Sighting/video	C1	Yes	Few seconds	On foot	Meadow / field / open space	Not in settlement	No
Camera trap	C2	No	up to 1 minute	On foot, with dog	Path / road	In town / city	Killed/live listock nearby
Wildlife kill	C3	Not clear	1 - 5 Min	From vehicle (car, tractor, lorry, etc.)	Forest	In scattered settlement	Dogs
Livestock kill	False		>5 minutes	On horseback	Yard / garden	Outskirts	Pet food
Wolf carcass	No evaluation possible		recorded time (notes)	Other	Premises	Not specified	Other sources of food
Wolf captured				By bike	Not specified	Not specified	Others (describe)
Other				By bike, with dog	Beach		Not clear
				From building	Other		Multiple attractors present (describe in notes)
				Grom hide / blind			Organic waste

Info about the dog	Shortest distance	Wolf perceives humans?	If yes, what does wolf do to show it perceived humans?	Wolf deliberately approached human?	Person deliberately approached wolf?	Wolf purposefully approached vehicle?	Photo / Video	Final assessment
Free	0 - 5m	yes	Stops and watches, curious	Yes	Yes, by foot	Yes	Photo	Unproblematic
On a leash	6 - 10m	No	Stops, caught by surprise	Yes and follows	Yes, by foot and follows	Yes and follows	Video	Demands attention
	11 - 30m	Not clear	Runs away, scared	Not clear	Yes, in vehicle	Not clear	Photo+video	Critical
	31 - 50m	Not clear (in vehicle)	Other (describe)	Not specified	Yes, in vehicle and follows	No	None	Dangerous
	51 - 100m	Physical contact - aggression (describe accurately)	Sees people but ignores them	No	Not clear	Not specified		No assessment possible
	> 100m				Not specified			

CASE SUMMARY

Concrete actions for maintaining wolves wild in anthropogenic landscapes of Europe LIFE21-NAT-IT-4417 WILD WOLF

T.2.1-T2.3 - Collection of current and past cases of bold behaviour of wolves toward humans - SUMMARY

					Type of behaviour							
Case ID	Region (country , federal state)	Location (next village / city)	Start date	End date	Wolf approaches people <30 mt	Closest distance	Time of day	Wolf allows people to approach <=30 mt	Wolf approaches / follows cars with clear signs of interest	Wolf repeatedly enters or stays in settlements / close to inhabited houses during daylight	Physical contact to people?	If yes, Describe
					Please select	Please select		Please select	Please select	Please select	Please select	Please select

Attractants					
Attractants were known	Attractants were searched for - which type of attractants?	Dogs involved?	If yes: Was the dog the main object of interest	Was there physical contact to dog	Attractants were removed
Please select	Please select	Please select	Please select	Please select	Please select

C. Wolf(ves) identity									Intervention			
Number of wolves involved	Age of wolf(ves) - class	Sex of wolf(ves)	Wolf(ves) handicaped / with evident disease	Describe disease	If dead or captured, any desease certified?	(Describe disease	Individual (s) known?	please describe: e.g., genetic number and / or social status	Intervention was undertaken	Describe intervention	Interventio n by whom	Intervention protocol in place (insert reference)
	Please select	Please select	Please select		Please select							

End of bold behaviour	Data quality and assessment					Summary	
How did the behaviour stop?	Confirmation: Was the bold behaviour confirmed by C1 data?	Describe	Was the cause of the bold behaviour known and confirmed by C1 data?	Please specify your interpretation	Assessment	Short summarising description of the case	Source
					Please select		

SUMMARY DROPDOWN OPTIONS

Wolf allows people to approach <=30 mt	Closest distance	Time of day	Wolf allows people to approach <=30 mt	Physical contact to people?	If yes: Was the dog the main object of interest	Was there physical contact to dog	Attractants were removed	How did the behaviour stop?	Was the cause of the bold behaviour known and confirmed by C1 data?	Assessment
No	0 - 5m	Day	No	No	Yes	Yes	Yes	Wolf dead	Known, confirmed by C1 data	Unproblematic
Yes, one time	6 - 10m	Night	Yes, one time	Yes, without injury	Yes	No	No	Wolf disappeared	Known, but not confirmed by C1 data	Requires attention
Yes, repeatedly	11 - 30m	Twilight	Yes, repeatedly	Yes, with injury	Partly	Not clear	Partly	Attractant removed	Partly known, confirmed by C1 data	Requires attention to critical
	31 - 50m					Yes repeatedly		Intervention	Partly known, but not confirmed by C1 data	Critical
	51 - 100m							Wolf still there but behaviour ceased	Unknown	Dangerous
	> 100m							Unknown		
								Other (describe)		

Appendix III. Detailed summaries of reported cases of bold wolves

Czech Republic

CZ_01 (Krkonoše, 2018)

On August 3, 2018, the yearling female wolf was found in the pen with sheep, scared of the electric fence and unable to escape. She probably followed other wolves, as there were 4 partially consumed sheep. After the electric fence was turned off and lowered, she managed to get out after spending approximately 30 hours in the pen. In the following days, the female was frequently seen near houses during the day. On August 6, she attacked a small dog and carried it into the woods. The dog's owner followed and pulled the dog out of the wolf's mouth. Afterwards, the female ran into a hotel, where she was captured. She showed no fear of people. She was examined for rabies and other diseases. She was euthanized after rabies antibodies were found. However, the autopsy did not confirm rabies. It is assumed that the wolf was raised in captivity and was vaccinated against rabies during that period.





The female wolf was initially found in an enclosure, unable to escape fearing the electric fence.
© Jiří Dvořák /KRNAP and © ČTK.

Germany

DE_01 (Lower Saxony, Munster area, 2014)

In early 2015, there were numerous media reports of wolf sightings in the territory of the Munster pack. The wolves were frequently seen during the day from cars and displayed very relaxed behaviour in the vicinity of the cars. There were also close encounters between wolves and people on foot. The wolves repeatedly approached walkers, let them approach or followed walkers. All C1 observations involved pups or later in the year yearlings of the Munster pack. In response to the reports, The Lower Saxony nature conservation authorities decided to intensify and professionalise the wolf monitoring in Munster and ordered to capture and collar the wolves of the pack and analyse the situation. In the summer 2015, bold behaviour in the territory declined significantly, ceasing completely after two yearlings were captured and radio collared. One of them later resumed its bold behaviour (Case 2016NI_MT6). The situation analysis found the breeding pair to be more tolerant to human activity than other wolves in Germany, but there was no evidence that the adult wolves were interested in humans or cars as their offspring from 2014. There were many rumours of the pups being fed and people playing with them, but these could not be verified. However, the behaviour of the young wolves is a clear indication of positive conditioning.

DE_02 (Lower Saxony and the Netherlands, 2015)

From February to April 2015, a wolf pup wandered through western Lower Saxony and for a few days through the Netherlands. The wolf used roads and was seen almost daily in or in close vicinity of settlements. The wolf tolerated the presence of people at close range but gradually showed increasing signs of insecurity during close encounters with people along his journey. In response to the unusual behaviour, the nature conservation authorities decided to capture the animal in order to examine it more closely and find out more about its identity. However, attempts to capture the animal were unsuccessful because it wandered too quickly. Genetic analysis later confirmed that it was one of the pups from the Munster wolf pack, born in 2014, which had previously displayed bold behaviour and was likely positively conditioned (Case above). At the beginning of April, the wolf returned to his parents' territory, wandered off again a few days later, and was killed shortly afterwards in a highway accident.

DE_03 (Lower Saxony, Munster area, 2015, MT6 case)

At the end of 2015, a number of close human-wolf encounters and close-range sightings from cars were reported in and around the territory of the Munster pack. The collared wolf MT6 was

involved in most of them. MT6 was one of two collared yearlings that were captured and radio collared after several Munster pack offspring had exhibited strong habituation and bold behaviour toward people and showed a clear interest in cars in early 2015. There were rumours that the 2014 Munster pack pups have been fed by people, but this could not be confirmed for sure. After radio collaring of MT6, there were for several months no reports of close encounters, just several close-range sightings from cars, all involving MT6. From December 2015 on, the yearling was frequently seen near or within settlements during the day. He mostly ignored people and dogs, but tolerated their presence at a distance of far less than 30 m. Several times the wolf approached people with dogs at a distance less than 5m. Deterrence attempts were carried out in March 2016. However, since the satellite unit in the wolf collar was not working any more and MT6 was roaming over 2000km² it was not possible to haze the wolf in a situation where it was showing unwanted behaviour. Instead the wolf was actively approached via the VHF transmitter while it was resting and then hazed by people with dogs. Following these actions the wolf was not seen for a week. However, after that, close encounters, attempts to approach people walking dogs, and sightings were reported again. His erratic behaviour made targeted deterrence impossible, and as the behaviour became more frequent, the wolf was legally shot on April 27, 2016.

DE_04 (Saxony, Lohsa, 2017)

In late summer / fall of 2017 numerous close distance sightings (0-5 m) of pups in the core area of the Milkel pack were reported. The pups showed a strong interest in the equipment of forest workers. Several times it appeared that they approached when they heard the mowing of a brush cutter. As soon as the sightings were reported, the monitoring was intensified and contact to the observers was established. Observers were asked to report any sighting immediately, by no means provide food to the pups, but haze them when they approached. Several hazing attempts were conducted by persons involved in the monitoring. On one occasion a pup was fired at with a rubber bullet. During winter, observations of pups became less frequent and finally the conspicuous behaviour ceased.



Hazing of one of the Milkel pups. © LUPUS Institute.

DE_05 (Saxony, Krauschwitz, 2017)

Between Christmas 2017 and New Year, three cases were reported (and later genetically proved) where a wolf preyed on dogs in the backyard of houses. In the following weeks a wolf, strongly marked by mange was observed almost on a daily basis within or close to three villages. The wolf was seen taking cats and breaking into rabbit stables on house yards during daylight. As the sightings became ever more frequent, often being at close distance, the responsible authority issued a shooting permit. On February 2, 2018, the wolf was shot close to a village. Veterinarian investigation of the carcass by the Leibniz Institute of Zoo and Wildlife Research Berlin (IZW) revealed that the wolf, besides having strong mange symptoms, was also infected with canine distemper and parvovirus. In addition, it had an injury to the spine, causing movement restrictions.



WILDBLICK

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The wolf GW701m in front of a house where it had taken a dog several days earlier. © LUPUS Institute.

DE_06 (Saxony, Obercrinitz, 2022)

In April 2022 numerous encounters between a wolf and a person walking its dog were reported to the wolf management. The encounters have started already in December 2021 and have become more frequent, almost daily, in the weeks prior reporting. The wolf appeared only in the dark and only when the dog was walked by one person only. The encounters took place not far from the dog owner's house at the edge of the village. Numerous videos showed the interaction between the young female wolf and the male dog on a leash. The dog owners did not try to prevent the encounters, on two videos, both wolf and dog were fed with treats. The monitoring in this area was intensified and the dog's owners were recommended to walk their dog only together (not as single persons), not in the dark, to use other areas for walking the dog and when encountering the wolf to actively haze it. After an active hazing of the wolf by one of the dog owners at the beginning of May, the situation ceased. No other wolves were confirmed in this area.

Greece

GR_01 (Pikrolimnh, 2017)

From November 2017, for several weeks to months, a very thin yearling wolf frequently visited a pig farm. An owner of the farm fed the wolf with pig remains. Wolf approached or allowed to be approached by the owner within a range of 6 to 10 metres. After some time, the wolf disappeared.

GR_02 (Kavala, 2018)

For several months in 2018, a wolf repeatedly approached a farmer or allowed itself to be approached by the farmer at a vineyard within a range of 0 to 5 metres.



The wolf from Kavala in the vineyard during one of its close encounters with a human. © Callisto.

GR_03 (Parnitha, Central Parnitha Pack, 2021)

From late fall 2021 to February 2022, up to three yearling wolves from the Central Parnitha pack were reported to repeatedly approach and follow humans at close distance during the day. Additionally, one dog was reported killed in the presence of humans and another small dog was grabbed by a wolf while being walked on a leash by a child. There were indications that some people had left food for the wolves to facilitate photographing them. Moreover, the wolves were likely habituated to human presence as pups due to prolonged exposure from an early age, as a very busy hiking trail ran near their den site. Guidelines were provided to forest service and PNP National Park. No permission was given for the intervention (trap or haze wolves).



The yearling wolf from the Central Parnitha pack. © Vasilis Drakopoulos.

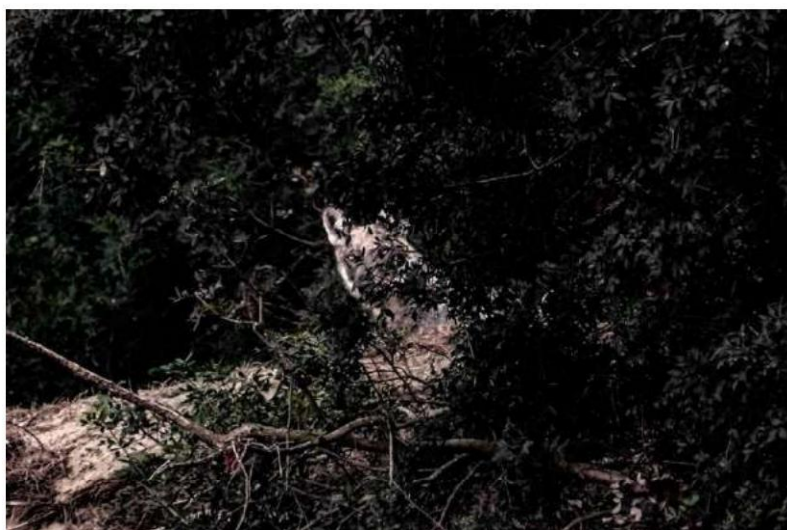
GR_04 (Parnitha, South-East Parnitha Pack, 2021)

From April 2021 to summer of 2024, close-distance human-wolf encounters were reported in the territory of the South-East Parnitha Pack. Over time, possibly multiple young individuals were reported approaching people, behaving fearlessly even at a short distance from humans, and allowing people to get close to them. One wolf even attempted to attack a dog while it was with its owner and in the presence of another observer. At least in one case, it is assumed that the wolf followed the runners to defend its pups, as the den site was located near a busy hiking trail, similar to the GR_03 case. It seems that the bold behaviour passes from litter to litter and then ceases when the wolves disperse or grow up. In addition to exposure to human presence from an early age, the territory contained many attractants, such as stray dogs, food left for stray dogs, and animal carcasses (livestock, animal leftovers and dead dog buried). Monitoring was intensified (camera traps), and wolf trapping and GPS collaring was carried out in the area. A leaflet to hikers was distributed and farmers were informed not to dispose of carcasses in the field.

Italy

IT_01 (Feniglia, 2018)

During spring and summer 2018, a yearling wolf repeatedly approached people at distances of 11 to 30 metres and allowed people to approach it within this range on the beach, trails, parking lot, and scattered settlements in and around the Duna Feniglia Natural Reserve during the day. It was also reported in the town of Porto Ercole. From the collected encounters, the wolf ignored people or watched them and then walked away. IEA and CUFA intensified monitoring, requested reporting encounters, held public meetings and educated people. There was also an unsuccessful trapping session with cages organized by local authorities.



Attractants were searched for.

No food was found, but every day the beach was full of people, so it was not possible to exclude food conditioning. The behaviour stopped without any known reason.

Wolf in Duna Feniglia Natural Reserve. © Paola Fazzi.

IT_02 (Otranto, 2020)



The wolf after capture @Majella National Park

In June 2020, a yearling wolf frequented the beach and the surrounding houses in Otranto during the day. It responded to calls, displayed a playful attitude towards humans, and fed on food left for pets. It also attacked a running woman (resulting in injury) and a child on a bike (without

injury). It was suspected to be raised in captivity, due to signs of collar on its neck. It was captured and moved to an enclosure.

IT_03 (Potenza, 2020)

Since June 2020, a female wolf has frequented the city of Potenza during the day. The female was captured, collared and released on December 24, 2020, in the Grancia Caterina Regional Forest near Potenza. After two months, she returned to Potenza during the mating period. The female was reported eating garbage, pet food and was seen mating with stray dogs. She allowed people to approach within 6 to 10 metres. In March 2021, she was captured again, sterilized and released in the Gallipoli Cognate Park.

IT_04 (Tolve, 2021)

In November 2021, three wolves (one adult and two juveniles) frequented Tolve village during both day and night. Predation on dogs was documented, and they approached people within 30 metres. Camera trap monitoring was initiated, attractants were removed (waste management), and visual and acoustic deterrents were implemented along with monitoring to verify their effectiveness. One wolf was captured and kept in captivity. After that, the others stopped entering the village for a while. In January 2022, five wolves were reported in the municipality near Tolve, with predation attempts on dogs and growling toward people near a butchery. On February 10, 2022, wolves were reported in Tolve again. After months of unsuccessful trapping attempts, deterrents were used. When wolves were still present in the village, trapping resumed. In early June, three individuals (one gravid female and two adult males) were captured and translocated.

IT_05 (Cecina, 2021)



In August 2021, a wolf was reported to approach people at a minimal distance of 5 metres during the day in the Natural Reserve Tomboli di Cecina. The public was instructed on how to act, to avoid feeding the wolf and to keep dogs on a leash. In November 2021, the same individual frequented the town Cecina both day and night, and approached people again. Possible food sources were removed. After that, the wolf was not sighted or captured by camera traps again.

The wolf on the riverbank. © Bottai.

IT_06 (Lecciona, 2022)

From May to September 2022, two wolves frequently visited Lecciona beach at various times of the day, showing no fear of people. Several videos were recorded of the wolves walking, marking or lying near people within a range of 6 to 30 metres. The wolves either watched people or completely ignored them, approaching them or allowing people to approach. One wolf was also recorded probably playing with a dog. Attractants were identified (garbage) and removed. The wolves eventually disappeared.

Poland

PL_01 (Bieszczady Mnt., 2018, Nowak et al. 2021)

A yearling male wolf regularly visited human settlements, searched for food in backyards of bars and households during daylight and allowed people to approach within 10 m before retreating slowly. At the beginning, it was not approaching humans by itself. Once it was observed when grabbing and killing a small dog. The wolf bit a woman on June 12, 2018, after approaching her at camp. On June 26, 2018, he bit two children playing outside in two different locations. The wolf was shot one hour after the second attack by a local hunter with permission. The male originated from a local pack and had no injury or disease. Interviewed local citizens reported that a lone wolf—most probably the same one who later attacked people—was observed in the vicinity of five villages at least 4 months before the attacks, from February 2018 on. There were indications that the wolf might have been taken from the wild and kept in captivity, but it was never confirmed.

PL_02 (Noteć Forest, 2018, Nowak et al. 2021)

From March 2018, a female yearling frequented two villages, was increasingly habituated and positively food conditioned. She approached people to a distance less than 30 metres, searched for food around houses, waited at the gate of house, where she was regularly fed. She also killed at least one dog. On July 21, 2018, the female attacked two women in the night and on July 27, 2018, she attacked a retired woman during the day at her garden. The wolf was shot in the morning after the second attack. The female had an unusually large belly, polysplenia and massive deposits of fat tissue around organs.

The Netherlands

NL_01 (Otterlo, 2022)

Starting in August 2022, a female wolf developed an interest in people in the National Park De Hoge Veluwe. The subadult was reported to repeatedly approach people and vehicles, with the closest distance ranging from 0 to 5 metres, and also allowed people to approach it within 30 metres. The behaviour was probably strongly influenced by photographers feeding the wolf to get closer pictures. The behaviour developed over an extended period without any intervention, as local authorities only allowed intervention after being pressured by provincial and court decisions. However, by the time interventions were authorized, the wolf already died from starvation.



Bold wolf at National Park Hoge Veluwe, Netherlands. © Ralph Buij, WENR.