Perspective

OBSERVATIONS OF WOLVES HUNTING FREE-RANGING HORSES IN NW IBERIA

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1. Introduction

In the mountains of NW Iberia, free-grazing horses *(Equus ferus)* have coexisted with wolves *(Canis lupus)* for millennia, developing a specific ecological relationship. Two breeds are recognised, the *Cabalo de Pura Raza Galega* in Galicia, NW Spain, and the *Garrana* in NW Portugal, which are known collectively as *garranos*. They are small[1], light horses (< 140 cm at the withers, < 300 kg; Pereira, 2018) that live in bands of one or more stallions with several mares, their foals and occasionally subadults from previous years (Lagos, 2013).

Although they are domesticated, *garranos* are left to graze year-round on common lands in the mountains, where there is hardly any human presence or influence over their breeding (Fig. 1). At least once a year, in May–October, their owners round them up for identification and deworming. Foals are taken for meat, which is the horses' main economic worth, although some are still used for riding, equestrian training or as draught animals (Gouveia et al., 2000; Pose-Nieto and Vázquez-Varela, 2005).

In recent decades, numbers of *garranos* have drastically declined due to socio-economic factors including rural abandonment, mechanisation of agriculture and crossbreeding with larger horses to increase meat production (Pereira, 2018). Recent surveys have found fewer than 3,500 free-ranging adult *garranos*, which is in contrast to the 1930s, when there were estimated to be up to 40,000 in Portugal alone (Pereira, 2018).

Wolf predation is also contributing to the plight of *garranos*. Due to low density and diversity of wild ungulates and a steady decline in numbers of small livestock (i.e. sheep and goats), horses are now the main livestock species preyed on wherever their range overlaps that of wolves, with foals being particularly heavily predated (López-Bao et al., 2013; Freitas and Álvares, 2021 in *CDPnews* issue 23). A better understanding of wolf hunting strategies and the defensive behaviour of horses may help to improve horse management and devise measures to reduce losses.

Wolves face different challenges when hunting according to the prey species involved, but some general principles seem to apply. MacNulty et al. (2007) described a sequence of phases: search, approach, watch, attack-group, attack-individual, and capture. Attack includes either pursuit (when prey flees) or harassment (if prey stands), in both cases including selection of an individual which, in the case of a

[1] Iberian wolves are also relatively small, with a shoulder height of c.60–70 cm and weight of 25–40 kg.

Fig. 1 *Garrana* mare and foal in NW Portugal. *(Photo: Karin Boldt/ACERG)*

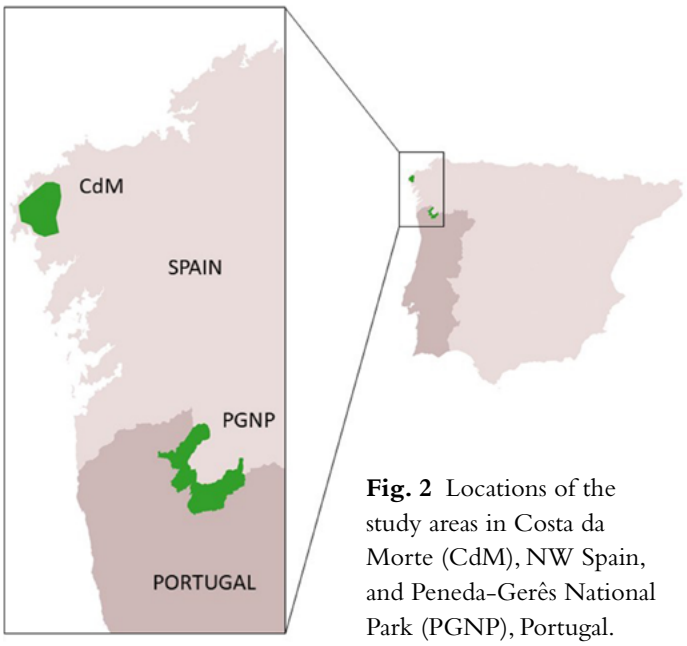

Fig. 2 Locations of the study areas in Costa da Morte (CdM), NW Spain, and Peneda-Gerês National Park (PGNP), Portugal.

successful hunt, is followed by its capture. Capture can also follow search or approach when a wolf grabs immobile prey (e.g. new-born foals).

During encounters with wolves, prey may react by approaching wolves, standing their ground or fleeing (Mech, 1970). When prey flees, wolves almost always immediately give chase but, if they fail to get close enough to attack, they may give up the pursuit. If prey animals stand their ground, wolves typically harass them until one is separated from the group or succumbs to injuries. When large prey animals are involved, it may take several hours until wolves can safely approach to kill and eat them.

It is difficult to study the hunting behaviour of free-living wolves directly because they are mostly active at night and are wary of humans. The few studies that exist are mostly based on opportunistic observations of attacks on wild prey (Mech et al., 2015). Information on wolf–horse interactions is scarce, making every reliable record, albeit anecdotal, potentially important. In cases of second-hand reports, however, care must be taken to avoid bias by critically evaluating observer subjectivity and possible influence of myths. We therefore decided to share field notes describing sightings of predatory interactions between wolves and free-ranging horses made by the first author and statements by shepherds interviewed by the second author. We hope this may encourage others to divulge their own observations and records which might be useful to researchers and managers as well as horse owners.

2. Study areas

Direct observations and footage of wolf attacks on horses were made in Costa da Morte (CdM), Galicia, NW Spain. Interviews with shepherds took place in Peneda-Gerês National Park (PGNP), NW Portugal (Fig. 2). CdM is an Atlantic coastal environment characterised by rugged cliffs and low mountain ranges of up to 650 m. PGNP is a mountainous area in the transition zone to a Mediterranean environment, dominated by granitic rocks with deep valleys and elevations reaching 1,545 m. Mountain pastures are characterised by meadows, herbaceous plants, heather and gorse *(Ulex europaeus)*, with deciduous and pine forest patches, meadows and agricultural fields in the valleys (Fig. 3). Wild prey is present throughout both areas: wild boar *(Sus scrofa)* are common and roe deer *(Capreolus capreolus)* are increasing but not yet abundant (< 2.2 inds./100 ha in CdM, Xunta de Galicia, 2004; 1.5–5 inds./100 ha in PGNP, Ferreira, 2003). Wolves are present at high densities: ≥ 2.29 inds./100 km² in CdM (Xunta de Galicia, 2008) and ≥ 2.6 inds./100 km² in PGNP (Álvares, 2011).

Human population density in the study areas is low and settlements are dispersed. Agriculture and livestock breeding are the main activities, usually in small-scale family production systems although in Spain there are also professional dairy farms, mostly inland. Husbandry is characterised by extensive grazing of cattle and horses that reach high stocking densities (up to 19 head/100 ha in PGNP; INE, 2001).

There are also shepherded flocks of goats and sheep, mostly in Portugal (e.g. 18–21 head/100 ha in PGNP; INE, 2001), as well as smaller flocks of 10–20 sheep, mostly in Spain, which are grazed in pastures closer to villages.

Groups of horses comprise between six and 40 animals, sometimes of two or more owners. In Portugal, most are purebred *Garrana* but many in Spain result from crosses with larger breeds. There are considerable losses of free-ranging horses and cattle due to wolf predation (see Freitas and Álvares, 2021 in *CDPnews* issue 23). Damage is compensated by authorities after an assessment to confirm wolf predation but, for owners of free-ranging livestock, eligibility criteria are difficult to meet. For example, in Portugal compensation is conditional on the presence of a shepherd and livestock guarding dogs, which is generally considered unfeasible with free-ranging horses (but see Lagos and Blanco, 2021 in *CDPnews* issue 23).

Fig. 3 Free-ranging band of *garranos* in PGNP, NW Portugal. *(Photo: ACERG).*

3. Direct observations

During the last 25 years, the first author of this article has regularly visited mountain pastures in Costa da Morte, Spain, to observe wolves and other wildlife. His field notes and extensive video recordings (made using a video camera attached to a telescope) include four records of predatory wolf–horse interactions. In the following sections, field notes of these observations are illustrated with images taken from the respective videos.

3.1 Mare protecting an injured foal from two wolves

16th September 2012, 08:57–20:25

"The intrusion at dawn by a hunter with his hunting dogs made me change the location of my usual vantage point. This inconvenience, however, enabled me an hour later to see two wolves on a mountain slope stalking a grey mare belonging to a band that, surprisingly, grazed several metres away. The wolves, a grey male and a browner female, were staring at the grey mare that seemed not to want to move away from a specific point, among some pine trees near a track. Located about 530 m away, I could see that she was protecting a foal that was trying, with difficulty, to stand up. From my position, the crown of a pine prevented me from seeing clearly what was happening to the foal. The first impression was that the wolves had tried to prey on a new-born, as the mare had a blood-stained flank. The wolves, patient, moved up to a point from where they could see the horses better (Fig. 4).

"They defecated and lay down. Shortly after I could see the foal and I estimated an age of two weeks old. The young horse had received several bites that left open wounds in the hindquarters and in the neck and was barely supporting itself. I understood that the foal was mortally wounded. The foal tried to follow the mother who was trying to join the band (grazing 200 m away). This triggered the predatory instinct of the two wolves that had retreated to a small rise nearby, waiting for the mare to leave the badly injured foal. The wolves hurried a last attack, but the mare got in the way and protected the foal (Fig. 5). The two wolves slowly moved away before the mare's corpulence, following the same route as before. They had time to lie down and watch the horses.

"The foal and his mother drifted away a few metres before the foal fell on the track. The wolves decided to retreat to an area of thick brooms on the opposite slope. The mother and foal were not able to join the band. They remained in the same spot, with the foal lying down, mortally wounded. The area was covered with thick fog. I left the area and came back in the afternoon. Through the fog I could see the wolves lying close to the foal and the mare (Fig. 6). At 20:15 I could hear the mare whinnying and running and, ten minutes later when the fog disappeared, I could only see a fox marking the area with a scat. The next day, at dawn, I saw a fox feeding on the foal's carcass."

Fig. 4 "The wolves, patient, moved up to a point from where they could see the horses better." (The foal's hindquarters are visible to the right of the trees).

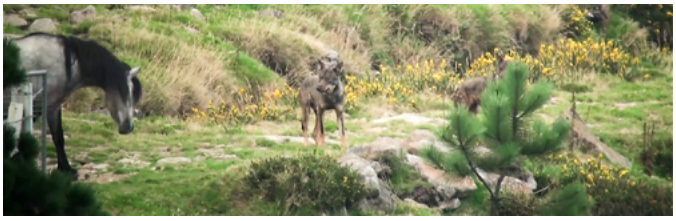

Fig. 5 "The wolves hurried a last attack, but the mare got in the way and protected the foal."

Fig. 6 "Through the fog I could see the wolves lying close to the foal and the mare."

Fig. 7 "Slowly the wolves withdrew and the horses relaxed and resumed their grazing routine."

3.2 Mares regroup around foals to protect them from two wolves

8th April 2017, 07:59–08:08

"From my vantage point I could see three bands of horses: two less than one kilometre away (one behind me, towards the west, and the other in front of me) and another 2.8 km away (northward). At first light the whinnying of several horses on a mountain top caught my attention. I directed the camera's viewfinder and saw two wolves heading towards a group of nine horses with two foals, one a few weeks old and the other even younger. The movements were very fast and in a few seconds the wolves were close to the group of horses and were harassing them. The wolves directed their attack at the foals but, in a few seconds, the mares formed a group with the foals in the middle, protecting them. Slowly the wolves withdrew and the horses relaxed and resumed their grazing routine (Fig. 7). It was a failed attack that lasted only a few seconds but set the whole group on edge."

3.3 Wolves harass horses and wait until they lose interest in dead foal

2nd August 2018, 07:37–10:20

"It is 07:30. I leave the car and start along the trail to the vantage point. I go up to the rock where I am going to wait and, before sitting down, I hear several whinnies and turn my head towards a band composed of a stallion and four mares. I see two wolves harassing the horses, charging and retreating a couple of times (Fig. 8). The horses are in a pasture plot located on a mountainside enclosed by a metre-high stone wall. The most daring wolf quickly retreats before a furious onslaught of the stallion (Fig. 9). The horses seem to be protecting a foal, about two months old, lying dead close to a stone wall. Behind the wall, I can see two wolves running. There are a total of three wolves participating. A chestnut mare approaches the dead foal. It seems the wolves are retreating but one of them turns and runs across the meadow, behind the low wall that separates him from the stallion. Another wolf follows him. They stop and look. A wolf tries to charge the horses from the opposite side but comes back quickly.

"I am at a distance of more than half a kilometre. At times it seems the activity slows down, the horses graze but the wolves observe them from a safe distance or from behind the wall. The horses begin to leave the area. Little by little they move away from the wall. A female wolf approaches the dead foal from the other side of the wall. The chestnut mare grazes away from the foal but without losing sight of it. The wolf goes around the wall and straight to the carcass. When the wolf is a couple of metres away, the chestnut mare begins an onslaught directed at the wolf. She does not reach it and the wolf protects herself on the other side of the wall. The she-wolf moves away a little more and lies down. In the meadow, the first rays of sun begin to shine. Meanwhile another wolf arrives. I can see its residual mammary glands, indicating she is the

Fig. 8 "I see two wolves harassing the horses, charging and retreating a couple of times."

Fig. 9 "The most daring wolf quickly retreats before a furious onslaught of the stallion."

Fig. 10 "All of them eat together until they are satisfied."

breeding female. The two wolves meet and the other female licks the breeder's muzzle.

"Once the mare is far away, the breeding female approaches the foal and, with prudence and measuring her steps, begins to eat. The other wolf approaches, fearful, and they both eat together. Suddenly the third wolf appears; it is a male. All of them eat together until they are satisfied (Fig. 10). The horses continue to graze on the meadow 100 m away."

3.4 A band protects the foals but wolves keep returning

12th July 2020, 12:00–22:40

"Chance, enormous effort and intensive monitoring of horse bands, with continuous counts of births and deaths, has given me my most unexpected field observation so far. Witnessing an attack from start to finish, in this case by five wolves on a band consisting of a stallion, three mares and three foals, is extremely rare. It was not, in the end, a successful attack with a kill, but nevertheless a huge insight into the ancestral relationship between wild horses and wolves, greatly contributing to my experience and knowledge of predator–prey relations.

"After an unsuccessful attempt to watch wolves from my vantage point, I went to check another group of horses. I had been monitoring this band since 11th May, when the three foals of the respective mares had already been born. When I found the band, suddenly I saw a wolf circling the horses. I focused the viewfinder on the foals and counted all three (about 10 weeks old at that time), but two of them had been bitten on the hindquarters and belly, the bright red colour of blood clearly seen. The wolf disappeared up the hillside. I persisted in waiting a couple of hours in case it came back but it did not. I returned in the afternoon and at 18:30 I saw the wolf again, resting in the bushes. The whole band was there together: the grazing horses and the semi-immobile and somewhat apathetic foals, close to their mothers.

"Hours later, at sunset after a calm and sunny evening, I noticed a lump to the left of the herd. Suddenly, it began a swift race toward the horses. It was a wolf, a male, and behind him two more appeared (one was the breeding female) from behind gorse bushes (Fig. 11). Shortly after, a fourth wolf (another female) joined the attack, running down from above. It was a surprise attack. The wolves harassed all the foals, but the mares protected them (Fig. 12). The three mares tried to kick the wolves with their hind legs and, with lowered heads, chased them away from the foals while the stallion chased any wolf that came closest to a foal. The male wolf persisted in threatening a brown foal and was the last to withdraw. In contrast, the breeding female, after the initial attack, was more cautious, observing the movements of her pack mates (Fig. 13). The non-breeding female was also quite persistent. After 2.5 minutes, the wolves withdrew without success. Except for the first moments, the foals were never left alone or helpless, nor did they move away from the band. The group made a strong and effective defence."

It is worth mentioning that, in this case, harassing wolves frequently exhibited play bows[2] when facing the horses, wagging their tails and sometimes leaping

[2] This is an easily recognisable behaviour in canids, characterised by bent forelegs and raised hindquarters.

forward (Fig. 14). This behaviour was either followed by fleeing, to avoid charging horses, or stopped if the horse turned its attention away from the wolf.

"The wolves withdrew but they did not forget the band. On 10th September I noticed the loss of one of the foals (which would have been approximately four months old). Due to this loss, the farmer moved the horses to a meadow near houses in the village. On 14th October they returned to their usual location.

Fig. 11 "It was a wolf, a male, and behind him two more appeared (one was the breeding female) from behind gorse bushes."

Fig. 12 "The wolves harassed all the foals, but the mares protected them."

Fig. 13 "The breeding female, after the initial attack, was more cautious, observing the movements of her pack mates."

Fig. 14 "…harassing wolves frequently exhibited play bows when facing the horses…"

On 23rd October I observed two wolves, the male and non-breeding female, revealing themselves from behind bushes after eating the second foal (at that time about 5.5 months old). On 3rd November I could see that there were no foals left in this band."

4. Interviews with shepherds

During interviews conducted in April–December 1995, shepherds in the PGNP region, NW Portugal, described a total of 166 wolf–livestock encounters. These accounts could not be verified, but they were considered credible by the interviewer (Ribeiro, 1996). Seven of them concerned alleged attacks on free-ranging horses, two others referred to wolves approaching grazing horses and one to the reaction of a band after detecting a wolf. Such statements were rarely the result of prolonged observations and shepherds usually reported having intervened to stop attacks. Their accounts of wolf–horse encounters can be grouped into several types of scenarios, as described below.

4.1 Wolves approaching horses

Shepherds reported that wolves frequently used landscape features (e.g. rocks, walls, water courses) and vegetation cover to approach horses without being detected. In two accounts, a shepherd described a situation where one wolf was hidden or lying down amongst vegetation, close to where a band of horses with foals was grazing. One of the foals seemed to be curious and approached the wolf. When the foal was far from the band its mother whinnied and it returned to her.

4.2 Horses bunching after detecting a wolf

Another account described the reaction of a band of nine mares and one stallion to an approaching wolf. The horses were scattered while grazing in woodland when they suddenly gathered together. The stallion and some mares raised their heads in an alert posture and, after a while, the observer saw a wolf moving along a nearby trail.

4.3 Wolves harassing and attacking horses

There were four accounts of attacks on single horses. Two of them described one wolf attacking a foal and the other two referred to two wolves attacking adult horses. In all cases, shepherds mentioned

that wolves were very agile and easily switched between frontal and rear attacks. Horses used their fore or hind legs to defend themselves. When attacking foals, wolves focused on the hindquarters (Fig. 15). In one case, a wolf managed to bring down a foal that was already weakened by injuries to its hindquarters before the observer was able to stop the attack.

The joint action of two or more wolves apparently greatly facilitated the capture of horses. For example, according to one of the accounts, two wolves took up positions in front and behind a horse. The wolf in front made a series of forward movements, alternating from one side of the horse to the other. The other wolf tried to bite the horse's hindquarters while avoiding its kicks. The shepherd mentioned that the wolf in front, "seemed to be playing with the horse, like dogs play with each other"[3]. In another description of an attack by two wolves on an isolated horse, the wolf in front managed to grab a horse by the neck when it turned its head back in response to attacks from behind by a second wolf. In this case, the shepherd intervened and both wolves ran away. According to shepherds, wolves usually flee when people approach them to stop attacks.

Two accounts described attacks on horse bands. In both cases, wolves focused on foals (Fig. 15), although other individuals that became separated from the band were also targeted and attacked. In one case, a single wolf moved around a band and made repeated attempts to grab one of the foals while avoiding the protective behaviour of the mare and other band members. In the other case, a wolf jumped to try to bite one of the foals in the neck but was forced back by the protective behaviour of other horses. Between attacks, the wolf sometimes lay down for a while a few metres from the band. The horses stayed together and fended off attacks from the rear by kicking backwards and from the front by trying to bite their assailant or using their forelegs to strike or stomp it. The stallion was said to circle around the band, moving between the mares or foals and the wolves.

Fig. 15 An injured *Garrana* foal in PGNP, NW Portugal. Wolves usually targeted foals and tried to grab and bring them down with repeated attacks to the hindquarters. *(Photo: Helena Rio-Maior)*

4.4 Wolf attempting to grab a fleeing horse

In the only account of a wolf pursuing horses, a wolf was seen running alongside galloping horses and leaping up in an attempt to bite one of them in the neck. The wolf managed to grab an adult horse when it changed direction, but the horse was able to release itself and escape. The horses galloped in an almost linear formation, one behind the other.

5. Discussion

We collected and analysed a total of 14 eye-witness accounts from two different sources that provide insights into the behaviour and strategies of Iberian wolves and free-grazing horses during predatory interactions in NW Spain and Portugal.

5.1 Hunting strategies of wolves

Wolves apparently took advantage of landscape features and vegetation cover to get as close as possible to prey before attacking. This behaviour has been previously reported in wolves hunting both wild and domestic species, with wolves in some cases approaching to within 10 metres before being detected (Mech, 1970; Vyrypaev, 1980). One of the shepherds interviewed in Portugal described seeing play-like behaviour of a wolf toward a horse and play bows were filmed by the first author during an attack by several wolves on a horse band. Play is typically directed at conspecifics, but Fox (1971) also observed wolves occasionally exhibiting play behaviours when interacting with prey.

In the accounts we collated, the main points of attack were described as the neck and hindquarters (Fig. 16), which is in accordance with data collected by the second author while accompanying inspectors

[3] Compare this with play bowing described in section 3.4 and shown in Fig. 14.

examining horse carcasses at alleged damage sites as part of the process of assessing claims for compensation (Ribeiro, 1996). In 11 cases (three mares, eight foals), incomplete consumption by wolves and scavengers allowed identification of individual bite wounds. Bites to the neck were seen in 7/11 cases, to the hindquarters or groin in 4/11 cases and to the flank or abdomen in 2/11 cases. A similar pattern was found by Lagos (2013) when examining foals injured by wolves and by the third author during a study of wolf predation on horses in Galicia (Palacios unpublished data).

It can take several hours for wolves to weaken or kill an animal and, as seen by the first author, attacks may be resumed after a break of several hours, days or even weeks. Rest periods may be common during prolonged attacks and have been observed in single wolves or packs attacking large prey species including bison *(Bison bison)*, muskox *(Ovibos moschatus)* and moose *(Alces alces)* (Carbyn and Trottier, 1988; Gray, 1983; Mech, 1970). Capture success is higher for larger packs when hunting more formidable prey, since they seem to be more cooperative (MacNulty et al., 2014).

5.2 Defensive behaviour of horses

When they detected wolves, *garranos* became alert, grouped together and either stood their ground or moved away. This is similar to reported responses to wolf howls of Konik polski horses, which grouped together tightly and stood with heightened alertness (Janczarek et al., 2020). When attacked, *garranos* either galloped away (Fig. 17) or stood their ground in a defensive group and tried to fend off wolves with rushes, attempts to bite or kicks of the fore and hind legs. The use of forelegs was also observed by Ebhardt (1954) in a band of Irish wild horses in northern Germany that advanced toward foxes *(Vulpes vulpes)*, badgers *(Meles meles)* or domestic dogs in a tight group. Horses fleeing in a linear formation (see section 4.4) was reported in a group of wild horses in Alberta, Canada: when they detected a wolf a few metres away, 14 mares and a stallion, that had been dispersed while grazing, bunched together and calmly abandoned the site in a linear formation with the stallion protecting the rear (Salter, 1978 in Bouman, 1990).

According to our records and reports, wolves targeted foals whenever they were present. Foals are highly vulnerable, particularly when in small bands or separated from the group. Mares whinny to encourage their foals to move closer to them, presumably so they can be more readily defended from attack. Such behaviour was mentioned by Vyrypaev (1980), based on accounts from guards of the Chatkal Nature Reserve in the former USSR. In a study in NW Portugal, after simulated wolf howls, foals moved closer to adult horses, their alertness increased and in approximately one third of cases bands fled (Rio-Maior et al., 2006).

The experience and perseverance of mares as well as the stamina and protective behaviour of stallions seem to be important factors influencing the outcome of attacks. The level of cohesion in a band, which reinforces group defence, may also be important, including the ability of stallions to keep mares together, preventing them becoming separated from the band and thus more vulnerable. Feist and McCullough (1976) stated that band stability results from the leadership ability of the stallion and the fidelity of the mares to the group. Lagos (2013) highlighted the importance of band cohesion, since mares with stronger and more stable associations have a higher rate of foal survival (see the article by Lagos and Bárcena in this issue). This author also suggests that more experienced mares may reduce predation by increasing vigilance and avoiding areas where the risk of being ambushed by wolves is higher (Fig. 18). Thus, any human intervention in the composition of bands, namely by adding or removing animals, should be made with care to avoid disturbing their social structure and negatively affecting band cohesion and defensive success.

Fig. 16 Foals can be severely wounded as a result of wolf attacks and may later succumb to serious injuries. *(Photo: Mónia Nakamura)*

6. Conclusions

Our article illustrates the potential of eye-witness accounts to supplement the rather limited information available on the strategies of wolves hunting free-ranging horses as well as the defensive behaviour of horses. Second-hand reports tend to be unverifiable but, if collected appropriately and interpreted cautiously, may provide some useful information. For example, the unusual play-like wolf behaviour described by one shepherd was later documented in video footage of another attack. The large body of material potentially available from informal observations could help guide further research on wolf–horse interactions as well as measures designed to improve horse husbandry and reduce losses to wolves.

Fig. 17 Fleeing *(galloping)* is one of the strategies used by horses to escape wolf attacks. *(Photo: Karin Boldt/ACERG)*

Fig. 18 A young *Garrana* foal rests while its mother grazes a few metres away in PGNP, NW Portugal. Experienced mares may reduce foal predation by increasing vigilance and avoiding areas where the risk of being ambushed by wolves is higher. *(Photo: ACERG)*

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