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10-18-1987

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R. Coppinger
Hampshire College, Amherst MA

J. Lorenz
Oregon State University, Corvallis OR

Lorna Coppinger
Hampshire College, Amherst, MA

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NEW USES OF LIVESTOCK GUARDING DOGS TO REDUCE AGRICULTURE/WILDLIFE CONFLICTS

by R. Coppinger[1], J. Lorenz[2] and Lorna Coppinger[1]

ABSTRACT

Pilot programs in several states have shown that livestock guarding dogs are 70-80% effective in reducing predation on livestock by wildlife, primarily coyotes. In order to increase that percentage, ineffective dogs were studied and new techniques tested that had the potential of turning problems into successes.

From the population of over 1,000 dogs that has been placed on farms and ranches nationwide during the past ten years under the auspices of the Livestock Dog Project at Hampshire College, data was analyzed for each of the three basic behaviors (trustworthy, attentive, protective) that a good guardian needs to exhibit. A wide range of scores was found within each behavior. Studies were then focused on transferring dogs with extremes of behavior to a specific livestock operation where the "defect" could be used to advantage.

In Oregon, dogs that had failed in at least one category were transferred to new ranches, resulting in 66% success. Results from field trials in Minnesota showed that inattentive and/or over-protective dogs could be used to test dogs' effectiveness against wolves. In New York, an over-protective, inattentive dog was placed on an emergency basis with a flock of experimental sheep, using the dog's travel trailer and a new tool, "invisible fencing," to situate it in an unfamiliar environment.

Results showed that the transfer strategy increased the number of successful guarding dogs, with minimal changes in livestock management. Other evidence indicated that the new techniques described here could also be used for wider applications of guarding dogs in agriculture.

[1]School of Natural Science, Hampshire College, Amherst MA 01002
[2]Department of Fisheries and Wildlife, Oregon State University, Corvallis OR 97331

INTRODUCTION

In recent years livestock guarding dogs (*Canis familiaris*) have been field-tested for their abilities to protect sheep (*Ovis aries*) and goats (*Capra hircus*) against predation by coyotes (*C. latrans*), domestic dogs (*C. familiaris*), and other wild predators (Coppinger et al. 1983a, Green et al. 1984). Studies have shown that livestock producers who use the traditional guarding breeds achieve 70-80% "superior" or "good" overall protective behavior from their dogs. These figures imply that 20-30% of the total number of guarding dogs studied are ineffective.

At Hampshire College's Livestock Dog Project, biologists and students maintain an on-going program of behavior studies in order to understand how dogs can protect livestock, and to try to increase the percentage of effective working dogs (Lorenz et al. 1986, Coppinger et al. 1987). The success of a guarding dog is measured by whether it is on a farm, working to the satisfaction of the producer. Within that successful behavior, three components have been identified (Coppinger et al. 1983b) as necessary for a dog to be effective. First, through genetic selection and proper rearing, they must show interspecific social bonding patterns toward the species to be protected, usually referred to as "attentiveness." Second, they must be "trustworthy," and not disrupt the well-being or management of the livestock by showing predatory or playful motor patterns which cause the livestock to flee. Third, they must be "protective," and react, usually agonistically, toward any species that tries to disrupt or harm the normal

routine of the stock.

Many successful dogs as well as unsuccessful ones do not show a complete repertoire of these behaviors. Improper or deficient repertoires can occasionally be corrected, but often not. Perhaps deficiencies exist in the genetic predisposition to display certain motor patterns, or ontogenetic experiences fail to elicit proper behaviors during critical developmental periods. Sometimes, improper dog behavior may be elicited by environmental stimuli. An example of this is seen when placing a dog with a new flock of sheep that has been heavily predated by coyotes or dogs. The dog's approach pattern stimulates the sheep to flee, which may elicit a chasing, or disruptive play routine, from the dog (Coppinger et al. 1987). To throw out the dog and the system at this point would be short-sighted. New methods in agriculture or anywhere else commonly require a sequence of trials, errors, and adjustments before a smooth-running operation is reached.

Investigations of the 20-30% ineffective dogs have yielded information on variations in normal guarding behavior that appeared to have application to other, specific livestock management operations. The studies reported in this paper present several new ways to use guarding dogs, suggested by those earlier results. The main effort could be termed "transfer," for that top layer of unsuccessful dogs must be transferred, either behaviorally or environmentally, in order to have a chance to succeed. It is generally accepted that behavioral expression is a synergism between genetic and environmental factors. Livestock guarding dogs are expected to show motivations that result in attentive, trustworthy and protective behaviors. However, it must be remembered that each of these broad behavioral categories is made up of a sequence of motor patterns. No two dogs are completely alike in the expression of these behaviors; the entire population of animals contains a continuous spectrum of variation. The work here is focused not on trying to change faulty behaviors but on using the observed variations in specific situations where they will work, thereby extending the usefulness of livestock guarding dogs.

The strategy is twofold. 1) Transfer a dog that is deemed ineffective on one farm to another farm; and 2) Take a dog that has a behavior peculiarity and move it to a habitat where that peculiarity becomes an advantage.

William Paul, USDA/APHIS/ADC, Grand Rapids, Minnesota, and Ron Danielson, Bigfork, Minnesota, provided extensive technical and field assistance during the dog/wolf study. The Clarence Priem family of Bigfork, Minnesota, provided field assistance and dog maintenance. Tim Coppinger trained dogs to the radio-controlled fencing. The work was supported by federal funds to Hampshire College and the Oregon State University Extension Service, administered by Animal Damage Control; by Hampshire College; and by the Oregon Department of Agriculture. Much of its success is due to the livestock producers who cooperate with the program.

METHODS

Generalized transfer

A population of 173 dogs in Oregon and Washington were studied. Data on birth, breed, sex, transfers to new farms, and longevity were routinely noted. Deaths were recorded as cull, accident or disease as in Lorenz et al. (1986). Transfers occurred for two reasons: 1) rancher sold sheep or 2) dog exhibited improper behaviors. In this study, only improper behavior transfers were considered. Dogs were termed problems by mutual agreement by the rancher and investigator Lorenz, regardless of the cause, and transferred if a suitable solution could not be achieved. Problem dogs were either untrustworthy or inattentive to the sheep, although one case involved a dog with a potential bite danger to humans. Transfer of a problem dog was analogous to a cull as defined in Lorenz et al. (1986), in that a dog was removed from a farm for failure to display a behavior required on the particular farm.

Success in this study was defined in terms of longevity. Transfer would be considered a desirable management

technique if it could be shown to increase the working years of a dog.

Specialized transfer

Portable homing-site -- If attentiveness could be induced in inattentive dogs, then such dogs could be placed in unfamiliar environments, with unfamiliar livestock, or strategically placed so as to intercept feeding routes of predators. Most dogs in a strange environment will seek out and remain by a familiar object. It is common for rabbit hunters, for example, to leave a jacket or the dog's travel kennel out for a wayward hound. Guarding dogs show similar conditioning to their travel trailer. They can also be raised in proximity to the trailer or a portable kennel, with food and water available in or under the box. In past studies in Colorado and New Mexico, this portable homing-site conditioning had impaired the observations, since dogs kept returning to the home-site and not the sheep. The trailer was tested for its positive effect in the fall of 1986 when Cornell University's experimental sheep flock began to lose 3-4 sheep per week to an unknown predator or predators from a 10+-hectare pasture in Ithaca, New York. The travel trailer was placed in the middle of the pasture, together with one adult male Maremma/Shar Planinetz, one pro-estrous, two-year-old female Anatolian Shepherd and an eight-month-old Anatolian pup. Both adult dogs were selected because of their prior lack of attentiveness to sheep. Radio-controlled fencing (Invisible Fencing Company, Waynesboro, Pennsylvania; see next section) to which the dogs had been trained was also placed around the pasture. The Cornell University shepherd monitored the pasture during the six weeks the dogs were present.

Radio-controlled fencing -- To test the effectiveness of guarding dogs against wolves, field trials were run in wolf territory. The radio-controlled fencing allowed the testing also of the effect of enforced attentiveness in a strange environment, as well as the possibility of positioning a dog in a strategic location in order to deter predation. Since it was impractical to try to induce a wolf to kill a cow (Bos taurus) on a farm, then place a dog to see if predation ceased, a simulated farm kill was set up. Two adult guarding dogs (one male Maremma/ Shar Planinetz cross, one female Anatolian Shepherd, both 5 years old) were used, transfers from farms where one had been overly-protective, the other inattentive. They were trained to stay within a radio-controlled fence. The perimeter wire carried an inaudible radio signal transmitted to a receiver-collar worn by the dog, keeping it about 4 meters from the wire.

Dogs were trained in two different ways. One, according to manufacturer's instructions, consisted in a series of training periods during which the dog was walked on a leash around the wire-surrounded pasture, and occasionally moved toward the wire to reinforce the dog's avoidance of the perimeter. Two, the dog was fitted with the receiver-collar and placed in an enclosure surrounded by radio-controlled fencing. It very quickly trained itself to avoid the perimeter.

Three bait stations were established in a remote area in wolf territory near Bigfork, Minnesota, along county road 344. Road kills, farm culls, and butcher scraps were the bait. Two stations were guarded by dogs within radio-controlled fence; one had no dog. Sites were located 1 km apart, and inspected twice a day. Wolf activity was visible due to tracks long the dirt road, which was smoothed each evening to erase the day's tracks. Wolf visits were noted in comparison with the presence of dogs at the two test sites. Stations were maintained from July 7 to August 31, 1987.

RESULTS

Generalized transfer

Table 1 lists the sample of 173 dogs by transfers and survivorship. Forty-nine (28%) dogs were transferred at least once. Of those 49, only 8 were permanently removed from duty. If transfers were considered potential culls, then transferring increased survivorship for 29 dogs (49 transfers minus total 20 culls) in the sample.

Table 1. Number of dogs according to the number of times transferred and corresponding causes of death. A=Accident, C=Cull, D=Disease

n Dogs	Number of Times Transferred	Number of Deaths A	C	D	Total
124	0	27	12	4	43
31	1	11	5	0	16
16	2	2	2	0	4
1	3	0	1	0	1
1	4	1	0	0	1

Table 2 demonstrates increased longevity as a result of transferring a problem dog. Two-thirds of the dogs survived a minimum of one year following their first and second transfers. Tables 1 and 2 demonstrate that dogs with behavior unacceptable on one farm worked satisfactorily on another farm. Dogs that were a problem on one ranch had a better than even chance of performing satisfactorily in a new environment. If all problems were solved by culling, the failure rate due to culling would be 35% (49 + 12/173). However, transferring reduced the failure rate by two-thirds to 12% (20/173).

Table 2. Increase in survivorship as a result of transferring dogs. Number of transferred dogs is less than in Table 1 because dogs were withdrawn if they were alive, but transferred less than 1 year prior to June 30, 1987.

n Dogs Transferred	n Times Transferred	n Dogs (%) Living >1 yr after transfer	n Deaths <1 yr after Transfer
45	1	30 (67%)	15
16	2	11 (69%)	5
1	3	0 (0)	1
1	4	0 (0)	1

Specialized transfer

Portable home-site -- The three dogs in the pasture in New York stopped predation on the flock totally. Two domestic dogs and one coyote were found dead in the pasture during the six weeks. Guardians do not normally kill predators, but merely warn them away; in this case, the over-protectiveness of the male might have been enhanced by the pro-estrous condition of the female. Bonding took place between the guardians and the sheep.

Radio-controlled fencing -- Table 3 shows the results of keeping dogs in a remote area by means of radio-controlled fencing, and their effect on use by wildlife, especially wolves, of bait stations.

Table 3. Visits by wolves to bait stations protected by dogs (W=Wolf takes bait; D=Dog present; #3=Control bait station with no dog.)

		July						August																															
		2					3											1										2										3	
		4	5	6	7	8	9	0	1	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
#1	W			X			X	X	X	X	X	X	X			X					X						X	X	X	X				X			X	X		
	D													X	X	X	X	X	X	X	X	X	X	X	X	X					X	X	X	X	X	X	X	X	X	X
#2	W					X	X	X	X	X	X	X							X		X						X	X	X	X						X	X		X	X
	D												X	X	X	X	X	X	X	X	X	X									X	X	X							
#3	W						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
	D																																							

The results show that predation at the bait stations was reduced from 97% (33 out of 34 nights) at the control site to 19% (7 out of 36) on nights a dog was present at the test sites. After the dogs were placed on the test sites there appeared to be a period of initial avoidance of the area by the wolves, followed by a period of increasing approach-threat to the dog and finally overt aggression. Neither the male at station #1 nor the female at #2 sustained any injuries. Encounters appeared to be ritualized dominance or territorial defense. When aggression increased between one dog and wolves, it was decided to put a second dog at station #1. No further aggression was directed toward them, but it was necessary to stop the trial after two days because of the beginning of bear season.

Two bears that visited station #1 daily returned only once (the first day) after the dog arrived. Ravens that constantly plundered all three sites limited their visits to the control site once the dogs were in place at the two test sites.

DISCUSSION

The transfer strategies reported on in this paper were successful in 1) increasing the usefulness of previously ineffective guarding dogs, and 2) capitalizing on an otherwise extreme, "defective" behavior and using it to advantage. Variation in the three basic guarding dog behaviors might be categorized in a continuous spectrum, from:

not protective--->over-protective
not trustworthy--->over-trustworthy
not attentive--->over-attentive

For this discussion, it is assumed that dogs have only one extreme behavior and that the other two behaviors are normal. Dogs with two or more extreme faults would have to be evaluated individually.

Protective behavior

Protective behavior is the display of aggressive (i.e., agonistic) motor patterns within the species or to a surrogate species. Several dogs have been returned to the Project because they were over-protective. They were trustworthy and attentive to the livestock, and would not let any wild or domestic species into the pasture, but were perceived as a threat to domestic pets or people. In several cases, the dog would not let a new flock of sheep mingle with the old, familiar flock. These dogs can be problems on farms or ranches with mixed livestock, or with lots of people and domestic dog activity, or where the dog drives deer from the range but the rancher makes part of his income from hunting leases. Yet these dogs are an advantage for emergency service on a farm where predation begins suddenly and severely, for they provide an immediate and protective presence. They have proven their worth on farms where the predatory species was unknown, in keeping competitive foraging species such as deer or rabbits away from grain or grass while the sheep were grazing, and

in keeping separately-managed flocks from mingling.

Some dogs showed no agonistic behaviors. One was so unprotective that it watched a pack of domestic dogs kill sheep. Usually such dogs do bark at intruders, and thus can be used on urban or suburban spare-time farms where the owner does not want the liability of an agonistic dog but does need an alarm system.

Trustworthy behavior

Trustworthy behavior is defined as a lack of sequenced predatory motor patterns (Coppinger et al. 1987). An over-trustworthy dog shows no predatory behavior at all. However, because they do not, it does not mean they do not show agonistic behaviors. Some have been successful in agonistic encounters with wolves. Over-trustworthy dogs have been useful for emergency service because they can guard a variety of species or be placed on farms where there are mixed species. They guard poultry and other excitable farm animals, including a herd of "wild" fallow deer (*Dama dama*) in Massachusetts.

An under-trustworthy dog displays, on occasion, the sequence of motor patterns recognized as predatory. In guarding dogs, these routines have been selected against, but dogs do appear with this characteristic. Sometimes a dog is inhibited from harming domestic livestock but will still hunt rodents or chase deer. This type of guardian is a distinct disadvantage in areas of dense wildlife, e.g., National Forests, or where hunting permits provide income. But they are an advantage in large areas where they can range widely. In areas where sheep or cattle are spread over dozens of acres, under-trustworthy dogs usually patrol and chase away all unwanted species. There is some evidence that an under-trustworthy dog induced to stay in an orchard would be highly useful at reducing damage by deer.

Attentive behavior

Attentive behavior is characterized by a dog's maintaining a proximity to the livestock, and showing dog/dog display patterns interspecifically (Coppinger et al. 1983b). Over-attentive dogs may display sexual, playful or dominance patterns that disrupt the normal routine of the livestock. Others, when introduced to a new flock that is wary of canines, may insist on approaching the flock even though such behavior causes the flock to flee. This situation impairs the dog's normal bonding patterns. Usually if the dog is confined with the flock or a portion of it, the animals will settle the problem amicably.

Under-attentive dogs are the main reason for high culling rates. Dogs wander or become attached to people or buildings, or are distracted by neighborhood dogs or people. Depending on the other behaviors they show, these dogs often make good subjects for use with the portable homing-site or invisible fencing.

CONCLUSION

These studies indicated that several new approaches to the use of livestock guarding dogs were effective for increasing the success of dogs that protect livestock from predators. A generalized transfer of a dog from one farm where it was not working for some reason to another farm resulted in success two-thirds of the time. Specialized transfers, where dogs that exhibited extremes in behavior were matched with particular environments, in conjunction with the use of portable home-sites and invisible fencing, also proved useful in solving a number of management problems.

During the past two years, specialized transfers have been used to:

1. Eliminate predation on farms where there was not time to raise and train a good guardian from a pup;
2. Aid or give temporary relief from predation by disrupting or intercepting the predators on farms/ranches where guarding dogs were not suitable either because of fleeing or aggressive sheep or other environmental complications;
3. Guard other species of livestock that a dog was not socialized with, including deer and poultry;
4. Guard or eliminate predation on a

non-domestic species (fallow deer) where the target species was "wild" and did not permit normal social bonding with the dog;

5. Provide evidence that dogs were effective against other predators by having them protect a bait station where depredation by bears, ravens, and wolves had been observed;

6. Correct faults in attentiveness by confining a wandering but otherwise good guardian to an area where stock needed protection;

7. Isolate a dog from environmental hazards such as highways along stock migratory routes or neighbors who persist in feeding wayward sheepdogs.

8. Locate a dog in remote pastures or rangeland.

Livestock guarding dogs appear to have a broad potential for solving a number of agricultural pest problems.

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