

Evaluating personality traits of captive maned wolves, *Chrysocyon brachyurus* (Illiger, 1815) (Mammalia: Canidae), for conservation purposes

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Abstract

The study of animal personality has important implications in conservation programs. When reintroduction is used for the preservation of a species, the survival ratio of reintroduced animals needs to be high. The determination of animal personality helps choosing the right animals, therefore increasing their survival chances and also increasing the reintroduction success. Three captive, male maned wolves were chosen for personality evaluation. Two personality tests were carried out and compared: The boldness score test estimated the level of boldness from a series of behaviors divided into bold, shy and fear categories; and questionnaires showed how zookeepers perceived the personality of the same three animals, while they were working with them. According to the boldness score calculation, Maned Wolf Two (MW2) was the boldest, followed, in order, by MW1 and MW3. According to the questionnaires, MW1 was the boldest, followed by MW2 and by MW3. Reasons for these contradictory results and variables that should be considered in both tests for increasing their accuracy are discussed. Used together, these tests showed to be helpful tools for choosing among individuals to be released in the wild.

Keywords: Maned wolf, personality tests, boldness score, questionnaires.

Introduction

There are 10 species of wild canids in South America (Soler et al., 2005) of which the maned wolf is the largest. It can be found from southern Amazonas state, in Brazil, to northern Argentina (Dietz, 1984; Deem & Emmons, 2005). They are most common in open savannah (Dietz, 1984; Sabato et al., 2006), tall grassland, shrub habitats, woodland with an open canopy (cerrado), and wet fields (IUCN, 2006). The maned wolf is an omnivorous species, eating small mammals, birds, reptiles and insects, as well as fruits (Aragona & Setz, 2001; Bueno et al., 2002; Santos et al., 2003; Bueno & Motta-Junior, 2004). It can be a primary, secondary or even a tertiary consumer, playing an important role in the ecosystem's stability. Therefore, its conservation is fundamental to the balance of its habitat (De Mattos et al., 2004).

Bandeira de Melo et al. (2007) showed that the maned wolf is not a solitary animal. Using GPS data, they found that male and female shared the same area before and after pups were born,

being most active in the crepuscular/nocturnal period (Bueno et al., 2002). The IUCN (2006) classified the species as near threatened, and mentioned habitat loss, body part trading and vehicle collision as its main threat factors. The Brazilian agency of environmental protection, IBAMA (2003) classified it as vulnerable.

The study of animal behavior is an important tool for animal conservation, since differences in behavior may influence individual fitness. A population can be affected by changes in individual temperament and this can modify the result of conservation efforts. Hence, temperament studies are essential for the success of conservation programs (McDougall et al., 2006). Behavioral traits or personality are a set of skills that are constant in an individual during its life. Animals show behavioral traits across time and across situations and they also show individual differences (Cavigelli, 2005). These differences suggest ecological and evolutionary consequences and they will determine the ability of the species to endure when facing an environmental change (Dall, 2004). Boldness and shyness are very important aspects of animal behavior and inappropriate levels of boldness can determine a reduction of the fitness in the wild. Reintroduced animals that fail to respond appropriately to dangerous stimuli may have their survival capacity reduced (Bremner-Harrison et al., 2004). Risk-taking tendency influences

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survival, reproduction and other aspects, including nutritional condition.

Different levels of boldness can determine if fish, for instance, will explore novel objects, discover novel food sources, inspect predators more often, find different shelter and so on (Brown & Braithwaite, 2004). Animals which are too bold may find themselves in danger when facing a predator. Animals that are too shy would also be in danger since they would spend more time hiding or being watchful than feeding, for example. Thus, the ideal situation would be an individual that is intermediate in the boldness and shyness continuum. The determination of these personality traits is crucial to define if a captive animal will be able to survive if released into the wild (Azevedo & Young, 2006).

There is no standardized method to assess personality. Hence, methods to assess animal personality vary depending on the study and may involve the introduction of novel stimuli, as made by Azevedo & Young (2006) for *Rhea americana*, and by Bremner-Harrison et al. (2004) for *Vulpes velox*, or involve the use of questionnaires applied to caretakers, zookeepers or anyone who is in contact with the animals, as done by Momozawa et al. (2003) for horses, and by Serpell & Hsu (2001) for dogs. According to Cavigelli (2005), behavior measures and well thought-out questionnaires filled in by experienced animal caregivers should be used jointly to assess animal personality.

Here two different methodologies to assess captive-animal personality were employed as tools for choosing captive maned wolves for releasing in the wild.

Material and methods

Study site

The study was conducted in the Zoological Garden of the Fundação Zoo-Botânica de Belo Horizonte – FZB-BH (S 19°51', W 44°01') - Minas Gerais - Brazil, from March to May, 2007.

Three captive-born adult male maned wolves (*Chrysocyon brachyurus*) were studied. One of them, Maned Wolf Three (MW3) was born in a semi-wild area of 32,000 m² where it has been kept since then, and the other two (MW2 and MW1) were kept in two different enclosures. A week before the beginning of

this study, MW2 was moved to an area similar to that of MW1. All of them were kept away from the public. The one in the semi-wild area (MW3) was wearing a Telonics radio transmitter, model 355 (3.5 x 3.5 x 2.8 cm, 100-110 g), which was used to know the position of the animal, and if it was approaching or going away. Complete identification of the three studied maned wolves is given in Table 1.

MW1 was kept in an enclosure (MES 20 — Mammal Extra Sector number 20) in an area of approximately 300 m², of which 15 m² correspond to a shelter delimited frontally by a brick wall (1.2-m high) and wire fence (mesh: 5 X 5 cm, wire: 12, height: 1.4 m) and by brick walls 2.8-m high on the sides and back. This enclosure is between two other ones, MES 19 (with a female maned wolf), and MES 21 (with male MW2). The shelter floor in MES 20 is cemented, while the rest of the enclosure is covered with grass (*Paspalum notatum*, Poaceae), with some trees such as *Solanum lycocarpum* (Solanaceae) and *Caryocar brasiliense* (Cariocaceae), and a tuft of *Pennisetum purpureum* (Poaceae). There was also a water bowl (80 cm in diameter and 20 cm in depth) in its outdoor area. The enclosure MES 21 is like MES 20, except that its outdoor floor is earth and that it has a pond 2.0 m in diameter. It was located between MES 20, and MES 22 (which housed a female maned wolf).

The semi-wild area is considered part of FZB-BH's reserve with approximately 32000 m² and the vegetation is characterized as transitional between semideciduous forest and cerrado. This enclosure has a constructed area of approximately 100 m² for handling the animal when necessary, an area of approximately 4,000 m² with very little vegetation, with a small part covered with *Pennisetum purpureum*, and a relatively dense secondary forest of 28,420 m² with several native trees such as *Copaifera langsdorfii* (Leguminosae), *Platypodium elegans* (Fabaceae), *Bowdichia virgilioides* (Fabaceae), *Trichillia pallida* (Meliaceae) and *Casearia sylvestris* (Flacourtiaceae).

The enclosure was delimited by a wire-mesh fence (2.3 m x 2.3 m modules, mesh 0.05 x 0.15 m, wire 12, 2.3 m high and 409 m long) supported by wooden poles, and by a 320 m-long brick wall 3.0 m high. Inside this enclosure, a 2.5 m x 2.5 m wooden observation stand was built 3.0 m above the ground. A cement water bowl (0.6 m x 0.5 m x 0.4 m and 0.2 m deep) was built next to the wooden stand. To help observations, a fiberglass booth was installed in the semi-wild open area. All the data were collected from visual observations from inside the fiberglass booth.

Table 1 - Identifications of the three male maned wolves kept in the Zoological Garden of the Fundação Zoo-Botânica de Belo Horizonte (FZB-BH, Minas Gerais state, Brazil) and studied here.

Name at FZB-BH	Animal identification in the study	Microchip	Place of birth	Studbook	Enclosure
Belo	MW1	00.01FB.C70A	FZB-BH – captivity	2197	MES 20
Faisca	MW2	00.0600.F40A	CBMM* - captivity	2011	MES 21
José	MW3	00.0600.07E1	FZB-BH – Semi-wild area	2583	Semi-wild area

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Diet

All the wolves were fed once a day, at 2:30 pm, except the one in the semi-wild area, which was fed at 5:00 pm. Water was provided *ad libitum* for all animals.

Personality tests and data collection

The ethogram used for behavioral data collection was previously created based on the literature (Carrilho, 1990; Fletchall et al., 2000) and 20 hours of previous observation (Table 2).

The behaviors were separated into three personality categories: bold, shy and fear. The behaviors classified as shy were alert and flehmen. The behaviors classified as bold were eating, inactive, walking, sniffing, playing, grooming, agonism, drinking, vocalization, foraging and hiding. The behaviors classified as fear were running, not visible, submission and pacing. Other behaviors were classified by the authors into bold, shy or fear categories in the laboratory, after their exhibition during each period of data collection.

Four objects with which the animals have never had previous contact were selected arbitrarily to use in the experiment: a bag, a flat ball, a street cone, and a tricycle. In each enclosure, we

Table 2 - Ethogram used to evaluate maned-wolf personality at the Zoological Garden of the Fundação Zoo-Botânica de Belo Horizonte, Minas Gerais state, Brazil.

Behavioral Category	Behavior	Sign	Description	
Foraging	Eating	EA	The animal eats the diet offered by the zoo.	
	Foraging	FOR	The animal looks for food items through the enclosure, sniffing, with its head towards the ground.	
	Hiding/ digging	HID	The animal gets the item and hides it, burying it or not.	
	Drinking water	DRI	The animal drinks water from the water bowl.	
Activity	Walking	WAL	The animal walks in the enclosure.	
	Running	RUN	The animal trots or runs in the enclosure.	
	Pacing	PAC	The animal moves repeatedly back and forth in the enclosure, for no apparent reason or function	
	Playing	PLA	The animal plays with the item.	
Inactivity	Inactive	IN	The animal stays still, standing, sitting or lying.	
Defense and territoriality	Odour marking	MAR	The animal urinates, rubs itself against the vegetation or defecates.	
	Sniffing	SNI	The animal sniffs the items placed in the enclosure.	
	Alert	AL	The animal adopts an alert posture (ears up, staring at an item, standing, sitting or lying).	
	Flehmen	FLE	The animal tastes or smells the air curling back its lips.	
	Agonism	AGO	The animal approaches the item with its fur raised along the back and with its ears back.	
	Submission	SUB	The animal approaches the item with its body close to the ground, ears back, whining and the tail between the legs.	
	Vocalization	VOC	The animal howls, whines (not followed by submission behavior), barks or growls.	
	Self keeping	Grooming/ Scratching	GRO	The animal, standing, sitting or lying, licks or scratches itself with the paws.
		Other behaviors	OTH	The animal exhibits other behaviors that were not previously listed and that are not included in the ethogram and check sheet.
	Not visible	Not visible	NV	The animal is not visible to the observer.

marked two concentric circles (inner and outer circumferences of 1 m and 2 m radius, respectively), with stakes (Fig. 1). Data collection was conducted through four consecutive days and each day, one of the four different objects was presented individually to each wolf on the centre of the circles. The daily food (normal diet) was also presented with the objects. All objects were presented only once to the maned wolves to avoid habituation. Both the novel objects and the food being placed inside the enclosure could be easily seen by the animals.

Boldness scores were calculated for each wolf according to Bremner-Harrison et al., (2004). The number of records of each behavior was counted and used in the calculation of the boldness scores: the total number of fear behaviors was multiplied by zero; the total number of shy behaviors was multiplied by one; and bold behaviors by two. The boldness score values for each animal, were the results of adding the totals of the multiplications – the higher the value, the higher the boldness of the animal

We recorded behavioral data displayed during the tests and the distance between the maned wolves and the novel objects, when the data was recorded. Data were collected using focal sampling with instantaneous recording of behavior every 15 seconds. If one wolf entered the circles or interacted with the object a number was given; number two if the animal was outside the circles, number one if the animal was in the outer circle and zero if the animal was inside the inner circle. Each data collection started immediately after the food was placed on the enclosure (beside the circles) and the object was placed on the centre of the circle, and lasted 60 minutes per wolf per day.

Additionally, a multiple choice questionnaire was elaborated and presented for the Zoo keepers to answer. The seven questions asked were simple, direct and specific. Common words were used to elaborate the questionnaire in order to make it easy for the keepers to understand it and to prevent misunderstandings. One question was related to how long each keeper had worked with the male maned wolves; the others were related to personality traits of each maned wolf, such as which was the most aggressive, which was the most fearful, which was most seen, which used to get the closest to them. A variety of bold, shy and fear adjectives was listed (Bold: curious, docile and mad; Shy: suspicious, nervous and quiet; Fear: scared, afraid and wimp). The keepers did not know which adjectives corresponded to bold, shy and fear categories. They were asked to mark the adjectives that they thought reflected each maned wolf temperament. The number of times each adjective was marked was counted according to bold, shy and fear categories. Questionnaires intended to evaluate keeper's perception of the animals' personalities. The answers were compared to the personality scores calculated with the personality tests.

Although the latency test (Bell, 2005) was also carried out in this study, it was abandoned due to the fact that the animals' enclosures were different in size and configuration, affecting the results.

Results

The boldness scores (Tab. 3) show that MW2 was the boldest of the three maned wolves, followed by MW1. MW1 was the one for which more behaviors were recorded at short distances of the novel objects, followed by MW2, while no behavior was recorded for MW3 nearby those objects (Tab. 4).

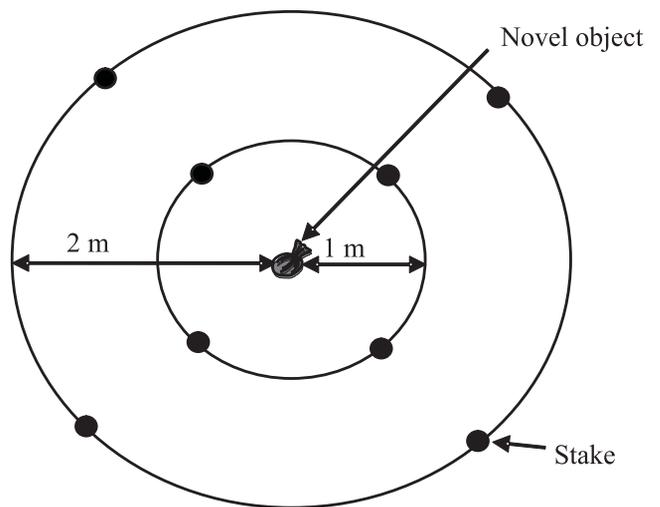


Figure 1 - Concentric circles used in the determination of maned wolves' personality. Food was offered beside the circles while the novel objects were offered to the wolves at the center of the circles.

The questionnaires were applied to six keepers, five of which answered that they had worked with the maned wolves for more than six months while one had worked for less than six months. According to four keepers, the most aggressive of the maned wolves was MW1 and the most fearful was MW2. MW1 was placed as the most courageous in the bold/fear continuum, followed by MW2, and finally MW3 as the most fearful. Four keepers said that MW1 was the one that got the closest to them. The adjectives marked by the keepers suggest that most of them thought MW1 was the most courageous, followed by MW2 and, finally, by MW3 which was the most fearful (Fig. 2). All keepers said they always saw MW1 and MW2; four keepers said they sometimes saw MW3 and two said they never saw it.

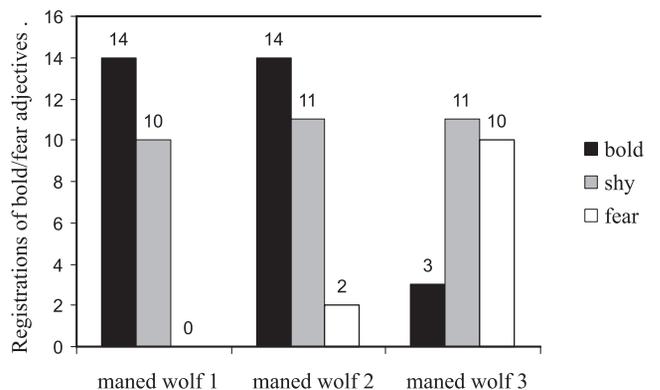


Figure 2 - Personality traits of maned wolves according to their keepers in the Zoo of the Fundação Zoo-Botânica de Belo Horizonte (Minas Gerais state, Brazil).

Table 3 - Number of behaviors recorded in each category and boldness scores for three male maned wolves studied in the Zoo of the Fundação Zoo-Botânica de Belo Horizonte (Minas Gerais state, Brazil).

	Maned wolf 1	Maned wolf 2	Maned wolf 3
Bold behaviors	327	873	102
Shy behaviors	36	59	21
Fear behaviors	601	32	841
Boldness score	690	1805	225

Table 4 - Number of times behaviors were recorded at different distances between each maned wolf studied in the Zoo of the Fundação Zoobotânica de Belo Horizonte (Minas Gerais state, Brazil) and a novel object.

Distance	Maned Wolf 1	Maned Wolf 2	Maned Wolf 3
0 - 1 m	10	6	0
1 - 2 m	8	3	0
> 2 m	946	955	964

According to the observations, MW2 was the most courageous, while the questionnaires indicated MW1 to be the most courageous. Both methods found MW3 as the most fearful. The tests agreed in the indication of the most fearful animal, but their assessments of the most courageous maned wolf were in conflict.

Discussion

The fact that the results of our experimental observations were not entirely coincident with those of the questionnaires answered by the zookeepers should not be surprising: Personality tests show individual behavioral specializations and these specializations define animal personalities (Dall, 2004); on the other hand, questionnaires reflect keepers' subjective evaluation of each individual. Of course, as suggested by Hsu & Serpell (2003), the ones who spend more time with an animal would know more about its typical behavior and, when the proper questions are asked, this information can be extracted in a reliable way. Thus, results obtained from these different methodologies should be regarded as complementary.

A number of factors can be cause for the differences observed in the results: Problems concerning questionnaire samples (e.g. number of respondent keepers, length of time since the keepers stopped working with the animals), enclosure sizes, animal habituations to their enclosures, placing of the circles, number of animals assessed, etc. Below, some of these problems are discussed.

MW1 was kept in an enclosure where it only had one hiding place and it did not offered enough space for the wolf to keep itself away from the keepers. For this reason, MW1 was usually visible, it could see the keepers when they came in with the food and normally got close to the keepers when it was being fed, even having the option to be hidden.

On the other hand, before the beginning of this study, MW2 was kept in a large area with many places to hide and enough space to keep itself way from keepers. Also, most of the keepers had worked with MW2 while it was being kept in the large enclosure, so when they feed MW2, it could be seen or not, but if it were visible it would not get close to them. For this reason the keepers had more contact with MW1. In the personality tests, MW2 interacted more with the novel objects put in the enclosure (i.e.: sniffing and marking the novel object), expressing many bold behaviors. While it was eating, it was always looking at the novel object, and after it ate enough, it would approach the novel object and sniff and/or mark it. On the other hand, MW1 did not interact much with the novel objects. It would sniff but very quickly would lose interest on them, even when remaining close to the novel objects (Table 4). Moreover, MW1 would not look at the novel object while eating. These results are consistent with the ones found by Coelho et al. (2011) for the same individuals, using stuffed-animal models reproducing maned wolf preys and predators. MW1 ignored the models, MW2 attacked the models and MW3 avoided the models.

It has been suggested (Carere et al., 2005) that boldness is inherent to novel environment exploration. Thus, the fact that MW2 was changed to a new enclosure just before the beginning of the experiments may have influenced their outcome: If MW2 was not habituated to its new enclosure, it may have become more inquisitive and more active, increasing its boldness score.

Another fact is that MW2 was always visible in its new enclosure, because it had no place to hide inside it. This increased its "inactive" records, therefore increasing its boldness score. MW2 was laying in most of its "inactive" records. On the other hand, MW1 could hide behind a tuft of *Pennisetum purpureum* (Poaceae) at the back of its enclosure if it wanted to. Despite the fact that, to completely hide itself, MW1 would need to lay down or keep itself very close to the ground, this increased its "not visible" records. Then, it is noteworthy that, if "inactive" and "not visible" records are not taken into consideration, MW2 appears less courageous than MW1 (as suggested by the questionnaires). Azevedo & Young (2006) found that the number of times an animal approached the object indicates the boldest animal. MW1 was the one most frequently approaching the novel objects. In its enclosure, the circles were delimited in the middle of its natural path to get to the food, so the animal had to cross the circles anyway when it was going to eat. This explains why it was the one which got closer to the objects most times. In MW2's enclosure, the circles were also in the animal path. In both cases, there was nowhere else to mark the circles. In MW3's area, we could position the circles between the feeding area and the observation booth. The animal was never close to the circles, and it was visibly nervous because of the objects (many "alert", "flehen" and "running" records). It always looked at the objects while eating, and would run away when it heard any sound from the woods or from outside the zoo's walls.

The results suggest that MW2 is the best qualified individual for possible reintroduction programs: In spite of having the highest boldness score, initially its behavior towards the novel objects was always cautious; the animal was visibly wary and only approached the novel objects a while after the beginning of the test (the expression of bold behaviors started after a distant evaluation of the danger elicited by the objects). On the other hand, MW1 completely ignored the novel objects. It might walk by them without doing absolutely anything and approach them almost instantaneously; MW3 did not approach the novel objects, but it also did not eat while these objects were in the enclosure. We suggest that this individual should undergo training sessions before being released, since boldness scores can be altered with training, as shown by Azevedo & Young (2006) and Bremner-Harrison et al. (2004).

Finally, the potential influence of the sample number (three) in the results found in this study should be justified. A large sample is obviously important to determine the personality categories inside the bold-shy continuum. Nevertheless, the tests were employed here as tools for choosing one of three individuals for reintroduction in the near future. Thus, despite the fact that the personality test and the questionnaires did not produce equal results, the combination of their results were useful in choosing the best specimen to be released in the wild.

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