

Assessing the Suitability of Herd Bulls for the Sustainable Herds Project of the Conservation Centers for Species Survival

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INTRODUCTION

Managing exotic ungulates in sustainable herds increases the need to identify bulls likely to be successful, non-problematic breeders (A. Eyres, H. Haefele, K. Snodgrass, personal communication). When compared to the more traditional management strategy of male-female pairs (Sawyer et al. 2011), the sustainable herd management approach places more importance on individual males and associated risks. An unsuitable herd bull could result in ten to twenty missed calving opportunities instead of one to three (Farin et al. 1989). Aggressive animals could also cause more damage due to less restricted contact with more individuals (Patton et al. 2001; Penfold et al. 2002). In general, the potential combined effects of heritability, stress and risk sensitivity need to be considered in choosing individuals suitable for reintroduction (Archard & Brathwaite 2010).

A systematic approach to scoring individual variation in bull suitability is needed to address these challenges associated with sustainable herd management. The purpose of this report is to present and explain an initial bull suitability assessment procedure developed at Fossil Rim Wildlife Center during summer 2012 (Appendix A).

PROPOSED DESIGN OF A BULL SUITABILITY SCORING SURVEY

In general, the suitability of bulls for herd breeding should be evaluated in three areas before each bull is introduced to the herd (Blockey 1978; Farin et al. 1989): (1) breeding soundness or the physical ability to breed females, (2) mating readiness or the behavioral ability to breed females, and (3) frequency and severity of problematic behaviors such as aggression. A survey filled out by someone familiar with the animal could be used to collect this information when an animal is transferred (Appendix A). The survey should consist of three main components: (1) a history of the animal's housing conditions and social environment (2) a behavior frequency scoring chart and (3) questions to identify any behavioral, health, or reproductive problems.

History of Housing Conditions

Housing conditions and social environments have been shown to affect certain behavioral traits, so a history of an individual's housing conditions can be used as a predictive tool. Consistent individual variation for behavioral traits is often called personality. Personality traits are controlled by genetic factors (the heritable aspect of personality, also called temperament) and non-heritable,

environmental factors such as previous experiences (Hausberger et al. 2004). This is shown by personality traits that change over time (Burdick et al. 2009; Kanda et al. 2012). In horses, neophobic reactions are influenced by genetic factors including sire and breed, while response to social separation, learning abilities, and emotionality are influenced by environmental factors such as housing condition and type of work (Hausberger et al. 2004; Lesimple et al. 2011). In cattle, type of rearing has been shown to affect numerous social traits including maternal behavior and escalation/de-escalation (Stricklin and Kautz-Scanavy 1984). The social and enclosure history of a bull (Appendix A: Housing History) can help managers know what to expect when the knowledge of an animal's behavior is limited by lack of observational opportunities.

Behavior Frequency Score

The behavior frequency scoring chart (Appendix A: Social Interactions) is a sample of the animal's personality, encompassing both the heritable and environmental factors, which should focus on behaviors relevant to bull suitability. In black rhinos, successfully breeding males tend to display dominant and olfactory behaviors less often (Carlstead et al. 1999). In captive cheetah, successful breeders are less tense and fearful (Wielebnowski 1999). Bold males are more successful in breeding in widely divergent taxa (Godin and Dugatkin 1996; Smith and Blumstein 2008). In cattle, high libido and serving capacity are linked to more efficient breeding (Blockey 1978; Farin et al. 1989). The behavior frequency scoring table should focus on clearly defined behaviors that are directly related to suitability, such as mating acts and displays of aggression, to maximize rater reliability and usefulness of the score.

Potential Problems

Open ended questions (Appendix A: Questions) should be used to collect information about the animal's behavioral, physical, and reproductive health. Management strategies vary across institutions, so questions collecting overlapping information in different ways can be used. These questions should ascertain if the bull has bred before, if he is physically capable of breeding, and if he has a history of causing problems with other animals or with humans. The details of this section can be modified to fit the destination institution's needs and the source institution's ability to provide information.

BACKGROUND AND EXPLANATION OF SCORING SYSTEM

Suitability assessments are already in use in the cattle industry (Table 1). Breeding soundness exams are used to determine if a bull is physically able to breed and reflect the pregnancy rates achieved by bulls (Farin et al. 1989), while libido and serving capacity tests have been used to measure a bull's sex drive and reflect its mating efficiency (Blockey 1978; Farin et al. 1989). This information summarizes the physical and behavioral suitability of a bull for mating, but it requires a behavioral test that may be cumbersome to managers. It also leaves out other behavioral aspects of suitability.

Recent developments in the field of animal personality have shown many correlations between personality and other traits that could be useful to animal managers (Table 1) but the objective measures of personality cannot be feasibly and usefully applied on a broad scale to manage exotic ungulates. Personality traits appear to be context specific (Armitage 1986; Coleman and Wilson 1998;

Table 1. Examples of scoring individual behavioral variation from the peer-reviewed literature

TAXON/Species Common Name	Description of Content	Source
UNGULATES		
Cattle	Serving capacity/libido tied to breeding efficiency	Blockey 1978; Farin et al. 1989
Cattle	Docility tied to average daily gain	Café et al. 2011; Muller and Keyserlingk 2006; Burdick et al. 2009
Horses	Neophobic reactions associated with heritable traits; emotionality and learning associated with environmental variations	Hausburger et al. 2004 Lesimple et al. 2011
Horses	Behavioral responses can vary widely within individuals	Seaman et al. 2002
Sheep	Boldness tied to food intake and productivity	Reale et al. 2000;
Black rhinos	Dominant and olfactory behaviors negatively correlated with breeding success	Carlstead et al. 1999
African Elephant	Keeper surveys and behavioral observations produce similar behavior profiles	Freeman et al. 2010
CARNIVORES		
Cheetah	Tense/fearful behaviors negatively correlated with breeding success	Wielebnowski 1999
Companion animals	The circular structure for personalities can be applied to cats and dogs and pet personalities correlate with owner personalities	Zeigler-Hill and Highfill 2010
Dogs	Similar personality traits can be measured in humans and dogs	Gosling et al. 2003
Cats	Sociability influenced by sire and socialization, neophobic reactions only influenced by sire	McCune 1995
RODENTS		
Yellow bellied marmot	Amicability tied to recruitment of female yearlings	Armitage 1986
Siberian dwarf hamsters	Personality trait associations change over time either due to development or habituation	Kanda, L. L., L. Louon, et al. (2012).
PRIMATES		
Chimpanzees	Identified five independent personality factors, three social and two non-social, showed correlations with gender and environment	Koski 2011
REPTILES		
Common lizard	Social tolerance tied to dispersal	Cote and Clobert 2007
FISH		
Sunfish	Shyness and boldness are repeatable but context specific	Coleman & Wilson
Tropical fish	Exposure of a population to predation can influence physiological and behavioral stress responses	Archard et al. 2012
Guppy	Boldness tied to food intake and productivity	Godin and Dugatkin 1996;

Koski 2011; Reale et al. 2000), and any associations that do exist may change over time (Burdick et al. 2009;Kanda et al. 2012), requiring managers to study all relevant personality traits separately before using them to inform decisions. Studies of social personality traits require time consuming observations or controlled experiments (Coleman and Wilson 1998; Cote and Colbert 2007; Hausberger

et al. 2004; Kanda et al. 2012; Koski et al. 2011; Reale et al. 2000) that are too cumbersome to be useful on a large scale. Some assessment techniques have been designed for large scale use (Café et al. 2011; Muller and von Keyserlingk 2006), but these are limited to livestock management and focused on response to human handling traits which do not correlate with the social traits useful in predicting herd breeding suitability (Reale et al. 2000).

The proposed keeper survey (Appendix A) was developed at Fossil Rim Wildlife Center with feedback from managers, keepers, and veterinarians. It can be used to collect the relevant personality information as well as the more traditional breeding soundness examination information if it is available. It can be expanded to include any information that the destination institution needs when a bull is brought in. Surveys (Carlstead et al. 1999; Wielebnowski 1999) and subjective assessments (Sebastian et al. 2011) have been shown to report valid behavioral data without intensive tests, supporting the use of surveys in assessing bull suitability. In the future, the information collected could be combined with bull performances to evaluate which criteria are most important to bull suitability.

RECOMMENDATIONS

1. This version of the Bull Suitability Survey should be used to document each of the breeding bulls in the inventory at Fossil Rim Wildlife Center.
2. Based on the experience of staff in the initial application of this scoring system, the survey instrument should be re-evaluated and revised until there is a consensus that it meets the criteria of accuracy, reliability, utility and feasibility.
3. When there is a consensus that the survey instrument has met the criteria for quality control, then it should be distributed within the C2S2 network for testing and further improvement.

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APPENDIX A

Bull Suitability Survey

Fossil Rim Wildlife Center

This survey is designed to collect the information relevant to management decisions involving the bull in question. It should be filled out by a current keeper upon transfer to give the destination institution enough information to place and handle the bull appropriately. Please fill it out to the best of your ability. Different institutions and different management strategies will have different types of information available, so fill out the survey to the best of your ability. Partial information is more useful than no information, so when details or complete answers are not possible, include the information that is available. Thank you for your time and effort.

Species: _____ Sire: _____
 Identification: _____ Dam: _____
 Birthdate: _____ Rearing: _____
 Sex: _____ Intact: _____
 ISIS: _____ Source: _____
 Studbook #: _____ Location: _____

Housing Situation

Describe the social groups and enclosures that he has been housed in since birth.

Start-Stop Dates	Group Type	Adult Females	Adult Males	Subadults	Calves	Group Size	Enclosure Type	Enclosure Size
20Jul11-Present	Natal, breeding, bachelor, etc.	Y	N	Y	Y	32	Pasture, pen, exhibit, etc.	>400 acres
Birth-								

How old was he when removed from his dam/natal group? _____

If housed with other species, list them here:

Social Interactions

Use the following to fill out the tables based on the frequency of observed behaviors towards each group:

- 0- Never
- 1- Less than once a week
- 2- Once a week
- 3- Multiple times a week
- 4- Once a day
- 5- Multiple times a day
- NA- No opportunity to observe, e.g. not housed with them

	Females	Juveniles	Other Males	Other Species
How often does he tend females?				
How often does he collect or herd the females?				
How often does he expend mating effort on receptive females?				
How often does he expend mating effort on unreceptive females?				
How often does he successfully copulate (e.g. ejaculatory jump observed)?				
How often is he with (staying near or interacting with) each group?				
How often does he actively avoid each group?				
How often does he display sexual behaviors?				
How often does he display parental behaviors?				
How often does he mildly escalate (e.g. displacing, horn toss or presentation)?				
How often does he intensely escalate (e.g. chase, charge, horn clash)?				
How often does he mildly deescalate (e.g. walk or look away, head low)?				
How often does he intensely deescalate (e.g. run away)?				
How often does he fight?				

QUESTIONS

Health Questions

Describe his current body condition.

Does he have any injuries or abnormalities? If so, what are they?

Does he have any persistent or recurring health concerns? If so, what are they?

How well does he hold condition while on pasture?

How many animals has he injured? _____

Describe the nature and severity of the injuries:

How many serious injuries has he sustained? _____

Describe the nature and severity of the injuries:

Performance Questions

Is he a proven breeder?

Has he had a fertility exam? If so, what were the results?

If he has failed to breed, what do you think the most likely reason is?

What is his average percent coverage of breeding age females? _____

Response to Humans

Describe how he responds to handling.

Describe how he responds to keepers.

Describe his interactions with guests.

Describe his response to new environments.

Describe his response to new stimuli (*e.g.* additions to enclosure or being moved to a new enclosure).

Keeper Comments

Do you think this bull will do well breeding a herd on a large pasture? Why or why not?

General Comments: