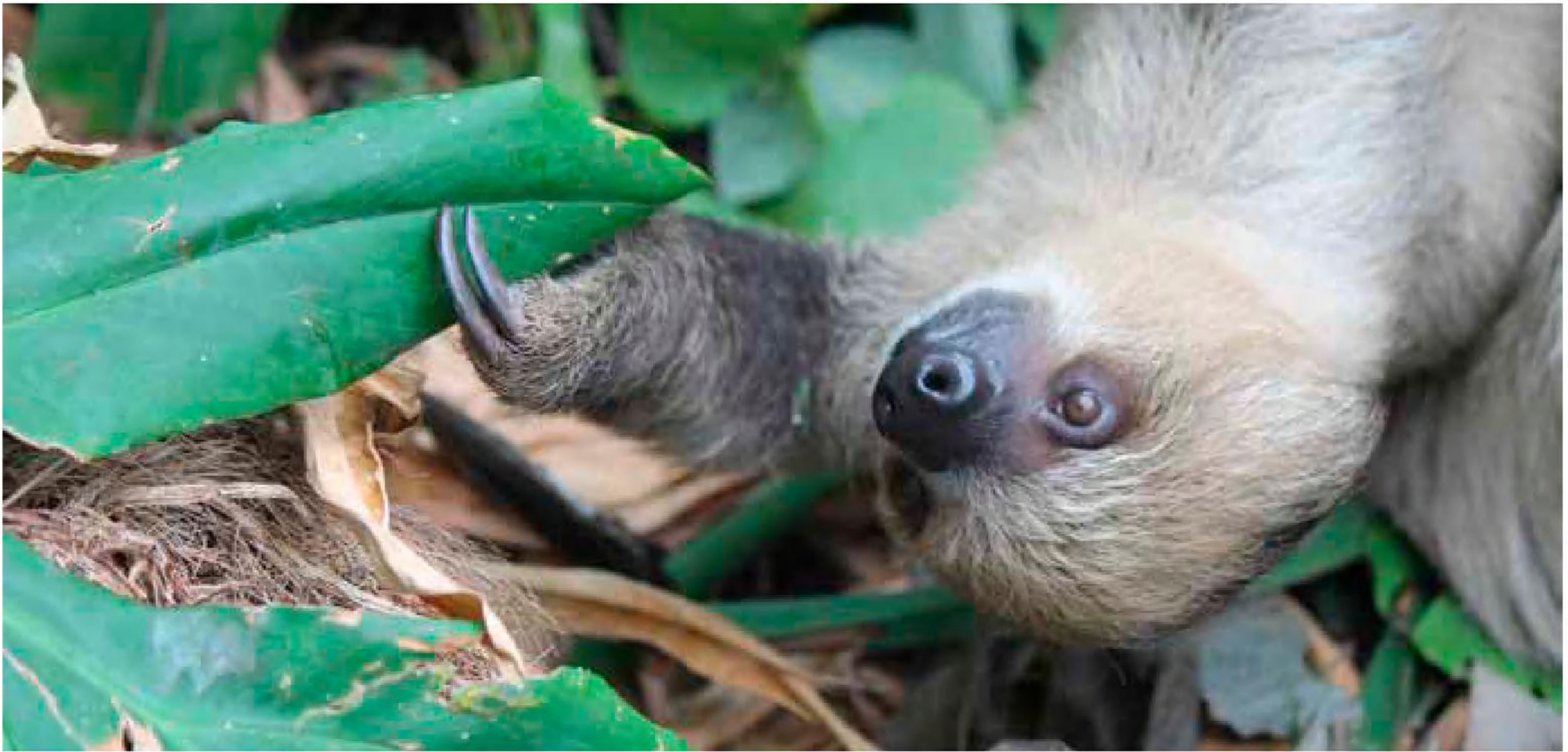


The Journal of the American Association of Zoo Keepers, Inc.

# Animal Keepers' Forum



June 2019, Volume 46, Number 6



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# Dietary Survey of Captive Southern White Rhinoceros Populations (*Ceratotherium simum simum*)

Daniel Soler, Lead Rhino Keeper  
Lion Country Safari  
Loxahatchee, Florida

For reasons that are not completely understood, rates of reproduction in captive-born southern white rhinoceros (*Ceratotherium simum simum*) females are surprisingly low, whereas the number of calves born to wild-caught rhinos has proven to be more predictable and prolific. Due to the low breeding success of captive-born females, nearly every mature female is currently recommended to breed by the southern white rhino [SWR] Species Survival Plan [SSP] advisory group. If reproduction were more reliable, then selective breeding to maintain gene diversity would be more probable.

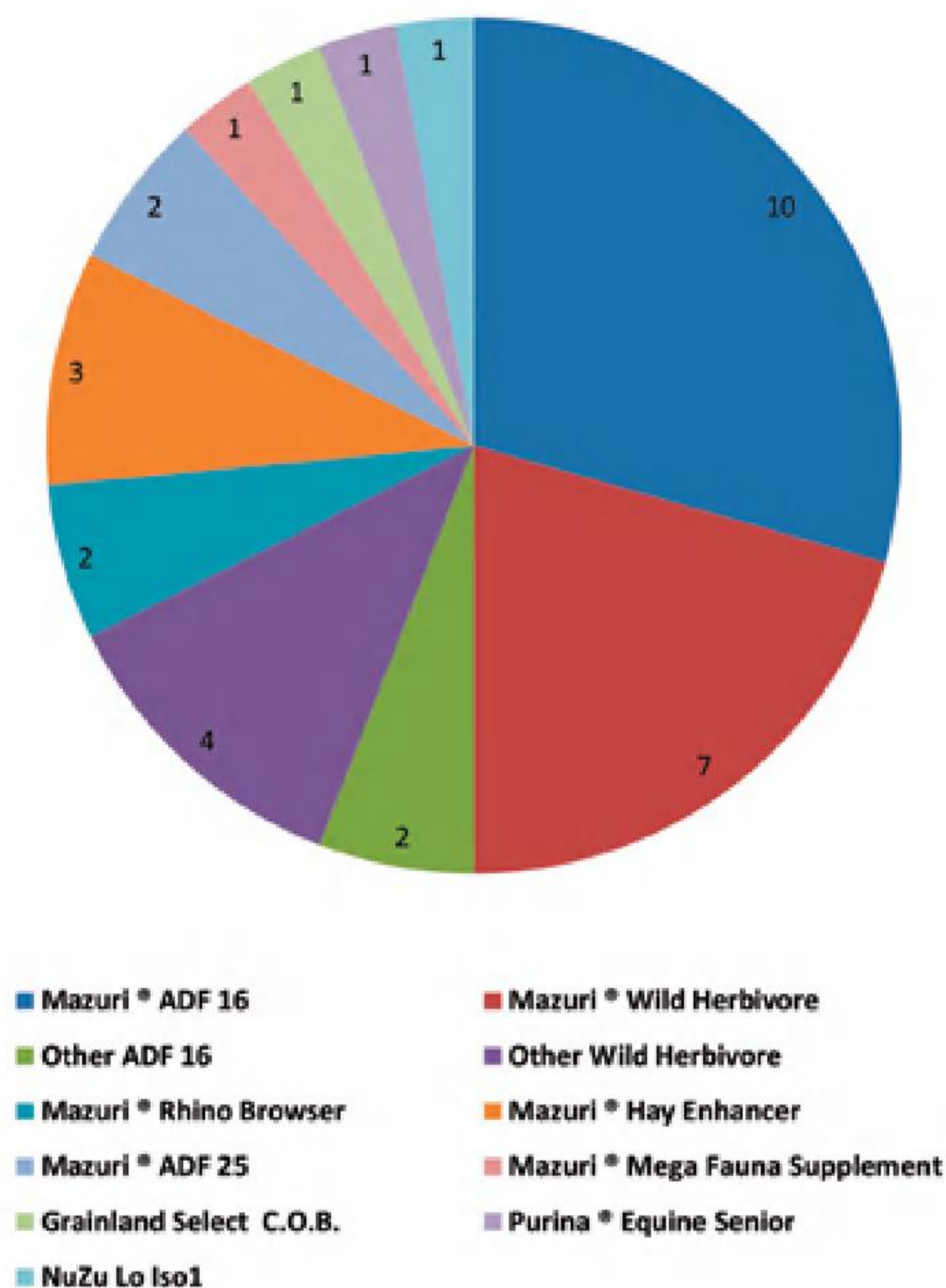
While there may be several factors contributing to this lack of reproductive success in captive-borns, diet and nutrition should

be carefully considered. As the domestic horse shares similar digestive physiology to the SWR, it currently serves as the best model for SWR diets [Metrione & Eyres, 2015; Dierenfeld, 1999]. However, research has shown that perhaps certain fat-soluble vitamins are not absorbed equally by both taxa [Clauss, 2002]. Furthermore, recent research has indicated that perhaps phytoestrogens present in the rhino diet are having a negative impact on breeding success in the species [Tubbs, 2016].

It may prove difficult for many zoos to provide the sheer volume of pasture that southern white rhinos require. Because of this, *ad libitum* grass hay is offered to rhinos as the primary portion of diet in almost all cases. Concentrated pellets are also often



Figure 1. Number of facilities feeding pellet type



offered as a supplement, as is recommended by the best-practice dietary guidelines for SWRs [Metrione & Eyres, 2015]. However, quantity suggestions are nebulous and dependent upon individual pellet formulations [Metrione & Eyres, 2015].

We seek to investigate the nutritional content of an appropriate southern white rhino diet. In service of this goal, we conducted a survey of current feeding regimes across facilities housing these rhinos. We hope to uncover what rhino-specific pellets should consist of, and how much—if any—should be offered in the daily diet. The first step in achieving this is to determine how captive rhinos are currently fed, which is what we present here. Future research should also investigate how that relates to reproduction and overall health.

### Methods & Results

There are currently 46 institutions accredited by the Association of Zoos and Aquariums [AZA] and four private institutions contributing to the southern white rhino SSP. We composed a survey that formally inquires about feeding routines and related management procedures at these facilities—such as weight management and blood screenings. We then compared the collected data using Microsoft Excel, and investigated patterns using descriptive statistics.

Of the 50 surveyed facilities, there have been 32 responses to date. As a result of imprecise dietary plans, we see a great deal of variation among institutions, which may contribute to the breeding and health limitations set on females in captivity.

The brands and types of pellets fed across those surveyed differed radically. Eight different types of pellets were used across at least five different brands. Wild Herbivore and ADF 16 are the dominant feed types, making up 33% (ten Mazuri®; four “other” brands) and 36% (seven Mazuri®; two “other” brands) of diets respectively. (See Figure 1).

The amount of pellets also vastly differs among institutions, with daily feed amounts weighing between zero and 12.7 kgs (See Figure 2). This is perhaps due to the independent formulation of the pellets that are fed out [Metrione and Eyres, 2015], or the perceived notion that smaller exhibits necessitate larger supplementation.

It is important to recognize that 24 facilities among 32 responders have less than three acres of available rhino pasture. In fact, 18 responded as having no pasture at all. In situations like these, it is no wonder that a supplemented diet is necessary (See Figure 3). While some facilities with large pasture and open spaces may not need to utilize pellets as part of SWR diets, many facilities do not have access to such exhibits.

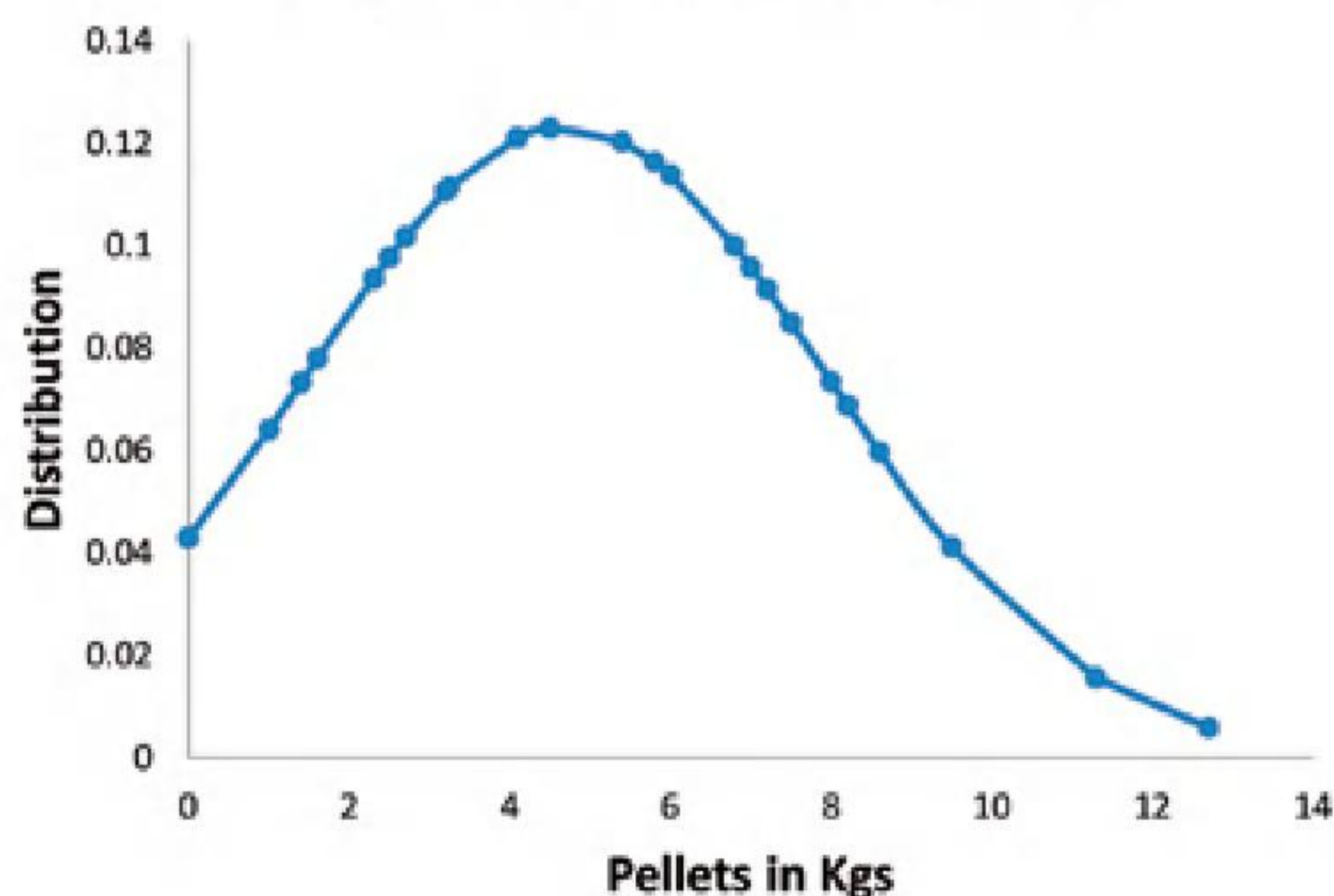
Also, despite research highlighting the negative effects of alfalfa on overall health [Tubbs et al., 2016], over 65% of these facilities still feed out some degree of alfalfa. However, exact quantities of alfalfa were not specified by all facilities, and research indicates excess alfalfa use hinders overall health, but if used in moderation effects are negligible [Clauss & Hatt, 2006; Tubbs et al., 2016; Tubbs, Personal Comm, 2017].

### Points of Interest and Lessons Learned

The typical diet of a southern white rhino is generally described as having a high fiber and low to moderate protein content [Clauss & Hatt, 2006]. Whether offering a strictly hay diet can meet these basic requirements is unknown and likely depends upon exhibit and pasture size. However, the question remains: should pellet concentrations focus on the fiber-protein content, the vitamin-mineral content, or all of the above?

Further, hay quality should be routinely tested and reported to SSP advisory committees in order to establish a better understanding of possible nutritional deficiencies. If necessary

Figure 2. Distribution of amount of pellets fed



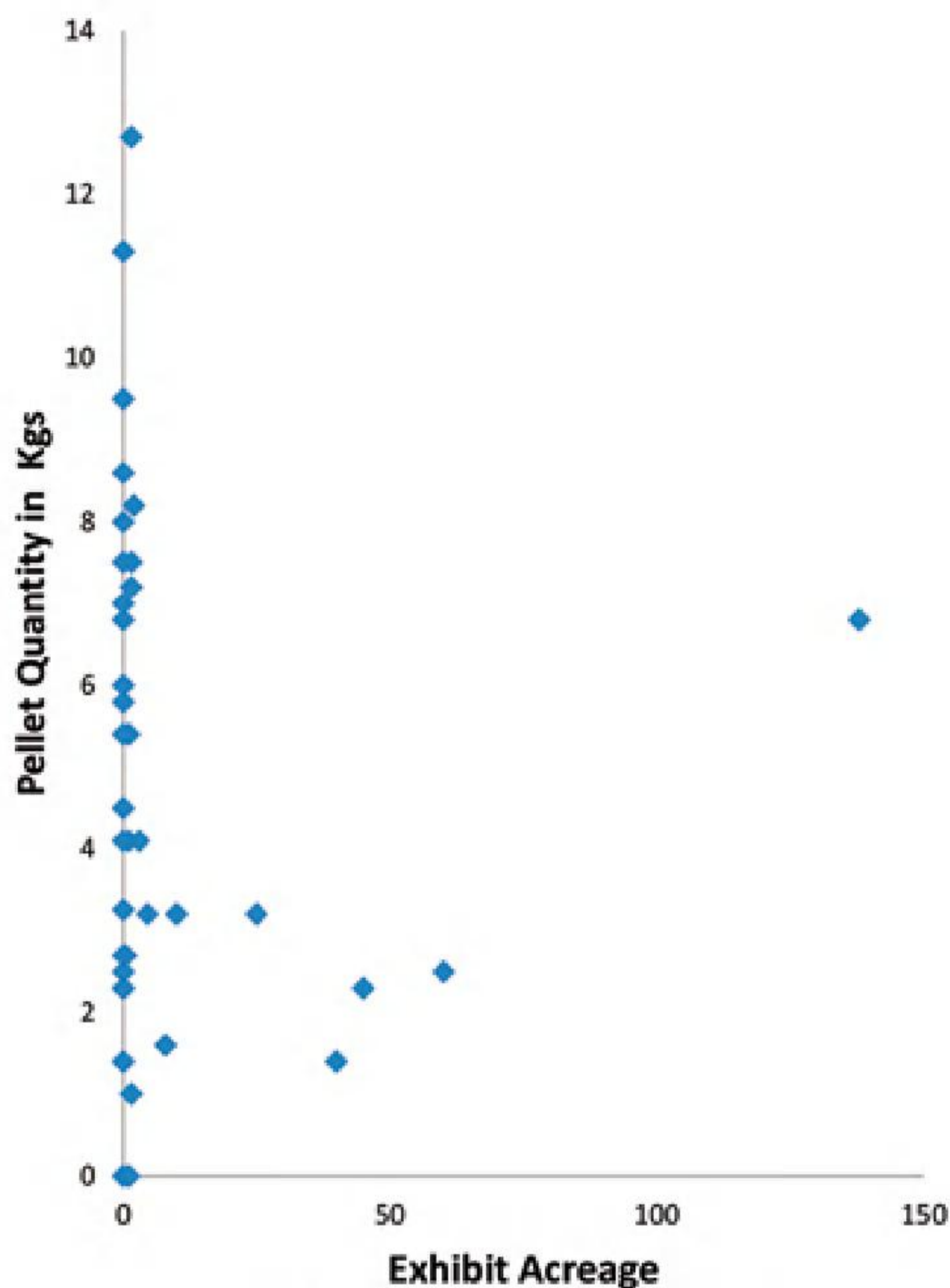


Figure 3. Correlating pasture size and pellet quantity

and/or possible, facilities in relatively close proximity should work together to establish a “best methods” protocol for hay acquisition. “The logical solution to the dilemma of limited availability of forage is to either contract farmers or cultivate land owned by the zoo. Potentially several zoos could collaborate to contract a farmer if it is more economical to purchase a high tonnage. Such cooperation should be a long-term commitment with a mutual learning process that would eventually result in the production of forage of the highest quality [Claus & Hatt, 2006].”

Thus far, only four of 32 facilities have reported deficiencies observed from blood analyses. However, it is unknown what percentage of surveyed facilities regularly engages in blood screens, as we neglected to ask this important question. Further, we cannot discern what screening assays are utilized at those facilities that do engage in the practice. Future research should include more specific questions about institutional blood analysis protocols and procedures.

Considering recent research [Tubbs et al, 2016], the number of facilities that continue to feed alfalfa to their SWR population was unexpected. However, it is imperative to recall that this survey did not specifically inquire about quantities of alfalfa fed; therefore, it is possible that the alfalfa offered is in very small amounts and therefore not overall detrimental to the animals’ health. This possibility is well-demonstrated by our own practices: Lion Country Safari regularly offers our southern white rhinos alfalfa in very small increments as

a training incentive or in situations that involve the media. Additionally, it is possible that the recent finding of alfalfa-related health detriments to SWRs may not have reached a widespread audience yet. Consideration should therefore be given to these data at future conferences and workshops.

While current recommendations for southern white rhino diet are modeled after recommendations for the domestic horse, SWR diet formulation must progress to the development of rhino-specific recommendations. In order for this to be accomplished, a better understanding of natural, balanced SWR diets is needed. Further research and experimentation is necessary in order to create a sufficiently nutritious pellet concentrate.

While it may not be possible to fully standardize diet procedure—due to individual facility circumstances—it could be feasible to reduce the amount of inconsistency across institutions and attain a more sustainable reproductive outcome in our captive southern white rhino SSP population. Given the lack of diet consistency currently found among facilities, it is apparent that further research is needed and steps should be taken to develop a cohesive, balanced dietary plan for the southern white rhino.

### Acknowledgments

I want to express my thanks to Lion Country Safari for allowing me to conduct this project as well as to the other facilities that participated; ABQ Biopark Zoo, Audubon Zoo, Birmingham Zoo, Brevard Zoo, Busch Gardens, Cameron Park Zoo, Detroit Zoo, Disney’s Animal Kingdom, Fossil Rim, Fresno Zoo, Glen Oak, Granby Zoo, Henry Doorly Zoo, Utah’s Hogle Zoo, Houston Zoo, Indianapolis Zoo, Jacksonville Zoo, Knoxville Zoo, Maryland Zoo, Memphis Zoo, North Carolina Zoo, Philadelphia Zoo, Rolling Hills, Safari West, San Antonio Zoo, San Diego Wild Animal Park, Seneca Park Zoo, The Wilds, Tulsa Zoo, Virginia Zoo, and White Oak. I would also like to acknowledge Adam Eyres for his help in facilitating responses from said facilities. Gratitude is extended to Ashleigh Kandrac and Dr. Elizabeth Hammond for helping to create the survey used in this study. Finally, a special thanks to Tina Cloutier Barbour for her assistance and guidance in completing this study. 🐘

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