
RHINO RAGE:

WHAT IS DRIVING ILLEGAL CONSUMER DEMAND FOR RHINO HORN

Alex Kennaugh
Principal Investigator

Acknowledgments

The author would like to thank NRDC's Science Center for the funding to conduct the research. The author would like to recognize, Dr. Adam Dutton, Zak Smith of NRDC, Dr. Haibin Wang and Professor Li (Aster) Zhang of Beijing Normal University for contributing to survey design or the review of the analysis or both. Also thank you to Kate Logan for support with translation, and to my colleagues in the NRDC China office for helping facilitate the work.

Table of Contents

- INTRODUCTION: THE CURRENT SITUATION AND WHY WE DID THE RESEARCH..... 4

- RESEARCH METHODOLOGY: HOW WE CONDUCTED THE RESEARCH 6

- KEY FINDINGS: POTENTIAL CONSUMPTION OF RHINO HORN IN EASTERN AND SOUTHERN CHINA..... 8
 - Awareness of rhino horn purchases among participants had regional variations..... 8
 - Rhino horn as a medicine..... 9
 - Rhino horn as a luxury good 11
 - How price effects purchases in both rhino horn product markets 13
 - How other exigent factors may affect consumer behavior 13

- CONCLUSIONS AND RECOMMENDATIONS: WHAT CURRENT DATA MEAN FOR POLICY 15
 - There is a need for more and better data about rhino horn markets 15
 - Need to consider behavioral economics and other disciplines in demand reduction strategy design..... 16
 - Need to do further analysis before international policy is considered 18

- APPENDIX: APPROXIMATE DEMAND FOR RHINO HORN AMONG RESPONDENTS IN 2014 20

Introduction:

The current situation and why we did the research

Southern Africa's habitat is home to the majority of the world's remaining rhino populations. South Africa alone has more than 80 percent of Africa's remaining rhinos, one-quarter of which are privately owned. Today private game ranches in South Africa cover an area nearly three times the collective size of all national and provincial protected areas on state land.¹ The remaining rhinos in South Africa roam freely in national parks and nature reserves, of which Kruger National Park is home to the most.²

Unfortunately, poaching rates for rhinos in Africa, on both state and private land, grew by nearly 40 percent a year from 2008 through 2013—and continue to rise.³ Why is poaching on the rise? Most experts believe that demand for rhino horn among Asian consumers is driving a lucrative black market that is financing and organizing poaching.

In one effort to address the poaching crisis, South Africa appointed a panel of experts in 2015 to examine the viability of legalizing international commercial trade in rhino.⁴ The 21-member task force, which includes conservationists, scientists, and immigration authorities, is contemplating its position as it hears from experts and the public on the matter, and a recommendation from the country's leaders is expected in March of 2016. If a proposal to legalize international trade is put forward, final approval would have to be given by CITES at the next Conference of the Parties, which convenes September 24, 2016 in Johannesburg, South Africa.

CURRENT LAW AND POLICY FOR RHINO HORN TRADE

Internationally, the rhino horn trade was banned in 1977 by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the primary global policy framework for regulating wildlife trade. At that time, all rhino subspecies were listed in Appendix I, the designation for species "threatened with extinction." The listing prohibits the import of species and specimens for primarily commercial purposes and requires import and export permits for all permissible trade in Appendix I species. The parties of the Convention downlisted the southern white rhino (*Ceratotherium simum simum*) population of South Africa to Appendix II in 1994 and did the same for the southern white rhino population of Swaziland in 2004, with an annotation limiting trade to hunting trophies and live rhinos going to appropriate and acceptable destinations, an effort that helped stabilize and, in some cases, increase rhino populations.

In demand countries of China and Vietnam, domestic policy varies. In China, there has been no legal market for traditional Chinese medicine with rhino horn as an ingredient since 1993. Rhino horn carvings dating before 1949 could be legally traded since 2003 and rhino horn carving acquired legally from auctions abroad could be imported into China. Since 2006, dozens of auctions were held inside China where people could legally purchase rhino horn carvings but that market stopped in November 2011. Vietnam announced plans to implement a new prohibition against the export,

import, selling, or buying of rhino specimen imports, but the new directive contains loopholes that concern some conservationists. Reports indicate that increased demand and the price of horn have induced Vietnamese nationals to enter the market. Between July 2009 and May 2012, 185 Vietnamese nationals entered South Africa (where 48 percent of the total hunts during that period took place) as pseudo hunters. Because they had no background in sport hunting, it is likely that they were recruited to get rhino horn intended for commercial sale. As the TRAFFIC conservation program has reported, "Beyond sport hunting, illegal trade networks supplying Vietnam have also acquired hundreds of rhino horns from other illegal sources in South Africa, including poaching, theft, and unregistered stocks held in the private sector."

In the primary supply country, South Africa, significant measures have been taken to stop illegal trade and stem poaching. The South African government placed a moratorium on national trade in rhino horn in 2009, a national Biodiversity Investigator's Forum was established in 2009, and a National Wildlife Crime Reaction Unit was launched in 2010. In 2011 the South African National Defense Force was mobilized to protect rhinos in Kruger National Park, and arrest rates rose—in fact, arrests nearly doubled in 2012 from 2010 and 2011 figures. And South Africa stopped issuing permits to Vietnamese nationals, in part, to prevent pseudo hunting.

REFERENCES

CITES, ar. II(I): CITES, Appendices I and II as of 4 February 4, 1977; CITES, Amendments to Appendices I and II of the Convention, CoP 9 (November 1994); CITES, Amendments to Appendices I and II of the Convention, Notification to the Parties No. 2004/073 (November 2004); Environmental Investigation Agency, "Vietnam's Illegal Rhino Trade: Undermining the Effectiveness of CITES," February 2013; CITES Secretariat, "Conservation of and Trade in African and Asian Rhinoceroses," SC61 Doc. 45.2 at 4, August 2011, www.cites.org/eng/com/sc/61/E61-45-02.pdr; Environmental Investigation Agency, "Vietnam's Illegal Rhino Trade," at 6, February 2013; Milliken and Shaw, Executive Summary, *The South Africa—Viet Nam Rhino Horn Trade*; *Government Gazette*, no. 31899, Notice No. 148, February 13, 2009; and personal communication with Dr. Haibin Wang.

A review of literature on the economics of rhino horn trade, commissioned in November 2013,⁵ demonstrated a relatively thin body of evidence: two academic studies and four less formal articles. Of these, the academic studies suggested that predicting the outcome of liberalizing trade was complex and difficult and that legal trade could increase poaching.⁶ Theoretical economists raised concerns about assumptions used by proponents of trade in a partial equilibrium model for a legal trade presented at the London Summit on Wildlife Trade in February 2014 and in a subsequent peer-reviewed paper.⁷ Yet, still there was no publicly available data concerning demand for rhino horn in China.

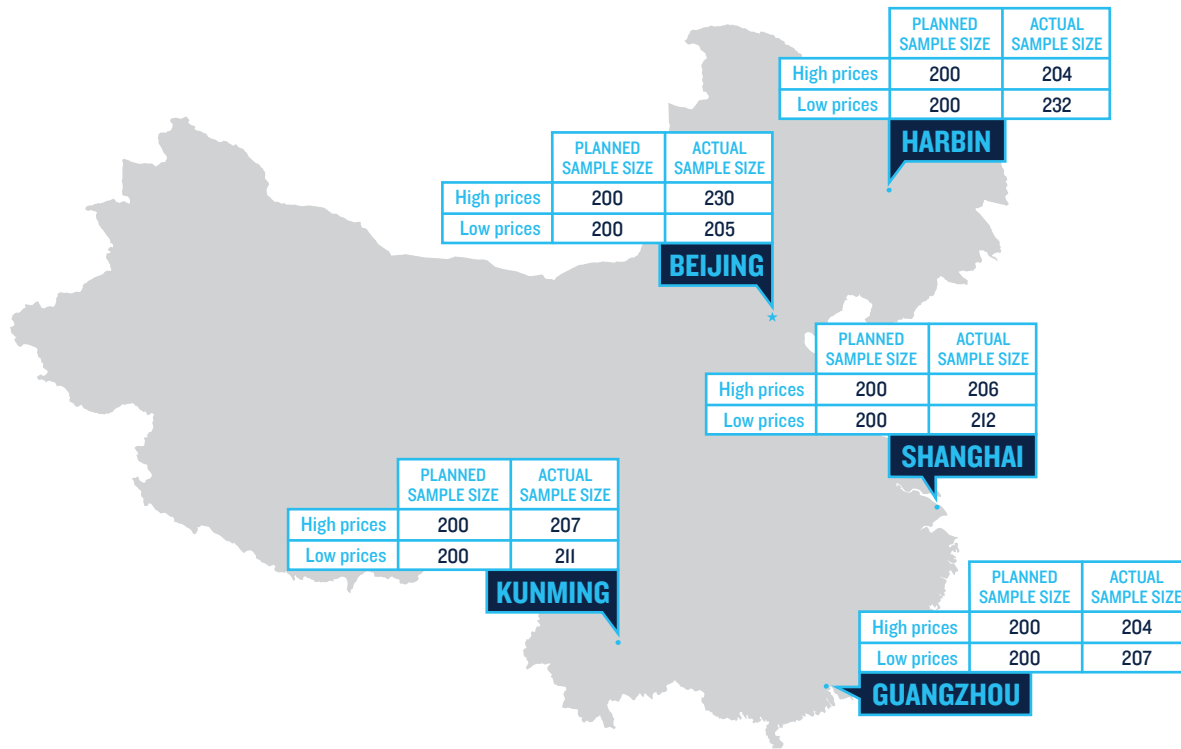
In response to the data gap, NRDC designed a behavioral economic study in 2014 in collaboration with economists from academic and research institutions. Conducted in five cities in eastern and southern China, the survey was designed to assess key purchasing drivers of potential demand for rhino horn products, measure willingness to pay for these products, evaluate whether there would be a destigmatization effect from legalizing rhino horn, and to approximate a sound estimate of current total demand for rhino horn in China.

It is the first of its kind in its research methodology on the subject of rhino horn, and the first rhino horn economic study done in China since the 1980s. Unlike previous analysis available—either for or against an international commercial legal trade—some of the data collected are statistically significant. We anticipate the information could inform both the design of future research, the design of demand reduction and management strategies, and help draw a more comprehensive picture of potential consumer demand in China for rhino horn to map against supply.

Research Methodology:

How we conducted the research

The survey was a stratified study in five cities China, based on longitudinal studies that indicated wildlife consumption in the cities of Beijing, Shanghai, Guangzhou, and Kunming.⁸ Later in the study design, the city of Harbin was added.



We aimed to do two things. First, to collect market data that could be used to draw demand curves to answer the question does current supply meet current demand. Answering that question is at the heart of the current proposal under consideration to legalize the international commercial trade. The second aim was to collect the consumer profiles of potential users of rhino horn to help inform demand reduction strategies, thereby improving effectiveness and enabling better monitoring and evaluation. Because there are few indications today that forces of supply and demand get to equilibrium, the study also measured things that characterize market behavior in dynamic environments, such as consumer preferences and legal, social, and political considerations.

Sampling methodology was random, using government databases and a few predefined consumer characteristics (it excluded those 18 years old and under and those who had not lived in the region for more than a year). A KISH matrix was used for determining who in a household would be accepted into the study when more than one eligible participant lived at a given address. The total sample size target was 2,000 respondents evenly distributed among the five cities; total sample size grew during the administration of the survey to a total of 2121.

Survey questions were developed using a stated preference technique, since the market for rhino horn is illegal in China. Stated preference experiments ask respondents to imagine a set of options for a product with associated costs and to express a preferred option.

The survey questionnaire was adapted on the research methodology used in other wildlife trade papers.⁹ It was developed in English first, reviewed by experts, finalized, and then translated into Chinese. The Chinese version of the survey was pretested on 10 Chinese postgraduate students in the United Kingdom and the United States who were proficient in both

written and oral English and Chinese. Incremental changes were made to the survey questions to aid in question understanding. An established market research firm in China, then reviewed the translated study one last time to smooth out any cultural nuances and/or bias. We did a second round of pretesting with 24 full mock interviews to finalize the survey.

The survey was administered via one-on-one in situ interviews over an initial period of four weeks in May and June 2014. Trained and experienced research interviewers read the questions to the interviewees and filled in their answers. Responses were checked by supervisors and randomly verified by follow-up phone calls. The survey was paused for about two months and then resumed for another four weeks in September and October 2014 using the same techniques. All responses were then compiled by the researchers in Chinese in November 2014, and some preliminary findings were presented in English in December 2014. The full data set was sent to an independent translator in January 2015, and a full analysis in English was available in March 2015.

The study did not measure for consumer behaviors that would indicate a willingness to substitute synthetic horn for real horn, or motivations to purchase horn for stockpiling, but the researchers welcome the opportunity to collaborate on further study and analysis.

One bias to the sampling method is that all the respondents reside in first- and second-tier cities. No respondents were interviewed in smaller cities (county-level), towns and rural villages. People in rural areas and small towns may depend more on traditional Chinese medicine because it is often less expensive than western medicine alternatives. This omission was simply due to the financial constraints of the project. Equally, it is the case that people living in larger cities in China are more affluent and so may be more inclined toward purchasing horn as a luxury good. For example, past auctions of rhino horn carvings, were held in the provincial capital cities such as Beijing, Shanghai, and Guangzhou, presumably because potential buyers for high-value products such as antiques and art concentrate in urban areas. To reflect a more comprehensive analysis of the latent market across China, the survey would be administered to a more stratified sample in non-urban areas.

Another factor that may confound the conclusion drawn from the sample questions about use over the last 10 years is the presence of an active, legal trade in rhino horn carvings dating before 1949 between 2003 and November 2011. These legal purchases would need to be factored out of any demand estimations.

SURVEY RESPONDENTS PROFILES		
GENDER DISTRIBUTION		
	Sample size	Percent
Male	1,006	47.4%
Female	1,115	52.6%
INCOME DISTRIBUTION		
Low income	209	9.9%
Middle income	908	42.8%
High income	955	45.0%
No regular income	14	0.0%
Refused to answer/ not sure	35	0.7%
EDUCATIONAL LEVEL DISTRIBUTION		
Low	220	9.4%
Middle	613	30%
High	1280	60.3%
Refused to answer/ don't know	8	0.03%
AGE DISTRIBUTION		
18-25 years	424	20.0%
26-35	679	32.0%
36-45	491	23.1%
Above 45	510	24.0%
Refused to answer/ don't know	17	0.8%

The survey was funded by NRDC's Science Opportunity Fund and was conducted according to NRDC's stated scientific and ethical standards. Before publishing, NRDC requires both internal and external peer review. In the case of this flagship approach, we conducted two peer reviews: one around the survey design and the other in the analysis.

We hope the consumer market information contained in this write up will help to inform ongoing discussion and design of demand reduction strategies. We will be following this report with two papers that will be submitted for peer review, which aim to answer two key questions: does current demand meet supply and how does future supply and demand, as well as key exigent factors affecting what seems to be two distinct markets, behave under different policy scenarios.

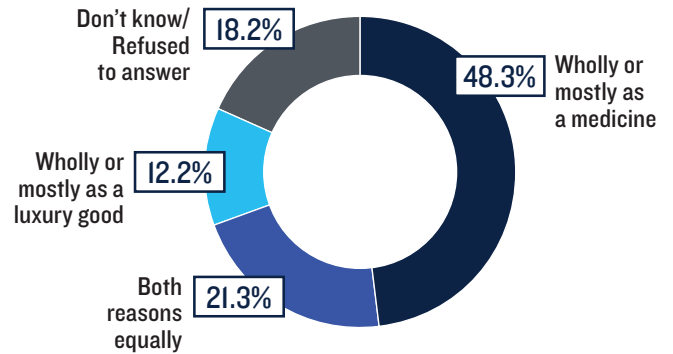
Key Findings:

Potential consumption of rhino horn in China

By measuring consumer behavior, including preferences, willingness to pay, and stigma effects, the study produced some key findings:

- Demand for rhino horn has differentiated into two markets: medicine and luxury goods
- Users behave differently in each market and exhibit regional differences
- The illegal status of the rhino horn trade and awareness of conservation issues dampen demand in both product markets

WHY DO PEOPLE BUY RHINO HORN?

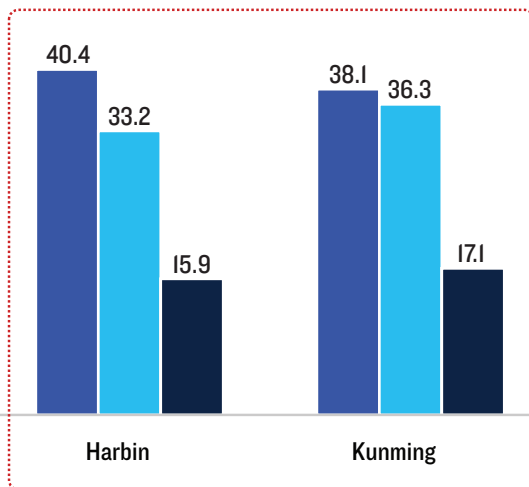


AWARENESS OF RHINO HORN PURCHASES AMONG PARTICIPANTS HAD REGIONAL VARIATIONS

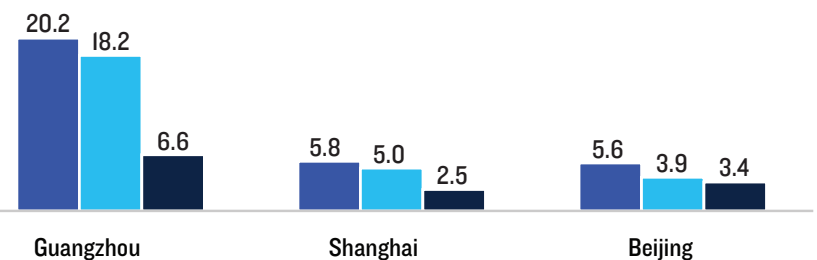
Respondents in Kunming and Harbin were most aware of uses for rhino horn, had the weakest knowledge of the law on rhino horn trade, and were the most likely to know someone who had bought rhino horn. In fact, the percentages of participants in Kunming who know that rhino horn is used as a medicine (69.1 percent) and believe that rhino horn is very important for traditional Chinese medicine (81.0 percent) were significantly higher than in all other cities surveyed. Participants in Harbin and Kunming also reported knowing more people who had bought rhino horn than participants in the other three cities.

On the other hand, respondents in Beijing and Shanghai showed the lowest awareness of uses for rhino horn and good knowledge of the law on rhino horn. They were also the least likely to know someone who had bought rhino horn. Participants in Guangzhou scored between the Harbin-Kunming and Beijing-Shanghai groups.

REGIONAL DIFFERENCES ARE SIGNIFICANT—KUNMING, HARBIN ARE MORE LIKELY TO KNOW SOMEONE WHO HAS BOUGHT RHINO HORN THAN THE OTHER THREE CITIES



REGIONAL DIFFERENCES (IN PERCENT): DO YOU KNOW SOMEONE WHO HAS BOUGHT RHINO HORN?



- Know someone who has bought rhino horn
- Know someone who has bought rhino horn medicine
- Know someone who has bought rhino horn as a luxury good

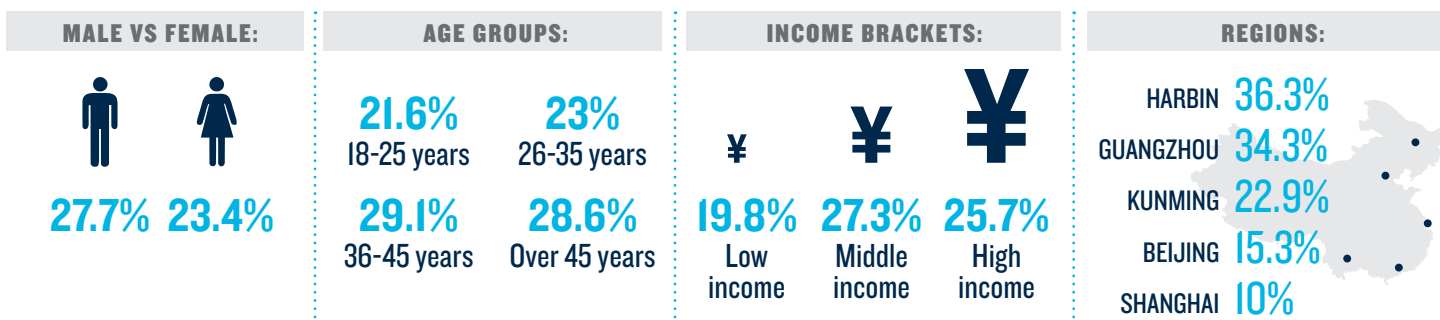
Note: This sample is from those people who said they knew rhino horn is used as a medicine.

RHINO HORN AS A MEDICINE

For most illnesses, the percentage of respondents choosing a combination of Chinese and Western medicine was greater than the percentage choosing only Chinese medicine. Overall, 44.9 percent of respondents said their medicine cabinet was half Western and half Chinese; 43.3 percent said it was all or mostly Western, and just 5.9 percent said it was all or mostly Chinese. Those surveyed appear to favor a regime of Western medicine, supplemented with Chinese medicine.

Because of the historical use of rhino horn as an ingredient in traditional Chinese medicine (one of the first description of medicinal properties of the rhino horn dates back to 2nd century BC in The Sacred Farmer's Materia Medica book), the survey explored the Chinese medicinal market in more depth. However, today no traditional Chinese medicines with rhino horn ingredients are in the Chinese pharmacopoeia. The survey looked at factors, including purchasing behavior when deciding whether to choose Western or Chinese medicine for various conditions, where people buy Chinese medicine, and what the profile of the Chinese medicinal rhino horn buyer looks like.

PROFILE OF CONSUMER WHO SAID THEY WOULD CHOSE RHINO HORN FOR MEDICINE



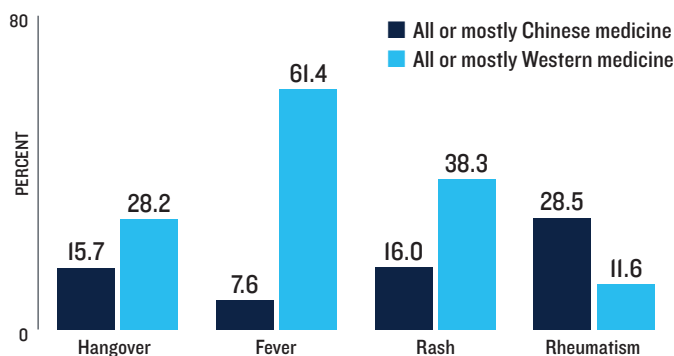
Note: This question was given to those people who said they knew rhino horn is used as a medicine.

Preferences for Chinese, Western, or some combination of medicine varied by illness

Most respondents chose Western medicine over Chinese medicine to treat three common acute conditions: fever (61.4 percent versus 7.6 percent), rash (38.3 percent versus 16.0 percent), and hangover (28.2 percent versus 15.7 percent). However, Chinese medicine was favored over Western medicine for rheumatism (28.5 percent versus 11.6 percent) and erectile dysfunction (11.7 percent versus 10.7 percent). For cancer as well as rheumatism, respondents reported a preference for a Chinese-Western combination (39.9 percent and 38.2 percent, respectively).

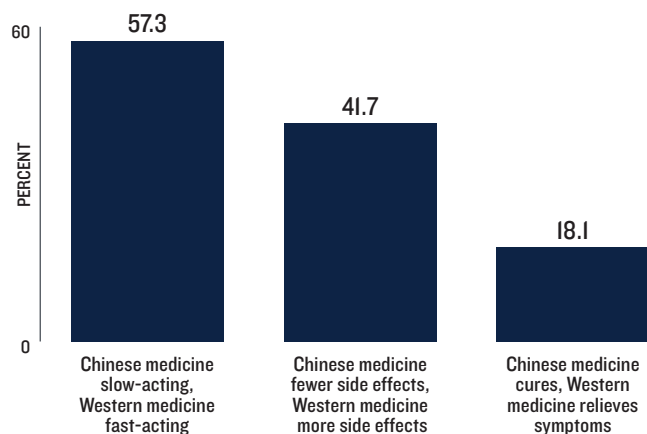
In treating six conditions, faster action was the most common reason given for choosing Western medicine, while fewer side effects was the most common reason for choosing Chinese medicine. Of those who said they would choose Western medicine to treat a fever, 77.8 percent said it was because of its quick results; the second-ranking reason was that it was very effective (42.1 percent). Of those who said they would choose Chinese medicine to treat rheumatism, 73.6 percent said it was because it had fewer side effects; the next-highest reason was that it would ease the symptoms (60.3 percent). These questions were asked of those people who said they would choose only Western or only Chinese medicine, and for the specific illnesses noted. The questions allowed multiple answers, so the totals add to more than 100 percent.

CHOICE OF MEDICINE FOR DIFFERENT CONDITIONS

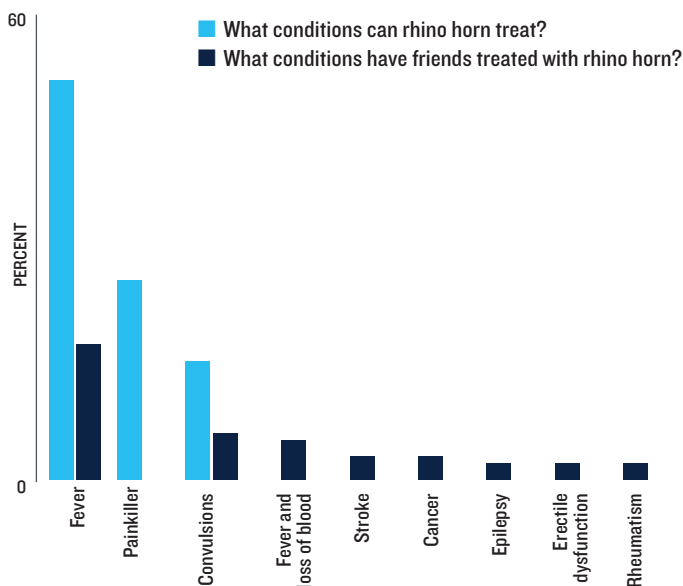


The top four places to buy Chinese medicine among respondents were Chinese medicine hospitals (44.2 percent), general pharmacies (28.3 percent), general hospitals (26.9 percent), Chinese medicine clinics (15.4 percent), and general clinics (11.4 percent). Other reported sources were local Chinese medicine markets (7.7 percent) and gifts from relatives or friends (3.7 percent). The question allowed multiple answers, so the total adds to more than 100 percent. Women are the main buyers of Chinese medicine for the home, buying it mostly themselves (75.5 percent) or asking their partner (20 percent) or mother (15.2 percent) or father (6.9 percent) to purchase it.

MAIN DIFFERENCES BETWEEN WESTERN AND CHINESE MEDICINE



COMMON CONDITIONS TREATED BY RHINO HORN



Nearly half of participants knew horn was used as a medicine of which half of them said it was used for fever

Although more than half of the participants knew that the horn is the most often consumed part of the rhino, the percentage who had heard that rhino horn is used as a medicine was 47.1 percent, the percent who had not heard that rhino horn is used as a medicine was 42.8 percent, and the percentage who declined to answer or didn't know was 8.6 percent. Even among those who said they knew it is used as a medicine, still more than 75 percent could not name any condition it is used to treat. Of those who said they knew that rhino horn is used as a medicine and could name a condition, 51.4 percent said that it is used to treat fever.

While just over half (52.5 percent) of the respondents said that rhino horn is important in Chinese traditional medicine, just 11.1 percent said it is not very important and 35 percent said they were not sure. Respondents who had suffered a serious illness were 12 percentage points more likely to know that rhino horn is used as medicine and were also 9.7 percentage points more likely to say that rhino horn is important to Chinese medicine.

Of those who knew that rhino horn is used in traditional medicine, 43.8 percent were aware there is an equally good or better alternative to rhino horn, 40.5 percent didn't know or were uncertain, and 15.7 percent said there is no alternative. Among those who were aware there is an equally good or better alternative, almost 70 percent said that the alternatives are more effective or the same. Those who had experienced a serious illness were more likely to say that alternatives to rhino horn are effective. Those who said rhino horn is important to Chinese medicine were less likely to think alternatives are effective.

Availability of Chinese herbal alternative of lower price provides an effective alternative to horn use for medicine

Irrespective of the price of rhino horn medicine, when given a choice between rhino horn medicine and Chinese herbal remedies costing RMB80, most respondents chose the Chinese herbal remedy.

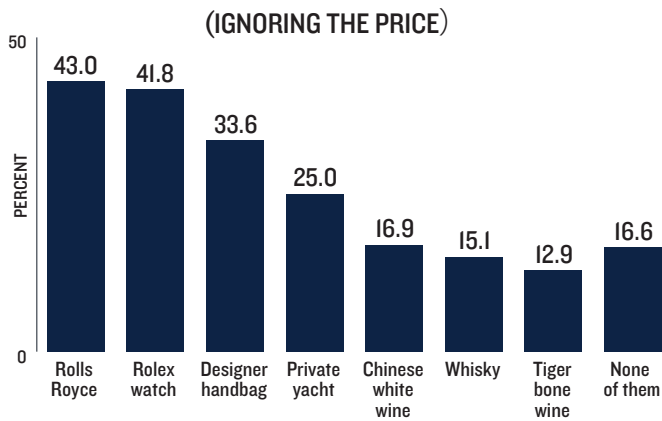
When a lower price bracket was given for rhino horn, 78.9 percent chose the Chinese herbal remedy over rhino horn medicine, and of those, 41.6 percent said they would make the same choice for all rhino horn price options. In the lower price bracket, 13.1 percent of respondents chose rhino horn medicine over the Chinese herbal remedy, and of those, 3.2 percent said they would choose rhino horn medicine for all price options.

When a higher price bracket was given for rhino horn, 81.7 percent chose the Chinese herbal remedy over rhino horn medicine, and of those, 66.5 percent said they would choose the Chinese herbal remedy regardless of rhino horn price. In the higher price bracket, 37.6 percent chose rhino horn medicine over the Chinese herbal remedy, and of those, 5.1 percent said they would choose rhino horn medicine for all price options.

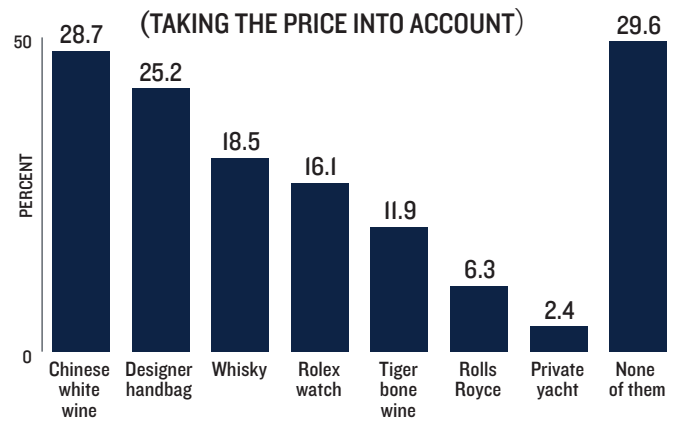
RHINO HORN AS A LUXURY GOOD

Born relatively recently out of China's rapid economic rise, the growing middle and upper classes are showing an interest in buying rhino horn as a luxury good. To get a better sense of what a luxury good means to participants and how it is valued, we asked a few questions about which luxury products they would like to buy (ignoring price) and which luxury product they were most likely to buy (taking price into account).

WHAT LUXURY PRODUCT WOULD YOU LIKE TO BUY?



WHAT LUXURY PRODUCT WOULD YOU LIKE TO BUY?



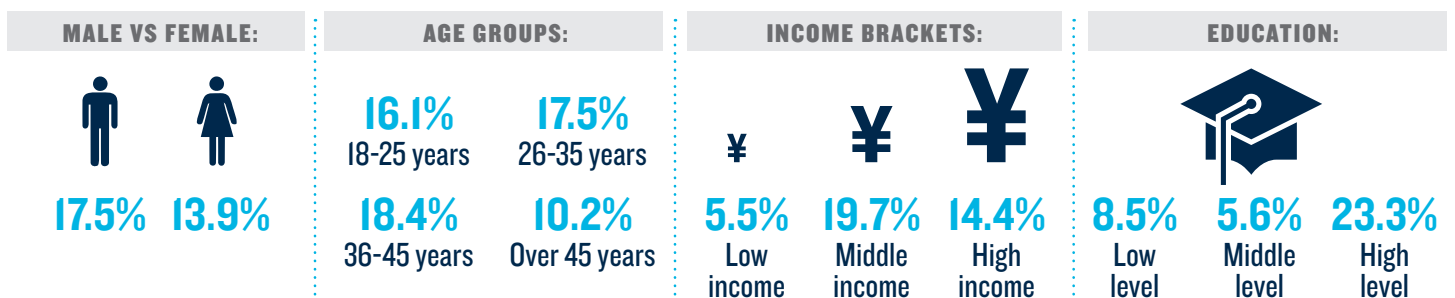
Ignoring price, 40 percent of survey respondents said their most coveted luxury good was a Rolls-Royce. Taking price into account, most respondents said Chinese white wine priced between RMB50 and RMB30,000 was the luxury good they would buy.

Among those who know horn can be used as medicine, 8.3 percent would buy it only as a luxury good.

There were many more respondents who said they knew someone who had bought rhino horn medicine than there were respondents who knew someone who had bought rhino horn as a luxury good. Only 12.2 percent believe that rhino horn is bought "wholly or mostly as a luxury good," while 48.3 percent said people buy rhino horn "wholly or mostly as a medicine." Some thought people buy rhino horn for both reasons equally (21.3 percent), and 18.3 percent didn't know or declined to answer.

Those who know someone who bought rhino horn as a luxury good mostly judged the purchase as worthwhile. Of all respondents who said they knew someone who had bought rhino horn as a luxury good, 77.3 percent believed that purchase made the buyer "happy" to one degree or another; 4.5 percent said the buyer was not at all happy or basically not happy.

POTENTIAL BUYERS OF RHINO HORN LUXURY PRODUCTS ARE YOUNG, WELL-EDUCATED MALES



Note: These four questions were given to those people who said they knew that rhino horn was used as a medicine but would only buy rhino horn as a luxury product and to those people who said they did not know that rhino horn was used as a medicine.

Main reason for buying horn as a luxury good is to “give as a gift” because it is “unique”

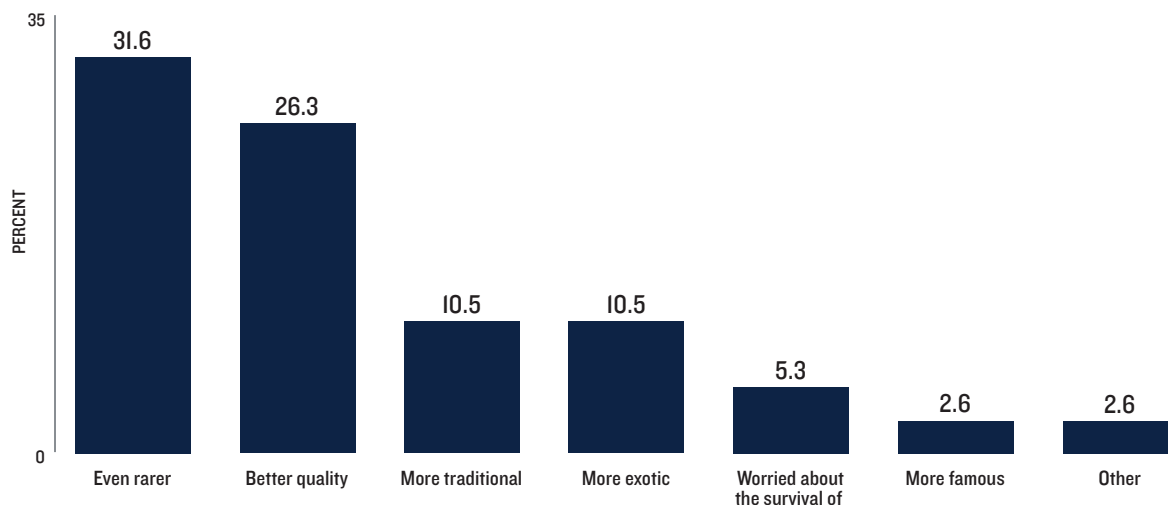
More than half of those who said they knew someone who had bought rhino horn as a luxury good and who knew it could be used as a medicine said the reason for the luxury purchase was to give it as a gift, either for a friend (33.0 percent) or for a business associate (16.4 percent). The next-highest reason to buy horn as a luxury good was because the user “just wanted to buy it” (18.2 percent). Other reasons were to display it in front of business associates (13.6 percent), to show it off to family and friends (9.1 percent), or to enjoy as an ornament/piece of art (0.9 percent). This question was open-ended, so the sum of responses is greater than 100 percent.

The psychology of buying rhino horn as a luxury good may stem from a desire for something rare or unique. Of those people who said they would consider buying rhino horn as a luxury good, 65.8 percent said they would buy it because it is rare. This could perhaps be related to a pursuit of individuality in Chinese culture. The next-biggest reason to buy horn was because it is very desirable (24.5 percent), it would bring the buyer prestige (19.9 percent), it is traditional (15.3 percent), and it is a sign of success (11.2 percent). Some 5.0 percent said they didn’t know why they would buy horn or declined to answer. The question allowed multiple answers, so the sum of responses is greater than 100 percent.

When asked to differentiate between African and Asian rhino horn at a higher price, the most popular reasons for buying Asian rhino was that it was even rarer than African (31.6 percent) and was of better quality (26.3 percent).

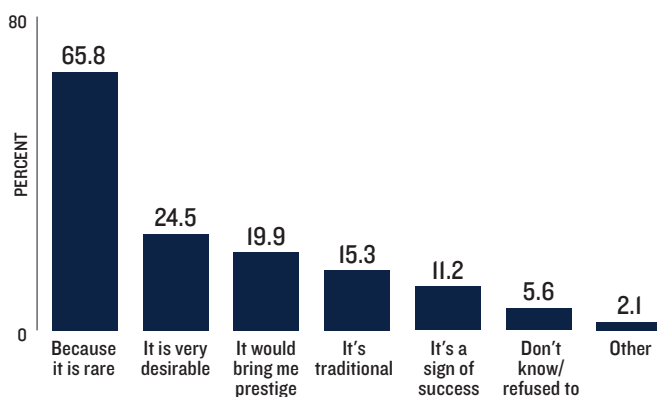
Top reasons for not buying rhino horn as a luxury good were concern about wildlife conservation (48.8 percent), the expense (42.1 percent), and a lack of interest in rhino horn (28.8). Respondents who said they didn’t know came to 3.5 percent. The question was asked of those people who said they were willing to buy other luxury items but not rhino horn. It allowed multiple answers, so the total is more than 100 percent.

WHY WOULD YOU BUY AN ASIAN RHINO HORN LUXURY GOOD IF IT WAS ‘EVEN MORE EXPENSIVE’?

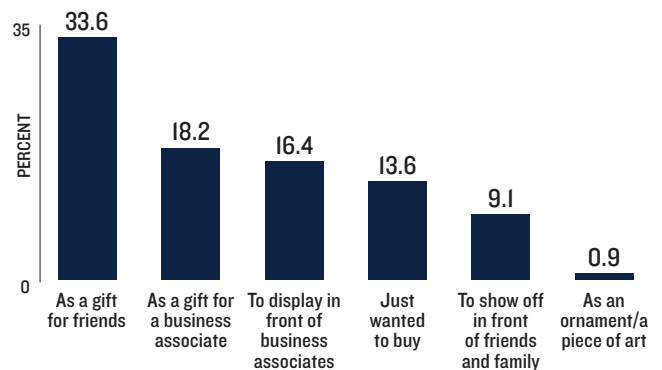


Note: This question was given to those people who said they buy Asian rhino horn even if it was “even more expensive”. Also, this question allowed multiple answers, so the total is greater than 100%.

REASON TO BUY RHINO HORN



REASONS SOMEONE THEY KNEW BOUGHT RHINO HORN

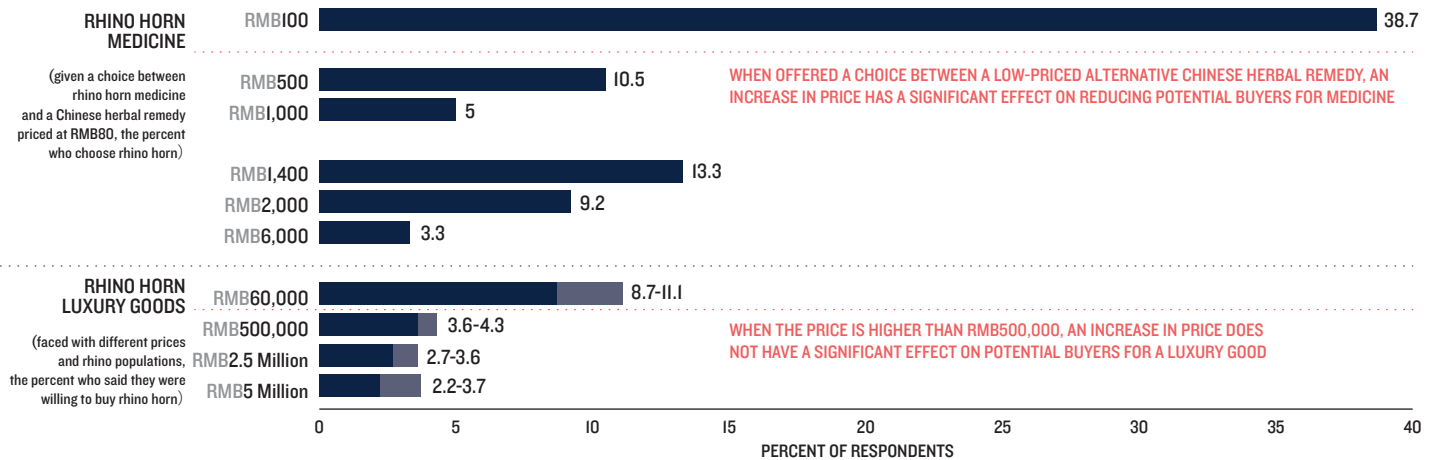


HOW PRICE EFFECTS PURCHASES IN BOTH RHINO HORN PRODUCT MARKETS

Each incremental rise in price of horn for medicine reduced the number of willing buyers

Given the choice between rhino horn medicine and a Chinese herbal remedy priced at RMB80, each increase in the price of the rhino horn medicine caused a drop in potential buyers, with the biggest effect on potential buyers when the price was low. The biggest shift in willingness to pay was when the rhino horn price rose from RMB100 to RMB500—the lowest-cost options offered in the low price bracket. The percentage of willing buyers fell by 28.2 percent.

PRICE HAS SIGNIFICANT EFFECT ON POTENTIAL BUYERS IN BOTH RHINO HORN PRODUCT MARKETS



In the lower price bracket, when the cost of rhino horn medicine (RMB100) and the Chinese herbal remedy (RMB80) were similar, there was not much difference between the percentage of participants who chose rhino horn (33.2 percent) and the percentage who chose the Chinese herbal remedy (36.4 percent). When the rhino horn medicine was more expensive (RMB1,000), the percentage who chose the Chinese herbal remedy was much greater (77.1 percent) than the percentage choosing horn (5.0 percent). In the higher price bracket, whatever the price of the rhino horn medicine (ranging from RMB1,400 to RMB6,000), the percentage who chose the Chinese herbal remedy (at the constant price of RMB80) consistently stayed above 70 percent.

Potential buyers of rhino horn luxury goods are sensitive to price when prices are low, not high

When we presented different prices for rhino horn luxury goods and different rhino populations, we found that when the price is raised by one increment, the number of potential customers will fall, but only slightly. Price changes in rhino horn as a luxury good also have the biggest effect on potential buyers when the price is low. When the price of a rhino horn product is below RMB500,000, the effect of lowering the price a level is more significant. However, when the price rises above RMB500,000, a change in price does not have much effect on willingness to purchase.

HOW OTHER EXIGENT FACTORS AFFECT CONSUMER BEHAVIOR

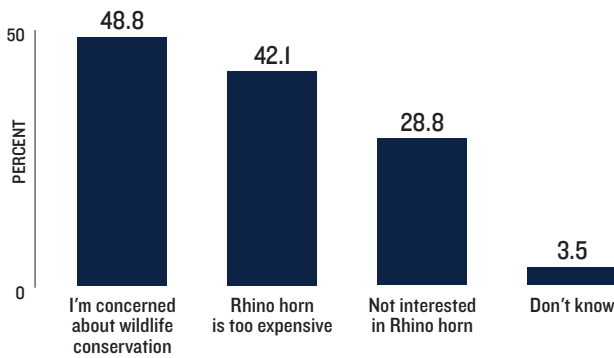
Rhino horn: The law, the risks, and ethics

Almost one-quarter of all respondents thought it was legal to buy rhino horn (16.2 percent) or said they didn't know whether it was (7.4 percent), demonstrating a major gap in education on the law. Only 0.3 percent declined to answer, with the balance affirming they were aware it is illegal to buy rhino horn. In Beijing and Shanghai, the percentage of respondents who knew it is illegal to buy rhino horn was more than or close to 78 percent and 91 percent, respectively. Interestingly, just over 77 percent of respondents in Harbin also reported knowledge that buying rhino horn is illegal. The percentage of respondents who were aware it is illegal to buy rhino horn dropped to 70 percent in Kunming and around 63 percent in Guangzhou.

More than 70 percent of respondents thought it was difficult to buy rhino horn, but most believed the risk of arrest for buying rhino horn was average or low. The perceived risk of arrest was relatively flat across all cities—around 6 on a scale of one to 10 in Shanghai and Beijing, around 5 out of 10 in Harbin and Kunming, and 5.5 out of 10 in Guangzhou. The average rating for the five cities for the likelihood of arrest was 5.7 out of 10.

When participants were asked what they thought the main punishments were for buying rhino horn, jail sentences of various terms totaled 60.4 percent of the responses (a medium jail sentence was cited by 29.9 percent of respondents, a long jail sentence by 18.9 percent, and a short jail sentence by 11.6 percent). Fines were also widely mentioned, at 53.5 percent, followed by a reprimand (9.6 percent), a small fine (8.1 percent), and the death penalty (4.8 percent). Some respondents (17.7 percent) said there were too many punishments to count.

WHY WOULD YOU BUY ANOTHER KIND OF LUXURY ITEM OTHER THAN RHINO HORN?



Note: This question was given to those people who said they were willing to buy other luxury items but not rhino horn. Also, this question allowed multiple answers, so the total more than 100 percent.

Rhino population levels had little or no effect on purchasing behavior for horn as a luxury good

When questions about buying preferences were coupled with questions about rhino population levels, the effect of population on potential buyers for rhino horn as a luxury product was not significant at any price. The greatest effect that rhino population levels had on potential buyers of rhino horn luxury goods was only 2.4 percentage points at the lowest price of RMB60,000. In that scenario, if there was a reported population of 20,000 rhinos, 11.1 percent of respondents said they would be willing to buy rhino horn. If the population was reported to be 100 rhinos, 8.7 percent of respondents said they would be willing to buy rhino horn. Otherwise, at all prices ranging up to RMB5 million and at rhino populations ranging from 100 to 20,000, the percentage of participants who said they were willing to buy horn did not vary much. In fact, for the same price, even a twentyfold change in the rhino population had little effect on the number of willing buyers of rhino horn luxury goods. This sample was taken from those people who did not know that rhino horn was used as a medicine and people who did know this but said they were willing to buy it only as a luxury good.

	Price (RMB)	Rhino population	Percent of potential buyers	
Lower price bracket	60,000	100	8.7	Range 2.4%
		5,000	10.3	
Higher price bracket		5,000	9.0	
		20,000	11.1	
Lower price bracket	500,000	100	3.6	Range 0.7%
		100	4.3	
Lower price bracket	2.5 million	100	3.6	Range 0.9%
		20,000	3.6	
Higher price bracket	5 million	5,000	2.7	Range 1.2%
		2,000	3.4	
Higher price bracket		5,000	3.7	
		20,000	2.2	

FOR THE SAME PRICE, EVEN A 20-FOLD CHANGE IN THE RHINO POPULATION, HAS LITTLE EFFECT ON THE NUMBER OF WILLING BUYERS.

Conclusions and Recommendations:

What current data mean for policy

In reviewing the availability of data before, during and after our study, mostly in grey literature, and by interpreting the results of our consumer market study in China, NRDC experts have drawn the following conclusions and recommendations:

- Funders, researchers and practitioners should encourage more robust research methods, transparency and sharing of data and analysis, and multidisciplinary approaches so that decision makers will have more reliable and objective information to inform policy interventions.
- Current demand reduction strategies should integrate behavioral economic data into project design, monitoring and evaluation. NRDC data could help support that effort for at least two rhino horn product markets in China.
- Researchers should collect more data and conduct more peer-reviewed analysis using the best available data before considering international legal trade of rhino horn, particularly answering:
 - (a) Does current total supply meet current estimated total demand?
 - (b) How would consumer purchasing behavior change and demand with the introduction of legal and/or synthetic horn into the market? Or synthetic horn?
 - (c) Do the limitations of the partial equilibrium model supporting the current international legal trade argument yield too much uncertainty for policy makers? If so, what other models should be considered to reduce risks and uncertainty in designing policy and law?

In the spirit of these recommendations, NRDC is willing to share our research methodology, survey design and the full data set with researchers, practitioners and policy makers for non-commercial purposes. Not only do we hope that that the information in this report will inform discussion and design of current demand reduction strategies, but we also hope to publish at least two peer-reviewed journal articles addressing some of the questions we raise above in advance of the upcoming Conference of the Parties for CITES to be held in late September/early October 2016.

Although beyond the scope of the research questions we posed, NRDC would like to recognize the strong conviction shared among a diverse group of stakeholders to ensure that we have a persistent population of wild rhinos in Africa now, and for generations to come. We see the uniformity behind that single goal in the strong measures taken by South Africa and other range states to increase anti-poaching security measures, to improve prosecutorial competence and to provide community-based natural resource management initiatives. We see it in China's maintenance of its domestic law against the legal trade of rhino horn and its efforts to increase seizures and enforcement. And we see it in the efforts in Vietnam to introduce demand reduction strategies for its consumer markets. Together, the skills and passions of a global effort could help solve one of today's most pressing conservation challenges: a sustainable, wild population of one of Africa's most iconic species—the rhino.

RECOMMENDATION I: FUNDERS, RESEARCHERS AND PRACTITIONERS SHOULD ENCOURAGE MORE ROBUST RESEARCH METHODS, TRANSPARENCY AND SHARING OF DATA AND ANALYSIS, AND MULTIDISCIPLINARY APPROACHES SO THAT DECISION MAKERS WILL HAVE MORE RELIABLE AND OBJECTIVE INFORMATION TO INFORM POLICY INTERVENTIONS.

Economic and market research on consumer behavior—for rhino parts, ivory and other species—has not been conclusive. Three reasons for this are (1) the predominant use of outmoded and inconsistent research methodologies, (2) isolated research efforts that duplicate data and/or reinforce data gaps, and (3) the lack of transparency and multi-disciplinary collaboration across the value chain. There is also a lack of trust in data collection and analysis among key stakeholders (governments, agencies, NGOs, donors, and perhaps even academic and research institutions) when advocacy positions are infused into the reporting of figures and analysis, which only further polarizes the discussions at a time when international trade policy could represent on one hand a possible opportunity for conservation and on the other a real threat to viable wild populations. The result is less informed policy and market interventions, lower return on investment of donor dollars, a relatively static set of strategies and less effective coupling of rhino support programs and demand reduction strategies that by definition must be responsive to one another.

To remediate this situation, we join the growing call among practitioners and decisions makers for sounder, collective and more transparent data collection and analysis. Data collection and analytical methodologies should be standardized to ensure the quality of the data and to increase consistency across studies allowing data to be shared, smoothed, and

connected. Research should be done in coordination with multiple disciplines, including some non-traditional actors in the conservation and wildlife trade sectors, to share best practices and market insights. And there should be some mechanism for sharing data, respecting the need for researchers and agencies to establish individual credentials (and funding), but recognizing the need to provide access to data to avoid the potentially steep opportunity costs associated with duplicate, insufficient and inconsequential research that can lead to misperception.

RECOMMENDATION 2: CURRENT DEMAND REDUCTION STRATEGIES SHOULD INTEGRATE BEHAVIORAL ECONOMIC DATA INTO PROJECT DESIGN, MONITORING AND EVALUATION. NRDC DATA COULD SUPPORT THAT EFFORT FOR AT LEAST TWO RHINO HORN PRODUCT MARKETS IN CHINA.

NRDC’s data indicate that there are at least two markets for rhino horn products in China, the medicinal market and a luxury goods market. It is important to consider the consumer qualities and purchasing behaviors when designing demand reduction or management strategies. Relevant conclusions and recommendations include:

1. Tailor strategies for regional differences
2. In medicinal markets, use a message that says there are equally effective alternatives available
3. In luxury markets, consider a combined communications strategy to shift consumers away from the idea that rhino horn is desirable and has value because it is “unique” and “rare”

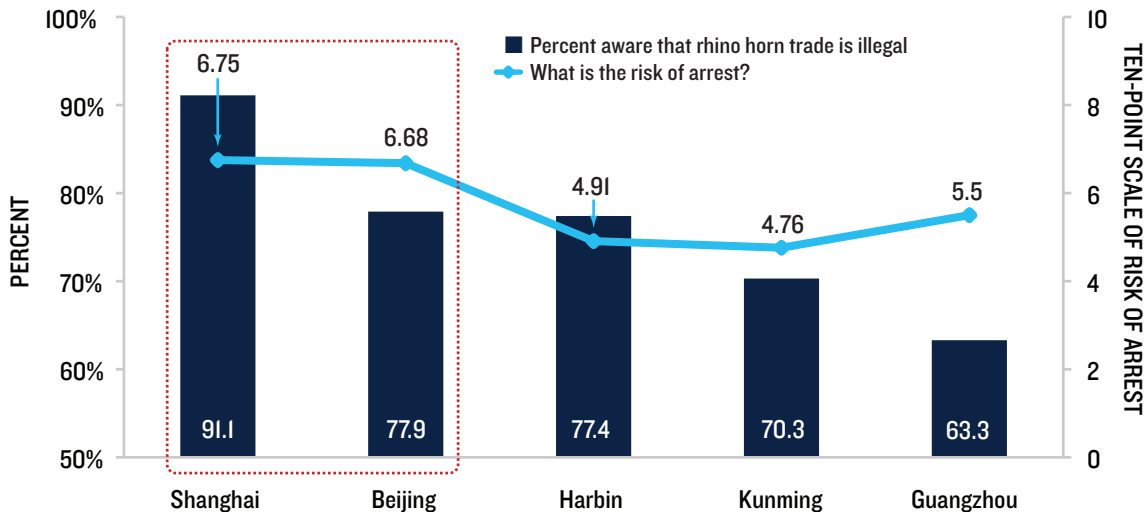
Tailor strategies for regional differences to bring greater awareness that rhino horn trade is illegal

Respondents in Kunming, Harbin and Guangzhou were more likely to have known someone who bought rhino horn. Also, respondents in these three areas were more willing to buy rhino horn medicine and rhino horn luxury goods than in Beijing and Shanghai. From this we can see that rhino horn trade may be busier in Kunming, Harbin and Guangzhou. These three areas also showed less awareness about both the legal status in China for rhino horn, the moral issues, and wildlife conservation more generally. These cities also thought that the risk of arrest for buying rhino horn was not that great.

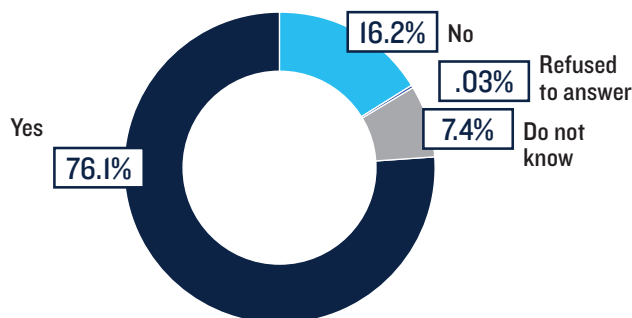
Thus, the data may compel a demand reduction strategy focused on increasing awareness among citizens in the cities of Kunming, Harbin and Guangzhou that the trade of rhino horn in China is illegal and that there is and will be strong enforcement of that law by the authorities in cooperation with the local governments. In the cities of Beijing and Shanghai, where awareness of law was higher, a better demand reduction strategy may seek to raise awareness that effective, low-cost Chinese herbal medicines are available as an alternative to rhino horn medicine. The more difficult consumer behavior to shift in both areas will be among those consuming horn as a luxury good, since the higher prices, rarity and uniqueness of the product is what attracts consumers to its purchase.

REGIONAL DIFFERENCES ARE SIGNIFICANT—BEIJING, SHANGHAI WERE MORE AWARE OF THE LAW ON RHINO HORN TRADE AND THOUGHT THE RISK OF ARREST WAS HIGHER

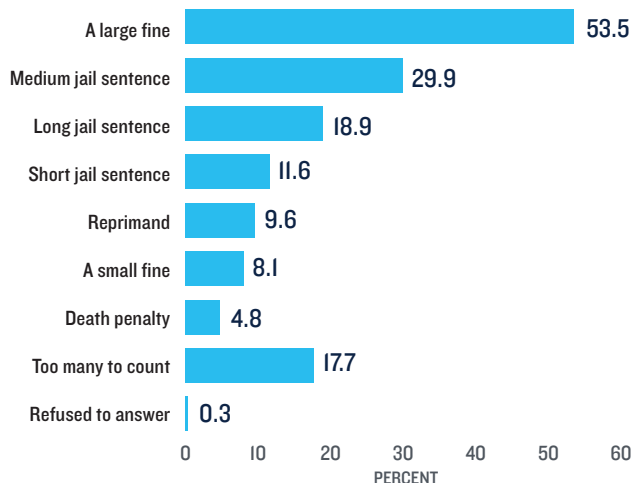
REGIONAL DIFFERENCES (IN PERCENT): DO YOU KNOW THAT BUYING RHINO HORN IS ILLEGAL AND HOW RISKY IS IT TO GET CAUGHT?



ARE YOU AWARE THAT IT IS ILLEGAL TO BUY RHINO HORN?



WHAT IS THE PUNISHMENT FOR BUYING RHINO HORN?



In medicinal markets, use a message that says there are equally effective alternatives available

Just over half of all respondents were not clear whether rhino horn is used as a medicine or not, what diseases it is used to treat, whether there are alternatives or not, and whether it is important to Chinese medicine or not. Thus, there is certainly scope for promoting alternatives to treat the most common conditions for which rhino horn is used as a medicine. Also, the overwhelming majority of those respondents who said they knew alternatives were available said that the alternatives were more or equally effective. This shows that where the public is concerned, it is not difficult for them to accept that there are equally good alternatives to rhino horn medicine.

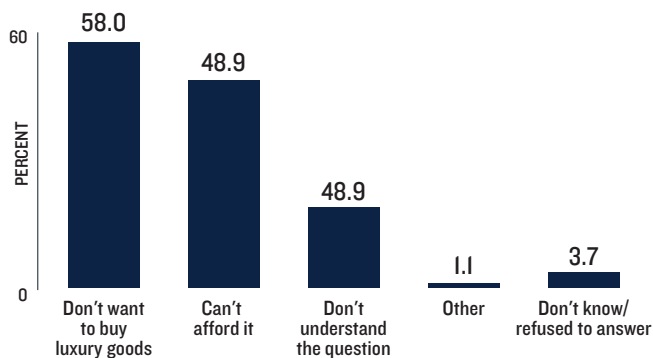
In designing demand reduction strategies targeted to potential consumers in this market, we recommend using positive and logical messages that explain the reasoning behind rhino horn medicine and alternatives using a scientific message, while showing respect for the special relationship that Chinese people have to traditional medicine, particularly for chronic conditions where consumers display a preference to traditional Chinese medicines. For acute conditions, such as fever, demand management strategies should focus on bringing awareness to more effective alternatives available for Western medicines. The messages could start with women, who are the majority of buyers of traditional medicine in traditional Chinese hospitals. Regional differences are also important, as in Guangzhou, Harbin and Kunming, respondents were more aware of alternatives to rhino horn medicine and were more likely to approve them.

In luxury markets, consider a combined communications strategy to shift consumers away from the idea that rhino horn is desirable and has value because it is unique

Price is a key factor influencing potential buyers for both rhino horn medicine and luxury goods but compared with medicine, luxury goods are also affected by a combination of other factors. Main drivers behind rhino horn luxury good purchases were to “give as a gift,” “unique,” and “personal preference.” The status of rhino populations did not have much effect on potential buyers although “caring about wildlife conservation” was a key factor in reducing purchases among potential buyers of rhino horn luxury goods. This may be a situation where aspirational buyers have sensitivity to conservation, but actual buyers would not change their purchasing decision for a specific product based on the status of the specific species population that supplies the material for the product.

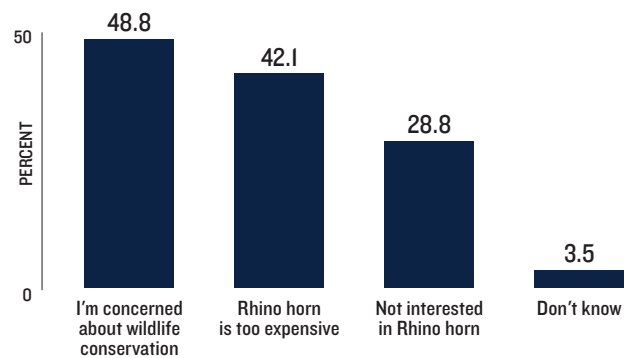
In designing demand reduction strategies for luxury goods, a combined communications strategy could aim to diminish the qualities of desirableness and rarity and the drive to give the good as a gift. This could be done by promoting awareness of wildlife conservation. It could also be done by promoting an equally or more attractive substitute luxury good.

WHY WOULDN'T YOU BUY A LUXURY GOOD?



Note: This question was given to those people who said they wouldn't buy any kind of luxury item. Also, this question allowed multiple answer, so the total is over 100%.

WHY WOULD YOU BUY ANOTHER KIND OF LUXURY ITEM OTHER THAN RHINO HORN?



Note: This question was given to those people who said they were willing to buy other luxury items but not rhino horn. Also, this question allowed multiple answers, so the total more than 100 percent.

RECOMMENDATION 3: RESEARCHERS AND ANALYSTS SHOULD COLLECT MORE DATA AND CONDUCT MORE PEER-REVIEWED ANALYSIS USING THE BEST AVAILABLE SCIENCE, PARTICULARLY ANSWERING:

- (a) Does current total supply meet current estimated total demand?
- (b) Do the limitations of the partial equilibrium model supporting the current international legal trade argument yield too much risk and uncertainty for policy makers?
- (c) If so, what other models should be considered so decision makers can incorporate factors such as consumer preference for wild versus farmed versus synthetic horn, the shrinking or swelling of demand, laundering, and the competitive advance of criminal syndicates.

Does current total supply meet current estimated total demand?

And how do potential negative effects compare to possible benefits of an international legal trade in rhino horn?

It is important to answer the question about whether supply can meet demand, because it underpins the economic case for a legal international trade presented in several self-published papers. The premise is based on an economic model of partial equilibrium, which demonstrates that a trade ban can make rhino horn artificially scarce and in turn make the price of rhino horn high, enticing criminals to kill rhinos illegally in order to fill the demand. The high prices are assumed to compensate for the costs and risks of illegal trafficking. The model also assumes that the demand for rhino horn is both stable and relatively insensitive to price movements. It concludes that by introducing a legal supply, prices will fall, making illegal trade unprofitable and suggests that legal trade will make quantities and prices easier to monitor and that it will generate revenue for resource-strapped authorities (and private business interests) that can be reinvested to improve security and conservation (and profit).

Following this argument, if the supply of rhino horn could not be produced fast enough to affect price, then one likely outcome of international legal trade could be to expand the current market and/or generate new markets. And if demand is too large with respect to the legal supply, there will be no incentive for traffickers to discontinue the illegal supply, particularly if the legal market masks the illegal one. So rather than alleviate poaching, legalization could actually intensify it.

By extrapolating the NRDC survey data, we estimated that 1.4 percent of all respondents may have bought rhino horn within 12 months of the administration of the survey, and that 8.1 percent may have bought rhino horn in the past 10 years (see Appendix: How we calculated the number of people who had bought rhino horn). Depending on the representativeness of the sample relatively to the Chinese population, we can begin to determine potential current demand and suggest that it could outstrip supply. The data is also suggestive that demand in both products might expand if legal trade was introduced because it would lift a current deterrent to purchasing. To reduce the uncertainty of this question, we are now preparing a collaborative peer-reviewed paper to have a more definitive answer.

Also, the possible negative effects of legal trade should be evaluated and measured against the possible benefits. As several relevant peer-reviewed journal papers about wildlife trade show, when known risks and real market conditions are considered, a legal supply may fail to compete with the illegal market—and may actually increase poaching. It should be noted that none of these studies were for rhinoceros. To summarize those papers, there are five types of market conditions in which legal trade fails to reduce poaching:

- If the **costs and barriers to market access for illegal supply are reduced** as a result of legalization, the introduction of a legal supply will fail to reduce poaching. It has been shown that in the presence of market power—when illegal suppliers are not passive price takers but can to some extent impose, bargain, or collude to influence market prices—legal markets will fail to reduce poaching, even if prices are reduced, because illegal traders could simply increase poaching to compensate for lost profits.^{10,11,12} In some cases, illegal traders can even outcompete farmers if the costs of poaching are lower than the costs of farming.¹³
- If legalizing trade **reduces the social stigma** associated with the consumption of a product, then legal trade can attract new consumers and expand the quantity demanded to an extent that poaching is not reduced and is possibly increased.¹⁴
- If **legal trade can mask illegal trade by laundering**, then it allows traffickers to access the market without engaging in dangerous, risky, and costly distribution activities. Laundering of wildlife products has been documented over a range of regulatory regimes, and in the cases of tigers, ivory, porcupines, green pythons, vicuña, and orchids.^{15,16,17,18,19} Even the highly regulated U.S. ivory market was shown to operate with as much as 30 percent of ivory from illegal sources.²⁰
- If legal farmed products are introduced and **consumers still prefer wild (poached) products**, then poaching may continue or increase if the consumer demand for wild products has characteristics that preserve a market niche for the illegal supply that the legal supply cannot fulfill. In the case of rhino horn, there will be distinct preferences for wild horn and poached horn over farmed or synthetic horn. Preferences for wild sources have been shown for other species where a legal trade was introduced, including black bears for bile.²¹
- If **poaching rates threaten the sustainability of wild populations**, then the safest policy mechanism to employ is to close markets until the populations stabilize and/or quotas or poaching rates drop low enough to not affect the viability of the wild populations.²² This conclusion is based on the 2008 sale to China of 60-plus tons of ivory, after which elephant poaching and the illegal ivory trade rose to historically high levels. Many agree that no amount of legal trade can satisfy the worldwide demand for ivory. Similarly, the demand for wild tiger parts has seen an increase in spite of China's legal tiger farms.

Do the limitations of the partial equilibrium model supporting the current international legal trade argument yield too much uncertainty for policy makers? If so, what other models and factors should be considered?

Economics is more than tracking consumers' reactions to price movements. Today's markets are much more dynamic, depending heavily on what alternatives are available, consumer preferences, and the regulatory environment in which the market operates. Market outcomes cannot accurately be forecast or even understood correctly if the entire decision environment is ignored.

The possible positive and negative effects of legal international trade in rhino horn may be better analyzed by removing the relatively restrictively assumptions under the partial equilibrium model. There are six important limitations to the partial equilibrium model in relation to wildlife markets:

- (1) This theory does not actually describe the market process by which agents maximize individual desires, or by which equilibrium is reached; it only describes the conditions for this to happen.
- (2) Time is simply not a factor in the model. But time is a factor in policy decisions.
- (3) This approach works only in one-commodity markets. Once more goods are introduced, relative prices become problematic.
- (4) It examines supply chains in an overly simplified way that is incompatible with how modern commercial organizations actually operate.
- (5) It ignores innovation, the continuous pursuit of new products and new markets, and new forms of operational organization.
- (6) This type of analysis does not consider uncertainty about market conditions, the behavior of other agents, the influence of historical experience, or the cumulative effects of relative products and prices.

Factors to consider in a new analysis would include potential demand expansion, consumer preferences for wild versus farmed versus synthetic rhino horn, laundering of horn, and the existence of the strategic behavior of competitors (criminal syndicates are suspected to be a major agent in the illegal trade of rhino horn). It would also be of interest to consider how potential new markets might shape demand and supply. Once these factors are consider, the projected costs and benefits of the introduction of international legal trade may yield different outcomes than the current model, particularly as an intervention to significantly reduce poaching. Again, we are currently collaborating with other researchers to develop an alternative model and aim to publish the results in a peer-reviewed journal before the end of 2016.

APPENDIX

APPROXIMATE DEMAND FOR RHINO HORN AMONG RESPONDENTS IN 2014

By extrapolating the data collected in this survey, we estimate that 1.4 percent of all respondents may have bought rhino horn in the past year (that is, within a 12-month period spanning roughly June 2013 to June 2014), and 8.1 percent may have bought it in the past 10 years.

In order to calculate the number of people who had bought rhino horn, interviewers showed the respondents three sets of cards on which statements were written. While ensuring their anonymity, the interviewers asked them to choose one card from each set and say whether the statement was true or false as it applied to them. The statements were:

SET 1

1. My favorite color is blue.
2. My favorite color is blue.
3. My favorite color is blue.
4. I am a man.

SET 2

1. I bought rhino horn in the last year.
2. I bought rhino horn in the last year.
3. I bought rhino horn in the last year.
4. My favorite color is blue.

SET 3

1. I bought rhino horn in the last 10 years.
2. I bought rhino horn in the last 10 years.
3. I bought rhino horn in the last 10 years.
4. My favorite color is blue.

FORMULAS USED:

1. According to the first set of statements and the gender of the respondent, we calculated the total percentage of people who “like blue” using the equation

$$\text{Like blue} = \frac{(RI-F\&A)}{(RI-F\&A) + (WI-M\&A)}$$

2. Based on the percentage of people who like blue, and from the responses to the second set of cards, we calculated the percentage of people who had “bought rhino horn in the last year” using the equation

$$\text{Bought rhino horn in the last year} = \frac{(R2-R\&B)}{(R2-R\&B) + [(W2-W2\&(I-P))]}$$

3. Based on the percentage of people who like blue, and from the responses to the third set of cards, we calculated the percentage of people who had “bought rhino horn in the last 10 years” using the equation

$$\text{Bought rhino horn in the last 10 years} = \frac{(R3-R\&B)}{(R3-R\&B) + [(W3-W3\&(I-P))]}$$

KEY TO EQUATIONS:

B = Drew “Favorite color is blue” card

A = Drew “I am a man” card

F = Male

M = Female

R = Answered “true”

W = Answered “false”

ENDNOTES

- 1 Milliken, T. and Shaw, J., Executive Summary, *The South Africa—Viet Nam Rhino Horn Trade Nexus: A Deadly Combination of Institutional Lapses, Corrupt Wildlife Industry Professionals and Asian Crime Syndicates*, A TRAFFIC Report, 2012.
- 2 Emslie, R.H., Milliken T, and Talukdar B., *African and Asian Rhinoceroses—Status, Conservation and Trade*. CoP16, Doc. 54-2 Annexe 2, CITES Secretariat, Geneva, Switzerland, 2012.
- 3 Republic of South Africa, Department of Environmental Affairs, “Rhino Poaching Statistics Update,” 2015, www.environment.gov.za/projectsprogrammes/rhinodialogues/poaching_statistics#2015.
- 4 Government of South Africa, Department of Environmental Affairs, “Media Statement on Announcement of the Committee of Inquiry to Deliberate on Matters Relating to a Possible Trade in Rhino Horn,” February 10, 2015, www.environment.gov.za/mediarelease/molewa_introduced_committeeinquiry.
- 5 Economists at Large, 2013. Horn of Contention: A review of literature on the economics of trade in rhino horn. Prepared for IFAW South Africa, Economists at Large, Melbourne, Australia.
- 6 Economists at Large, 2013. Horn of Contention: A review of literature on the economics of trade in rhino horn. Prepared for IFAW South Africa, Economists at Large, Melbourne, Australia.
- 7 Nadal, A and Aguayo, F. Leonardo’s Sailors: A Review of the Economic Analysis of Wildlife Trade, LCSV WORKING PAPER SERIES NO. 6, June 2014
- 8 Zhang L and Yin F. “Wildlife consumption and conservation awareness in China: a long way to go.” *Biodiversity Conservation* (May 2014) 23: 2371-2381.
- 9 A.J. Dutton, C. Hepburn, and D.W. Macdonald, “A Stated Preference Investigation into the Chinese Demand for Farmed vs. Wild Bear Bile,” *PLoS ONE* 6, no. 7 (July 20, 2011): e21243.
- 10 Abbott, B., & van Kooten, G. C. (2011). “Can Domestication of Wildlife Lead to Conservation? The Economics of Tiger Farming in China.” *Ecological Economics*, 70(4), 721–728. doi:<http://dx.doi.org/10.1016/j.ecolecon.2010.11.006>.
- 11 Damania, R., & Bulte, E. H. (2007). “The Economics of Wildlife Farming and Endangered Species Conservation.” *Ecological Economics* 62(3–4), 461–472. doi:<http://dx.doi.org/10.1016/j.ecolecon.2006.07.007>.
- 12 Bulte, E. H., & van Kooten, G. C. (1999). “Economic Efficiency, Resource Conservation and the Ivory Trade Ban.” *Ecological Economics* 28(2), 171–181. doi:[http://dx.doi.org/10.1016/S0921-8009\(98\)00048-2](http://dx.doi.org/10.1016/S0921-8009(98)00048-2).
- 13 Damania R. & Bulte, E.H. (2007).
- 14 Fischer, C. (2004). The Complex Interactions of Markets for Endangered Species Products.” *Journal of Environmental Economics and Management* (Vol. 48, pp. 926–953). Washington, D.C. doi:<http://dx.doi.org/10.1016/j.jeeem.2003.12.003>.
- Government of South Africa, Department of Environmental Affairs. (2014). “The Viability of Legalising Trade in Rhino Horn in South Africa,” (pp. 1–108). Pretoria, South Africa.
- 15 Hemley, G., & Mills, J. (1999). “The Beginning of the End of Tigers in Trade?” In J. Seidensticker, S. Christie, & P. Jackson (Eds.), *Riding the Tiger*. Cambridge: Cambridge University Press.
- 16 International Fund for Animal Welfare (IFAW). (2006). “Ivory Market in China—China Ivory Trade Survey Report,” IFAW.
- 17 Brooks, E. G. E., Robertson, S. I., and Bell, D. J. (2010). “The Conservation Impact of Commercial Wildlife Farming of Porcupines in Vietnam.” *Biological Conservation* 143(11), 2808–2814. doi:<http://dx.doi.org/10.1016/j.biocon.2010.07.030>.
- Merrill, Austin. “Locking Horns.” OnEarth. @_austinmerrill.
- 18 Lyons, J. A., & Natusch, D. J. D. (2011). “Wildlife Laundering Through Breeding Farms: Illegal Harvest, Population Declines and a Means of Regulating the Trade of Green Pythons (*Morelia viridis*) From Indonesia.” *Biological Conservation* 144(12), 3073–3081. doi:<http://dx.doi.org/10.1016/j.biocon.2011.10.002>.
- 19 Phelps, J., Carrasco, L. R., & Webb, E. L. (2014). “A Framework for Assessing Supply-side Wildlife Conservation.” *Conservation Biology: The Journal of the Society for Conservation Biology* 28(1), 244–57. doi:10.1111/cobi.12160
- Xuixiang, M., Caiquan, Z., Jinchu, H., et al. (2006) “Musk Deer Farming in China.” *Animal Science* 82(01), 1–6.
- 20 Martin, E., & Stiles, D. (2008). *Ivory Markets in the USA* (p. 122). Kingsfold, West Sussex and London.
- 21 Dutton (2011).
- 22 Bennett, L. Elizabeth (2014), *Legal Ivory Trade in a Corrupt World and Its Impact on African Elephant Populations*. *Conservation Biology*. doi: 10.1111/cobi.12377.
- Biggs et al (2013), Conrad (2012), Eustace (2012), Lockwood (2011), Martin (2011), Moyle (2007, 2013), ‘t Sas-Rolfes (2012), Loon (2012), Challender and MacMillan (2013).