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Consumption and Conservation:

Assessing the prevalence and nature of the illegal trade and consumption of the pre-Caspian saiga population

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I would like to dedicate this work to Anne Gethin-Jones,

for your tireless support and inspiration

Declaration of own work

I declare that this thesis, "Consumption and Conservation: Assessing the prevalence and nature of the illegal trade and consumption of the pre-Caspian saiga population," is entirely my own work, and that where material could be construed as the work of others, it is fully cited and referenced, and/or with appropriate acknowledgement given.

Signature: ………………………..

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Carlyn Samuel

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Acronyms and Abbreviations

AIC	Akaike Information Criterion
CS	Carlyn Samuel
CWA	Centre for Wild Animals of the Republic of Kalmykia
CZBR	Cherne Zemyli Biosphere Reserve
EJMG	EJ Milner-Gulland
FH	Forrest Hogg
IUCN	International Union for Conservation of Nature
NRB	Non Response Bias
RRT	Randomized Response Technique
SDB	Social Desirability Bias
SNR	Stepnoi Nature Reserve
UCT	Unmatched Count Technique
YA	Yuri Arylov

Abstract

Illegal hunting continues to threaten the Critically Endangered saiga antelope, *Saiga tatarica tatarica*¸ across central Asia. The pre-Caspian population, southwest Russia, is facing a precarious future, attributable to heavy and persistent poaching for the antelope's sought-after horn and to a lesser extent, meat. The trade and use of saiga horn is well-recognised, but there are many layers of uncertainty concerning the nature and prevalence of saiga meat consumption, and its respective trade.

Employing an emerging tool for eliciting unbiased prevalence estimates of sensitive behaviours – the Unmatched Count Technique (UCT) – the study reveals that the prevalence consumption of saiga meat in the rural districts of Kalmykia (Russian Federation) is both high and widespread. Local perceptions of meat availability and reports given by key informants emphasize that the supply of saiga meat – through local trade mechanisms – is irregular despite the existing demand. Findings suggest that consumption has linkages to lower household socioeconomic status and limited protein access; however, people's views of the different qualities of saiga meat are diverse, reflecting a range of values, tastes and pre-existing cultural norms. For example, saiga meat is seen more as a luxury item by richer sections of society than the poor. The study explores the social norms underpinning consumption behaviour, and reveals an association between perceived social norms regarding the acceptability of saiga meat and its consumption. Results from this study form a foundation for future research, and stress the need for greater understanding of the human dimensions surrounding saiga poaching, trade and consumption.

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1. Introduction

1.1. Rule-breaking in Conservation

The management of people's behaviour and understanding individual decision-making processes is of increasing interest to the conservation and natural resource management sector. There has been a recent shift within the conservation literature away from the use of economic models to explain and understand human decision-making - e.g. the decision to poach is assumed to be determined by the material gain of non-compliance relative to the cost of sanctions imposed - and towards utilising conceptual frameworks developed in the fields of psychology and sociology (Hatcher et al., 2000; Holmes, 2003; Milner-Gulland et al., 2010; Milner-Gulland, 2012; Majic et al., 2011). One such framework, the theory of planned behaviour (TPB), posits that behavioural intention is driven by an individual's attitudinal beliefs, perceived behavioural control and perception of prevailing social norms towards the given behaviour (Azjen, 1991). There are few that directly link positive attitudinal beliefs or perceived social norms to behavioural expression; a link that is important in predicting the impact of conservation interventions on resource users (Holmes, 2003; Milner-Gulland et al., 2010). However, when investigating rule-breaking behaviours, such as illegal meat consumption, acquiring information to populate such frameworks becomes a major methodological challenge.

Rules that govern human behaviour by regulating, restricting or prohibiting the use of biological resources lie at the core of conservation and natural resource management systems. These rules are implemented through formal institutions and mechanisms in a myriad of conservation contexts, from the patrolling of protected areas on land to the setting of fishing quotas at sea (Keane et al., 2008). However, in practice, these formal mechanisms are often costly and under-resourced; resulting in weak enforcement and leaving conservation success reliant on voluntary compliance - an assumption that is typically violated. Illegal logging, for example, can account for 90% of total timber production in some cases (Contreras-Hermosilla, 2000; Blaser et al., 2005; The World Bank, 2006), and illegal fishing is widely recognised as one of the major threats to the sustainable use of marine resources (Clarke and Harris, 2003; Agnew et al., 2009). Therefore, monitoring non-compliance to rules governing natural resource use is essential for estimating accurate harvests, informing policy and

evaluating the success of conservation interventions.

Understanding the nature and extent of non-compliance, and the identities (or characteristics) of rule-breakers remains a key challenge for biodiversity conservation (Gavin et al., 2010). Non-compliant behaviours are often illegal or taboo (e.g. against prevailing social norms) so rule breakers may refuse, either wholly or partly, to take part in direct questioning for fear of retribution. Despite researchers' best efforts to guarantee anonymity, some respondents may still refuse; resulting in a non-random sample (non-response bias). Rule breakers may also lie to project a more favourable image of themselves to the interviewer (social desirability bias). The disciplines of sociology, psychology and criminology have looked extensively at this problem and have developed a range of indirect questioning techniques to further protect respondent confidentiality and counter these biases (Singer et al., 1995). Such techniques have included using ballot boxes, the three-card method (GAO, 1998), the Randomised Response Technique (RRT) (Warner, 1965) and the Unmatched Count Technique (UCT) (Droitcour et al., 1991; Dalton et al., 1994). Comparative studies have shown that these indirect methods perform well in reducing the biases provoked by direct questioning (St. John et al., 2010b; Coutts and Jann, 2011; Fairbrass et al., 2012; Nuno, 2013).

1.2.   Poaching, trade and consumption of the saiga antelope; a case study

The saiga antelope, *Saiga tatarica tatarica,* is found in semi-arid deserts of Kazakistan, Uzebekistan and the north-west pre-Caspian (Russian Federation). It has suffered the most rapid decline of any large mammal species known to date, dropping from a global population of more than 1 million to below 50,000 in less than a decade (1993-2001) (Milner-Gulland et al., 2001). The dramatic decline is mainly attributable to a sharp increase in poaching at this time, which occurred as a direct result of the dissolution of the Soviet Union (1991) and the subsequent collapse of rural economies and state controls on hunting. Male saigas were selectively hunted for their lucrative horns, which are used in traditional Asian medicine, eventually causing a reproductive collapse (Milner-Gulland, 1995; Li et al., 2007; Kuhl et al., 2009). In response, local and global conservation efforts have helped to slow the saigas' dramatic decline, and in some populations the trend is reversing (e.g. Betpaka-dala, Kazakhstan) (CMS 2010). However, there are still substantial concerns over the viability of certain populations (CMS 2010; von Meibom et al., 2010) and evidence suggests that the pre-Caspian population, located in the Republic of Kalmykia and Astrakhan province (Russian Federation), is still experiencing heavy poaching (Kuhl et al., 2009; von Meibom et al., 2010;

Dorward, 2013).

Through triangulating reports from multiple key informants, Kuhl et al. (2009) found that poaching was conducted by 7-32% households in two rural villages in Kalmykia during their field work in 2004. The generation of income from international horn sales was generally reported to be the perceived primary motivation for poaching, but Kuhl et al. (2009) suggested that poachers also derive significant income through meat sales. Over 90% of households surveyed within Kalmykia confirmed that meat was actively traded within their village (Kuhl et al., 2009). Reducing the uncertainty surrounding the prevalence of meat consumption, identifying shared characteristics of consumer households and understanding the systems of trade are priority issues for saiga conservation in Kalmykia (Kuhl et al. 2009; von Meibom et al. 2010; Iu.N. Arylov, pers. comm.).

In Kalmykia, local people hold strong positive attitudes towards saigas and their preservation (Whitebread, 2008; Kuhl et al., 2009; Howe et al. 2011; Dorward, 2013), many see the saiga antelope as a national symbol and some still recognise the linkages between saiga and their pastoralist roots (Waylen et al., 2012). However, poverty and unemployment seemingly override such attitudes leading to, in some circumstances, engagement in poaching (Kuhl et al., 2009; Waylen et al., 2012). In the transboundary saiga population of Ustyurt (Uzbekistan and Kazakhstan), Phillipson & Milner-Gulland (2011) found that while local people felt that hunting for horns was unacceptable, hunting for meat was considered more acceptable. The linkages between behavioural predictors, such as perceived social norms, and saiga meat consumption in Kalmykia are unknown. Improving our understanding of these relationships may aid the design of more targeted conservation interventions within Kalmykia and other saiga range states.

1.3.   Project aims

This research project has three main objectives:

a. To understand the nature of saiga meat consumption, and the social norms towards its consumption
> i. What are characteristics of saiga meat are local consumers likely to value?
> ii. What are the social norms surrounding meat consumption?

b. To determine the prevalence of saiga meat consumption within the communities neighbouring Kalmykia's natural reserves
> iii. What is the prevalence of household saiga meat consumption?

iv. What socioeconomic factors do households that have a high likelihood to consume saiga meat share?

c. To investigate the current drivers of poaching and saiga meat trade

v. What are perceived drivers that influence engagement in poaching?

vi. What characterises the meat trade?

Using an indirect questioning technique, the Unmatched Count Technique, and by triangulating results with qualitative data gleaned through key informant interviews, this project will estimate the prevalence and shared characteristics of households within the Kalmykia's saiga range that consume saiga meat. Key informant interviews will reveal insights into the trade of saiga meat, including: current routes, mechanisms and prices. Both fixed-response questionnaires and open-ended interviews will explore the different values and tastes, and the social norms surrounding saiga meat consumption.

2. Background

2.1. Sensitive behaviours: understanding human decision-making

Conservation interventions often focus on changing adverse patterns of human behaviour, such as overexploitation of natural resources. In order to alter behavioural patterns, we must first understand the predictors of human decision-making. To review the many theories addressing the relationship between people and the predictors of non-compliant behaviour is beyond the scope of this study. Instead, I will focus on a model for understanding human decision-making, developed by psychologists and sociologists, which has been recently been called to the attention of conservation research (St. John et al. 2010).

2.1.1. Theory of Planned Behaviour

Azjen (1991) developed the Theory of Planned Behaviour (TPB) from a preceding model known as the Theory of Reasoned Action (Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980). TPB is commonly used by social scientists as a framework when investigating the predictors of a behavioural action (Figure 2.1; Hardeman et al., 2002). This model states that a behavioural intention is shaped by: a person's attitudinal beliefs towards the behaviour, perception of social norms surrounding the behaviour and perceived behavioural control, which all interact with multiple dimensions of their social circumstances, such as poverty, resource ownership and access to alternative livelihood options (Holmes, 2003). According to Ajzen's model, the strengths of each of the predictors can vary from one behavioural context to another. In contexts where people commit to adverse conservation actions in spite of pro-conservation attitudes (e.g. Kuhl et al., 2009; Infield & Namara, 2008), other predictors such as perception of social norms or perceived behavioural control may be key in shaping engagement in a particular behaviour (Beedell & Rehman, 2000).
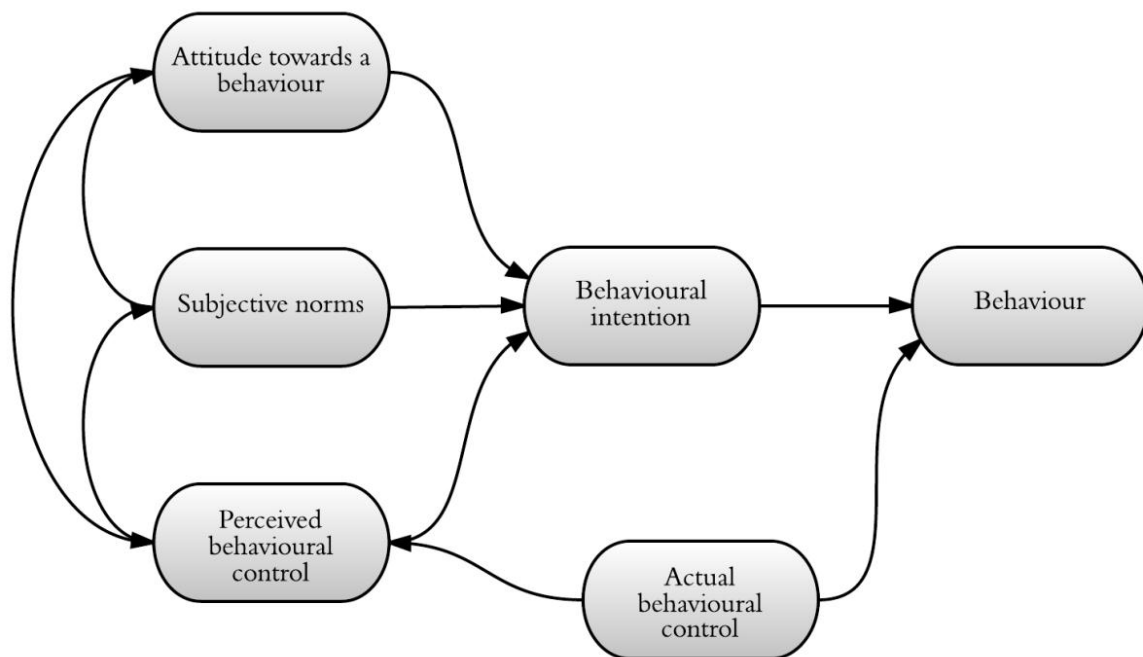
Figure 2.1. Ajzen's (1991) Theory of Planned Behaviour (simplified)

2.1.2. Social norms

Within the TPB framework, social influence is represented by the subjective norms component (Figure 2.1), which includes the individual's perception of the opinions that other people hold towards a given behaviour (Azjen, 1991). In a study context, individual perceptions of subjective norms towards a specific behaviour, such as poaching or bushmeat consumption, are considered to be important predictors of behavioural intentions and thus, of behavioural expression. Social norms have been empirically linked to behavioural action in the past (Colding & Folke, 2001; Barr 2007). In the UK, Barr (2007) found that recycling waste behaviours by students was strongly underpinned by descriptive norms (e.g. the perception that others are engaging in the behaviour too). Natural resource use in some forest communities in Madagascar, for example, is largely governed by *fadys* (or taboos) which prohibit or regulate the harvest of some species (Jones et al., 2008; Jenkins et al., 2011; Hogg et al., 2013). Where social norms are strongly held by the community or society, non-conformists are more likely to be addressed by others through informal sanctions or informal means (e.g. body language) (Minato et al., 2010). Ultimately, through better understanding individual perceptions of social norms surrounding a specific behaviour, policies and conservation interventions can be designed more effectively.

2.2. Surveying sensitive behaviours

2.2.1. An introduction to indirect questioning

Direct questioning of resource users is traditionally thought of as a cost-effective way to assess harvest quantities and consumption. However, where there are rules governing natural resource use, there are often rule-breakers (Keane et al., 2008). In these cases, direct questioning has two major pitfalls. First, despite the researchers' best efforts to assure respondent anonymity, some rule breakers will still fear retribution and therefore avoid some or all of the questions. This has been referred to as non-response bias (NRB) and can lead to a non-random sample of the population and may vastly underestimate the prevalence of a given behaviour (Blair & Imai, 2012). Second, in the presence of an interviewer, the rule breaker may feel obliged to bend the truth in order to project a more favourable image of themselves - social desirability bias (SDB) (St. John et al., 2010b). In response, indirect questioning techniques have been developed to further protect respondent confidentiality and thus facilitate the collection of more accurate and honest data.

The Randomized Response Technique (RRT) (Warner, 1965), has received recent attention in the conservation literature concerning the elicitation of sensitive behaviours (Solomon et al., 2007; St. John et al., 2010; Razafimanahaka et al., 2012). Whilst RRT can be implemented in different ways, all forms rely on the pairing of a non-sensitive question or contingency (e.g. forced response designs) with the sensitive question of concern. For example, in a study investigating illegal resource use in Uganda, Solomon et al. (2007) used a paired-alternative RRT design, where the respondent tosses a coin whilst hiding the outcome – 'heads' or 'tails' – from the administrator. The respondent then randomly picks an overturned photograph - either depicting illegal resource use or the 'heads' side of a coin. The respondent is then asked a simple 'yes/no' response question; the answer of which is contingent on whether or not he/she got a 'heads' or 'tails' earlier and, which photograph he/she selected (paired-alternative design). By knowing the probability that the respondent is answering the sensitive question one can calculate an unbiased estimate of the prevalence illegal resource use (Solomon et al., 2007). Whilst Solomon et al. (2007) considered RRT as a potentially powerful research tool for conservation; it has been criticized for its complexity during application, especially when respondent literacy is low (Razafimanahaka et al., 2012). RRT also has been found to invoke feelings of suspicion and mistrust, as found in rural Uzbekistan and Kazakhstan during an investigation into the poaching and trade of saiga antelope (Phillipson & Milner-Gulland,

2011).

2.2.2. The Unmatched Count Technique

A second method of indirect questioning, the unmatched count technique (UCT), has more recently entered the conservation literature (Nuno et al., 2013). Sometimes referred to as the 'item list technique', UCT estimates the prevalence of a sensitive behaviour by randomly assigning respondents to control and treatment groups, where the control group receives a list of non-sensitive items (or behaviours) and the treatment group receives a list of the same non-sensitive items plus one sensitive item. Respondents are asked how many of the items apply to them, but not which ones, thus ensuring individual anonymity and reducing the likelihood of SDB. The percentage of respondents who have carried out the sensitive behaviour or 'item' (e.g. poaching) can be calculated by the difference between the mean number of items picked in each group. In a novel study, Nuno et al. (2013) used UCT to estimate the prevalence of poaching in the Serengeti and found that 65 % of respondents found the questions easy to understand; and, whilst <10% found the questioning very uncomfortable, 77% respondents were 'not uncomfortable at all'. With UCT trials in which a number of different items of varying sensitivity were investigated, less robust results were obtained for the most sensitive behaviours (Fairbrass, 2012).

2.2.3. Designing a UCT study

There are several important assumptions to consider when designing a UCT study:

   a. <u>Assigning respondents to control and treatment groups must be random</u>: this assumption can be easily met through the use of a randomizing device (e.g. coin) prior to questioning.
   b. <u>No design effects</u>: an assumption that is violated if the likelihood of selecting control items differs in the presence or absence of the sensitive item.
   c. <u>No liars</u>: an assumption that is hard to test (Blair & Imai, 2012) but is influenced by the control items and the sensitivity of the sensitive item.

Considered selection of control items is essential in minimising the risk of violating assumptions b. and c. (Imai, 2010). Selected control items should be non-sensitive, in 'theme' with the sensitive item (e.g. masking its sensitivity) and minimize the risk of so-called 'ceiling' and 'floor' effects. If the respondent is affirmative for all control items then admission to the sensitive item removes all confidentiality, thereby undermining the purpose of the UCT (a ceiling effect). If no control items are affirmative then respondents may fear

admission to the sensitive item to be too revealing (a floor effect). Reducing variance in UCT responses is also worthy of consideration; some control items should have a similar likelihood of being affirmative across the study system, thus reducing the standard error in prevalence estimates (Zigerell, 2011). One of most regularly cited limitations of UCT is that large sample sizes are required to yield accurate prevalence estimates (Tourangeau & Yan, 2007; Blair & Imai, 2012; Nuno et al., 2013), whilst it is also criticized for its lack of statistical flexibility when performing multivariate analyses (Imai, 2010).

2.2.4. Triangulating towards the truth

Relying on a single source of information removes the opportunity to calibrate for likely biases, which are inherent when researching sensitive or illegal behaviours like bushmeat consumption (Gavin et al., 2010). Therefore triangulation, or concurrent verification of data from another source, is critical to improving accuracy of results (Duraiappah et al., 2005; Gavin et al., 2010). For example, Pitcher et al. (2002) used data from observations, written correspondences (e.g. emails, letters) and published findings to estimate unreported catch in two fisheries in Iceland and Morocco. Key informant interviews are also widely used to assess illegal or taboo activities, often providing a rich source of information if a foundation of trust exists (Croes, 2012). Kuhl et al. (2009) used both key informant interviews and semi-structured questionnaires to estimate the prevalence and role of poaching for saiga antelope products in rural steppe communities across central Asia.

2.3. Case study: the saiga antelope

2.3.1. Saiga ecology and behaviour

The saiga antelope (*Saiga tatarica*) is a semi-nomadic ungulate endemic to the semi-arid deserts of central Asia. It is unique to its genus, but is recognised by two subspecies, *Saiga tatarica tatarica* and *Saiga tatarica mongolica*. The latter, *S. t. Mongolica,* is represented by one small population found in Mongolia. The former, *S. t. tatarica,* is restricted to four populations; two in Kazakhstan, one transboundary population shared between Kazakistan and Uzbekistan (sometimes Turkmenistan too) and one in pre-Caspian Russia (Figure. 2.2).

The saiga antelope is highly gregarious, forming large herds during seasonal migrations between grazing pastures and breeding sites (Milner-Gulland et al., 2003; Singh et al., 2010).

This herding strategy can also be witnessed during calving, where thousands of individual aggregate, presumably to reduce the risk of predation (Bliznyuk, 2002; Milner-Gulland et al., 2001). Saigas also exhibit high fecundity; female saiga achieve sexual maturity after 8 months, often giving birth in their first year, and with twinning rates as high as 64% (Milner-Gulland et al., 2001).

2.3.2. Historical and current populations

The saiga antelope has been hunted for its horns, meat and hides for several centuries, with records of historic exports of Saiga Antelope horns to China from the 18th century. By the early 20th century widespread hunting had reduced saigas to the brink of extinction but, following a total ban on hunting in 1919, the populations slowly recovered. Under strict Soviet legal controls, commercial hunting of saigas resumed in the 1950s (Robinson & Milner-Gulland, 2003). The situation changed radically with the breakdown of the Soviet Union in 1991, where rural economies in former Soviet states collapsed, leading to a sharp increase in poaching throughout the saiga's range (Lushchekina & Struchkov, 1998).

Between 1993 and 2001, the global saiga population suffered a 95% decline, mainly due to poaching for trade in Saiga horns and meat (Milner-Gulland et al., 2001; CMS, 2006). The sought-after horns, borne only by the males, are particularly targeted by poachers and are traded to East and South-east Asia as prized ingredients in traditional Asian medicine (Li et al., 2007; von Meibom et al., 2010). The selective hunting of males has contributed to a skewed sex-ratio of the saiga and their eventual reproductive collapse, which has exacerbated the situation (Milner-Gulland et al., 2003). At present, the global population of the nominate subspecies, *S. t. tatarica*, is estimated to be at around 56,300–61,300 animals, down from 1,250,000 in the mid-1970s. In 2002, it was up-listed on the International Union for Conservation of Nature's red list to Critically Endangered (Mallon, 2008).
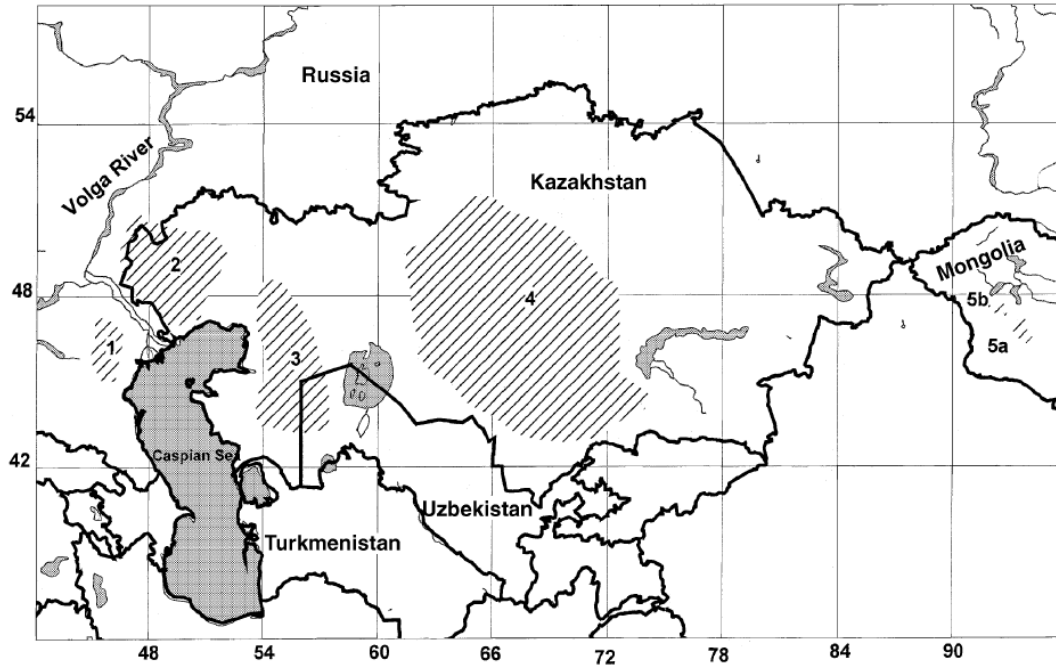
Figure 2.2. The distribution and approximate range of S. tatarica along with country borders and latitude and longitude. S.t. tatarica: 1 – North West Pre-Caspian, 2 – Ural, 3 – Ustiurt, 4 – Betpak-Dala. S.t. mongolica: 5 – Mongolia (5a – Shargyn Gobi, 5b – Mankhan). (Source: Milner-Gulland et al., 2001)

2.3.3. The Republic of Kalmykia

The autonomous Republic of Kalmykia is located in the southwest of the Russian Federation, bordering the Astrakhan region to the west, Volgograd to the north and Dagestan to the south. This little known state covers 76,100km^2, supporting areas of steppe, semi-arid desert and desert habitat (Grin, 2000). Human population currently numbers around 300,000, with 45% ethnically Kalmyk. The economy is based on livestock farming, with 70% of agricultural land serving as pasture and 14% as arable farmland (Orichova, 2004). As a result, the majority of the population are rural inhabitants (Grin, 2000), although the rural areas have continued to depopulate (pers. obs.). Increasing livestock numbers throughout the 1980s have helped turn 30,000-50,000ha of steppe into desert each year (UNESCO, 2004). Recent decreases in sheep numbers have seen a reversal in these trends, allowing some areas of the steppe to recover (Hölzel et al., 2002). Kalmykia remains one of the poorest regions of Russia, with 33-38% of the population under the countries official subsistence level and one of the highest poverty ratio gaps (UNDP, 2010). The Republic of Kalmykia is the only Buddhist state in geographical Europe (Harvey, 2013).

2.3.4. Kalmykia: People and Culture

The early Kalmyks were a subset of a Mongol tribe, Oirats, who came to the vast Pre-Caspian steppe in the mid-17th century (Guchinova, 2006). They developed strong links to the environment, revering the saiga antelope which mirrored their nomadic existence (Grin 2000). In the 1920s, the Soviet powers established collective state farms ending Kalmyk pastoralism. Their adjustment to settled life was abruptly halted in 1943, when many Kalmyks were exiled to Siberia. Ethnic Russians, Kazakhs and people from the northern Caucasus moved into to the Republic to work on the farms (Waylen et al., 2012). The exiled Kalmyk people returned in 1957, but they had little freedom to express their pre-Soviet beliefs and practices – by then the norms of Soviet society were firmly embedded (Grin, 2001).

In 1991 the Soviet Union collapsed and the political reforms, known as perestroika, ended the financial support given to collective farms, leaving many people destitute. In order to meet their most basic needs people were thus driven to adopting any available strategy, legal or otherwise, including poaching for income and subsistence (Waylen et al., 2012). At the same time Russian and ex-Soviet state borders with China and SE Asia reopened, promoting the sudden resurgence in poaching activity in Kalmykia and other saiga range states. Today, many Kalmyks still have a strong connection with their nomadic pastoralist culture, including Lamist Buddhism, which integrates ancient shamanic teachings like the 'Old White Man' – a deity connecting humans to both animate and inanimate nature (Waylen et al., 2012).

2.3.5. Saiga in the Republic of Kalmykia

The north-west pre-Caspian saiga population (Kalmykia and Astrakhan) has followed the global trends described above. A complete ban on hunting in the 1920s, alongside new rural Soviet policies (collectivism), facilitated a recovery from critically low numbers (Sokolov & Zhirnov, 1998). By 1950 the legal hunting of saiga in Kalmykia resumed, primarily for meat. Harvest levels peaked in the late 1950s and 1970s at over 100,000 individuals per year (Chan et al., 1995). By 1997, a total ban (apart from for scientific purposes) was placed on hunting saiga. However, by 2001 the population had dropped to 15,000-20,000, a dramatic reduction from estimated 400,000 individuals in the early 1980s (Milner-Gulland et al., 2001; Neronov et al., 2012). In 2009, the pre-Caspian population had dropped again to a reported 9,000-13,000 individuals, and further still in 2013 to some 7,000 individuals (Dorward, 2013) (Figure 2.3).
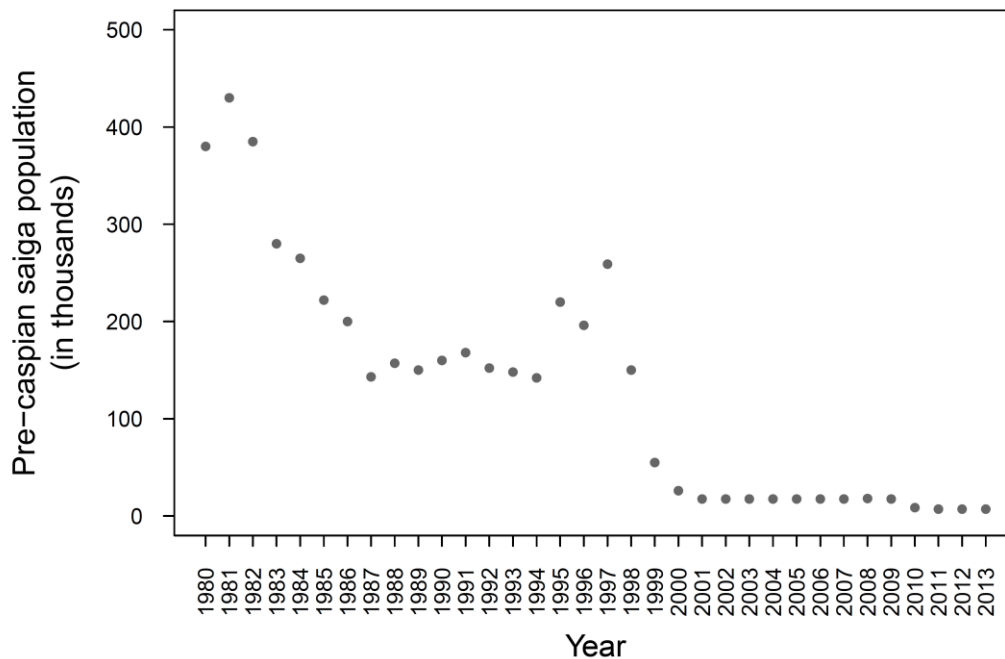
Figure 2.3. Population trend of the Pre-Caspian (Kalmykia) saiga population from 1980-2000 (Dorward 2013). Source data: 1980-2000 from Milner-Gulland et al. (2001), 2001-2007 from CMS (2006, 2010), 2008-2010 from Neronov (2012), 2011 from Arylov (2011), and 2012-2013 from Kuznetsov (2013).

In 1990, the federal government established the Cherne Zemyli Biosphere Reserve (CZBR), a large area of steppe dedicated to the preservation of the saiga antelope and other steppe species. A decade later, the Stepnoi Nature Reserve (SNR) was created as a provincial reserve by the Astrakhan province's government. As numbers have dwindled, the distribution of saiga has become largely restricted to the reserves (Neronov et al., 2012).

2.3.6. Saiga Poaching in Kalmykia: An Overview

In 2004, Kuhl et al. (2009) found that saiga poaching was carried out by 7-32% of village households in two known poaching centres in Kalmykia. Households engaging in poaching activities tended to own motorbikes, be poorer relative to other village households, and were more likely to have a household head unemployed or in part-time employment rather than full-employment (Kuhl et al., 2009). During a study into local ecological knowledge of saiga distribution, Leon (2009) found that some villages were more variable in their reporting of saiga sightings than others; suggesting that, for respondents from known poaching centres, the nature of the questioning was sensitive. von Meibom et al. (2010) suggests that there are still

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a small number of well-organised, well-resources and local poaching teams operating in and around CZBR area. To date, occasional arrest reports and anecdotal evidence suggests that saiga population is still experiencing heavy poaching, threatening the immediate viability of the Pre-Caspian population (Iu.N. Arylov, pers. comm.).

During the 1980s, saigas were primarily hunted for their meat; however in the 1990s, amidst a series of poorly orchestrated hunting bans, there was a noticeable shift to the procurement of horns, with carcasses frequently left behind at kill sites (von Meibom et al., 2010). Horns were, and to lesser extent still are, sold to international markets via Moscow and other routes (Traffic 2010). In 2000, poachers began to sell meat regularly again from roadsides and in local villages (von Meibom et al., 2010), although the trade routes and mechanisms are still unknown. During 2004, one whole saiga cost approximately 300 RUB (10 USD) and horns fetched around 2000 RUB per kilo (75 USD; Kuhl et al., 2009). Von Meibom et al. 2010 suggest that prices for saiga products have increased significantly over the last decade.

In 2004, Kuhl et al. (2009) compared saiga meat and horn prices and suggested that the 'sale of saiga meat contributes to the large majority of poaching income within villages', despite the common perception that horn sales were primary motivation for hunting saiga. Saiga meat was occasionally referred to as the 'meat of the poor', a long-standing view back to Soviet times (Kuhl et al., 2009). The majority of respondents surveyed (89%) named poaching as the greatest single threat to the saigas' persistence in Kalmykia. Interestingly, villagers -including known poachers - were acutely aware of the saigas' ongoing plight and held strongly positive attitudes to saiga and their conservation (anti-poaching) (Kuhl et al., 2009). There is still great uncertainty surrounding local attitudes and social norms towards saiga meat consumption.

3. Methods

3.1. Study site

The study was carried out in the Republic of Kalmykia, between 1st May and the 10th July 2014. Six settlements – Adyk, Erdnyevsky, Komosomolsk, Kulkhutta, Utta and Yashkul' – and 40 farmsteads were surveyed (Figure 3.1). All settlements were within the saiga's distribution range (Leon, 2009), located within the districts of Yashkulsky and Chernozemelsky, and were associated with recent poaching activity and suspected saiga meat consumption (Iu.N. Arylov, pers. comm.). Settlements were also chosen for their small size to allow for more representative sampling of households. The larger towns of Yashkul' (8%) and Komsomolsk (4%) had considerably lower representation (Table 3.1). Farmsteads, bordering the Cherne Zemyli Biosphere Reserve (CZBR), were also selected within the sample as some are suspected of being involved in saiga poaching and trade (Dorward 2013; Iu.N. Arylov, pers. comm.).
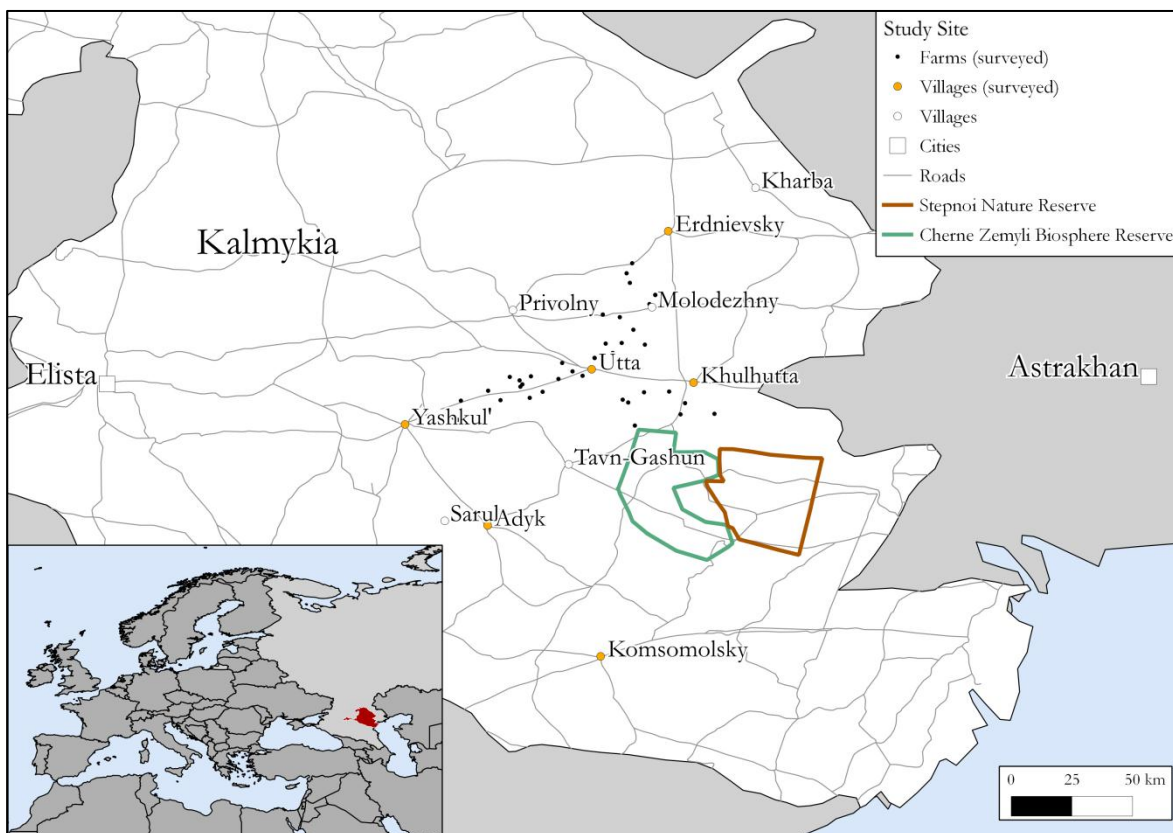
Figure 3.1. Study site

Table 3.1. Settlement populations, sample sizes and number of respondents in main questionnaire.

Settlement	Population Size	Total No. of Households	No. of Households Surveyed	% Household Interviewed per village
Yashkul'	6020	620	47	8
Adyk	932	224	40	18
Komsomolsk	5100	1103	39	4
Khulkhutta	419	130	33	25
Erdnyevsky	883	181	40	22
Utta	820	264	41	16
(Farms)	-	-	40	-
Total	-	-	280	-

3.2. Data collection

Methods used included both quantitative and qualitative social research techniques to ensure that both a breadth and depth of information was obtained (Bernard 2002). By combining various methods the study was able to triangulate results from different sources, thereby reducing uncertainty surrounding the sensitive issues of illegal meat consumption (Gavin et al., 2010). Six settlements and 40 farms were visited over a 10 week period, allowing for one week surveying per settlement and one week to visit the farms. An immersive strategy was adopted, walking on foot from house to house (except for farmstead visits), and living and eating with local families (Kapila & Lyon, 2000). All interviews were conducted by the author (FH) and a Russian interpreter, enabling live translation at the time of questioning. Participants were presented with a small gift out of respect for traditional customs. It was made clear to all respondents that information collected would be anonymous, questions could be skipped and the interview could be stopped at any point (whilst some questions were skipped, all interviews ran their full length). For each study settlment, a meeting with the head of village administration was arranged to inform the relevant local authority about the project and its duration. A conceptual model outlining the methods adopted for each objective is depicted below (Figure 3.2).

Figure 3.2. Conceptual model for project objectives and methods used.
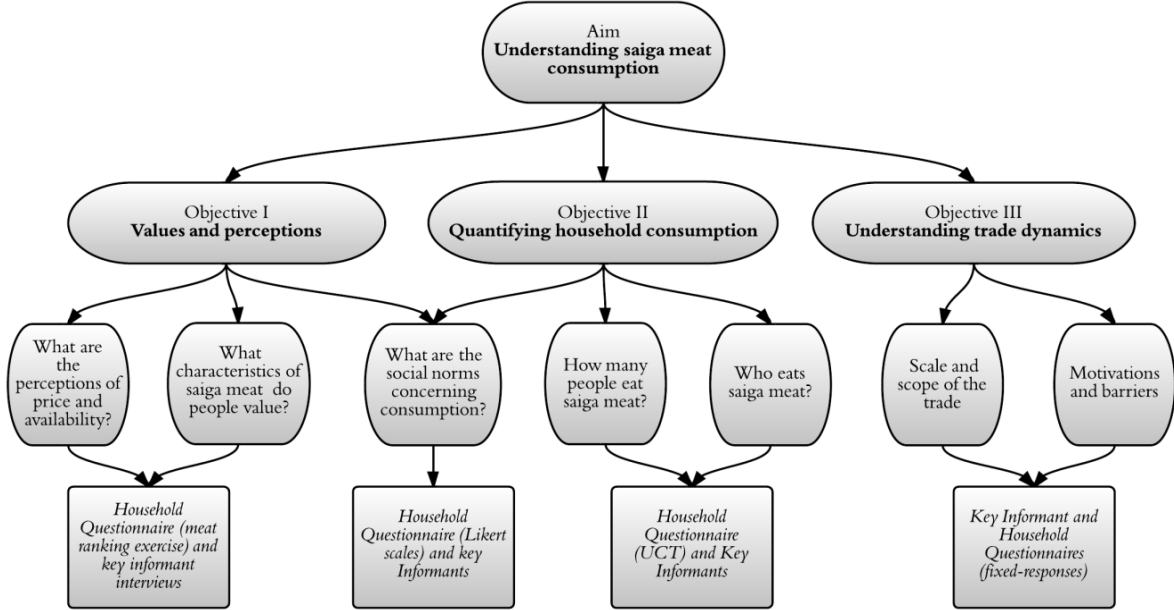
3.3. Questionnaires

Questionnaires were conducted face to face and designed to avoid ambiguity; including non-leading questions and using non-technical terminology (Coolican's 1994). They were as concise as possible to minimize questioning time and help maximise the sample sizes required by UCT studies. A household was defined by 'all that share a cooking pot' (Kapila & Lyon, 2000). If the head of household was not available for questioning, then the next available adult (16+) was approached. Houses were selected using systematic sampling where every third household was approached to ensure broad coverage. In the larger towns (Yashkul' and Komsomolsk), a mapping exercise was conducted with an interpreter and two local volunteers to ensure even coverage. Farmsteads were selected by local staff at the CWA based on travel time, fuel budget and distance from CZBR.

The questionnaire was divided into six sections (Appendix 7.1). Section 1 included a series of individual-level demographic characteristics whilst section 2 & 3 focused on understanding the socioeconomic situation at the household level (see Tables 3.2 & 3.2 under Data Analyses for summary). Devising a composite wealth score for comparable estimates of relative household wealth across the entire study system was beyond the scope of the study. Relative household wealth was therefore based on categorising the jobs of household heads (Appendix 7.2).

Section 4 included the 'single item' UCT to calculate prevalence estimates on household engagement in three sensitive activities: hunting (legal), saiga meat consumption and saiga poaching (Appendix 7.3; Nuno et al., 2013). Hunting for some wildlife species in Kalmykia is permitted by law (e.g. wolves, hares), and is considered an important pastime for some residents (Iu.N. Arylov, pers. comm.). It is expected that legitimate hunting activities are less sensitive than saiga related activities, which are forbidden by law. UCT was chosen for its simplicity and straightforwardness over RRT, which invoked suspicion and resulted in heavy biases during surveys in other saiga range states (Phillipson & Milner-Gulland, 2011). Respondents were asked how many items they or anyone else within their household had performed over a given period of time. For hunting and saiga meat consumption, a period of 6 months was delimited for recall, whereas for poaching a full year was chosen. These windows of time were considered to be wide enough to detect behaviours, and short enough to reduce recall bias and be reflective of current trends (Iu.N. Arylov, pers. comm.). The UCT questions were arranged in an order of increasing sensitivity – hunting (legal) followed by saiga meat consumption and finally saiga poaching - to reduce design effects inherent in sensitive list experiments (Anderson et al., 2007). The non-sensitive items for the UCT questions were selected during a preliminary workshop held by FH and staff at the CWA, and followed guidelines outlined by Zigerell (2011). All UCT questions were preceded by a warm-up question on TV shows to familiarise the respondents with the technique.

Section 5 explored local perceptions of the relative values of saiga meat in a ranking exercise which required respondents to rank saiga meat in comparison to three other available domestic meats (mutton, beef and horse) on four criteria. Criteria included price, healthiness, taste and how commonly the meat is consumed within the village. The ranking exercise doubled up as a useful 'way-in' for open-ended questioning with the more responsive interviewees to gain a richer understanding of local opinions surrounding saiga meat and its consumption. Using a 6-point Likert scale of agreement (de Vaus, 2002; Francis, 2004), section 6 investigated the strength and direction of people's perceptions of social norms surrounding meat consumption, poaching and saiga conservation (Ajzen, 2013). Finally, fixed response multi-choice questions were administered to assess local perceptions of incentives behind the current poaching activities and the underlying barriers to controlling ongoing engagement in the activities (Section 7). The options selected for section 6 were based on previous studies conducted across the saiga range (Phillipson & Milner-Gulland, 2011).

The questionnaires were reviewed by EJMG (Imperial College London), CS (Imperial

College London) and YA (Centre for Wild Animals, Kalmykia) before being piloted on 16 randomly selected respondents in Yashkul' town on the 1st and 2nd of May (2014). Minor amendments were made for mistakes made during translation. The initial UCT responses, although far too few to test for behaviour detection, yielded some variability in item counts without generating undesired ceiling and floor effects. The pilot study was also critical for FH to fine-tune the application and explanation of UCT as several different interpreters were used throughout the data collection period.

In total, 364 people were approached across the study system with 280 people agreeing to take part in the main questionnaire. On average (median), the main questionnaires lasted 20 minutes, ranging from 10 to 50 minutes (times include UCT and any open-ended questioning made after the questionnaires).

3.4. Key Informant Interviews

Open ended questions were used to explore key informant knowledge on illegal activities involving the poaching, trade and consumption of saiga. As advised by Gavin et al. (2010), the interviews were guided by a series of when, where, who and why-type questions within the broad themes of: - poaching, use of saiga products, saiga meat trade, and consumption of saiga products (Phillipson & Milner-Gulland, 2011; Appendix 7.4). Interviews were informal allowing room for the interviewee to direct the course of questioning. Given the highly sensitive nature of the study topics, respondents who displayed an openness and willingness to share knowledge during the main questionnaire were asked if they could partake in a key informant interviews and/or recommend anyone who would be willing to be a key informant (e.g. chain referral). Interviews where either translated into English at the time of questioning or later that day. All key informant interviews were anonymous and no audio recordings or GPS points were taken to further protect individuals.

Across the six settlements and 40 farmsteads, 22 key informant interviews were conducted, lasting between 20 and 120 minutes. A demographic overview of the key informants is included in the appendices (Appendix 7.5).

3.5. Data analyses

Statistical analysis was carried out in R 3.0.1 (R Core Team, 2013), Microsoft Excel was used for data management and maps drawn in QGIS (QGIS development Team, 2013).

3.5.1. Prevalence of behaviours

Prevalence of UCT answers to meat consumption, hunting and poaching were calculated by comparing the difference in means between the control and treatment groups:

$$n = \bar{x}_1 - \bar{x}_0$$

Where $\bar{x}_1$ is the mean number of items picked by the treatment group and $\bar{x}_0$ by the control group. As the households were randomly assigned to the control or treatment group, the difference in the means is a function of some respondents in treatment group endorsing the sensitive behaviour. The standard error for the difference between the two means was calculated using the 'ictreg' function within the 'list' package, built for the R environment (Imai & Blair 2012).

3.5.2. Checking assumptions: UCT

The validity of UCT rests on three core assumptions; (1) treatment status is randomly selected, (2) there are no design effects and (3) there are no liars. The first was easily met during data collection through a randomizing device (coin toss) used to assign respondents to the treatment or control groups. The second assumption is violated when number of control items selected differs in the presence or absence of the sensitive item. To test whether this assumption was met, a statistical test (ict.test) developed by Blair & Imai (2012) was used. This test compares the proportion of control items picked between the control and treatment groups, that is, if the addition of the sensitive item significantly alters (calculated by testing stochastic dominance relationships) the likelihood of a control item being chosen then the null hypothesis of no design effects is rejected. Statistical analysis of the third assumption, 'no liars', is beyond the scope of this study, but issues and observations concerning this assumption will be informally analysed in chapter 4 and discussed in chapter 5.

3.5.3. Modelling UCT responses

First, univariate linear models were fitted with each household-level variable (Table 3.2) and an interaction term for treatment status (treatment or control) (Holbrook & Krosnick, 2010) to explore the difference in prevalence estimates between factor levels. Next, a full linear model was fitted to all household variables (plus an interaction term for treatment status). Using Akaike Information Criterion (AIC), an automated model selection was conducted but, given the relatively low sample size, the top model fitted poorly to the data and yielded very high standard errors reducing power. Therefore, the univariate linear models were considered the

more robust approach.

Table 3.2. Summary of variables tested for association with household meat consumption (unit of response = household level)

Unit of Response: Household Level			
Categorical Variables			
Variable	Level	N	Explanation
Job type of Household Head	Professional	52	Job status of household was used as a proxy for relative household wealth. Saiga meat has been referred to as the 'meat of the poor' in a previous study (Kuhl et al., 2009). See Appendix 7.2 for a further explanation on job categorisation process.
	Farm Owner	36	
	Skilled worker	40	
	Unskilled worker	67	
	Pensioner	36	
	Unemployed	36	
	Unknown	13	
Ethnicity of Household Head	Kalmyk	185	Waylen et al., (2012) found strong cultural ties exist between the Kalmyk ethnic group and the saiga antelope
	Non-Kalmyk	95	
Location type	Village (<1000 people)	154	Village and steppe inhabitants are closer to the saiga habitat and therefore closer to the trade source.
	Town (>5000 people)	86	
	Steppe	40	
Settlement	Adyk	40	Settlement level differences in consumption prevalence may also occur (Kuhl et a.,l 2009), although all target settlements have had reports of saiga poaching in the past.
	Erdniyevsky	40	
	Khulkutta	33	
	Komsomolosk	39	
	Utta	41	
	Yashkul'	47	
Residency time	> 20 years	199	Residency time may affect household perceptions of prevailing social norms, whilst also catering for connections into the trade of meat.
	< 20 years	81	
Continuous Variables			
Variable	unit	Median	
Household Size	Number of individuals	3	Household size may affect household ability to carry out diverse livelihoods and may be related to wealth and occupation.

3.5.4. Ranked data

Response rates to the meat ranking exercise were compared between different demographic groups (Table X) visually using box and whisker plots and the differences statistically checked using chi-squared tests. Where expected values were low, Fisher's exact tests were used instead (Crawley, 2007). Ranking scores for the four criteria (price, health, taste and consumption) were then tested against the same socioeconomic variables using Kruskal-Wallis chi squared tests, and 'kruskalmc' post hoc test to confirm the direction of effects (in R package pgirmess) (Siegel & Castellan, 1988).

3.5.5. Social norms

The responses to the social norm Likert scales were first explored graphically. Responses to the social norm of saiga meat consumption, 'most adults in my community think that eating saiga meat is a bad thing to do' were binned into two categories: "Agreement" (agree + strongly agree) (n=136), and "Non-agreement" (neutral + disagree + strongly disagree + not sure) (n=144). This allowed for sufficient within-category sample sizes to test for differences between individual level variables (Table 3.3) and household level variables (Table 3.2). Prevalence estimates for saiga consumption between the two social norms groupings ("Agreement" and "Non-agreement") were also calculated using the same method described in 3.5.3. In testing individual perceptions of social norms against household prevalence estimates, the study assumed that the individual's perception reflects the wider household's view. This assumption is supported by the knowledge that household consumption of saiga is likely to be a shared behaviour, unlike more individualistic behaviours such as hunting.

Table 3.3. Summary of the individual-level demographic variables collected

Unit of Response: Individual Level		
Categorical Variables		
Variable	Level	Count
Age	16-29	52
	30-49	108
	50+	120
Gender	Male	152
	Female	128
Education	Primary	17
	Secondary	178
	Higher	85
Household head	Yes	162
	No	118
Ethnicity	Kalmyk	183
	Non-Kalmyk	97
Born Local	yes	141
	No	139
Social status	Homemaker	20
	Pensioner	41
	Student	9
	Unemployed	27
	Working	183

3.5.6. Analysing qualitative data

Key informant interviews were analysed thematically, drawing out consistent messages and themes. Some key topics central to the interview design - for example, the relative importance of different saiga products for poachers - are presented as a percentage of the respondents who answered similarly. If an important theme emerged, but was touched upon by just a few informants, their identity codes are presented (e.g. K104) which corresponds to the demographic summary in Appendix 7.5. Quotes are presented throughout the results sections which either encapsulate shared views or give a unique insight, giving depth to the quantitative results.

4. Results

4.1. Perceptions towards saiga meat

Local perceptions towards the characteristics of saiga meat were explored using a ranking exercise where respondents ranked saiga meat, horse, beef and mutton against four criteria – price, healthiness, tastiness and consumption (e.g. most consumed vs. least consumed within the village area).

4.1.1. Response rates to the ranking exercise

Given the direct style of questioning and the sensitivity of saiga meat consumption, the meat ranking exercise was highly sensitive for many people. Of the 280 people who participated in the main questionnaire, 54%, 57%, 60% and 59% refused to respond to the price, healthiness, tastiness and consumption ranking respectively. 'I don't know about saiga meat' or 'I haven't heard of saiga meat being sold here' were the most common refusals voiced. Demograpihc differences in response rates are summarised in Table 4.1. Female respondents were more likely to respond than male for all four ranking criteria, as were non-household heads in comparison to heads. Younger respondents (<30) were more likely to respond to the price and consumption ranking exercises than middle aged (31-50) or older (50+). Respondents of certain social statuses were more likely to respond too. For example, working people were less likely to respond to the consumption ranking criteria than pensioners, homemakers or the unemployed. Overall, the response rates to the ranking exercise were significantly higher in Yashkul', Komsomolsk (the two towns) and Erdniyevisky, than Adyk, Utta, Khulkhutta and farmsteads (Appendix 7.6).

Table 4.1. Chi-square test results for differences in response rates to the meat ranking exercise between demographic groups (unit of response = individual)

		Response Rates to the Meat Ranking Exercise (chi-square test)			
Demographic Variable	Ranking Criteria	chi-squared value	DF	p value	Direction
Age	Price	6.33	2	0.042**	*Older people (50+) less likely to respond to price and conssumption ranking than younger (<30) or middle aged (31-50)*
	Health	3.29	2	0.193	
	Taste	1.78	2	0.410	
	Consumption	7.00	2	0.030**	
Gender	Price	4.76	1	0.029**	*Female respondents more likely to respond than male*
	Health	3.43	1	0.064*	
	Taste	3.20	1	0.074*	
	Consumption	5.32	1	0.021**	
Education	Price	3.87	2	0.144	*No significance*
	Health	3.11	2	0.211	
	Taste	1.18	2	0.211	
	Consumption	2.41	2	0.554	
Head	Price	9.52	1	0.002***	*Non-household heads more likely to respond than heads*
	Health	8.51	1	0.004***	
	Taste	7.79	1	0.005***	
	Consumption	11.19	1	0.001***	
Born local	Price	0.06	1	0.804	*No significance*
	Health	0.90	1	0.343	
	Taste	0.50	1	0.479	
	Consumption	0.22	1	0.642	
Ethnicity	Price	0.02	1	0.877	*No significance*
	Health	0.04	1	0.841	
	Taste	0.41	1	0.520	
	Consumption	0.09	1	0.770	
Social Status	Price	6.12	4	0.191	*For consumption ranking, unemployed, homemakers and pensioners more likely to respond than working people*
	Health	5.60	4	0.231	
	Taste	4.63	4	0.327	
	Consumption	8.00	4	0.091*	

(* significant to p=<0.1, ** significant to p=<0.05, *** significant to p=<0.01)

4.1.2. Price

For the price ranking exercise (n=130), 58% of people thought that saiga was the cheapest of the four meats, whereas 29% of respondents considered it as the most expensive (Figure. 4.1). Respondents that were younger (<30) were more likely to rank saiga as more expensive

(relative to the other meats) than middle aged (30-49) or older (50+) respondents. Social status had some effect on perception of price too; compared to students, pensioners were more likely to rank saiga meat as less expensive (Table 4.2).
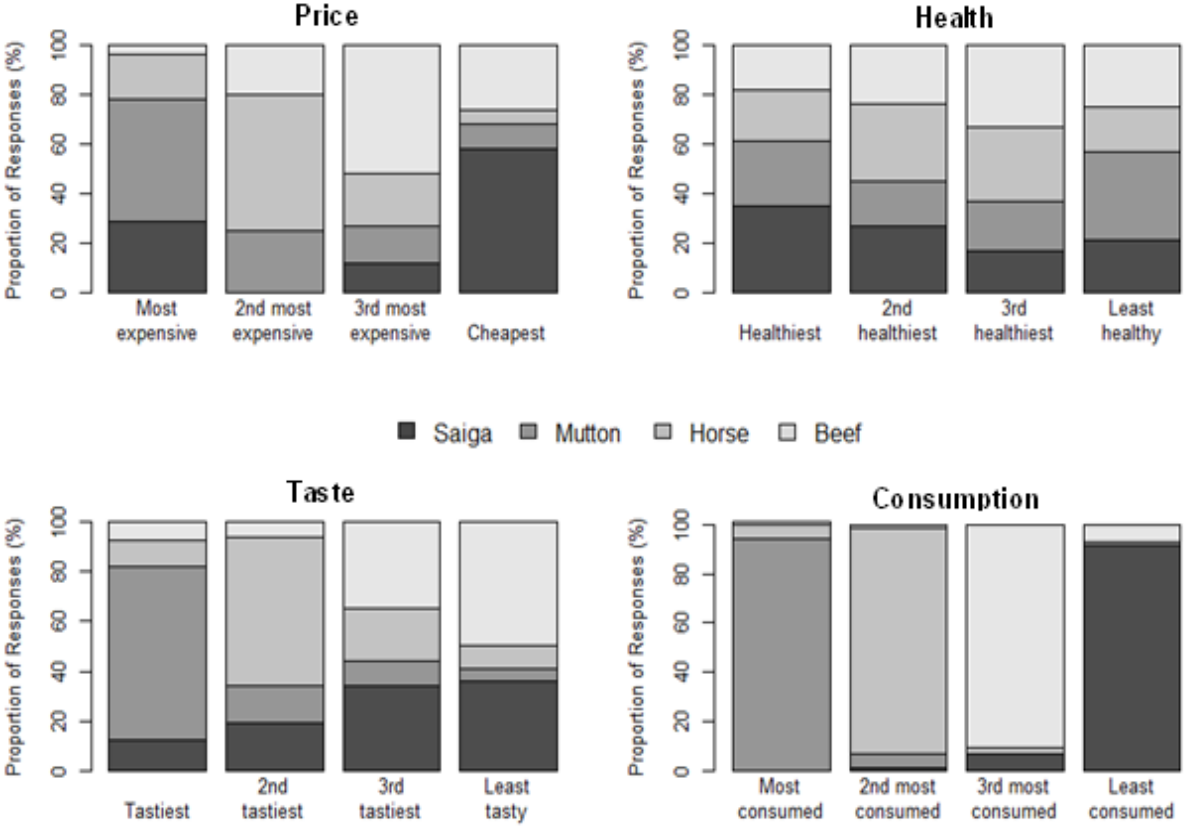
Figure 4.1. Four meats ranked on four different criteria: price (n=130), healthiness (n=116), taste (n=112) and how commonly consumed the meat is in the respondent's community (n=121).

Household-level variables also exerted some influence on perceptions of price (Table 4.3). Respondents with skilled workers as household heads tended to rank saiga meat as more expensive than those headed by farm owners. Settlement-level differences were also detected; respondents from the large town of Komsomolsk perceived saiga meat as pricier than the smaller Kuhlkhutta village. This finding is supported by location level differences where saiga meat prices, relative to the other meat types, are perceived as higher in towns (Yashkul' and Komsomolsk) compared with villages (Adyk, Erdniyevisky, Khulkhutta and Utta).

Table 4.2. Results of the meat ranking exercise (unit of response = individual)

Responses to the Meat Ranking Exercise (Kruskal-Wallis test)					
Demographic Variable	Ranking Criteria	chi-squared value	DF	p value	Direction
Age	Price	16.14	2	0.000***	*Older people (50+) and middle aged middle aged (31-50) more likely to rank saiga meat as less expensive and less tasty than younger people (<30)*
	Health	2.77	2	0.251	
	Taste	5.60	2	0.061*	
	Consumption	1.98	2	0.372	
Gender	Price	2.34	1	0.126	*No significance*
	Health	0.03	1	0.855	
	Taste	0.43	1	0.513	
	Consumption	0.54	1	0.462	
Education	Price	3.26	2	0.196	*People with higher education more likely to rank it as less tasty than people with secondary or primary education*
	Health	0.02	2	0.989	
	Taste	5.16	2	0.076*	
	Consumption	2.81	2	0.245	
Head	Price	4.43	1	0.035**	*Non-household heads more rank saiga meat as more expensive and tastier than household heads*
	Health	1.62	1	0.203	
	Taste	4.15	1	0.035**	
	Consumption	0.01	1	0.919	
Born local	Price	2.34	1	0.126	*No significance*
	Health	0.16	1	0.687	
	Taste	1.80	1	0.180	
	Consumption	0.80	1	0.371	
Ethnicity	Price	3.87	1	0.049	*No significance*
	Health	0.00	1	0.993	
	Taste	1.48	1	0.223	
	Consumption	1.48	1	0.180	
Social Status	Price	17.03	4	0.002***	*For price, pensioners more likely to rank saiga as less expensive than students. For consumption, unemployed, homemakers and pensioners more likely to score saiga as more common than working people.*
	Health	4.83	4	0.305	
	Taste	1.92	4	0.750	
	Consumption	8.68	4	0.070*	

(* significant to p=<0.1, ** significant to p=<0.05, *** significant to p=<0.01)

Table 4.3. Results of the meat ranking exercise (unit of response = household)

Variable	Ranking Criteria	Kruskal-Wallis chi-squared value	DF	p value	Direction
Responses to the Meat Ranking Exercise (Kruskal-Wallis)					
Job type of head of household	Price	14.55	5	0.012**	*Skilled workers percieve saiga meat prices as higher than farm owners*
	Health	3.75	5	0.711	
	Taste	6.31	5	0.389	
	Consumption	3.64	5	0.725	
Settlement	Price	21.32	6	0.002***	*Khulkhutta respondents percieved the meat as cheaper than Komsomolsky respondents*
	Health	3.49	6	0.745	
	Taste	8.54	6	0.201	
	Consumption	6.18	6	0.403	
Location (Steppe, Village, Town)	Price	11.68	2	0.009***	*Town percieves saiga meat prices higher than village*
	Health	0.76	2	0.686	
	Taste	2.73	2	0.256	
	Consumption	0.04	2	0.979	
Ethnicity of Household Head (Kalmyk, Other)	Price	0.14	1	0.708	*No significance*
	Health	0.00	1	0.993	
	Taste	1.48	1	0.223	
	Consumption	1.79	1	0.180	

(* significant to $p=<0.1$, ** significant to $p=<0.05$, *** significant to $p=<0.01$)

4.1.3. Health

Saiga meat was ranked as the 'healthiest' meat of the four - 35% of respondents ranking saiga as top (*n*=121). None of the individual level or household level demographic variables tested could explain differences in opinions regarding the relative healthiness of saiga meat in comparison to the other meats (Table 4.2 and Table 4.3). However, qualitative data did reveal a complex relationship between saiga meat and health issues. A common theme was that saiga meat contained 'vitamins and minerals' that other meats lacked:

> *"Saiga meat is good for health - it is a wild meat and therefore is rich in vitamins and other forms of nutrients"* - explained a former sheep breeder from Yashkul' (K101).

Older informants (K102, K107, K117) also spoke about the healing potential of saiga meat, which is sometimes consumed to treat unknown sicknesses:

> *"In the late 1990s my son became very ill, so I sent a shepherd for saiga meat… three days later my son was healthy once again"* - recalled another resident of Yashkul'

(K102*).*

"People are permitted to eat saiga if they are sick or have no other option" (K106).

As an elderly woman from Khulkhutta explained, the relationship between saiga products and curing illnesses is not restricted just to meat in Kalmykia:

"*In the past, it was a custom to burn dry old saiga skin to exorcise a place from evil spirits. It was also believed that horns of saiga and a particular snake species could cure certain ailments"* (K107).

Although today the use of saiga meat to treat illness is considered very rare (K101, K102, K107), it would seem a more general perception of it being healthier lingers.

4.1.4. Taste

Respondents (*n* =112) considered horse the least tasty meat (50%), followed by saiga (36%), whilst mutton claimed highest proportion of first place rankings for the tastiest meat (70%) (Figure 4.1). Analysis of ranked scores suggested that age of respondent has some effect on perceptions of taste, with younger people (<30) ranking saiga as tastier than middle aged (30-49) and older (50+) people (Table 4.2). The ranking exercise for taste was notably the most sensitive of the four criteria, with respondents hesitating before answering or skipping the question. This is probably because respondents felt that ranking on taste implied personal use. Some key informants revealed that taste is an important characteristic for some consumers:

"*People want it because it is tasty, healthy, and sometimes cheap"* (K117)

"*If saiga meat is sold, it is because it's a delicacy"* (K121)

4.1.5. Consumption and availability

According to the meat ranking exercise for consumption (*n*=116), respondents perceived saiga as the least commonly consumed of all four meats (92%), followed by horse (7%). Whilst no one thought saiga was the most commonly consumed meat, 1% of respondents placed saiga second and 7% placed saiga the third most commonly consumed. Social status of the respondent explained some variation in rankings. Unemployed, homemakers and pensioners were more likely to score saiga meat as more commonly consumed than working (full or partially employed). Key informants highlighted that meat supply is often low despite relatively high demand:

"*There are many people after [saiga] meat, but sometimes it's not available"* (K109).

4.2. Household meat consumption

4.2.1. Violation of assumptions

Control and treatment groups were not significantly different in their household-level variables (Appendix 7.7), which helps to satisfy the first assumption of a UCT design – assignment to control and treatment groups is random. Design effects for the meat consumption UCT were tested for using the ict.test function within the 'list' package (Blair & Imai 2012), which strongly suggests that the experiments did not have any significant design effects (Bonferroni-corrected p-value = 0.99). However, respondents during the farmstead visits (mainly farmers and farmhands) were more suspicious of the UCT question than villagers. On several occasions a farmer answered 'one' item, despite rearing both sheep and pigs (both meats were included as non-sensitive items) suggesting that the inclusion of saiga was having some design effect on UCT answers for steppe inhabitants. The third assumption, that there were 'no liars', was not tested statistically. However, increasing prevalence estimates from hunting, which is not expected to be particularly sensitive, to saiga meat consumption (expected to be sensitive) gives confidence in the honesty of reported behaviours across the study system.

4.2.2. Estimated prevalence of behaviours

There were 280 responses to each of the four UCT questions, with 141 in the control group and 139 in the treatment group (Appendix 7.8). UCT prevalence estimates reveal that all three sensitive behaviours are conducted within the study system (Figure 4.2), however the standard errors for household engagement in saiga poaching (prevalence = 3%, ±9) crosses zero percent, reducing the confidence in detection of this behaviour. Legal hunting was found to be widely conducted across Yashkulsky and Chernezemelsky districts (prevalence = 26%, ±8). Reported game species included wolf, hares, foxes, ducks and wild boar. The prevalence estimate for household saiga meat consumption was 34% (±9). For TV shows list - the warm-up question - estimates reveal that 52% (±13) of the study population had watched 'Let Them Talk' (a news programme) during the week prior to questioning.
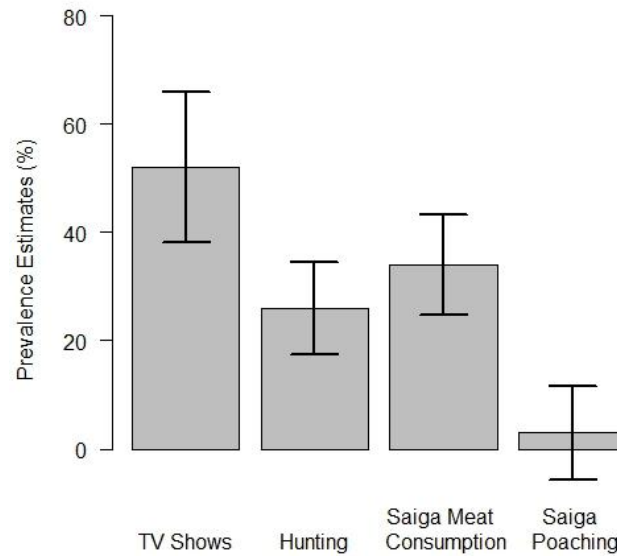
Figure 4.2. Estimated prevalence of sensitive behaviours calculated by the difference in means between control group (n=141) and treatment (n=139) for the single item Unmatched Count Technique. Note TV shows is a non-sensitive list topic included as a warm up question.

4.2.3. Predictors of household saiga meat consumption

Linear models were fitted with a single household-level predictor variable with an interaction term for UCT treatment status. By fitting an interaction term, statistical comparisons between the differences in prevalence estimates of the treatment group and the control group within each factor level can be calculated. Despite the significance of the individual effect sizes in some models, the overall model fits were low (R^2 values < 0.1). This may be a reflection of the UCT design, which purposely increases variability in response in order to provide anonymity.

UCT prevalence estimates suggest that households headed by farm owners, professionals (e.g. teachers, lawyers) and pensioners were less likely to have consumed saiga meat than those headed by skilled workers (e.g. craftsmen, mechanics), unskilled workers (e.g. farmhands) or unemployed (Table 4.4; Figure 4.3). Interestingly, households headed by farm owners have consumed significantly more types of meats than households headed by skilled workers, unskilled workers, and unemployed, in spite of having a significantly lower prevalence estimate for saiga consumption (Table 4.4). The standard errors for prevalence estimates for households headed by skilled workers, unskilled workers and unemployed did not cross zero percent increasing our confidence in the direction of this effect (Figure 4.3A). Ethnicity of household head had no significant effect on consumption (Figure 4.3B; Appendix 7.9), nor did household size and residency time (Appendix 7.10; Appendix 7.11).

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Table 4.4. Model parameters for job category of household head and prevalence of saiga meat consumption. Ref. = reference level.

	Dependent variable: UCT counts for meat types consumed	
Intercept	2.308***(-0.217)	
Treatment	-0.177 (-0.272)	
Job type of household head:		*Interaction between job type and treatment status:*
Farm Owner	*Ref.*	*Ref.*
Pensioner	-0.308 (-0.274)	0.32 (-0.382)
Professional	-0.341 (-0.26)	0.347 (-0.350)
Skilled workers	-0.641** (-0.276)	0.879** (-0.368)
Unemployed	-0.508* (-0.279)	0.752** (-0.378)
Unskilled workers	-0.469* (-0.259)	0.644* (-0.333)
Observations		267
R^2		0.077
Adjusted R^2		0.038
Residual Std. Error		0.783 (df = 255)
F Statistic		1.944** (df = 11; 255)
Note:		*p* **p* ***p<0.01
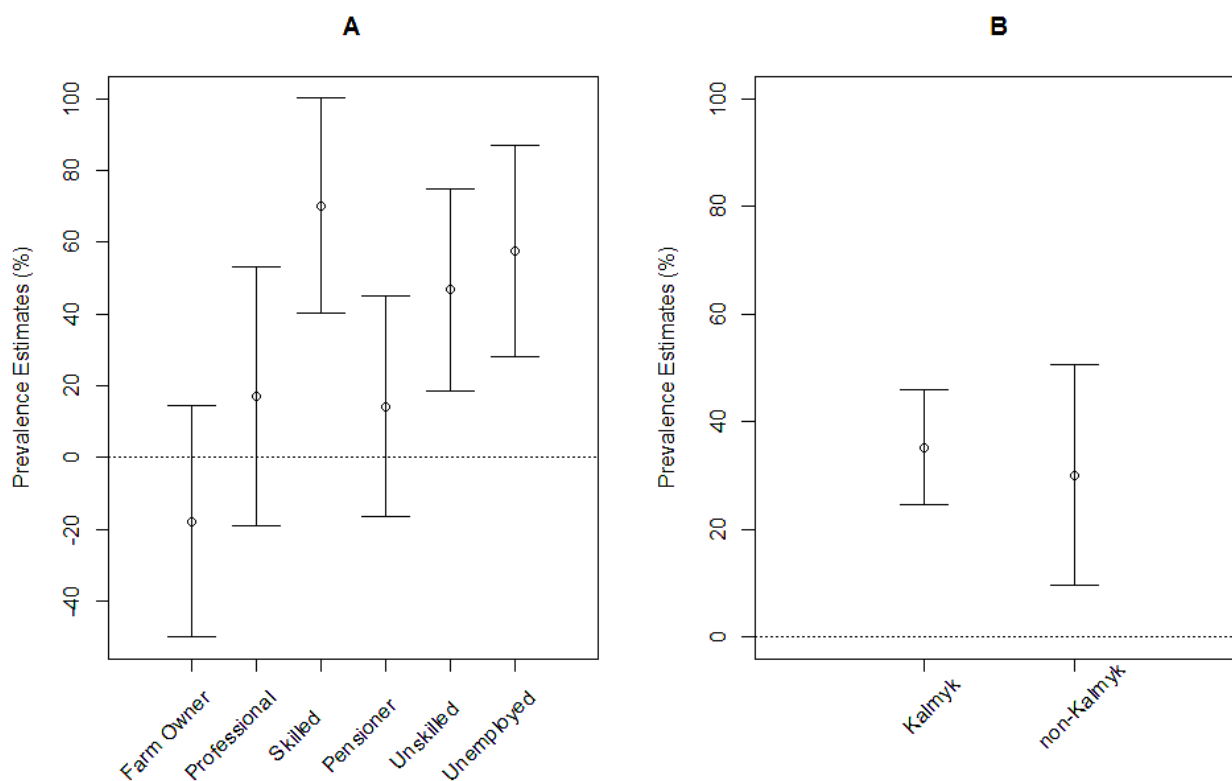
Figure 4.3. Differences in for estimated prevalence for illegal saiga meat consumption between different job types (A) and ethnicities (B).

Spatial predictors of saiga meat consumption were also explored; households located in villages (<1000 people) had a higher estimated prevalence of saiga meat consumption than both steppe (e.g. farms) and town (>5000 people) households (Figure 4.4c), but village was only significantly higher than steppe consumption (Table 4.5). The small sample size for the steppe category (n=40) produced wide error bars crossing zero percent prevalence (Figure X.). UCT estimates between settlements exhibited wide standard errors (SE range: 19 - 34) (Figure 4.4d), with Erdniyevsky and Kuhlkhutta both significantly higher for consumption than Yashkul' (Table 4.6).

Table 4.5 Model parameters for household location and prevalence of saiga meat consumption.

	Dependent variable: UCT counts for meat types consumed	
Intercept	2.105***(0.174)	
Treatment	-0.153 (0.240)	
Location:		*Interaction between location and treatment status:*
Steppe (farms)	*Ref.*	*Ref.*
Town	-0.279 (0.207)	0.352 (0.291)
Village	-0.197 (0.195)	0.681** (0.270)
Observations		280
R^2		0.090
Adjusted R^2		0.073
Residual Std. Error		0.759 (df = 274)
F Statistic		5.403*** (df = 5; 274)
Note:		*p* **p* ***p<0.01
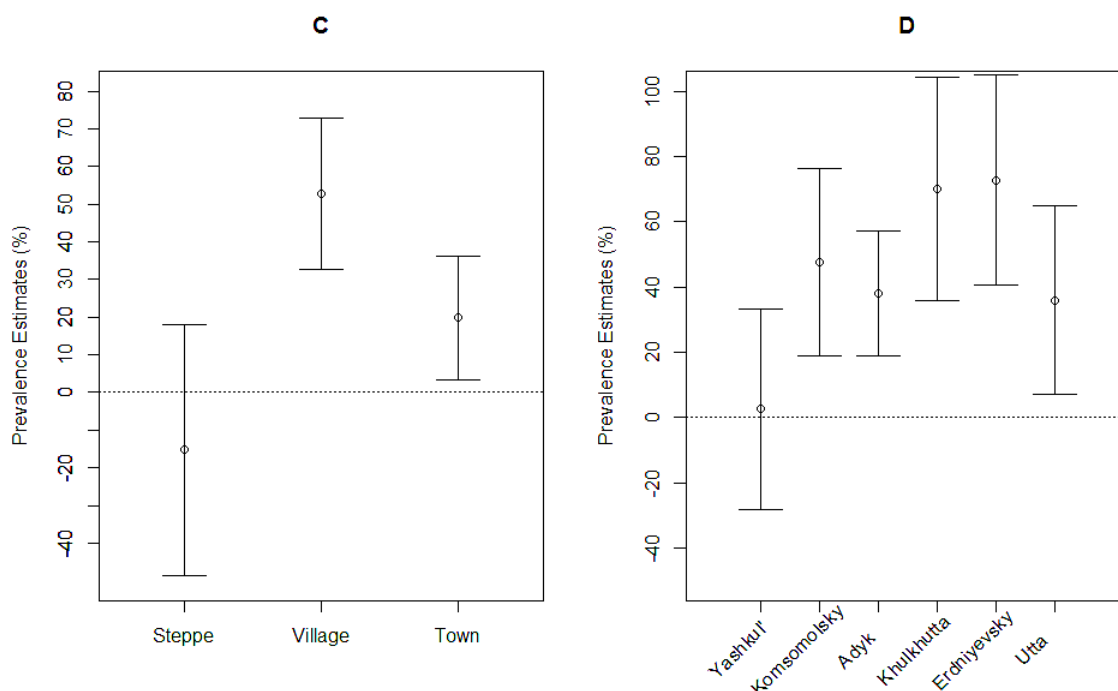
Figure 4.4. D Differences in for estimated prevalence for illegal saiga meat consumption between different locations (C) and settlements (D)

Table 4.6. Model parameters for prevalence of saiga meat consumption between settlements

	Dependent variable: UCT counts for meat types consumed	
Intercept	2.074***(0.140)	
Treatment	0.352*** (0.114)	
Job type of household head:		*Interaction between job type and treatment status:*
Yashkul'	*Ref.*	*Ref.*
Adyk	-0.120 (0.209)	0.353 (0.316)
Erdnievsky	-0.169 (0.212)	0.701** (0.316)
Khulkhutta	-0.274 (0.235)	0.674** (0.334)
Komsomolosk	-0.600*** (0.218)	0.450 (0.318)
Utta	-0.130 (0.222)	0.334 (0.315)
Observations		240
R²		0.148
Adjusted R²		0.107
Residual Std. Error		0.729 (df = 228)
F Statistic		3.607*** (df = 11; 228)
Note:		*p *p **p<0.01

4.3. Social norms

Three different Likert scales were administered in the main questionnaire (n=280) to explore local people's perceptions of prevailing social norms surrounding saiga conservation and illegal exploitation (Figure 4.5). The vast majority of respondents either agreed (78%) or strongly agreed (14%) with the statement: 'I feel the same way about the importance of protecting saiga as other people in my village.' This sentiment is in line with the general concern voiced by many people during the survey over the depleting saiga population in Kalmykia. The majority disagreed (82%) with the statement: 'most adults in my community believe that hunting saiga is acceptable.' Only 3% agreed that poaching is deemed acceptable by other members of their local community. The final statement, 'most adults in my community believe that eating saiga meat is a bad thing to do' revealed greater variation than the other two. Whilst 47% of respondents agreed with the statement, 20% were either neutral or not sure, and 27% disagreed. Three people strongly disagreed with the statement – all below 30 years, Kalmyk ethnicity and with higher education.
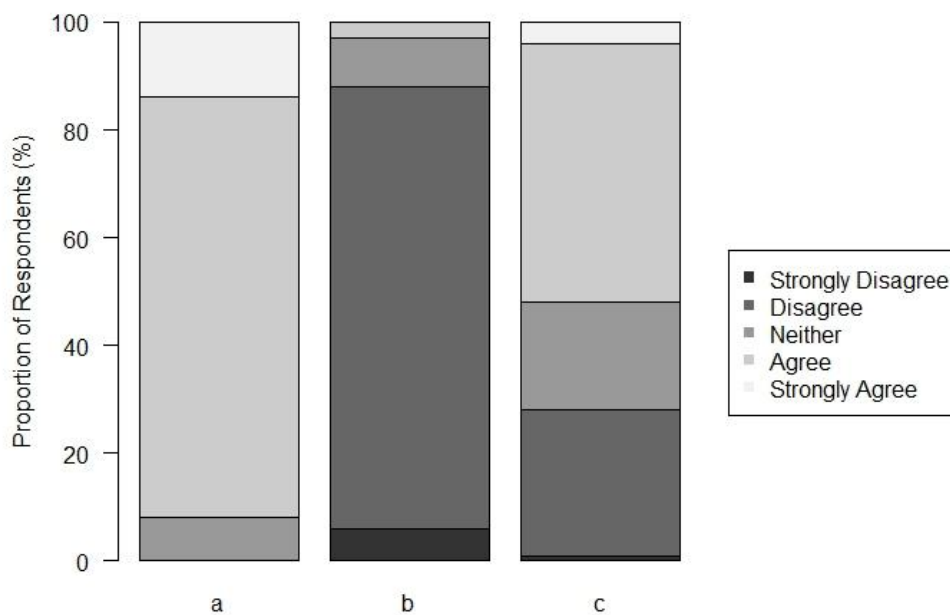
Figure 4.5. Responses (n=280) to the social norm statements: a) I feel the same way about the importance of protecting saiga as other people in my village; b) most adults in my community believe that hunting saiga is acceptable; c) most adults in my community believe that eating saiga meat is a bad thing to do.

Responses to the social norm statement on the acceptability of saiga meat consumption were combined into two groups. An "Agreement" group (n = 136) either agreed or strongly agreed with the statement – 'most adults in my community believe that eating saiga meat is a bad thing to do' – whilst a "Non-agreement" group (n=144) contained those that disagreed, strongly disagreed or were either neutral or not sure. Female respondents were significantly more likely to agree with the social norm 'most adults in my community believe that eating saiga meat is a bad thing to do' than males (x^2=4.33, df=1, p=0.03). None of the other individual-level demographic variables or household-level variables were able to explain differences in perceptions of social norms surrounding saiga meat consumption (Appendix 7.12).

Comparisons of UCT answers to meat consumption between groupings "Agreement" and "Non-agreement" suggest that perception of social norms had an association with household saiga meat consumption (Table 4.7). The "Non-agreement" group had an estimated prevalence of 49% (SE 14) whereas the "Agreement" Group yielded a much lower prevalence estimate, 15% (SE 12), for household saiga meat consumption (Figure 4.6).

Table 4.7. Model parameters for social norm groups and prevalence of saiga meat consumption.

	Dependent variable: UCT counts for meat types consumed	
Intercept	1.929^{***} (0.084)	
Treatment	0.155 (0.130)	
Social norm group:		*Interaction between groups and treatment status:*
"Agreement" group	*Ref.*	*Ref.*
"Non-agreement" group	-0.051 (0.132)	0.335^{*} (0.186)
Observations		280
R^2		0.062
Adjusted R^2		0.052
Residual Std. Error		0.768 (df = 276)
F Statistic		6.095^{***} (df = 3; 276)
Note:		*p **p ***p<0.01

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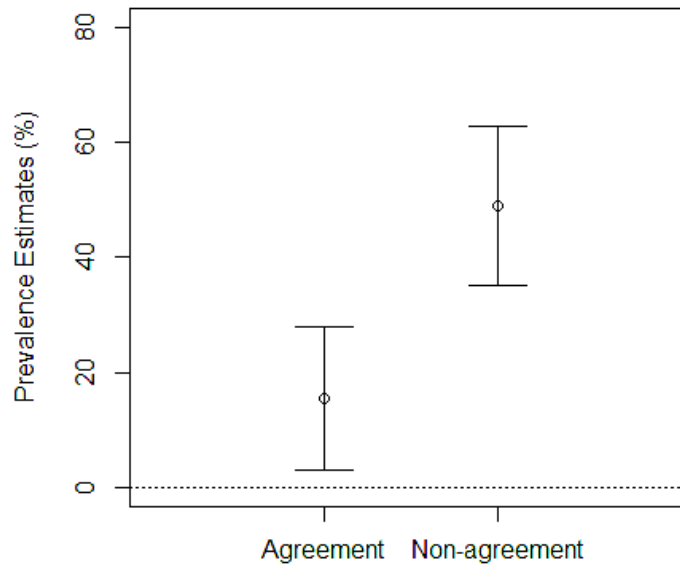
*Figure 4.6. Prevalence estimates of household consumption of saiga meat for "Agreement",
n=136, those that agreed with the social norm most adults in my community believe that
eating saiga meat is a bad thing to do and "Non-agreement", n=144, those that disagreed or
where neutral/not sure to the same statement.*

4.4. The Trade

4.4.1. Motivations for engagement in poaching and trade

The vast majority of respondents (70%; n=280) viewed poaching as the biggest current threat to the Kalmyk saiga population. Climate change issues, such as extreme weather (10%) and lack of grass (9%), infrastructure/development (6%) and predation (3%) scored much lower. Local perceptions of the top reasons behind engagement in saiga poaching revealed a wide array of opinions (Figure 4.7). Supplementing income was the top reason given (34%; n=280), followed by main income (25%) and supplementing diet (18%). Although less common, recreation (15%) was another perceived incentive in driving engagement in saiga poaching. Tradition and cultural reasons for hunting was perceived by only 1% of the survey population as a primary reason for engagement in the activity.
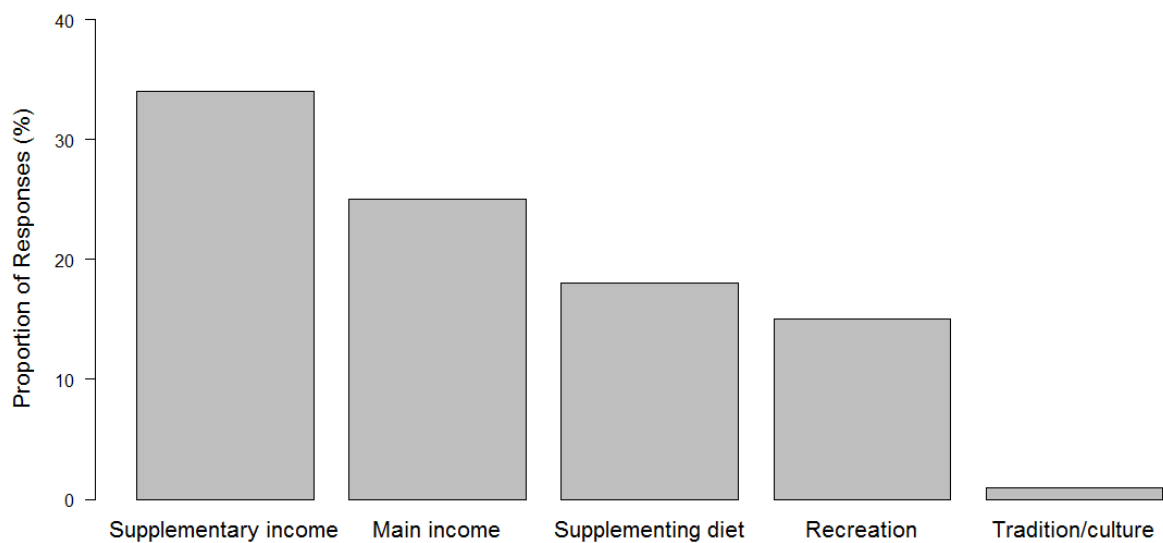
Figure 4.7. Respondent perceptions (n=280) of the top reasons for engagement in poaching of saiga.

4.4.2. Poacher profiles

Key informant interviews with hunters, farmers and ex-poachers revealed profound insights into the motivations behind poaching. 'The poor hunt for income and rich hunt for enjoyment' was a common theme voiced by key informants during the interviews (72%, n=22). An ex-poacher near Utta summarised:

"Hunters and poachers are different people and will hunt saiga for different reasons. Poachers generate income from poaching whereas hunters are more motivated by enjoyment [recreation] and possibly for meat consumption" (K121).

Most key informants (82%, n =22) identified men, local to Yashkulsky and Chernozemelsky districts, as the primary poachers:

"I've seen many poachers recently; they are local people from nearby villages and they come on motorbikes" - a farm owner based on the edge of CZBR (K121).

"Poachers are local as they must know the landscape very well to catch saiga. To hunt saiga is a difficult challenge and requires great skill and commitment" - An ex-poacher from Erdniyevisky expanded on this theme (K112).

Another 'hunter' profile also emerged through discussions – many people cited that richer people, sometimes officials, engage in hunting too. Approximately half (47%, n=22) of the key informants, mentioned corruption as a notable force in the poaching situation in Kalmykia. Alongside limited resources and funding for rangers, corruption between government officials, rangers and poachers was a consistent theme mentioned by people during the survey:

*"There are people in Utta and Khulkhutta that rely on poaching for income – sales of meat and horns. They deliver horns and meat to Astrakhan. Over the last 12 years not one of these poachers has been caught by the authorities, but everyone knows who they are" (*K110*).*

"*The poachers today are not only local people but also the officials" (*K108*).*

*"Everyone in the villages knows who the poachers are; no one is willing to tell [the authorities]" (*K107).

"The poachers today are not only local people but also the officials" (K101).

*"[Poachers] tend to be those who live near the reserve or saiga hotspots and are unemployed or lack income, but hunting of saigas is also carried out by some rangers, officials and people in power, who conduct these activities for recreation" (*K105).

4.4.3. Use of saiga products

All key informants were asked about their opinions on the relative importance of horn products and meat for poachers and within the trade system (Figure 4.8). There was a variety of opinions but the majority of key informants (61%, n=22) perceived horns to be the most sought after product (Figure 4.8).

> "*Today saigas are poached for their horns mainly. They are medicinal and fetch high prices in foreign markets*" Khulkhutta resident (K117).

However, 39% (n=22) believed that personal consumption of meat and income generation through the meat trade have been the primary factors in driving poaching over recent years. As a farmhand nearby the CZBR summarised:

> "*[poachers] target the male saiga [with horns], because they are highly valuable, but there are very few left. Instead, they will take females for the meat trade*" (K121).

Figure 4.8. The remains of an advertisement looking to procure saiga horn; location, Molodezhny, Kalmykia; photograph, FH.

4.4.4. Trade in saiga meat

The saiga meat trade occurs at a variety of scales. Some of the meat is transported by bus (sometimes mixed in with mutton) to the urban centres of Elista in Kalmykia and Astrakhan in the neighbouring region (Astrakhan Oblast) (K112, K114, K118). Meat is also traded locally too:

> "*The poachers sell meat along the road and take the trade to other towns too,*

probably Utta […] this activity happens throughout the year. The sale and purchase of meat is very discrete." (K109).

Local sales are both opportunistic and coordinated. A respondent from Erdniyevisky recalled a situation in early 2014 where people arrived from a neighbouring village, Kharba, looking to sell saiga meat from the back of a vehicle. Contrastingly, a key informant from Utta (K117) spoke of a more coordinated trade:

"Village sales are coordinated by telephone and delivered by motorbike. People usually buy the entire carcass for about 1000 RU [28 USD] […] there are many people [in Utta] after meat, some people place orders in [advance]."

Two key informants (K114, K110) mentioned a roadside cafe near Utta where saiga meat can sometimes be bought discreetly over the counter. Although it seems possible to access saiga meat throughout the year (K109, K114, K117, K118), some key informants believed that supply is higher in the summer and autumn (July-November), as the saiga are more likely to roam beyond the borders of the protected areas and the females are thought to carry more body weight (K114, K117). A third of key informants (36%, n=22) reported meat prices for saiga, which were given in both kilograms (n=8) and per carcass (n=2). Per kilogram, the mean price was 163 RUB (4.4 USD)(range 120-200), and 1000 RUB (27 USD) (range n/a) for a single carcass. Taking average weight on an adult saiga as 16.5 kg (Kuhl, 2008), meat bought by the carcass costs per kilo approximately 61 RUB/kg (1.7 USD). In the Astrakhan region, the price of saiga meat may be as high as 200 RUB/kg, 5.4USD, but this is explained by the fact that there are only a few traders that come infrequently (K118). One respondent was approached by traders in Elista, the capital of Kalmykia, offering saiga meat for just 120 RU/kg (3.3 USD), highlighting the range in prices across the trade system. Three key informants (K107, K113, K114) spoke of changes in prices over the last decade:

"In some areas [saiga meat] prices have risen - some view it as a luxury meat and poorer people can no longer afford it" (K114).

Although domestic meat prices vary with season and between villages, beef is the generally the most expensive (mean: 210 RUB/Kg (5.7 USD), range: 200-250), followed by mutton (mean: 190 RUB/Kg (5.1), range: 170-200), then horse (mean: 160 RUB/Kg (4.3), range: 160-180). In the settlements surveyed, people's perceptions of meat prices (section 4.1.2) – with saiga generally ranked as one the cheapest of four meat types - tended to align with the reported meat prices.

4.4.5. Perceived barriers to controlling poaching and trade

Fixed response questions in the main questionnaire (n=280) revealed unemployment as the biggest perceived barrier to reducing saiga poaching (51%) (Figure 4.9). A lack of legal protection (e.g. the penalties for infractions are too low/weak), insufficient law enforcement (e.g. rangers unable to catch poachers), and social pressure (e.g. hunting is seen as a normal thing to do by people around you) were considered as top barriers by fewer respondents (15%, 14%, and 8% respectively). The category 'other' included 'greed', 'for meat' and 'for entertainment'. 7% of respondents were 'not sure'.
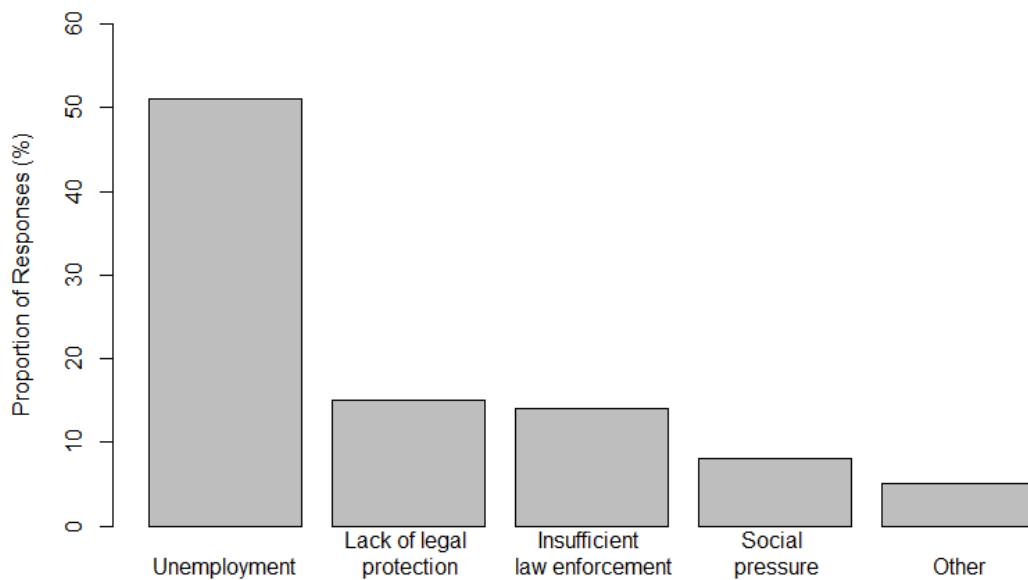
Figure 4.9. Respondent perceptions (n=280) of the top barriers for controlling poaching of saiga.

Some respondents, who live close to the CZBR, believed that increasing the penalties will not help the situation, emphasising that the solution lies in improving employment opportunities. Others respondents commented on the role that corruption has in defying anti-poaching and trade-control efforts. One male respondent from Utta summarised this viewpoint:

> *"Although the penalties for breaking hunting rules are very high, there is opportunity to bribe officials to reduce or eliminate the charges entirely."*

5. Discussion

This study suggests that consumption of saiga meat in the western rural districts of Kalmykia is linked to lower household socioeconomic status and is associated with the perceived acceptability of social norms regarding consumption. Findings indicate that saiga meat is a luxury food item for the richer sections of society, particularly amongst urban markets. People's views of the different qualities of saiga meat are diverse, reflecting a range of values, tastes and pre-existing cultural norms. Findings support existing concerns over ongoing poaching of the pre-Caspian saiga population and expose a new angle on the trade and use of saiga products. This chapter discusses the study's findings and limitations, placing them within the broader poaching context in Kalmykia. Drawing on studies from other saiga range states and the wider conservation literature, it also makes recommendations for future lines of research and practical conservation actions.

5.1. Poachers, products and prices

Saiga horn, borne only by males, was widely suggested to be the most sought-after product by poachers, which corroborates findings from 2004 (Kuhl et al., 2009). However, key informants highlighted the fact that trade in meat was also a significant motivation for poachers. Today, less than 5% of the adult saiga pre-Caspian population are male – much lower than the natural sex ratio (V. Badmaev, pers. comm.). At such low densities, generating income from horn sales is perhaps at its most difficult for poachers, in spite of increasing horn prices (von Meibom et al., 2010). Female saigas, on the other hand, are (relatively) more abundant and may be caught for personal consumption or the meat trade. Most steppe inhabitants who reported seeing saiga recently stated that the groups were small and consisted of females and calves only.

Prices of saiga meat have increased over the last decade. Purchased by the carcass, saiga meat costs on average 67 RUB (1.5 USD) per kilo – a three-fold increase from 2004 estimates (20 RUB, 0.5 USD; Kuhl et al., 2009). Even allowing for inflation (2004-2013 the mean inflation rate for the Russian Federation = was 9.35% per annum; www.inflation.eu), is a 50% increase in real terms. Reports by key informants suggest prices range substantially across the study system too, supporting evidence that urban markets also play a role in driving the meat trade (von Meibom et al., 2010).

This study shows that legal hunting is still a widely conducted activity across Yashkulsky and Chernezemelsky districts (percentage prevalence = 26, ±8%), in particular for wolves, which threaten livestock (pers. obs.). Indeed, hunting has been a part of Kalmyk culture for many centuries - as a pastime, for supplementing diet and for military training (Khodarkovsky, 1992). Through the survey period it became clear that some people distinguish between two types of saiga hunter, 'poachers' (*brakon'er*) and 'hunters' (*ohotnik*), and have different motivations for saiga poaching. The former is driven by income generation, through horn and meat sales, and is seen by the public as the primary reason for the current poaching crisis; the latter motivated by enjoyment values and personal consumption. Thus, the survey responses suggest that there is a faction of the (legitimate) hunting community that may opportunistically hunt saiga for personal use, something not previously acknowledged. This is noteworthy given that hunters are often strong advocates for the sustainable use of wildlife and conservation, as they are intimately connected with the natural environment (Paulson, 2013). Conservation outcomes for large mammals have been realised elsewhere through harnessing the hunting community as powerful actors for changing resource use patterns and reinforcing conservation values (Paulson, 2012; Knott, 2013). Thus, exploring ways to engage the hunting community in conservation is a potential avenue for future research in the area.

5.2. Estimating saiga meat consumption: high prevalence, low availability

This study has successfully employed an emerging research tool within the field of conservation − the Unmatched Count Technique − for estimating the prevalence of sensitive behaviours. Increasing prevalence estimates from hunting, which is not expected to be particularly sensitive, to saiga meat consumption (expected to be sensitive) gives confidence in the honesty of reported behaviours whilst also highlighting an important design issue. Ordering topics by increasing sensitivity gradually may help satisfy assumption number two (no design effects) and assumption three (no liars) in UCT experiments. UCT could serve as a useful research technique in saiga conservation and for understanding rule breaking behaviours across the antelope's range.

According to the UCT estimates, approximately one third of the households (prevalence = 34%, ±9) within the study sample admitted to consuming saiga meat, at least once, over the six months prior to the survey. Prevalence estimates for poaching were low (prevalence =3%, ±9), with standard errors crossing zero percent prevalence, highlighting several limitations to UCT experiments. Firstly, for UCT to detect behaviours that are conducted by a minority

within the study system, large sample sizes are necessary to gain confident estimates of prevalence. Secondly, with highly sensitive behaviours, such as poaching of saigas, there are far greater incentives to not respond or to respond dishonestly to any form of questioning. The data collection period also highlighted the care and attention needed when training interpreters (or researchers) in administering the UCT questions to ensure consistency in delivery (pers. obs.).

Perceptions of the regularity of saiga meat consumption were as considerably lower than three other meats - mutton, beef and horse – suggesting that whilst consumption prevalence may be high across the study system, saiga meat is rarely eaten by consumers. People would sometimes recall 'when some meat traders came through the village earlier in the year', signifying that for the majority of villagers, the trade is infrequent and sporadic. However, a view shared by key informants was that, if it were available, there would many people interested in buying saiga meat.

5.3. Is consumption linked to poverty?

Poorer households within the study system had a greater association with saiga meat consumption. Household wealth was characterised by the job type and status of household head, which served as a quick, albeit crude, proxy for relative household wealth. Observations during fieldwork signalled that 'skilled', 'unskilled' and 'unemployed' respondents had lower standards of living than the presumed richer 'professionals' and 'farm owners', giving some confidence to the measure's reliability (pers. obs.). Results indicate that poorer groups, mentioned above, are more likely to consume saiga meat but also have less overall access to other protein sources than other groups, such as farm owners. This finding implicates impoverishment and limited access to a variety of protein sources with household engagement in consumption. This is reflective of a general pattern seen throughout the world – direct linkage between illegal natural resource use and poverty (Mainka & Trivedi, 2002).

Location of household also had some association with saiga meat consumption, with significantly higher prevalence estimates for village households than steppe households. A greater range and availability of protein sources in the steppe, home to pastoral farming, may reduce the 'need' for saiga meat. However, the significant difference may be also function of a small sample size for the steppe category and/or a consequence of stronger social desirability bias. Based in the steppe and closer to roaming herds, farmers and farmhands are known to engage in hunting for game species (pers. obs.), with some being suspected of saiga poaching

(Kuhl et al., 2009). This could mean that UCT questions were more sensitive for respondents in the steppe category than those in villages or towns, possibly biasing results. It was clear that some smaller, more remote, villages, such as Khulkhutta and Erdnyevisky, are suffering more acutely from a lack of employment opportunities, state services and depopulation than larger towns (pers. obs.). Incidentally, Leon (2009) found greater reporting bias from these same two villages during a study into local knowledge of saiga distribution. Indeed, villages such as Khulkhutta, Erdnyevisky and Utta are known poaching centres (Kuhl et al., 2009; pers. obs.), located close to the reserve and on the main road from Elista to Astrakhan (a known trade route for saiga products; von Meibom et al., 2010), so it is perhaps expected that some settlements had a greater association with consumption than others.

5.4. A Diversity of views: a diversity of consumers?

During and after the sudden collapse of the rural economy during Perestroika in the early 1990s, saiga meat served as a crucial protein source for the most vulnerable, earning its title as 'the meat for the poor' (Kuhl et al., 2009). Indeed perceptions of price show that the majority of respondents considered saiga meat as cheaper than other domestic meats – a perception that matches reported prices from the villages. People tended to rank saiga meat as healthier than three other readily available meats, supporting a notion that pre-existing ideas surrounding saiga meat as a 'survival meat' and a remedy for ailments are still embedded in rural Kalmykia. Sentiments such as, 'if you are sick then you are permitted to eat saiga despite its illegality', were shared by some people. Indeed, wild ungulate meat has been shown to be a superior meat compared to domestic meats, with lower fat content and higher nutritional value (Crawford et al., 1970; Eltringham, 1984).

Some people alluded to saiga meat's superior tastiness over other meats; however the Kalmyk mutton, which is celebrated by both the Republic and neighbouring oblasts for its high quality, sat firmly in pole position at the end of the ranking exercise. Compared to older people, younger people within the study system thought of saiga meat as being 'tastier', relative to the other meats; which could be a result of social desirability bias, but is more likely to be a reflection of an emerging trend – saiga meat as a luxury food item for the rural rich and possibly, in urban markets. Saiga meat was sometimes referred to as a 'delicacy' and is considered more expensive in towns than in smaller, more rural, villages. Several key informants also mentioned a trend of increasing prices with increasing distance from the source. In other systems, wild meat has become a food source for townspeople or wealthier

sections of society; serving as a luxury food for a few, rather than a basic protein source for the masses (Mainka & Trivedi 2002).

Household ethnicity had no significant association with consumption prevalence, suggesting ongoing economic hardship in rural Kalmykia overrides pre-existing Kalmyk cultural norms which revere saiga as holy animals. It is also likely that some non-Kalmyks have forged strong spiritual connections with the steppe and wildlife.

> *"I choose to live in the steppe, it brings me peace [...] I see the saiga as a sacred animal and symbol of Kalmykia"*

> - A farmer, of Dagestani heritage, and a third generation immigrant to Kalmykia

5.5. Is eating saiga meat socially acceptable?

Saiga meat consumption and hunting were found to be sensitive topics (for example half of respondents refused to participate in the meat ranking exercise), widely recognised as prohibited by law, and often referred to as taboo in traditional Kalmyk culture (Waylen et al., 2012). This suggests that the prevailing normative beliefs surrounding hunting saiga and consumption are 'in line' with conservation aims. Indeed, the vast majority of people perceived that the wider community sees hunting saiga as an unacceptable behaviour (82%).

However individuals' perceptions of other people's social norms regarding saiga meat consumption were more variable, demonstrating a conflict of opinions. Whilst half of the people (47%) thought that most members in their community believe that 'eating saiga meat is a bad thing to do', a significant proportion of people either disagreed (27%) or remained neutral or not sure (20% combined). Interestingly, the study also revealed an association between people's perceptions towards the social norms and their consumption behaviour, suggesting a predictive linkage between perceived acceptability and non-compliance.

Fishbein and Ajzen (1975) argued that, underpinned by knowledge, the predictive strength between attitudes, social norms and perceived behavioural control on carrying out behaviours vary between contexts. Whilst this study did not directly consider attitudes towards consumption, previous research across saiga range states show that positive attitudes towards saiga and their conservation are sometimes overruled by poverty, leading to rule-breaking behaviour (Kuhl et al., 2009; Howe et al., 2011; Phillipson & Milner-Gulland, 2011). In general, the literature proposes that personal factors - e.g. attitudinal beliefs - are stronger predictors of behavioural intention than perceptions of social norms (see Armitage & Conner

2001 for a review). These results, however, suggest an association between divergent social norms and behavioural actions, i.e. to consume or not to consume. As common rules and social norms are important aspects of social capital (Pretty & Smith, 2004), these observed divisions could be indicative of depleted social capital and low community cohesion. This indication, combined with the social-network analyses provided by Dorward (2013), suggests, specifically, a lack of 'bridging' social capital – "the capacity of groups to make links with others that may have different views, particularly across communities" (Pretty & Smith, 2004).

The lack of multivariate analysis means that the relative predictive strength of social norms against other circumstantial factors, such as household poverty, for consumption behaviours could not be tested statistically. A third prong to Ajzen's theory of planned behaviour, which was formally addressed, is perceived behavioural control (i.e. 'I feel that I have no other choice but to eat saiga meat'). In this behavioural context, perceived behavioural control is probably linked to poverty and may well be a strong predictor of saiga meat consumption in Kalmykia and other range states (Ajzen, 1991; Terry & Hogg, 1996). The lower availability of meat types in villages compared to farms supports this hypothesis, as does a history of reliance on saiga meat for sustenance during extended periods of hardship.

> *"Tsagan Aav [The White Old Man] is an ancient shamanic deity and a Buddhist symbol. It is believed that if you are facing starvation, Tsagan Aav will present you with a Saiga for survival"*
>
> - An elderly Kalmyk woman from Khulkhutta

5.6. A pathway ahead

Damerell et al. (2011) completed a recent survey in Uzbekistan and Kazakhstan and found that community awareness events helped to re-align conflicting perceptions of social norms with pro-conservation outcomes. The Centre for Wild Animals of the Republic of Kalmykia (CWA), an independent organisation based out of Elista, collaborates with village schools and administrations within the study system organising awareness events (e.g. Saiga Days) and setting up children's clubs (e.g. Steppe Wildlife Clubs). If these initiatives were to involve the wider community, Saiga Days and other awareness events could provide a platform for bridging connections between different community members and re-aligning social norms surrounding consumption. According this study's findings and those of others (Leon, 2009; Khul et al., 2009), Khulkhutta and Erdnyevisky, and nearby villages such as Molodezhny,

should be targeted for awareness raising activities.

> *"Saiga Day needs a bigger venue… We need to do more to save our Kalmyk symbol for the next generation. Saiga is a living representative from the mammoth fauna era… This is a rare kind of animal that must not be lost."*

> \- A 16-year old girl, member of Yashkul's Steppe Wildlife Club 'Living Heritage'

Furthermore, through understanding how different groups of people perceive prevailing social norms towards consumption (e.g. farmers, hunters, officials), we may be able to identify towards which members of society awareness-raising initiatives could most usefully be focussed on. Hunters, in particular, are intimately connected with the environment and are probably most aware of the rules governing resource-use and the ongoing depletion saiga numbers (pers. obs.). Knowledge has been shown to underpin pro-environmental behaviours elsewhere (St John et al., 2010a; Keane et al., 2011; Fairbrass, 2012) exploring ways in which to engage the hunting community in future conservation initiatives would be a worthwhile exercise.

5.7. Final thoughts

The saiga antelope is a national treasure for the Republic of Kalmykia. However, market forces, corrupt governance and poverty are seemly driving the ongoing depletion of the pre-Caspian saiga population. Consumption of saiga meat in the rural districts of western Kalmykia is linked to poverty, for it remains cheaper than other domestic meat and is seemingly nutritious. In contrast, there is also evidence suggesting that saiga meat is sometimes sought after by richer sections of society and traded, albeit irregularly, in urban markets further afield. People's views of the different qualities of saiga meat are diverse, reflecting a range of values and pre-existing cultural norms. There is an apparent divergence in perceived social norms regarding saiga meat consumption, which in turn have some association with saiga consumption behaviours. Through acknowledgement of this diversity, and assimilation of the insights provided by this study, a base map is provided for researchers and practitioners to better navigate the complex context surrounding the scale, mechanisms, and social dimensions of the illegal harvesting and consumption of Kalmykia's national icon; the saiga antelope.

6. References

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7. Appendices

7.1. Questionnaire

English version

<div align="center">

Adult Household Questionnaire

</div>

Interviewer: _____

Date: _____

Village: _____ (**Sub-village:** _____)

Respondent Number:_____

Household Number:_____

COIN TOSS:

HEADS – BASELINE UCT CARDS

TAILS – TREATMENT UCT CARDS

"My name is Forrest. I am a Student from England. We are conducting a short questionnaire about the views of people in Kalmykia about the environment. The questionnaire will only take about 20 minutes.

If you choose to take part in the questionnaire, your name will not be recorded and your answers will not be shared with other members of the community or the authorities. Would you like to continue with the questions?"

[If **NO**, write gender and approximate age of respondent and FINISH HERE]

Gender: Male _____   **Age:** 18-25 _____

           Female _____   26-45 _____

                                       46-65 _____

                                       66+ _____

[If **YES**, write down time interview started]   **Start time:** _____

Section 1: Individual socio-demographic information (about respondent only)

1.1) Gender: Male/Female

1.2) Age: _____

1.3) Are you the head of household?   Yes _____ No _____

1.4) Ethnic group [tick one]

    Kalmyk   Russian   Chechen   Dagestani   Other (state):_____

1.5.) Ethnicity of household head……………………..

1.6) Level of education [tick one]

    a.   Primary

    b.   Secondary

    c.   University degree/higher education

d. None

1.7) What is your occupation *(tick as appropriate)*?
a) Working ☐ Please specify…………….
b) Unemployed (with profession) ☐ Please specify……………
c) Unemployed (no profession) ☐
d) State pension ☐
e) Student ☐
f) Homemaker ☐
g) Other ☐ Please specify…………..

Section 2) About your household (about household)

2.1) In this household:

Male_____ Female_____ Total _____

Adults (16-50)_____ Elderly (>50)_____ Children (<16)_____

2.2) Household structure

Relation to head	Sex	Age	Social status	Education Level

(Include Head of Household Job Type)

Social Status Options:
a. *working (please specify)*
b. *unemployed (no profession)*
c. *unemployed (profession–specify)*
d. *state pension*
e. *pupil*
f. *student*
g. *home-maker*
h. *other (please specify)*

Education Level Options:

a. *Primary*
b. *Secondary*
c. *University/College*
d. *None*

2.3) How many years has your household lived in this village/farm? _____

Section 3) Household Livelihoods and Assets (about household)

3.1) What is the current Employment Status of Household Head?
a. Full employment
b. Partial employment

c. Unemployed

3.2) Do you own livestock (including poultry)? YES / NO

Type of animal	Number	Subsistence or income

3.3) Does your household own any vehicles? YES / NO

Type of vehicle	Number	Age	Model
Motorbike			
Non off-road car			
Off-road car			
Bus, Minibus			
Tractor/Machinery			

Section 4) Unmatched Count Technique

I'm now going to ask you a series of question in a way which ensures that your answers remain anonymous. I will start with a question about TV to show you how the technique works.

6.1) I am going to show you a card with TV Shows. I am going to read their names and then I want you to tell me <u>how many</u> of these TV Shows you have watched over the past week? Please, <u>don't tell me which ones, just tell me HOW MANY. (Show Card)</u>

<div align="center">

1   2   3   4   5

</div>

*6.2) I am going to show you a card with outdoor activities. I am going to read their names and then I want you to tell me <u>how many</u> of these outdoor activities have you, or any member of household, has done over the **6 months**? Please, <u>don't tell me which ones, just tell me HOW MANY. (Show Card)</u>*

<div align="center">

1   2   3   4   5

</div>

*6.3) I am going to show you a card with food items. I am going to read their names and then I want you to tell me <u>how many</u> of these food items have you, or any member of household, eaten over **the last 6 months**? Please, <u>don't tell me which ones, just tell me HOW MANY. (Show Card)</u>*

<div align="center">

1   2   3   4   5

</div>

*6.4) I am going to show you a card with outdoor activities. I am going to read their names and then I want you to tell me <u>how many</u> of these activities have you, or any member of your household, has done over the **last year?** Please, <u>don't tell me which ones, just tell me HOW MANY. (Show Card)</u>*

<div align="center">

1   2   3   4   5

</div>

Section 5). Meat Ranking Exercise

4.1) Could you rank these different meats in order for the following criteria?

Meat Type	The most Expensive?	The best for health?	The tastiest?	The most commonly consumed in your village/area?
Mutton				
Beef				
Horse				
Saiga				

Comments……………………………………………

Section 6) Saigas and Social Norms (about-individual)

For this section there is no right or wrong answer, we are just interested in your opinion, please consider your answers carefully and honestly.

5.1) We would like you to respond to a collection of statements *(show card)*:

    a) I feel the same way about the importance of protecting saiga as other people in my village.

        Strongly disagree,   Disagree,   Neutral,   Agree,   Strongly Agree,   Not Sure

    b) Most adults in my community believe that hunting saiga is acceptable.

        Strongly disagree,   Disagree,   Neutral,   Agree,   Strongly Agree,   Not Sure

    c) Most adults in my community believe that eating saiga meat is a bad thing to do.

        Strongly disagree,   Disagree,   Neutral,   Agree,   Strongly Agree,   Not Sure

Section 7) Perceptions of drivers, and barriers to controlling, poaching

6.1) In your opinion, what is the greatest current threat to the saiga in Kalmykia *(tick one only)*?
        a. Extreme weather   ☐
        b. Development and infrastructure   ☐
        c. Hunting by people   ☐
        d. Predation (e.g. by wolves)   ☐
        e. Lack of Grass   ☐
        f. Other *(please state)*……………………………………… ☐

6.2) Thinking about Saiga, what might be the top reason (mark with a star) and supplementary reasons (tick as many as desired) for hunting this species (show card)?

        a. As a main source of income

        b. To supplement other sources of income

        c. To supplement Household diet

        d. Tradition/cultural importance

        e. Recreation

6.3) Which factors might encourage hunting (show card)? Please give the top reason, and any other additional reasons.

        a. Unemployment *(e.g. lack of other livelihood options)*

        b. Insufficient law enforcement

        c. Lack of legal protection (e.g. the penalties are too low)

        d. Social influence (e.g. hunting is seen as a normal thing to do by some people)

        e) Other (please state). _____

Thank you very much for participating in our questionnaire. Do you have any further comments on the questions covered?

        Finish time_____

_____

Russian Version

Interviewer: _____
Date: _____
Village: _____   **(Sub-village:** _____)
Respondent Number:_____
Household Number:_____

COIN TOSS:

HEADS – BASELINE UCT CARDS

TAILS – TREATMENT UCT CARDS

"Меня зовут Форест. Я студент из Англии.Я провожу опрос среди местного населения в Калмыкии ,чтобы узнать их мнения об окружающей среде. Это займет примерно 20 минут.

Если вы согласитесь принять в нем участие, то ваше участие будет абсолютно анонимным и ваши ответы не будут нигде опубликованы или переданы другим жителям или представителям органов

власти. Вы хотели бы продолжить отвечать?"

[если нет, укажите пол и приблизительный возраст респондента и завершите опрос]

пол: муж _____   **возраст:**   18-25 _____

       жен _____   26-45 _____

       46-65 _____

       66+ _____

[если да, отметить начало опроса]   **время старта:** _____

Section 1

(только отвечающий)

1.1) Пол: муж /жен

1.2) Возраст: _____

1.3) Являетесь ли Вы главой семьи?   Да _____   Нет _____

1.4) Этническая группа [отметьте один]

калмык   русский   чеченец   дагестанец   другая (укажите):_____

1.5) Уровень образования [отметьте один]

1.начальный

2.средний

3.высшее\среднеспец

4.без образования

1.6) Ваш род занятия (укажите)

1. работает (профессия)
2.не работает (нет профессии)
3.не работает (имеет профессию)
4.пенсионер\ка
5. школьник
6. студент
7.домохозяйка
8.иное (пожалуйста,укажите)

Section 2

2.1) В данной семье:

муж_____ жен_____ всего1 _____

взрослые (16-50)_____ пожилые (>50)_____ дети (<16)_____

2.2) состав данной семьи

Отношение к главе семьи	пол	возраст	Социальный статус	образование

Варианты для ответа на вопрос о соц. статусе
1. работает (профессия)
2.не работает (нет профессии)
3.не работает (имеет профессию)
4.пенсионер\ка
5. школьник
6. студент
7.домохозяйка
8.иное (пожалуйста,укажите)

Уровни образования*:*

1.начальное
2 среднее
3.высшее /среднеспец.
4.без образования

2.3) сколько лет ваша семья проживает в данном селе\стоянке? _____

Section 3

3.1) Текущее состояние занятости главы семьи?

1.Полная занятость

2.Частичная занятостьPartial employment

3.Не работает_____

3.2) Есть ли у вас домашний скот (включая домашних птиц)? Да /Нет

Виды животных	численность	Для продажи,собственного употребления, или то и другое

3.3) есть ли в семье собственный транспорт? Да /Нет

Вид транспорта	количество	возраст	марка
Мотоцикл			
Легковой автомобиль			
Внедорожник			
Автобус, микроавтобус			
Трактор/сельхозмашины			

Section 4

Я задам ряд вопросов, ваши ответы останутся анонимными. Я начну с вопроса о телепрограммах.

4.1) Я покажу список телешоу. Укажите ,СКОЛЬКО из этих программ вы просмотрели за прошлую неделю? Пожалуйста, не называйте, какие именно, просто укажите их **КОЛИЧЕСТВО** *. (Show Card)*

1   2   3   4   5

4.2) Я покажу вам список видов деятельности на открытом воздухе .Укажите, СКОЛЬКО из перечисленных видов выполнили вы , или кто-то из членов семьи за **прошедшие 6 месяцев**? *Пожалуйста, не называйте, какие именно, просто укажите их* **КОЛИЧЕСТВО**. *(Show Card)*

<div align="center">1   2   3   4   5</div>

*4.3) Я покажу список продуктов. Укажите, СКОЛЬКО из перечисленных продуктов ели вы , или кто-то из членов семьи за **прошедшие 6 месяцев**? Пожалуйста , не называйте , какие именно, просто укажите их **КОЛИЧЕСТВО** . (Show Card)*

<div align="center">1   2   3   4   5</div>

*4.4) Я покажу список видов деятельности на открытом воздухе. Укажите, СКОЛЬКО из перечисленных видов выполнили вы или кто-то из вашей семьи за **прошедший год?** Пожалуйста, не называйте, какие именно, просто укажите их **КОЛИЧЕСТВО**. (Show Card)*

<div align="center">1   2   3   4   5</div>

Section 5

5) Распределите различные виды мяса в зависимости от отношения к ним жителей вашего села\района?

<div align="center">**Баранина, Говядина, Сайгачатина, Конина**</div>

- Самый дорогостоящий
- Самый полезный для здоровья
- Самый 'вкусный'
- Самый потребляемый

Section 6

Нас интересует только ваше личное мнение, пожалуйста, будьте внимательны и откровенны.

6) Как вы относитесь к следующим утверждениям?

Абсолютно не согласен -- Не согласен -- Нейтральное -- Согласен – Абсолютно согласен
Не уверен

a) Как и другие жители нашего села, я осознаю важность проблемы по охране сайгаков.

b) Большинство взрослого населения нашего села считает, что охота на сайгака допустима.

c) Большинство взрослого населения нашего села считает, что потребление мяса сайгака неприемлемо.

Section 7

7.1) Как Вы считате, какая самая большая угроза для сайгака в Калмыкии *(отметьте только один ответ)*?

      a. Изменение климата
      b. Развитие индустрии и инфраструктуры
      c. Охота
      d. Хищники (нпр., волки)
      e. Бедные пастбища
      f. Другое *(пожалуйста укажите)*…………………………

7.2) Что является главной причиной (одна) и второстепенными причинами охоты на сайгака?

1. Основной источник дохода

2. Дополнительный источник дохода

3. Дополнительная часть пищевого рациона

4. Традиция\часть национальной культуры

5. Развлечение

7.3) Что, по вашему, может стать причиной охоты на сайгака? Пожалуйста, укажите главную и второстепенные причины.

1. Безработица (недостаток средств к жизни)

2. Неудовлетворительная работа охотинспекторов

3. Недостаточная суровость соответствующих законов (напр. слишком мягкое наказание)

4. Общественное влияние (напр. некоторые считают охоту обычным явлением)

5. Иное (пожалуйста, укажите). _____

Большое спасибо за участие! Есть ли у вас какие-либо пожелания или дополнения к заданным вопросам?

7.2. Job categories used as an indicator for relative household wealth

Job category	Job types (*n*)	Rationale for categorisation based on personal observations and local knowledge
Farmer Owner (n=36)	Farm Owner (36)	Farmers Owners' are some of the wealthiest households in rural Kalmykia, usually owning multiple vehicle types and livestock
Professional (n=52)	Teacher (12), Lawyer (3), Doctor (5), Entrepreneur (4), Economist (3), Police (3), Fireman (6), Accountant (5), Vet (3), Village admin. (4), Engineer (4)	The 'Professional' bracket consists of relatively high salaried positions. Household heads are usually university educated. Vehicle ownership is high.
Skilled (n=67)	Farm technician (7), Ranger (4), Mechanic (6), Librarian (5), Communications (3), Civil servant (4), Security (5), Driver (17), Electrician (4), Blacksmith (3), Machine operator (6), Sports coach (3)	The skilled bracket consists of tradesmen, such as mechanics, electricians and operators. It also included relatively lower salaried (compared to the 'professionals') positions such as librarians, security, and civil servants. 'Driver' was included in skilled position as most owned good vehicles and were wealthier relative to unskilled bracket.
Unskilled (n=40)	Farmhand (26), Labourer (9), Cleaner (3), Hunter (2)	The unskilled bracket included by low skill and paid positions that were often temporary. Hunter was included as both households were observably poor (relative to the skilled category).
Pensioner (n=36)	NA	Pensioner' household wealth varied substantially, as pensions and livestock ownership differ between occupants. Therefore, pensioner was separated out into its own category.
Unemployed (n=36)	NA	As expected, households headed by an unemployed member were, generally, the poorest relative to all other categories. Some similarities are drawn with the 'unskilled' category - low standards of living, low vehicle ownership and low livestock ownership.
Unknown (n=13)	NA	NA

]

7.3. UCT Cards

('Behaviour of interest' emboldened for clarity)

Card 1 TV Shows

(English)

[Control]	[Treatment]
Local news	Local news
Who wants to be a millionaire?	**Let them talk**
Good night kids	Who wants to be a millionaire?
Guess the melody	Good night kids
	Guess the melody

(Russian)

[Control]	[Treatment]
Местные новости	Местные новости
Кто хочет стать миллионером?	**Пусть говорят**
Спокойной ночи, малыши	Кто хочет стать миллионером?
Угадай мелодию	Спокойной ночи, малыши
	Угадай мелодию

Card 2. Hunting

(English)

[Control]	*[Treatment]*
Fishing	Fishing
Grocery Shopping	Grocery Shopping
Archery	**Hunting**
Yard maintenance	Archery
	Yard maintenance

(Russian)

[Control]	[Treatment]
Рыбалка	Рыбалка
Покупки	Покупки
Стрельба из лука	**Охота**
Хозяйственные работы по двору	Стрельба из лука
	Хозяйственные работы по двору

Card 3: Meat Consumption

(English)

[Control]	[Treatment]
Mutton	Mutton
Goat	**Saiga**
Wild duck	Goat
Pork	Wild duck
	Pork

(Russian)

[Control]	[Treatment]
Баранина	Баранина
Мясо коз	**Сайгачатина**
Дикая утка	Мясо коз
Свинина	Дикая утка
	Свинина

Card 4. Poaching

(English)

[Control] Hunting for Wild Duck Breeding Cattle Grocery Shopping Yard Maintenance	*[Treatment]* Hunting for Wild Duck Breeding Cattle Grocery Shopping **Hunting for saiga** Yard Maintenance

(Russian)

[Control] Утиная охота Разведение скота Покупки Хозяйственные работы по двору	*[Treatment]* Утиная охота Разведение скота Покупки **Охота на сайгака** Хозяйственные работы по двору

7.4. Key Informant Interview preparation sheet

Key Informant Interview Guideline (adapted from Phillipson & Milner-Gulland, 2011)

Herein lies a rough guideline of topics to cover throughout the interview. The interview should be informal and conservational, not question and answer based. The aim is to allow the informant cover ground that he/she is comfortable with and knowledgeable on.

SECTION A) General Practice/behaviour
1. Which species are hunted in this area?
    a. Why? (*could include abundance, ease, economic importance, etc*)

Type of Species	Reason for Hunting	Hunting Method Used	Months of Year hunted

2. Generally, are these species as easy to hunt each year? (*here, referring not to cryptic nature but to perceptions of changes in abundance...*). If there are changes, what might have caused them? How might this effect hunting behaviour?
3. Does season play an important role in any of these hunting practices? If yes, why?
4. How many times per week (month?) do people hunt (on average)?
5. Do people hunt alone or in groups for these species?
6. If in groups, how many people would there be in a group?
7. Do people hunt for personal consumption or sale?
8. Do people hunt for someone else outside of the household (e.g. to order for middlemen)?
9. If yes, for whom (how often, why, where, etc)?

SECTION B) Saiga-Related
Trade-Meat
10. Could you describe the trade in saiga meat? Please consider what percentage of meat is consumed in local households,
11. The reasons for this,
12. The percentage sold in the village compared to outside,
13. The location of these outside markets,
14. How it is sold (publically or privately),
15. Who is involved and at what level (middlemen, outsiders or locals),
16. What kinds of the kinds of people take part in these activities?
    a) Ethnicity
    b) Occupation
    c) Gender
    d) Age
    e) Education
    f) income levels
    g) social status
    h) other

17.What are the trades routes, both regionally and nationally?
18. How it is transported,
19. Prices at different levels of the trade and
20. These prices in relation to livestock prices.
Trade-Horn
21. Could you describe the trade in saiga horn? Please consider how it is sold (publically or privately),
22. Who is involved and at what level (middlemen, outsiders or locals),
23. What kinds of people take part in these activities? a) Ethnicity b) Occupation c) Gender d) Age e) Education f) Income levels g) Social status h) other
24. What are the trade routes both regionally and internationally
25. How it is transported and,
26. Prices at these different levels of the trade
Hunting Saiga
27. How far from the village do people travel when hunting saiga?
28. How many saiga could be caught on a hunting trip (winter/summer)?
29. Could you describe in more detail the techniques and methods used (when, how, how often, how many people in a group, etc)?
30. Do people cross the any borders to hunt saiga?
31. Which animals are being hunted (if possible, please provide an overall off-take %)? Does this differ between seasons?

	Summer	Winter
Adult Male		
Adult Female		
Young of Either		

32. What kinds of people take part in these activities?
       a) Ethnicity
       b) Occupation
       c) Gender
       d) Age
       e) Education
       f) Income levels
       g) Social status
       h) Other

33. Have you noticed any changes to the quantity of the following in the last 5 years,
       a) saiga being hunted,
       b) meat being consumed locally,
       c) meat being traded in both the village and outside
       d) horn being traded?

34. If yes, how would you characterise these changes? What might be the reasons for these changes?

35. What might be the main causes of
       a) hunting,
       b) trading meat
       c) trading horn?

36. Are middlemen involved in the trade in horn or meat? Are they outsiders or locals? If outsiders, where do they come from? What kind of people are they?

37. Where, in your opinion, are saiga products either sold or purchased? What are the prices for horns and meat (per kg or piece)?

Type of location (market, rail roads, houses, etc)	Privately or publicly	Months product sold	Meat (animal/kg/currency)	Horn (kg/currency)

38. Do trade routes differ for different kinds of saiga product? In what way?

SECTION C) Law Enforcement

39. Are people aware that hunting and trade of saiga products is illegal?

40. Do people know that it is listed in the Red Book of Uzbekistan?

41. If yes, what kind of effect does the saiga hunting and trade ban (and the listing of the species in the red book) have on hunting and trading behaviour.

42. What kind of effect does law enforcement, or those rules and regulations that refer to saiga, have on hunting and trade behaviour?

43. How do locals perceive general wildlife-related law-enforcement here?]
44. What measures should the state take that might reduce the illegal hunting of saiga?

45. What measures should be taken to reduce the illegal trade in saiga products?

46. How might hunters and traders themselves be convinced to stop this hunting and trading saiga?

SECTION D) Demographic Information

Age	Gender	Ethnicity	Occupation

7.5. Key informant IDs and demographic summary

Key Informant ID	Village Location	Gender	Ethnicity	Occupation
K101	Yashkul'	Male	Kalmyk	Ex-sheep breeder
K102	Yashkul'	Male	Kalmyk	Ranger (CZBR)
K103	Adyk	Male	Kazakh	Farmer
K104	Komsomolsky	Male	Kalmyk	Reserve Officer (CZBR)
K105	Komsomolsky	Male	Kalmyk	Scientist
K106	Komsomolsky	Male	Kalmyk	Policeman
K107	Khulkhutta	Female	Kalmyk	Pensioner
K108	Khulkhutta	Male	Kazakh	Unemployed
K109	Khulkhutta	Female	Kazakh	Farm Owner
K110	Khulkhutta	Female	Kalmyk	Farm Owner
K111	Erdniyevsky	Male	Kalmyk	Hunter
K112	Erdniyevsky	Male	Russian	Farmhand (ex-poacher)
K113	Erdniyevsky	Male	Kalmyk	Village administration
K114	Erdniyevsky	Male	Kalmyk	Driver
K115	Erdniyevsky	Male	Kazakh	Farmer Owner (hunter)
K116	Utta	Female	Russian	Pensioner
K117	Utta	Female	Kazakh	Village administration
K118	Farms (Cherne Zemyli)	Male	Kazakh	Farm Owner
K119	Farms (Cherne Zemyli)	Male	Kalmyk	Farmhand
K120	Farms (Cherne Zemyli)	Male	Kalmyk	Farm Owner
K121	Farms (Cherne Zemyli)	Male	Dagestani	Farmhand (ex-poacher)
K122	Farms (Cherne Zemyli)	Male	Dagestani	Farm Owner

7.6. Response rates for the ranking exercise between household variables

Ranking Criteria	chi-squared value	DF	p value	Direction
Job Type (N=7)	Response Rate to Price Ranking	13.6099	6	0.034**
	Response Rate to Health Ranking	8.7646	6	0.1873
	Response Rate to Taste Ranking	9.302	6	0.1573
	Response Rate to Commonality Ranking	11.36327	6	0.078*
Village (N=7)	Response Rate to Price Ranking	27.0974	6	0.0001***
	Response Rate to Health Ranking	22.297	6	0.001***
	Response Rate to Taste Ranking	16.6322	6	0.01073**
	Response Rate to Commonality Ranking	19.6551	6	0.003189***
Location (Steppe, Village, Town)	Response Rate to Price Ranking	16.1218	2	0.0003156***
	Response Rate to Health Ranking	13.3529	2	0.00126***
	Response Rate to Taste Ranking	8.289	2	0.01585**
	Response Rate to Commonality Ranking	11.1154	2	0.003858***
Ethnicity of Household Head (Kalmyk, Other)	Response Rate to Price Ranking	0.0236	1	0.8779
	Response Rate to Health Ranking	0.0402	1	0.8412
	Response Rate to Taste Ranking	0.4149	1	0.519
	Response Rate to Commonality Ranking	0.0858	1	0.7696

(* significant to p=<0.1, ** significant to p=<0.05, *** significant to p=<0.01)

7.7. Tested differences between control group and treatment group to satisfy the first assumption of UCT experiments: assignment to groups is random

Control group versus Treatment group			
Household Variable	chi-squared value	DF	p value
Job type	6.53	5	0.36
Ethnicity	0.71	1	0.40
Location type	0.53	2	0.77
Village	2.38	5	0.79
Residency time	0.00	1	1.00

7.8. UCT counts for three sensitive behaviours

	Saiga meat consumption				Hunting				Saiga Poaching			
	Control Group		Treatment Group		Control Group		Treatment Group		Control Group		Treatment Group	
Response Value	Frequency	Proportion	Frequency	Proportion	Frequency	Proportion	Frequency	Proportion	Frequency	Proportion	Frequency	Proportion
0	1	1	1	1	0	0	0	0	0	0	3	2
1	35	25	18	13	24	17	11	8	13	9	10	7
2	85	60	78	56	86	61	87	62	74	52	67	48
3	16	11	32	23	30	21	27	19	50	35	54	38
4	4	3	8	6	1	1	14	10	4	3	5	4
5			2	1			0	0			0	0
Total	141		139		141		139		141		139	

7.9. Model parameters for Ethnicity of household head and prevalence of saiga meat consumption.

	Dependent variable: UCT counts for meat types consumed	
Intercept	1.887^{***} (0.079)	
Treatment	-0.153 (0.240)	
Ethnicity of Household Head:		*Interaction between ethnicity and treatment status:*
Kalmyk	*Ref.*	*Ref.*
Non-Kalmyk	0.068 (0.141)	-0.052 (0.196)
Observations		280
R^2		0.047
Adjusted R^2		0.036
Residual Std. Error		0.774 (df = 276)
F Statistic		4.501^{***} (df = 3; 276)
Note:		*p**p***p<0.01

7.10. Model parameters for Household size and prevalence of saiga meat consumption

	Dependent variable: UCT counts for meat types consumed	
Intercept	1.727^{***} (0.153)	
Treatment	0.455^{**} (0.222)	
Household size:		*Interaction between house size and treatment status:*
Household size	0.049(0.038)	-0.032(0.056)
Observations		280
R^2		0.052
Adjusted R^2		0.042
Residual Std. Error		0.772 (df = 276)
F Statistic		5.076^{***} (df = 3; 276)
Note:		*p**p***p<0.01

7.11. Model parameters for Household size residency prevalence of saiga meat consumption

	Dependent variable: UCT counts for meat types consumed	
Intercept	1.920*** (0.077)	
Treatment	0.282** (0.110)	
		Interaction between residency time and treatment status:
Residency time:		
Residency (>20 years)	*Ref.*	*Ref.*
Residency (<20 years)	-0.042 (0.143)	0.190 (0.204)
Observations		280
R^2		0.050
Adjusted R^2		0.039
Residual Std. Error		0.773 (df = 276)
F Statistic		4.809*** (df = 3; 276)
Note:		*p **p ***p<0.01

7.12. Chi square results for testing demographic variables against social norm response to saiga meat; "Agreement" groups and "Non-agreement group"

'most adults in my community believe that eating saiga meat is a bad thing to do'				
Individual-level Variable	**chi-squared value**	**DF**	**p value**	**Direction**
Age	1.38	2	0.501	*No significance*
Gender	2.17	1	0.099*	*Women more likely to agree with the social norm than men*
Education	1.14	2	0.566	*No significance*
Head	0.14	1	0.711	*No significance*
Born Local	0.35	1	0.554	*No significance*
Ethnicity	0.73	1	0.393	*No significance*
Social Status	1.62	4	0.805	*No significance*
Household-level variable	**chi-squared value**	**DF**	**p value**	**Direction**
Job type of Household Head	3.75	5	0.586	*No significance*
Village	6.50	5	0.370	*No significance*
Location	0.39	2	0.821	*No significance*
Ethnicity of Household Head	0.35	1	0.552	*No significance*
Residency Time	0.11	1	0.943	*No significance*