



Assessing Motivations for the Illegal Killing of Lesser White-fronted Geese at Key Sites in Kazakhstan (2017)

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AEWA Lesser White-fronted Goose International Working Group

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Photo on cover:

Conducting questionnaire surveys in rural north-western Kazakhstan. © Isabel Jones

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Executive summary

The Lesser White-fronted Goose (LWfG) is a globally threatened migratory species (Jones et al., 2008). North-western Kazakhstan hosts important staging grounds for the autumn and spring LWfG migration (Cuthbert and Aarvak, 2016; Yerokhov, 2013). Hunting is a primary driver of declining LWfG populations, but the motives behind illegal LWfG hunting are currently unknown (Jones et al., 2008; Madsen et al., 2015).

In September and October 2017, questionnaire surveys were developed and deployed with the Association for the Conservation of Biodiversity in Kazakhstan (ACBK). The aim was to identify the social, economic and demographic drivers for goose hunting in general and illegal hunting of LWfG in particular. Since there is also potential for accidental hunting of LWfG, this can enable conservation work to be targeted towards demographics most responsible for goose hunting. Surveys were conducted by two teams across Northern Kazakhstan and Kostanay Regions, with a total of 189 people responding in full to the questionnaires.

Questionnaires employed the Unmatched Count Technique (UCT) which is an effective technique when attempting to elucidate patterns of human behaviour relating to socially sensitive activities including illegal hunting (Nuno and St. John, 2015). We assessed the ability of the UCT to detect patterns in human behaviour with low sample sizes, by testing whether goose hunting prevalence increased with goose hunting licence ownership. As expected, ownership of hunting licences was a significant predictor of increased goose hunting prevalence, and confirmed the method's validity for asking sensitive questions regarding hunting. To investigate potential illegal goose hunting we asked if respondents had undertaken goose hunting during the spring/summer season. Waterbird hunting was banned in spring/summer from 2017, and therefore we tested compliance levels with this new legislation. We found no evidence of non-compliance among our survey respondents, and thus no evidence for illegal goose hunting during the spring/summer season. However, our sample sizes were smaller than expected and even though the validation suggested the method worked successfully, this result should be interpreted with caution.

Using direct questioning we found strong evidence suggesting that there is a significant lack of knowledge regarding whether LWfG are protected or not, including respondents who owned goose hunting licences: 11 % of respondents owning a goose hunting licence did not know LWfG were protected. Given that there are an estimated 10,000 hunters in north-western Kazakhstan (Yerokhov, 2013) we therefore estimate that potentially over 1000 hunters, with goose hunting licences, may be unknowingly illegally hunting LWfG through lack of knowledge of species protection.

Our analysis revealed that hunting for cash was not found to be a motivator for goose hunting. However, we stress that the majority of our survey respondents were likely to be engaging in legal goose hunting, and therefore identifying motives for illegal hunting remains a challenge mainly due to the highly dispersed nature of hunters across the landscape. We were also not able to ask questions about accidental illegal hunting of LWfG because it was deemed to be too sensitive. Future work should focus on increasing survey sample size and adding additional questions regarding self-reporting of hunting take and accidental take of LWfG. Questionnaires should also be developed across the LWfG flyway as motives for hunting will likely differ between geographic regions due to differing socio-economic and socio-ecological situations.

Acknowledgements

The project, expedition and field data collection could not have been undertaken without the support from a number of individuals and organisations. We would like to thank Nina Mikander from the UNEP/AEWA Secretariat for continuous support surrounding the initial development of this project, and arranging fieldwork with ACBK in Kazakhstan. Special thanks go to Alexey Timoshenko, Ivan Zuban, Konstantin Zhadan, and Murat Baidildin for organising fieldwork logistics and conducting the questionnaire surveys. Thanks also to Sergey Pasechniy and Valeriy Odincev for being drivers, mechanics and field team supporters. Funding for this project was generously provided by the Norwegian Environment Agency and the Finnish Ministry of Environment.



ACBK and Stirling University colleagues in the field © Isabel Jones

1. Introduction

The African-Eurasian Waterbird Agreement (AEWA) recognises that hunting of migratory waterbirds across range states is legitimate, provided that populations are maintained in ‘favourable’ conservation status across their entire range. Illegal hunting jeopardises the efficacy of hunting legislation aimed at achieving sustainable hunting levels for migratory species, and threatens those species with vulnerable populations such as the Lesser White-fronted Goose (Jensen et al., 2016; Jones et al., 2008; Madsen et al., 2015). Thus, it is essential to understand the motives behind illegal hunting to ensure that appropriate interventions can be implemented to ensure the longevity of migratory waterbird populations across range states (Madsen et al., 2015).

1.1 Assessing motives for illegal hunting

Understanding human decision-making is key when trying to assess motives for illegal hunting (St John et al., 2013). Social surveys are often used as a means of directly questioning individuals about illegal activity, however, individuals may not wish to respond or may provide false answers to conform to desirable social behaviour (Nuno and St. John, 2015). In order to overcome these factors, ‘specialised questioning techniques’ have been developed to increase respondent willingness to answer questions relating to sensitive topics and improve respondent honesty (reviewed in Nuno and St. John, 2015). Techniques such as the Unmatched Count Technique (UCT; Droitcour et al., 1991) are being increasingly used in conservation settings, including for asking questions relating to illegal hunting (Nuno et al., 2013; Whytock et al., 2018).

The UCT can be used in combination with direct questioning, to gain information on both the sensitive topic and other important variables such as demographic information, which may help to explain the prevalence of the illegal activity (Nuno et al., 2013; Nuno and St. John, 2015; Whytock et al., 2018). The UCT is simple for respondents to understand and generates data which can be statistically modelled with potential explanatory variables. Crucially, the UCT generates fully anonymised data, and protects both the respondent and the interviewer from knowing whether the respondent has engaged in the sensitive activity (Nuno and St. John, 2015).

1.2 The Lesser White-fronted Goose

The Lesser White-fronted Goose (henceforth LWfG; *Anser erythropus*) is a small long-distance Palearctic migrant, which breeds discontinuously from Scandinavia to eastern Siberia. LWfG have variable, and only partially-known migration routes from northern breeding grounds to the Mediterranean via key staging areas in Central Asia and Europe (Aarvak and Øien, 2003; Jones et al., 2008; Lorentsen et al., 1998; Marchant and Musgrove, 2011). The forest-steppe and steppe regions of north-western Kazakhstan are particularly important for migrating LWfG (Yerokhov, 2013), and it has been estimated that up to 50 % of the critically endangered Fennoscandian LWfG population and the entire Russian Western Main subpopulation of LWfG pass through north-western Kazakhstan in a 3-5 week period in autumn (Cuthbert and Aarvak, 2016; Fox et al., 2010; Jones et al., 2008); the Western main LWfG population also migrates back through Kazakhstan in the spring (Jones et al., 2008; Yerokhov, 2013).

The global population of LWfG has declined rapidly since the middle of the 20th Century, with breeding grounds becoming increasingly fragmented, and important habitats lost (Fox et al., 2010; Jones et al., 2008). The species is globally threatened and is recognised as ‘vulnerable’ by the IUCN (IUCN, 2017). In Kazakhstan, the LWfG is considered to be threatened with extinction and has been included in the national Red Data Book since 2002 (Yerokhov, 2006). The International Single Species Action Plan for LWfG states that hunting and habitat loss are the main threats to LWfG (Jones et al., 2008).

1.3 Hunting in Kazakhstan

Legal hunting

The forest-steppe and steppe regions of Kazakhstan have numerous lakes and wetlands, which are among the most extensive and important in Central Asia for waterbirds including geese, ducks and swans (Anatidae; Yerokhov, 2006). Hunting is popular in Kazakhstan, with separate hunting seasons for different hunting species designated throughout the year (Fig. 1). There are approximately 10,000 hunters in north-western Kazakhstan (Yerokhov, 2013). Hunters are often part of official hunting clubs located in rural towns and villages. The ‘Mistral’ hunting club in Kostanay Region, for example, has ~350 members who hunt every weekend during hunting seasons, and also attracts international hunters.

The regional hunting quota is decided by local authorities depending on estimated species populations, and can vary between years and among regions. Hunters can purchase licenses on a ‘first come first served’ basis, until the regional hunting quota is reached. A typical waterbird hunting licence for five ducks and one goose is in the region of T10 000 (US\$30). Licences state the quota of animals permitted to be killed, and hunters are required to self-report the take of each species on each hunt by recording this information on licences. Most hunting is undertaken for personal meat consumption, however, in some areas of high unemployment some bartering or selling of wild meat may occur.

Skilled hunters can shoot between one to three geese in two to three hours, which can increase to eight to ten birds under favourable conditions (Yerokhov, 2013). LWfG fly in mixed flocks with White-fronted Geese and Greylag Geese (Cuthbert and Aarvak, 2016), both of which are permitted to be hunted. LWfG are hard to distinguish from White-fronted Geese in flight, opening up the possibility for accidental (and illegal) killing of LWfG. Indeed, inspections of hunters’ bags between 1996 and 2001 revealed that between one to three LWfG were shot for every 100 Greylag or White-fronted Geese. However, in the Arkalyksky area of Kostanay Region, the rate of offtake of LWfG was much higher at one LWfG per 20-30 Greylag or White-fronted Geese (Yerokhov, 2013).



Fig. 1: Schematic of the annual cycle of hunting seasons in Northern Kazakhstan and Kostanay Regions. Schematic developed with information from the Association for the Conservation of Biodiversity in Kazakhstan (ACBK).

Illegal hunting

Hunting inspectors patrol 10,000 ha blocks with one inspector responsible for ~3000 ha in north-western Kazakhstan. Patrols are carried out every day in the mornings and evenings when hunters are likely to be heading into the field or returning, with patrols focussing on the most popular hunting sites. Hunting inspectors check hunters' licences and whether the hunter is complying with quotas. However, hunting inspectors can only check inside the hunting bag if a member of the police is also present. If hunters are caught illegally hunting then they are fined and if found hunting a red-listed species they face imprisonment. It is currently unknown what the motivations are behind illegal hunting of migratory waterbirds in Kazakhstan. Understanding potential drivers of illegal hunting is essential if appropriate measures to reduce illegal activity are to be implemented, in order to achieve sustainable hunting practices (Madsen et al., 2015).

1.4 Study aims

In this study, we aimed to begin to identify the motivations behind illegal killing of LWfG in key sites in Kazakhstan. We used questionnaire surveys involving direct questioning and the Unmatched Count Technique (Nuno and St. John, 2015) to understand the hunting system – both legal and potentially illegal – across the north-western LWfG staging grounds. Questionnaires were developed in Kazakhstan with representatives from the Association for the Conservation of Biodiversity in Kazakhstan (ACBK) to ensure that questions were appropriate to the study system. We asked questionnaire respondents about the types of hunting licence they owned, and the quotas permitted on licences. In addition, we aimed to contextualise hunting in terms of demographic information of respondents e.g. age and employment status, and the level of knowledge regarding the hunting protection status of key waterbird species, including LWfG. By using the UCT we aimed to statistically test the potential drivers of goose hunting, including demographic variables, hunting licence ownership, and species protection knowledge.

We tested the efficacy of the UCT in picking up signals of hunting activity in this study system by asking two questions which were highly likely to result in a positive signal of increased goose hunting prevalence. We hypothesised that 1) owning a waterbird hunting licence would increase the prevalence of goose hunting over a 12 month period, and 2) goose hunting prevalence would increase in the autumn/winter, when hunting waterbirds is legally permitted (Fig. 1). From 2017, Kazakhstan banned waterbird hunting during the spring and summer (Fig. 1). Thus, we aimed to assess the degree of non-compliance of hunters with this change in law, and whether demographic variables and knowledge of species' hunting protection status increased the prevalence of illegal goose hunting activity during the spring/summer hunting ban: we therefore hypothesised that 3) lack of knowledge of species' hunting protection status would lead to a positive signal of increased goose hunting prevalence during the spring/summer, and thus non-compliance with the spring/summer waterbird hunting ban. Finally, we aimed to assess if one of the potential drivers for goose hunting – both legal and illegal – was for financial gain, and hypothesised that 4) goose hunting is undertaken for cash.

2. Methods

2.1 Study area

Surveys were conducted in rural north-western Kazakhstan across two regions that host key staging grounds for migratory LWfG, Northern Kazakhstan and Kostanay Region (Fig. 2; Cuthbert and Aarvak, 2016; Yerokhov, 2013). The forest-steppe and steppe landscape is characterised by a mosaic of lakes, agricultural land and forest patches with low human population densities. Small villages and isolated homesteads are scattered throughout the landscape. Waterbird hunting is permitted at selected lakes, with signs demarcating whether hunting is permitted or restricted.

2.2 Questionnaire surveys

Due to the highly dispersed nature of people across rural north-western Kazakhstan, in order to survey sufficient numbers of people and to guarantee that a high proportion of respondents were actually engaging in hunting (whether legally or potentially illegally), questionnaire respondents were recruited in two ways: opportunistically in villages, at lakes, and in agricultural land, or during a pre-arranged gathering of local hunters at a hunting club. Surveys were conducted in September and October 2017, during the legal water bird hunting season to ensure maximum interaction with hunters.

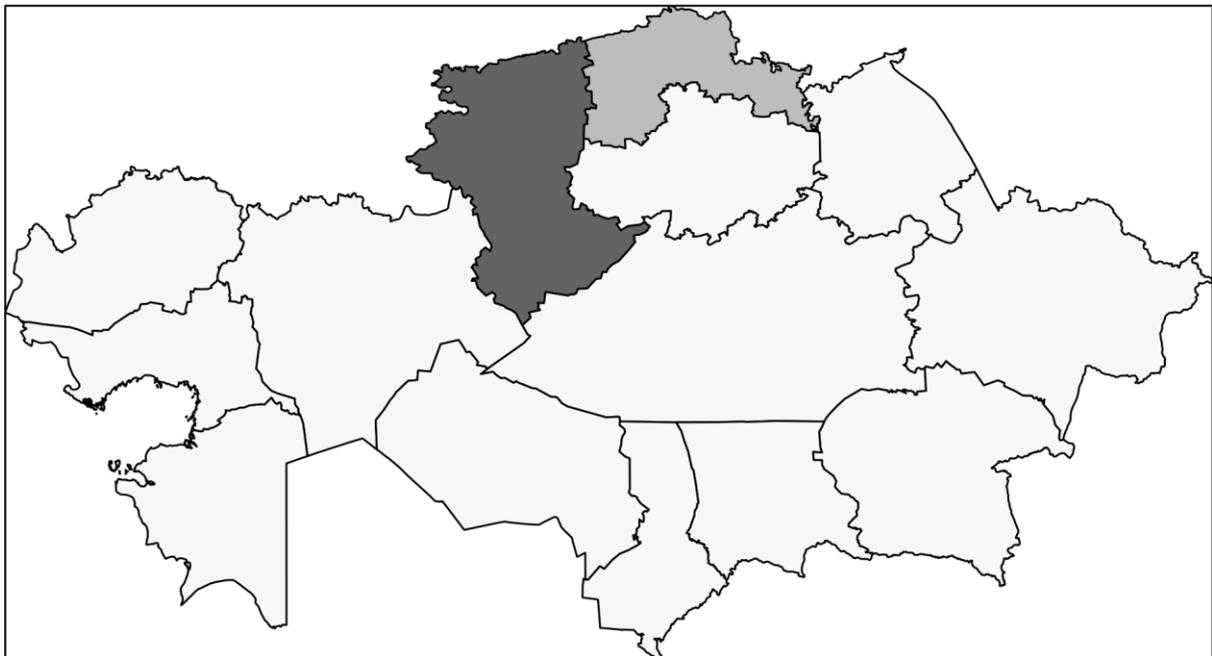


Fig. 2: Geographic location of study area in north-western Kazakhstan. Kostanay Region is denoted in dark grey, and North Kazakhstan in light grey. Questionnaires were conducted in 46 rural sites, with 188 people responding in full to questionnaires. Map created using data from GADM (Global Administrative Areas, 2017) using R package ‘sp’ (Pebesma et al., 2017).

Demographic information

Using direct questioning, we collected demographic information including ‘gender,’ ‘age,’ ‘ethnic group,’ and whether respondents were the ‘head of household,’ along with how many ‘years in formal education,’ ‘months employed in the past year,’ ‘number of adult males and females, and children in household,’ and lastly the ‘number of people in household in full-time, seasonal or no employment over past year.’

Hunting licences and quotas

To understand the prevalence of legal waterbird hunting among respondents, we asked respondents for information on the type of hunting licence they owned. For simplicity regarding hunting licence nomenclature, we use ‘ducks’ to indicate all other waterbird species permitted on licences (ducks form the majority of other waterbirds permitted to be hunted). Thus, respondents could own ‘goose and duck’, ‘only goose’ or ‘only duck’ licences, or own ‘no licence’. We also asked how many birds were permitted to be hunted on each licence. The number of birds permitted were variably reported by respondents, such that quotas <10 birds related to the hunting quota over a 3-5 day period; quotas >15 birds related to the total number of birds permitted for the whole season.

Knowledge-level regarding species’ hunting protection status

We assessed the knowledge-level of respondents relating to whether different waterbird species are permitted to be hunted or not. We asked respondents to answer ‘yes’ ‘no’ or ‘don’t know’ to whether Greylag Geese, Red-breasted Geese, Mute Swans and Goldeneye Ducks are protected i.e. are non-hunting species. Correct answers were awarded one point and the total score was summed for each respondent. Separately, we asked if LWfG were protected from hunting, with respondents categorised as ‘correct/incorrect’ based upon their answer.

Goose hunting prevalence

To ask questions regarding ‘sensitive’ topics such as illegal hunting, we employed the Unmatched Count Technique (UCT; Droitcour et al., 1991) which has previously been used in surveys of illegal hunting behaviour (Nuno et al., 2013; Whytock et al., 2018). The UCT involved respondents being shown a list of pictures of activities, and being asked how many of the activities applied to the particular question being asked. Respondents were randomly assigned ‘control’ or ‘treatment’ activity lists by tossing a coin. Control and treatment activity lists included four non-sensitive activities: ‘farming or herding,’ ‘driving a taxi,’ ‘construction’ and ‘milking cows.’ Treatment activity lists included the non-sensitive activities, with the addition of the sensitive activity ‘hunting geese.’ During development of the questionnaire with ACBK, it was decided that including ‘hunting Lesser White-fronted Geese’ as the sensitive activity, was, in effect *too sensitive* with the strong possibility of respondents withdrawing from the questionnaire leading to a critical loss of data. Hunting geese with a permit is legal in Kazakhstan, therefore, to be able to capture potential illegal hunting activity with the less sensitive ‘hunting geese’ option, we included a question regarding seasonality of hunting, as goose hunting is only legally permitted in the autumn (Fig. 1).

Activities were selected based on their relevance to the study system, such that each activity must have the possibility of being undertaken by the respondent. To avoid ceiling and floor effects i.e. respondents selecting all or none of the activities (Tsuchiya et al., 2007), both common and less common activities to both female and male respondents were selected. This was a particularly important consideration because if respondents within the ‘treatment’ groups selected five activities, then they would inadvertently reveal they have undertaken the sensitive activity. A key benefit of the UCT is that respondents do not state which activities they have undertaken, only how many. Therefore, both the respondent and interviewer are protected from knowing whether the sensitive activity has been undertaken (Nuno and St. John, 2015).

Respondents were asked four questions using the UCT: 1) How many of these activities have you done in the past year? 2) How many of these activities have you done in the autumn/winter (September-February)? 3) How many of these activities have you done in the spring/summer (March-August)? 4) How many activities have you done for cash? The UCT relies upon respondent willingness to participate and understanding of the technique being used. Thus, we also asked respondents if the questionnaire was easy to understand, if they felt anonymous, and whether they felt comfortable answering the questionnaire. The interviewer was also asked to assess the perceived level of respondent understanding, willingness and honesty. A sample copy of the questionnaire and activity lists are included in Appendix 1.

Ethics statement

Formal ethical review of the project and questionnaire was conducted by the General University Ethics Panel at the University of Stirling (application GUEP262). Any work involving people, and particularly vulnerable groups who may be involved with illegal activities, requires consideration of ethics. Key ethical considerations for this study included anonymising all data, including village names, to protect the identity of respondents who may have potentially been engaging in illegal activity (St. John et al., 2016).

2.3 Data analysis

All analyses were performed in R (version 3.4.2; R Core Team, 2017) using linear mixed effects modelling (LMM) and generalised linear mixed effects modelling GLMM (using R package ‘lme4’; Bates et al., 2017). Due to the low sample size for female respondents compared to males (23 and 166 respectively), and as hunting is almost exclusively undertaken by males, we omitted data from female respondents from statistical analyses. Similarly, some ethnic groups were represented by a single respondent (Table A2.1) and thus we did not include ‘ethnic group’ in statistical analyses. Due to relatively low numbers of respondents having single hunting licences (only goose or only duck) we combined these licences into a ‘single licence’ category to boost statistical power in analysis. Finally, due to the complexity surrounding whether bird hunting quotas were reported for either a 3-5 day period, or for the whole season, information on bird hunting quotas was omitted from statistical analyses.

We inspected co-linearity of predictor variables, and for any pair of co-linear variables ($r > 0.6$) we dropped the variable which explained the least variation in the response variable. Due to co-linearity with ‘number of people in full time employment’ we excluded ‘number of adult males’ ‘number of adult females’ ‘number of children’ and ‘number of people unemployed’ from analysis: a summary of predictor variables included in analyses is presented in Table 1. To account for pseudoreplication of data originating from the same site, ‘site’ was included as a random effect in models.

We generated all models with possible combinations of predictor variables using ‘dredge’ (R package ‘MuMIn’; Barton, 2017), with top models compared using AICc. If an interaction term was present in the model, models were only considered when the interaction term was included with its constituent fixed effects. Only variables included in top models with $\Delta AICc < 2$ were included in the final model. Model residuals were inspected for normality and final models were bootstrapped from 200 re-samples to generate 95 % confidence intervals. Predictor variables with confidence intervals not including zero were deemed to have a significant effect on the response variable.

Table 1: Summary of variables used in mixed effects modelling. For statistical analyses licences for only geese or only ducks were combined into a ‘single licence’ group.

Variable type	Variable	Description
Demographic	Age	Continuous (range = 18-77; mean = 45.8; sd = 13.4)
	Years formal education	Continuous (range = 8-30; mean = 13; sd = 3)
	Months employed	Continuous (range = 0-12; mean = 9.3; sd = 4.4)
	Number of people in full-time employment	Continuous (range = 0-9; mean = 2; sd = 1.5)
	Years in village	Continuous (range = 1-77; mean = 25.9; sd = 13.7)
Hunting licence	Licence type	Categorical (goose and duck, n = 55; only goose, n = 6; only duck, n = 9; no licence, n = 48)
Knowledge	Score of correct answers regarding species’ protection status	Continuous (range = 0-4; mean = 3; sd = 1)
	LWfG protection status	Categorical (correct, n = 108; incorrect, n = 58)

Knowledge-level regarding species’ hunting protection status

We used GLMMs to analyse the degree of respondent knowledge regarding species’ protection status. The total sum of correct knowledge answers was modelled with demographic variables and hunting licence type using a Poisson error structure (link = “log”). We modelled whether respondents correctly answered if LWfG were protected from hunting using a binomial error structure (link = “logit”) due to the inclusion of a categorical response variable.

Goose hunting prevalence

Prior to analysis of UCT data we tested for a ‘design effect’ whereby the addition of the sensitive activity in the treatment list influences responses to the control list using ‘ict.test’ (R package ‘list’; Blair et al., 2016). We found no evidence of a design effect ($P > 0.05$). We used LMMs to model n list items (number of activities undertaken), with predictor variables including demographic variables, degree of knowledge, and hunting licence type (Table 1). Two-way interactions between predictor variables and ‘survey group’ (control or treatment) were included to examine the effect of all variables, including the sensitive activity which only appears in treatment groups.

3. Results

A total of 197 people were approached in 46 sites across Northern Kazakhstan and Kostanay Regions, with 8 individuals (4 %) declining to participate in the survey. Interviews lasted 6 minutes on average (sd = 2.5). 166 males and 23 females were interviewed in full, with 80 respondents included in the ‘control’ and 109 in the ‘treatment’ groups. The majority (36 %) of respondents were Russian (Table A2.1), and the mean age of all respondents was 45 years (sd = 13.4). 97 % of the 188 respondents that participated in full said that the questionnaire was easy to understand, 95 % felt anonymous, and 92 % said they felt comfortable answering the questions. The perceived honesty of respondents was also high, with 90 % of respondents seeming to be very honest when answering questions.

Hunting licences

Hunting licences were owned by 42 % of male respondents (n = 70; no females owned a hunting licence), with the majority of licences being for both geese and ducks (Table 2). Of the respondents who owned licences, 87 % were legally allowed to hunt geese (n = 61). Three goose species (Greylag Goose, White-fronted Goose, and Bean Goose) and ten species of other waterbirds were listed on licences. Greylag Geese were the most common species to be listed on hunting licences (Fig. 3).

Table 2: Summary of male respondents and hunting licence ownership in treatment and control survey groups. Single licences (goose licence only and other bird licence only) were combined in analyses to give one ‘single licence’ level within the ‘licence type’ variable. No female respondents owned a hunting licence.

Survey group	Number of respondents	Goose and duck licence	Goose licence only	Other bird licence only	No licence
Control	64	23	2	4	18
Treatment	102	32	4	5	30

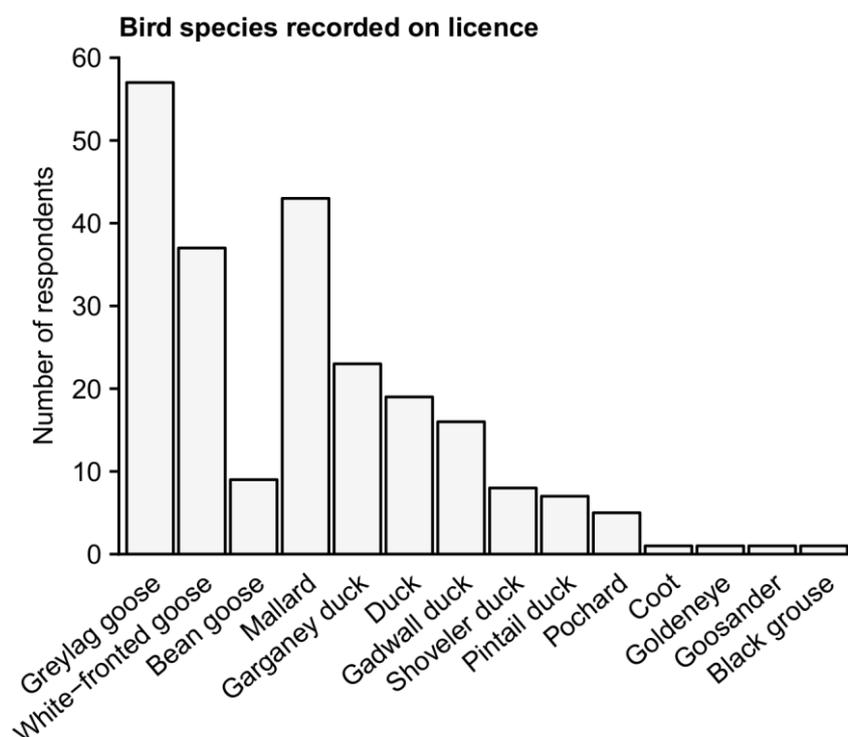


Fig. 3: Species of birds listed on hunting licences owned by survey respondents. Note that the White-fronted goose is the Greater White-fronted goose, which is permitted to be hunted with a licence.

Hunting quotas were given as either numbers of birds allowed per 3-5 days, or for the whole hunting season (Fig. 4). 12 respondents (30 % of weekly goose licence holders, and 19 % of all goose licence holders) stated that they were allowed to hunt <10 geese every 3-5 days; 17 respondents (85 % of seasonal goose licence holders, and 28 % of all goose licence holders) stated that they were allowed <30 geese over the whole hunting season (Figs. 4a & b). For other birds, including ducks, most respondents had a quota of <5 birds per 3-5 days period, with few hunters allowed <60 birds in the whole season (Figs. 4c & d).

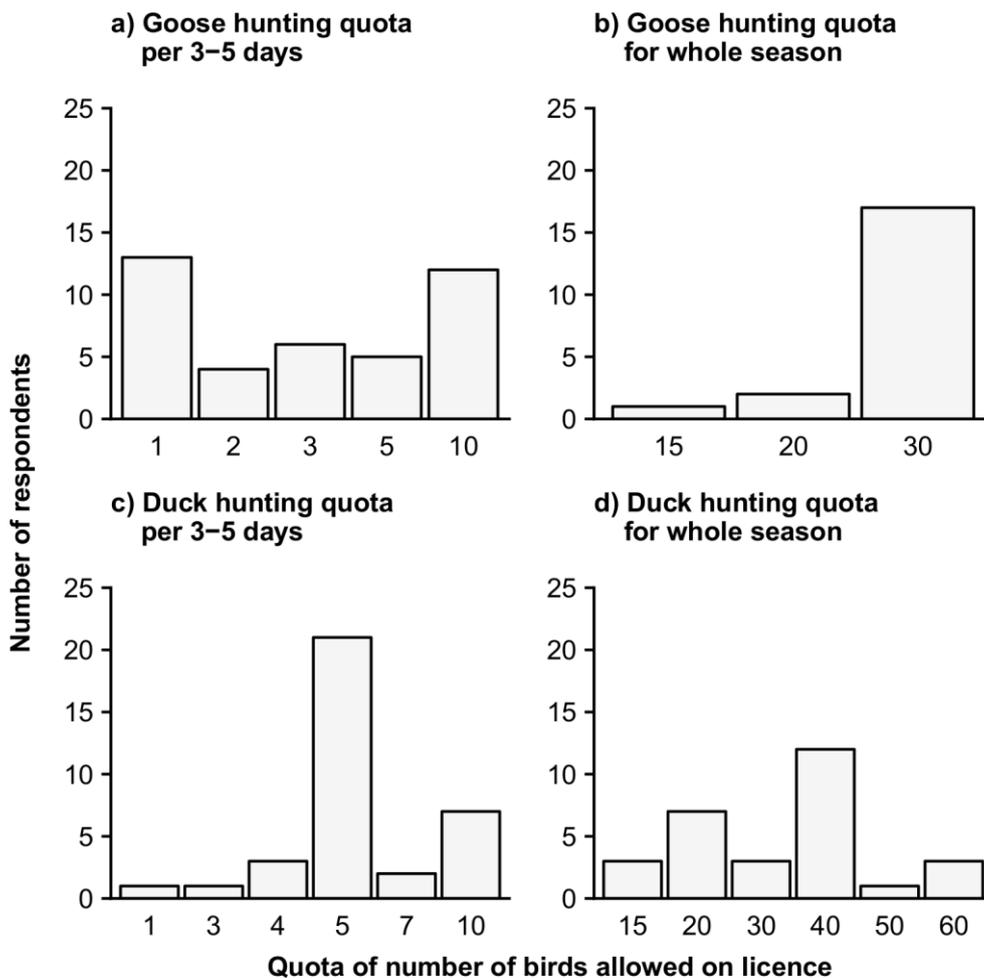


Fig. 4: Quotas for number of birds allowed to be hunted on hunting licences owned by respondents. Only male respondents owned hunting licences.

Knowledge

As we were principally concerned with hunters' knowledge of protected species, we focused on data concerning male respondents as no females surveyed owned hunting licences or were engaged in hunting. Regarding knowledge of whether LWfG are protected from hunting, 65 % of male respondents correctly answered that LWfG are protected from hunting. However, over a quarter of male respondents (28 %) did not know the protection status of LWfG, and ~7 % thought LWfG were not protected (Fig. 5).

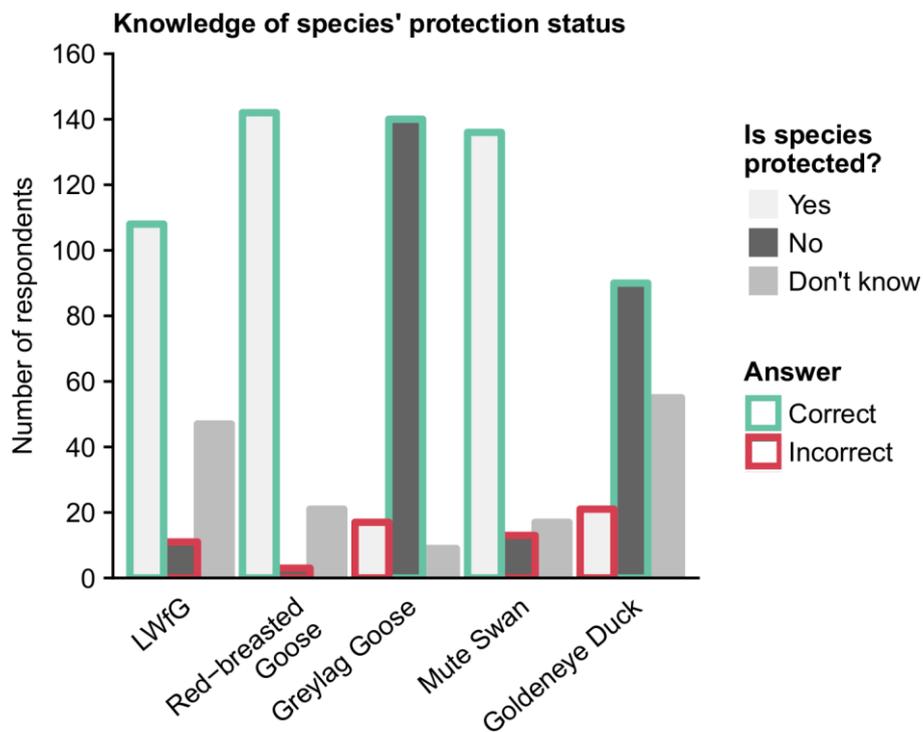


Fig. 5: Summary of male respondent's knowledge surrounding species' hunting protection status. We do not include female data as we are principally concerned with the knowledge of hunters: no females surveyed owned hunting licences or were engaged in hunting. LWfG, Red-breasted Geese, and Mute Swans are protected from hunting. Greylag Geese and Goldeneye Ducks are not protected from hunting.

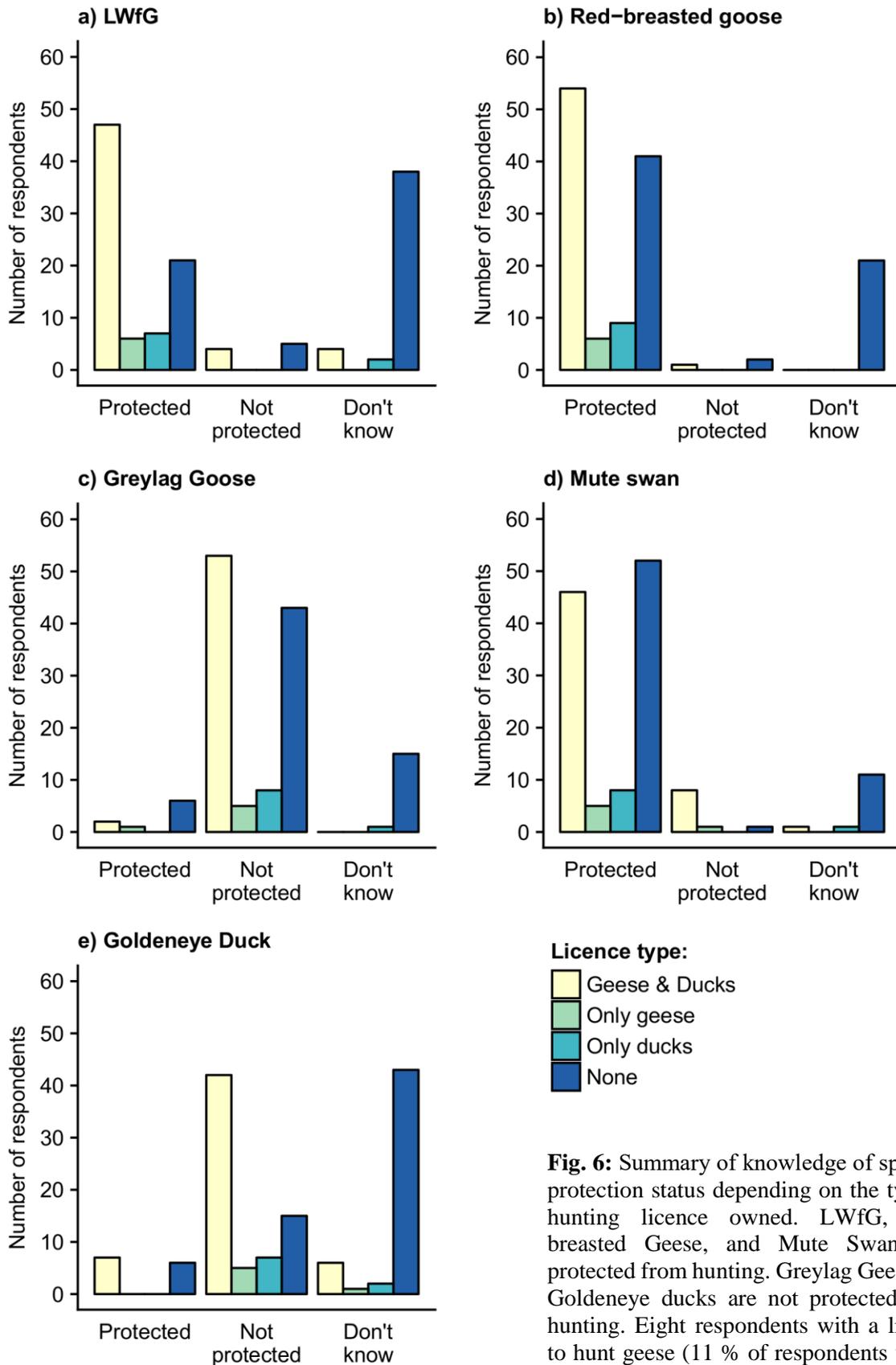


Fig. 6: Summary of knowledge of species' protection status depending on the type of hunting licence owned. LWfG, Red-breasted Geese, and Mute Swans are protected from hunting. Greylag Geese and Goldeneye ducks are not protected from hunting. Eight respondents with a licence to hunt geese (11 % of respondents with a goose hunting licence) did not know LWfG were protected.

Respondents that did not know LWfG are protected either had no hunting licence, or had a licence for geese and ducks, indicating that 11 % (n = 8) of hunters with a permit to hunt geese were not be aware that LWfG are protected from hunting (Fig .6a). This is reflected by the fact that having a goose and duck licence or a single goose or duck licence was not a significant predictor of correct knowledge of whether LWfG are protected or not (Fig. 7a). However, good overall knowledge of the protection status of other bird species significantly increased the likelihood that a respondent had the correct knowledge that LWfG are protected (Fig. 7a). In terms of demographic variables influencing the degree of LWfG protection knowledge, the number of people in full time employment within a household was the only significant predictor, and increased the likelihood of having correct knowledge (Fig. 7a). Overall knowledge of whether multiple species (Mute Swan, Greylag Goose, Red-breasted Goose and Goldeneye Duck) were protected was significantly increased when respondents had a single licence (either for geese or ducks), but the effect was marginal (Fig. 7b).

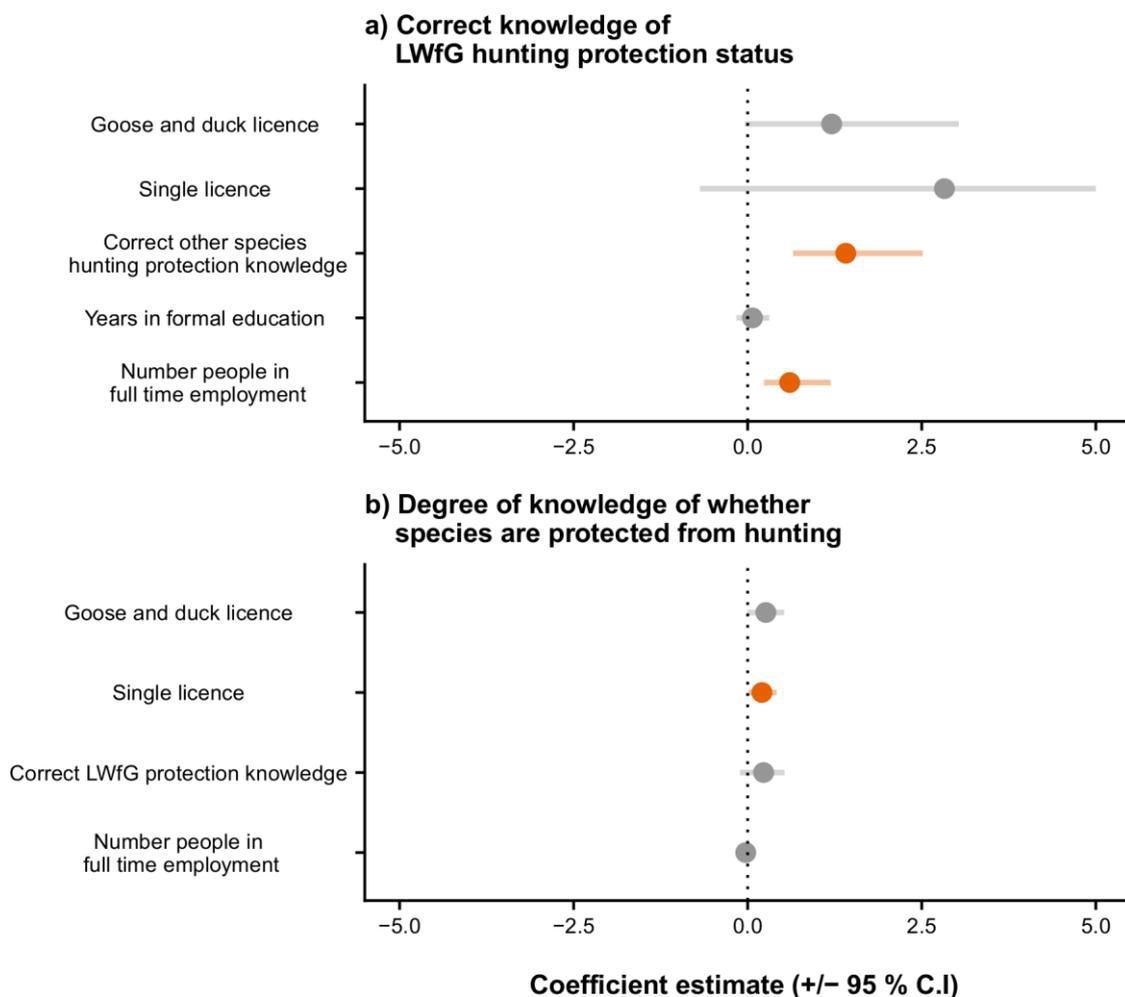


Fig. 7: Relative effect sizes of coefficients included in final models of a) whether respondents correctly answered whether LWfG are protected from hunting or not, and b) the summed score of correct answers relating to the hunting protection status of other species including Red-breasted Geese, Greylag Geese, Mute Swans and Goldeneye ducks. 95 % confidence intervals were generated from 200 bootstraps of the final model.

Goose hunting prevalence

As expected for hypothesis 1, owning a goose and duck licence significantly increased the prevalence of goose hunting over a year. We also found that the number of people in full time employment significantly reduced the likelihood of goose hunting (Fig. 8a). Goose hunting is legal in the autumn hunting season, and confirming hypothesis 2, we found that owning a goose and duck licence significantly increased the prevalence of goose hunting during this period (Fig. 8b). The confirmation of hypotheses 1 and 2 supports the use of the UCT in detecting signals of human behaviour, despite the low sample size ($n = 166$ for statistical analyses).

Goose hunting is illegal in spring/summer, and we failed to detect any variables having a significant effect on the prevalence of goose hunting during this period (Fig. 8c). We therefore did not detect any signal for illegal activity relating to seasonal hunting bans, therefore our data did not support hypothesis 3. Finally, we did not find any evidence for any variables leading to an increase in goose hunting for cash (hypothesis 4); the number of months employed was the only significant variable and had a slight negative effect on the number of activities undertaken for cash (Fig. 8d). Model summaries are presented in Table A2.2.

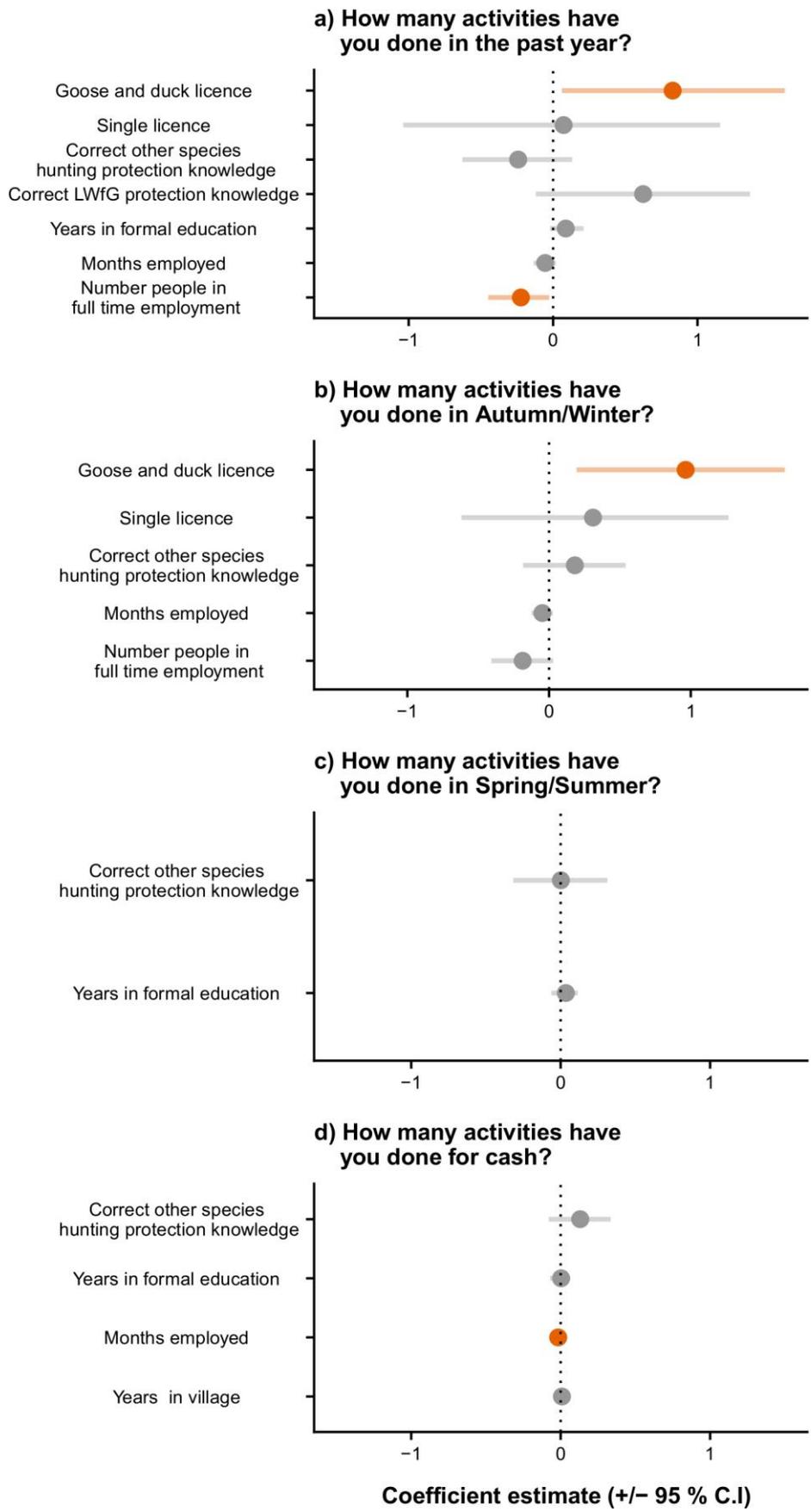


Fig. 8: Coefficient estimates with 95 % confidence intervals for final models. Confidence intervals were generated from 200 bootstraps, and where they do not cross zero, the variable has a significant effect.

4. Discussion

We found strong evidence for a lack of knowledge surrounding the protection status of LWfG among respondents who owned hunting licences: 11 % of respondents legally able to hunt geese did not know that LWfG were protected, indicating that LWfG may be at risk from legal hunting, as well as potential illegal hunting, in Kazakhstan. As we expected we found that goose hunting prevalence increased with goose hunting licence ownership. Such a result indicates that even with a small sample size, it is possible to detect differences in hunting prevalence using the UCT suggesting the UCT is an effective method for elucidating patterns in human behaviour surrounding hunting in north-western Kazakhstan. Furthermore, we found that levels of full time employment reduced the prevalence of goose hunting, which was substantiated by the fact that financial gain was not found to be a significant driver of goose hunting prevalence. We did not find evidence for goose hunting occurring in the spring/summer, indicating that there is good compliance with the spring/summer hunting ban amongst survey respondents. However, results from the UCT should still be treated with caution given the low sample size.

Hunting licence ownership does not guarantee knowledge of species protection status

Ownership of goose hunting licences was not a significant predictor of species' hunting protection status (Fig. 7). Of the respondents owning a goose hunting licence, 11 % did not know LWfG are protected (Fig. 6a). Assuming our respondents are representative of the ~10,000-strong hunting community (Yerokhov, 2013), this suggests that in the region of 1100 hunters with goose hunting licences may have insufficient knowledge regarding LWfG protection status. Thus, a significant proportion of hunters legally hunting geese, may be unknowingly hunting the protected LWfG.

Furthermore, the 2017 recommended goose hunting offtake for Kostanay and North Kazakhstan combined is 71,240 (ACBK, unpublished data). LWfG fly in mixed flocks and can be hard to distinguish from White-fronted Geese: approximately one LWfG per 100 White-fronted or Greylag Geese may be accidentally killed (Yerokhov, 2013). Using the recommended goose offtake figures for 2017 for North Kazakhstan and Kostanay (ACBK, unpublished data), there is therefore the potential for ~700 LWfG to be accidentally killed per year across these two regions. Given that there is evidence for a lack of knowledge surrounding species protection of hunting licence owners, and a significant margin for accidental hunting of LWfG, continuing stakeholder engagement and education programmes may help increase hunter knowledge and reduce the potential for conflict between hunters and conservation practitioners. Continuing stakeholder engagement is particularly important given that during unstructured discussions after surveys, a number of respondents expressed anger at the fact that hunting quotas have been reduced in recent years and that the cost of licences has gone up: some respondents revealed that they were formerly hunters, but due to the increase in cost of licences and fear surrounding being fined over non-compliance, they would now rather not hunt at all.

Compliance with the spring/summer hunting ban among survey respondents

We did not find any evidence for non-compliance i.e. illegal goose hunting during the spring/summer period when waterbird hunting is banned (Fig. 8c). This is encouraging, as the spring/summer is important for pre-nuptial migration: hunting during this period can skew sex ratios and severely impact recruitment, which is particularly harmful to threatened species (Juillet et al., 2012). Historically, hunters in north-western Kazakhstan hunted waterbirds during the autumn period in order to lay down food reserves for the winter months (Yerokhov, 2013). Our data suggest that hunting is still primarily carried out during this autumn period (Fig. 8b), and that meat is still used for personal consumption given that we did not find evidence for goose hunting being undertaken for financial gain (Fig. 8d).

Caveats and improvements

Though we were successful in picking up signal of behaviour using the UCT, we had a very low sample size and therefore may not have had the statistical power to detect signals of non-compliance surrounding the spring/summer hunting ban, and whether financial gain was a rare, yet significant motivator for goose hunting. In other studies using the UCT to identify motives for illegal hunting, sample sizes of >1100 (Nuno et al., 2013) and >700 (Whytock et al., 2018) were used, and therefore we strongly suggest further deployment of questionnaire surveys across the region to improve statistical power. In order to survey sufficient numbers of respondents engaging in hunting, surveys were conducted in four hunting clubs, where club members were asked to ‘drop in’ and complete a survey on a pre-arranged day. Surveying hunters in this way may have given a biased subset of the potential hunting population in north-western Kazakhstan: membership of a hunting club might lead to high compliance of hunting seasons for example.

It has been suggested that the presence of a third party can hamper reporting of sensitive activities (Tourangeau and Yan, 2007). Conducting surveys in remote areas in low temperatures often necessitated using either the vehicle or homesteads for questionnaire surveys. In such instances, other people were sometimes in close proximity to the respondent and interviewer including, for example, family members and members of the field survey team. While conducting interviews in a more informal setting, and removing ‘secrecy’ around the survey likely improved respondent willingness to cooperate, respondents may have been aware of conforming to social norms and thus may not have answered honestly when being asked about sensitive topics (Nuno and St. John, 2015). This may have been a particular issue when interviews were conducted in hunting clubs, as club members seemed acutely aware of hunting legislation and the penalties for non-compliance. Furthermore, it became clear in some instances that respondents were wary of ‘foreigners,’ including Kazakh nationals from cities, and thus care needs to be taken in future surveys to be sensitive regarding the personnel conducting interviews and any potential third parties present (Tourangeau and Yan, 2007).

During survey development, it was decided to use ‘hunting geese’ as the sensitive activity to understand if illegal goose hunting was occurring during the spring/summer hunting ban. However, it may be that hunters complying with hunting seasons may be miss-reporting the take from hunts, and avoid reporting if LWfG are accidentally shot for fear of fines or prosecution. In further surveys of the hunting community, a UCT question regarding whether respondents have purposefully miss-reported offtake would be a valuable addition.

Illegal hunting is challenging to detect across large areas with highly-dispersed hunters

Discussions with hunting inspectors responsible for patrolling ~3000 ha blocks of hunting grounds revealed additional difficulties in assessing the motives for illegal hunting in north-western Kazakhstan. Illegal hunters can be wealthy individuals from larger towns and cities, with powerful off-road vehicles enabling them to rapidly ‘escape’ if hunting inspectors approach. Hunting inspectors typically use their own vehicles for patrols, which tend to be older and slower. Hunting inspectors reported anecdotally that while there were lower numbers of illegal compared to legal hunters, illegal hunters can kill (and injure) many more animals than legal hunters.

The fact that illegal hunting may be relatively rare confounds our ability to detect the motives for illegal hunting, as it is extremely unlikely to encounter illegal hunters across this large landscape with a highly dispersed human population. We suggest that questionnaires should be repeated in the future to increase sample size and improve the probability of detecting non-compliance.

Conclusions

We conclude that knowledge of protected species status appears to be an important factor that potentially limits sustainable hunting practices in Kazakhstan. However, the possible motives for goose hunting, both legal and potentially illegal remain unclear, though our survey respondents did not appear to hunt geese for financial gain.

We strongly suggest that further questionnaire surveys be deployed throughout the region to boost statistical power in detecting potential non-compliance surrounding the spring/summer hunting ban. Furthermore, additional questions regarding self-reporting of hunting take should now be asked, as this may provide information on non-reporting of accidental LWfG hunting.

Of immediate concern is the lack of knowledge regarding hunting protection status of LWfG in a significant proportion (11 %) of respondents who owned hunting licences.

To avoid potential conflicts surrounding reduced hunting quotas and hunting licence costs, as well as improving knowledge of species' protection status, we advocate for increased stakeholder engagement and education regarding hunting. A means of reaching a high proportion of legal hunters would be to engage hunting clubs in any stakeholder engagement; the means to engage with illegal hunters remains a challenge, due to the difficulties of patrolling large areas with limited resources.

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Appendix 1

A1.1 Questionnaire

Анкета: Казахстан 2017
Questionnaire: Kazakhstan 2017

Interviewer/Интервьюер:

Date/Дата: _____

Village/Село: _____ GPS coordinates

INSTRUCTIONS FOR ENUMERATOR: / ИНСТРУКЦИЯ ДЛЯ УЧЕТЧИКА:

Before starting the questionnaire, you must “play a game” to know which cards should be used for this person or household. Here are the rules: / Перед началом опроса вы должны «сыграть в игру», чтобы узнать, какие карты следует использовать для этого человека или семьи. Правила:

Toss a coin, if you get: / Подбросить монетку, если будет:

HEADS, please use cards **C** / **ОРЕЛ**, используйте карточки **C**;

TAILS, please use cards **T** / **РЕШКА**, используйте карточки **T**.

Which side of the coin did you get? / Какая сторона монеты выпала?

Which cards will you use? / Какие карточки вы будете использовать?

Please, always follow these rules! Thank you!

Пожалуйста, всегда соблюдайте эти правила! Спасибо!

PLEASE READ OUT: ПОЖАЛУЙСТА, ПРОЧТИТЕ:

“My name is [name of enumerator]. I am here on behalf of The Association for the Conservation of Biodiversity in Kazakhstan and the University of Stirling, who are collecting information for a study about people and wildlife in Kazakhstan. We are conducting a short questionnaire about rural communities in Kazakhstan and this will only take a few 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?”

“Меня зовут [имя учетчика]. Я здесь от имени Ассоциации сохранения биоразнообразия в Казахстане и Университета Стирлинга, которые собирают информацию для изучения людей и дикой природы в Казахстане. Мы проводим короткий опросник о сельских сообществах в Казахстане, и это займет всего несколько минут.

Если вы решите принять участие в анкете, ваше имя не будет записано, и ваши ответы не будут переданы другим членам сообщества или властям. Вы хотели бы продолжить анкетирование?”

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

[Если **НЕТ**, напишите пол и приблизительный возраст респондента и **ЗАВЕРШИТЕ ЗДЕСЬ**]

Gender/Пол: Male/Мужской _____ Female/Женский _____

Age/Возраст: 16-25 _____ 26-45 _____ 46-65 _____ 66+ _____

[If **YES**, write down time interview started / Если **ДА**, записать время начала]

Start time/ Время начала: _____

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

Раздел А: Индивидуальная социально-демографическая информация

A1. Gender/Пол: Male/Мужской _____ Female/Женский _____

A2. Age/Возраст: _____

A3. Are you the head of household?/ Вы – глава семьи? Yes/Да No/Нет

A4. Ethnic group/Национальность [Circle one/ Выберите одну]

a) Kazakh / Казах

b) Russian / Русский

c) Ukrainian / Украинец

d) German / Немец

e) Other / Другая _____

A5. How many years have you spent in formal education?/ Сколько лет вы получили формальное образование? _____

A6. In the last year (between September 2016 and August 2017) how many months have you been employed?/ За последний год (с сентября 2016 по Август 2017) сколько месяцев вы были трудоустроены?

Section B: Household socio-demographic information (about household)

Раздел В: Семейная социально-демографическая информация (о семье)

B1. In your household:/ В вашей семье:

a) How many adult males (18 years old or older) are there? / Сколько взрослых мужчин (старше 18 лет)? _____

b) How many adult females (18 years old or older) are there? / Сколько взрослых женщин (старше 18 лет)? _____

c) How many children (younger than 18 years old) are there? / Сколько детей (младше 18 лет)? _____

B2. During the last year (between September 2016 and September 2017), how many people in your household had:/ В течение последнего года (с сентября 2016 по сентябрь 2017), сколько людей в вашей семье имели:

a) Full-time employment?/ Полную занятость? _____

b) Seasonal employment?/ Частичную занятость? _____

c) No employment?/ Безработные? _____

B3. How many years has your household lived in this village? / Сколько лет ваша семья живет в этом селе? _____

Section C: CONTROL (ASK ONLY IF YOU GOT HEADS AT THE START)

Раздел С: Контроль (СПРАШИВАТЬ ТОЛЬКО ЕСЛИ ВЫПАЛ ОРЕЛ)

[Read out/ Прочтите] I am going to show you a card with activities. I am going to read their names and then I want you to tell me how many of these activities you have done.

Please, don't tell me which ones, just tell me HOW MANY.

Я покажу вам карточку с действиями. Я собираюсь прочитать их названия, а затем я хочу, чтобы вы рассказали мне, сколько из этих действий вы выполняли. Пожалуйста, не говорите мне, какие именно, просто скажите мне, **СКОЛЬКО**

[Show card C Training, read the names and ask if the person understands/ Показываете карточку С, читаете названия и спрашиваете респондента]

C1. How many of these activities have you done in the past month?/ Сколько из этих действий вы сделали за последний месяц?

[Circle answer/ Обведите ответ]

1 2 3 4

[Read out/ Прочтите] Thank you, I am going to show you a card with some activities again. I am going to read their names, and then I want you to tell me how many of these activities you have done.

Please, don't tell me which ones, just tell me HOW MANY.

Спасибо, Я снова собираюсь показать вам карточку с действиями. Я собираюсь прочитать их названия, а затем я хочу, чтобы вы рассказали мне, сколько из этих действий вы выполняли. Пожалуйста, не говорите мне, какие именно, просто скажите мне, **СКОЛЬКО**.

[Show card C Livelihood activities, read the names and ask if the person understands/ Показываете карточку С, читаете названия и спрашиваете респондента:]

C2. How many of these activities have you done in the past year? (September 2016- September 2017)? / Сколько из этих действий вы выполняли в прошлом году? (Сентябрь 2016- Сентябрь 2017)? [Circle answer/ Обведите ответ]

1 2 3 4

C3. And how many of these activities have you done in the Autumn/Winter? (September-February)? / Сколько из этих действий вы выполняли Осенью / Зимой? (Сентябрь-Февраль)? [Circle answer/ Обведите ответ]

1 2 3 4

C4. And how many of these activities have you done in the Spring/Summer? (March-August)? / Сколько из этих действий вы выполняли Весной / Летом? (Март-Август)? [Circle answer/ Обведите ответ]

1 2 3 4

C5. And how many of these activities have you done for cash? / Сколько из этих действий вы выполняли за оплату? [Circle answer/ Обведите ответ]

1 2 3 4

[Read out/ Прочтите]

Thank you, now I am going to read a list of animals, and for each animal I want you to tell me if you think they are a protected species or not. Please just say yes, no, or don't know.

Спасибо, теперь я собираюсь прочитать вам список животных, и я хочу, чтобы вы сказали мне, какие из этих животных относятся к охраняемым видам. Пожалуйста, просто отвечайте «да», «нет» или «не знаю».

C6. Which of these species is a protected species? / Какие из этих видов являются защищенными? [Circle answer/ Обведите ответ]

Mute swan / Лебедь-шипун	Yes/Да / No/Нет / Don't know/Не знаю
Goldeneye / Гоголь	Yes/Да / No/Нет / Don't know/Не знаю
Lesser White-fronted goose / Пискулька	Yes/Да / No/Нет / Don't know/Не знаю
Greylag goose / Серый гусь	Yes/Да / No/Нет / Don't know/Не знаю
Red-breasted goose / Краснозобая казарка	Yes/Да / No/Нет / Don't know/Не знаю

[Go to section D/Переходите к разделу D]

Section T: TREATMENT (ASK ONLY IF YOU GOT TAILS AT THE START)

Раздел Т: ОБРАБОТКА (ИСПОЛЬЗОВАТЬ, ЕСЛИ ВЫПАЛА РЕШКА)

[Read out/ Прочтите]

I am going to show you a card with activities. I am going to read their names and then I want you to tell me how many of these activities you have done.

Please, don't tell me which ones, just tell me HOW MANY.

Я собираюсь показать вам карточку с действиями. Я собираюсь прочитать их названия, а затем я хочу, чтобы вы рассказали мне, сколько из этих действий вы выполняли. Пожалуйста, не говорите мне, какие именно, просто скажите мне, СКОЛЬКО.

[Show card **T Training**, read the names and ask if the person understands:

Показываете карточку **T Подготовка**, читаете названия и спрашиваете респондента]

T1. How many of these activities have you done *in the past month*? / Сколько из этих действий вы сделали за последний месяц? [Circle answer/ Обведите ответ]

1 2 3 4 5

[Read out/ Прочтите] *Thank you, I am going to show you a card with some activities again. I am going to read their names, and then I want you to tell me how many of these activities you have done. Please, don't tell me which ones, just tell me HOW MANY.*

Спасибо, Я снова собираюсь показать вам карточку с действиями. Я собираюсь прочитать их названия, а затем я хочу, чтобы вы рассказали мне, сколько из этих действий вы выполняли. Пожалуйста, не говорите мне, какие именно, просто скажите мне, СКОЛЬКО.

[Show card **T Livelihood activities**, read the names and ask if the person understands:

Показываете карточку **T Деятельность семьи**, читаете названия и спрашиваете респондента]

T2. How many of these activities have you done *in the past year*? (September 2016- September 2017)? / Сколько из этих действий вы выполняли в прошлом году? (Сентябрь 2016- Сентябрь 2017)? [Circle answer/ Обведите ответ]

1 2 3 4 5

T3. And how many of these activities have you done *in the Autumn/Winter*? (September-February)? / Сколько из этих действий вы выполняли Осенью / Зимой? (Сентябрь-Февраль)? [Circle answer/ Обведите ответ]

1 2 3 4 5

T4. And how many of these activities have you done *in the Spring/Summer*? (March-August)? / Сколько из этих действий вы выполняли Весной/Летом? (Март-Август)? [Circle answer/ Обведите ответ]

1 2 3 4 5

T5. And how many of these activities have you done *for cash*? / Сколько из этих действий вы выполняли за оплату? [Circle answer/ Обведите ответ]

1 2 3 4 5

[Read out/ Прочтите] *Thank you, now I am going to read a list of animals, and for each animal I want you to tell me if they are a protected species or not. Please just say yes or no.*

Спасибо, теперь я собираюсь прочитать вам список животных, и я хочу, чтобы вы сказали мне, какие из этих животных относятся к охраняемым видам. Пожалуйста, просто отвечайте «да», «нет» или «не знаю».

T6. Which of these species is a protected species? / Какие из этих видов являются охраняемыми? [Circle answer/Обведите ответ]

Mute swan / Лебедь-шипун	Yes/Да / No/Нет / Don't know/Не знаю
Goldeneye / Гоголь	Yes/Да / No/Нет / Don't know/Не знаю
Lesser White-fronted goose / Пискулька	Yes/Да / No/Нет / Don't know/Не знаю
Greylag goose / Серый гусь	Yes/Да / No/Нет / Don't know/Не знаю
Red-breasted goose / Краснозобая казарка	Yes/Да / No/Нет / Don't know/Не знаю

[Go to section D/Переходите к разделу D]

Section D: Hunting licences (FOR ALL RESPONDENTS)

7. a) Have you bought a licence to hunt geese? (Yes / No)
 а) Вы купили лицензию на охоту на гусей? (Да / нет)

If yes/ Если да:

- b) With your licence, which goose species, and how many individuals of each species can you hunt? _____
 б) С вашей лицензией, какие виды гуся и сколько людей каждого вида вы можете охотиться?

8. a) Does your license include other birds apart from geese? (Yes / No)
 а) Включает ли ваша лицензия других птиц помимо гусей? (Да / нет)

If yes/ Если да:

- b) Which species and how many individuals can you hunt for each species?

 б) Какие виды и сколько людей вы можете охотиться за каждым видом?

**Section E: Opinion about cards (FOR ALL RESPONDENTS)
 Раздел E: Мнение о карточках (ДЛЯ ВСЕХ РЕСПОНДЕНТОВ)**

[Read out/ Прочтите] *Finally, we would like to know your opinion about the cards I showed you and the questions I asked you using these cards. For each of the topics in the table below, you should choose your answer: / Наконец, мы хотели бы узнать ваше мнение о карточках, которые я показал вам, и о вопросах, которые я задал вам, используя эти карточки. Для каждой из тем в таблице ниже вы должны выбрать свой ответ:*

	Was this easy to understand? / Были ли они легкими для понимания?	Do you feel your answer to this was anonymous? Вы чувствуете, что ваш ответ на это был анонимным?	Did you feel uncomfortable answering this? Вам было неудобно отвечать на эти вопросы?
UCT cards/ Карточки	Yes / No / Don't know Да / Нет / Не знаю	Yes / No / Don't know Да / Нет / Не знаю	Yes / No / Don't know Да / Нет / Не знаю

[Read out/ Прочтите] *Thank you for giving your time to complete this questionnaire. Your answers will help us understand how people live in rural Kazakhstan, and how can we improve our techniques when collecting information from local communities.*

Спасибо, что потратили свое время на заполнение данной анкеты. Ваши ответы помогут нам понять, как люди живут в сельской местности Казахстана и как улучшить методы сбора информации от местных сообществ.

[Write down time of completion / Запишите время окончания]

End time / Время окончания: _____

QUESTIONS FOR ENUMERATOR / ВОПРОСЫ ДЛЯ УЧЕТЧИКА:

Was this respondent willing to answer your questions? / Был ли этот респондент готов ответить на ваши вопросы? [Circle answer/ Обведите ответ]

Very much / Да, полностью Moderately / Средне A little / Немного Not at all / Нет

How well did this person understand the questions? / Насколько хорошо этот человек понимал вопросы? [Circle answer/ Обведите ответ]

Very well / Очень хорошо Moderately / Средне A little / Немного Not at all / Нет

Do you think this person was honest when replying? / Как вы думаете, этот человек был честен, когда отвечал? [Circle answer/ Обведите ответ]

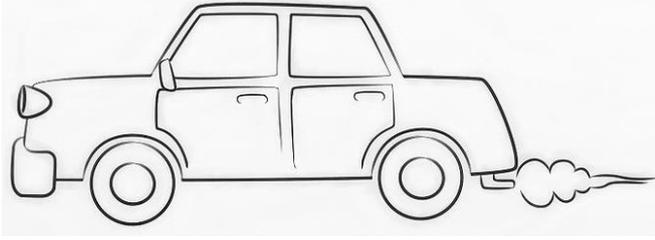
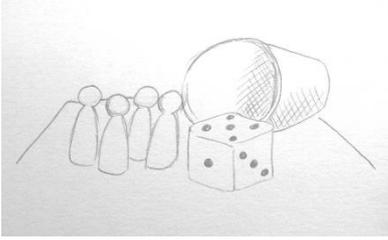
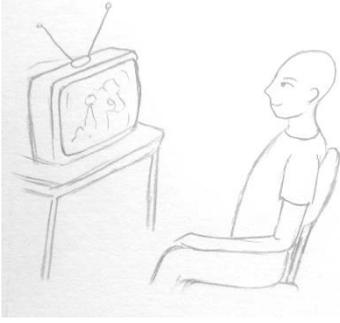
Very much / Да, полностью Moderately / Средне A little / Немного Not at all / Нет

Other comments / Другие комментарии?

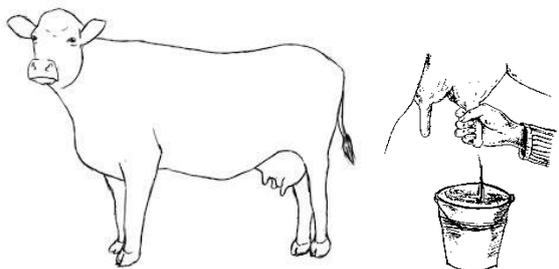
A1.2 Activity lists

Some images reproduced with permissions from Whytock et al. (2018)

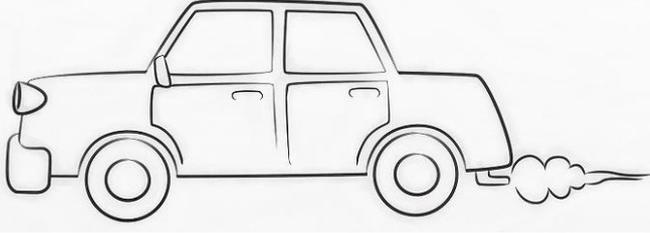
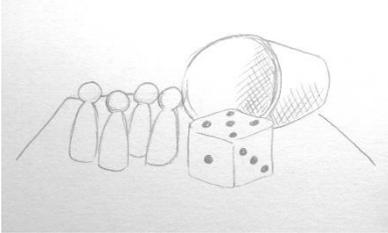
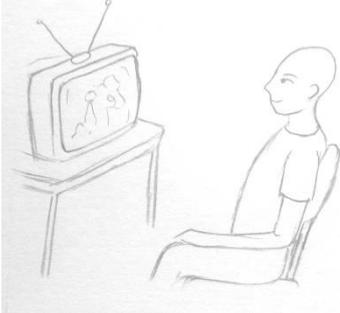
Card C: Training

Riding in a car	 A simple line drawing of a car from a side profile. The car has a boxy shape, typical of older models. A cloud of exhaust smoke is coming out of the tailpipe at the rear.
Playing games	 A line drawing of a board game. On the left, there are four small, rounded game pieces standing upright. To their right is a rectangular box, likely the game box, which is tilted open. In front of the box are two dice, one showing a six and the other showing a one.
Watching TV	 A line drawing of a person sitting in a chair, facing a television set. The television is on a small table and has two antennae on top. The screen of the television shows a simple scene with two figures. The person is shown in profile, looking towards the TV.
Visiting a city	 A line drawing of a city skyline. There are several buildings of varying heights. Two prominent skyscrapers are the central focus, one with a pointed top and another with a more rounded top. The sky is filled with small circles representing clouds or sun.

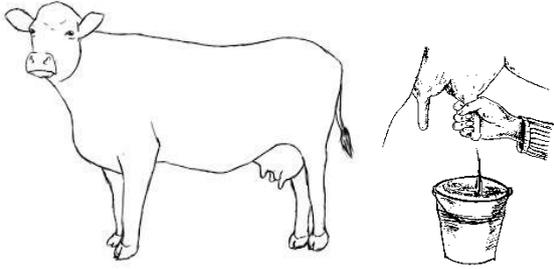
Card C: Livelihood activities

<p>Farming or herding</p>	
<p>Driving a taxi</p>	
<p>Construction</p>	
<p>Milking cows</p>	

Card T: Training

<p>Riding in a car</p>	
<p>Playing games</p>	
<p>Watching TV</p>	
<p>Visiting a city</p>	
<p>Playing football</p>	

Card T: Livelihood activities

<p>Farming or herding</p>	
<p>Driving a taxi</p>	
<p>Hunting geese</p>	
<p>Construction</p>	
<p>Milking cows</p>	

Appendix 2

Table A2.1: summary of respondents' ethnic groups

Ethnic group	Gender	
	Female	Male
Azerbaijani	0	1
Belarusian	0	4
Czech	0	2
German	2	12
Kazakh	13	48
Lezgin	0	2
Lithuanian	0	1
Polish	0	1
Russian	4	64
Ukrainian	4	31

Table A2.2: Summary of all top models with $\Delta AICc < 2$, their constituent fixed effects, and relative weight of each model. All models included two-way interactions between ‘survey group’ (treatment or control) and fixed effects, with ‘site’ as a random effect.

	Parameters	df	Log(L)	AICc	$\Delta AICc$	AICc weight
How many activities have you done in past year?	Correct LWfG knowledge	15	-132.8	300.5	0.00	0.09
	Number people in full time employment					
	Score correct protected species					
	Hunting licence type					
	Correct LWfG knowledge	13	-135.52	300.7	0.18	0.08
	Score correct protected species					
	Hunting licence type					
	Score correct protected species	7	-143.04	301.1	0.64	0.07
	Score correct protected species	9	-140.76	301.3	0.77	0.06
	Correct LWfG knowledge					
	Correct LWfG knowledge	17	-130.6	301.6	1.07	0.05
	Number people in full time employment					
	Score correct protected species					
	Hunting licence type					
	Years formal education					
	Hunting licence type	9	-141.07	301.9	1.38	0.05
Correct LWfG knowledge	15	-133.64	302.2	1.68	0.04	
Hunting licence type						
Score correct protected species						
Months employed						
Correct LWfG knowledge	11	-138.81	302.2	1.72	0.04	
Number people in full time employment						
Score correct protected species						
Months employed in last year	11	-138.93	302.4	1.95	0.04	
Hunting licence type						
How many activities have you done in Autumn/Winter?	Months employed	9	-138.02	295.7	0.00	0.22
	Score correct protected species					
	Hunting licence type	13	-138.56	296.7	0.93	0.14
	Months employed					
	Score correct protected species					
	Months employed	11	-136.36	297.2	1.51	0.1
Number of people in full time employment						

	Score correct protected species					
	Hunting licence type	15	-131.42	297.6	1.87	0.09
	Months employed					
	Number people in full time employment					
	Score correct protected species					
How many activities have you done in Spring/Summer?	Score correct protected species	6	-137.63	288.0	0.00	0.3
	Score correct protected species	8	-135.8	288.9	0.91	0.19
	Years in formal education					
	-	4	-140.39	289.1	1.12	0.17
How many activities have you done for cash?	Years in village	6	-94.71	202.2	0.00	0.16
	Months employed	8	-92.53	202.4	0.21	0.15
	Years in village					
	Years formal education	8	-93.15	203.6	1.44	0.08
	Years in village					
	Score correct protected species	8	-93.2	203.7	1.56	0.07
	Years in village					
	Months employed	10	-90.85	203.8	1.59	0.07
	Score correct protected species					
	Years in village					
Knowledge of species protection status	Correct LWfG protection knowledge	3	-195.00	396.2	0.00	0.19
	Correct LWfG protection knowledge	4	-194.71	397.8	1.57	0.09
	Number people in full time employment					
	Correct LWfG protection knowledge	5	-193.64	397.8	1.61	0.085
	Licence type					
Correct knowledge of LWfG protection status	Licence type	6	-50.51	113.8	0.00	0.22
	Number people in full time employment					
	Score correct protected species					
	Number people in full time employment	4	-52.85	114.1	0.28	0.19
	Score correct protected species					
	Licence type	7	-50.37	115.8	1.99	0.08
	Number people in full time employment					
Score correct protected species						
Years in formal education						



AEWA
Lesser White-fronted Goose
International Working Group



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