~~General r~~Results

Out of the 60 sites with preinstalled Infra-Red Camera Traps (IR CTs) I chose for my study, 56 were included in the analysis. 19 of them remained unchanged through the whole study period as a control group. The remaining 37 were divided in two treatment groups that alternated on being equipped with an additional white LED CT in three month periods. ~~The periods they were equipped with white LED are referred to in this section as LED (periods), and the periods without white LED are referred to as IR (periods).~~

The effect of camera trap sensor had an overall minor effect on detection rates. In general, the control group (ordinary camera) had somewhat lower detection rates than the sites in the two treatment groups consisting of camera traps with either sensors being IR- or LED. Between the IR- and LED periods I expected the IR periods to have the highest detection rate, but LED was somewhat higher for most species (see table [tab:params]).

Out of all nine species included in my analysis, only the red squirrel showed a diurnal pattern. Roe deer and pine marten were active throughout the day, but both had their peaks in the twilight hours.

I will present detailed results of all the nine species included in my analyses in order of most to least number of events, as shown in figure TK. Each species is presented with a figure showing activity across time of day, a photo taken with a white LED CT of the species, a visualisation of the model parameters, set up in the form of an equivalence test, and a plot of the marginal means of the fixed effects in the GLMM model, showing the detection rates of all three groups (Control, IR and LED) along a time axis. The periods camera traps were equipped with white LED are referred to in this section as LED (periods), and the periods without white LED are referred to as IR (periods).

If there were any effect of the white LED, the IR period should show a regression to the norm, ie. counteracting the trend during the LED periods. Thus, if the LED had a negative slope along the time axis, the IR should have a positive slope. Further, the detection rate at the start of each period, should correspond somewhat to the detection rate at the end of the previous period. Still, that pattern could be skewed to some extent due to my visitation of each location at the start of all IR and LED periods.

Finally, I will present/discuss the performance of my models (e.g. assumptions, variation explained, AIC scores). The GLMM of the red squirrel failed to converge, and is therefore excluded from my results.

Roe deer

Roe deer was the most common species in my dataset, with a total number of events $\approx$ 1200. The species was detected at all times of day, with marked peaks of activity during the twilight hours. Looking at the density curves in figure [fig:raadyr]c, the overall pattern was consistent between camera traps (the control group) and cameras with the different flash periods. Although the figure doesn't tell us if each photo was taken before or after sunrise/sunset, there seems to have been a significant portion taken during the twilight.

Merknad [AM1]: Materiale og metode

Merknad [AM2]: Det er først nå jeg skjønner hva du mener…

Merknad [AM3]: Why?

Merknad [AM4]: Dette kan du ta til diskusjon

Merknad [AM5]: Det er først nå jeg skjønner hva du mener…

Merknad [AM6]: Til analyser

Merknad [AM7]: Control period? Det som er uklart.
Control group – er egentlig control period?
IR og control group er lik – bare ulike tider?

Thus, it has been dark enough that the white LED has been triggered. However, there were little activity during the middle of the night, when the light stimuli would have been at it's strongest. Consequently, most photos were taken when the flash stimuli wasn't at it's strongest. Just to repeat myself, the overall pattern stayed the same for all periods, which at least tells us that any effect of the flash seems to have been small.

There were almost 100 more photos of roe deer in the control group~~,~~ than in the two treatment groups, but the control group also had more active camera trapping days. IR periods also had more active CT days than the LED periods, which means that the detection rate was slightly higher with the white LED present.

This pattern is also demonstrated in figure [fig:raadyr]a. However, the variation in the main effect of each period type (Control, IR and LED) were very large, and none of the periods were significantly different from each other.

Looking at figure [fig:raadyr]b, the main effect of the IR and LED periods have a wide CI, which makes us unable to conclude on the groups' true effect sizes. IR is estimated to be within the Region of Practical Equivalence (ROPE), and LED is estimated to be outside, but the large variation still present in the data prevents a conclusion. Considering the time variable, and it's interaction, all are within the ROPE, and the test tells us to accept it's practical equivalence to H0, namely that there is no effect. Still, when interpreting a continuous variable as this, it is worth considering it's scale. I scaled my time variable to represent 10 day intervals, in order for the model to converge. That means the estimated effect of time since deployment is ten times larger than it would have been if it remained as 1 day intervals. Conversely, had I scaled it to represent the whole span of 84 days, the estimated effect and confidence interval would have been 8.4 times larger than what it is now (≈ 0.4), and so would it's confidence interval. The equivalence test would be undecided on the effect of time since deployment.

Nevertheless, the control-group is what I am using as a reference point to what is normal. What I am interested in investigating is whether, and to what extent, the LED group deviates from the control group.

As mentioned, the main effect is non-significantly positive compared to both the control and the IR. The same is true along the time axis. Both the slope for IR and LED are practically equivalent to the slope for control. Interesting to note, is however, that the slopes cross each other, which is what they would do if there is an effect of the LED, ie. that the IR periods counteract the effect of the LED periods.

Thus, I fail to reject the null hypothesis that white LED flash affects the detection rate of roe deer. Still, the variance is too large for me to be able to accept it.

Red fox

After trimming data superceding a period length of 84 days, the red fox was ~~my~~ the second most common species with TK events.

Merknad [AM8]: Tolkning – til diskusjon

Merknad [AM9]: Da burde du vel gi som rate?

Merknad [AM10]: Ikke hvis rate?

Merknad [AM11]: Hvilken pattern?

Merknad [AM12]: Og da stopper du der!!!!

Merknad [AM13]: Dette er diskusjon.
Og det er god metode-diskusjon! Flytt dit

Merknad [AM14]: Dette er også diskusjon

Merknad [AM15]: Kan vel bare slettes

Merknad [AM16]: metode

The red fox was also active during the whole day, but with a more pronounced peak in the late evening continuing until~~l~~ the break of day, as visualised in figure [fig:rev]c. The overall pattern was similar between each group (Control, IR, LED), ~~which leads me to think that~~and the overall effect of white LED was minor. In a standard null hypothesis significance test (NHST) no parameters were significant.

The GLMM explaining variation in detection rate of red fox had a substantial explanatory power (conditional R2 = 0.19), but the part related to the fixed effects alone (marginal R2) was just 0.001. In other words, most of the explained variation in detection rate was due to seasonal changes and variation between the different camera sites captured in the random terms~~, and that the model was a worse fit for red fox than roe deer~~.

~~In a standard null hypothesis significance test (NHST) no parameters were significant.~~

Looking at figure [fig:rev]a, the detection rate of red fox was generally lower in the control and IR-periods than in the LED-periods, and only the LED-periods showed a tendency towards a time-trend.

Merknad [AM17]: hvis ikke sign - kutt

Considering the equivalence test in figure [fig:rev]b, the large variation in IR and LED hinders any decision on H0, although the estimate of LED (0.18) hints at a considerable attractant effect.

The slopes along the time axis (Time and Time * IR/LED) are practically equivalent to H0, ie. shows no sign of a substantial effect.

Model performance

The models explaining variation and whatnot, mostly due to the random terms. This is to say that after having accounted for variations between camera sites, and seasonal fluctuations, there still was a lot of variation in the dataset left to explain, and the period-categories of "Control", "IR" and "LED" interacting with time since deployment didn't explain much of it.

Merknad [AM18]: dette er diskusjon

method:
Using the performance package i checked various assumptions, and all held up
Overdispersion, zero-inflation and singularity all held up in every model.