

Average effects

The following models include all data points (not just one per light/dark period). To account for any autocorrelation in the data, we introduce two additional predictor variables as smooth terms: time of night (*TIME*) and baseline bird density (*BIRD_DENSITY*). These smooth terms account for variation explained by temporal changes in bird numbers through the night and as a result of changes in baseline bird density—separate from any effect of the Tribute in Light (*LIGHT*).

Numbers of birds

0.5° elevation angle

We test for effect of light on the total number of birds present in the cylinder with radius 500 m and height 4.5 km, calculated from the 0.5° elevation angle sweep.

```
# 'stationary.radar.model.light' is a custom function to construct the necessary models
# and compare AIC values
```

```
n.birds.e1.model = stationary.radar.model.light(response.name="logst(n.birds.cyl.e1)",
                                                the.data=dt1,elev="e1")
```

```
##              df      AIC
## mod.light      23.37065  98.69452
## mod.light.year 24.82408 101.31629
## mod.interact   29.16755 105.87983
```

```
bm = n.birds.e1.model
```

The best model includes *light* only.

```
summary(bm)
```

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## eval(parse(text = response.name)) ~ eval(LIGHT) + s(as.numeric(eval(TIME))),
##   by = year) + s(eval(BIRD_DENSITY), by = year)
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -718.92637  230.15140  -3.124  0.00207 **
## eval(LIGHT)1    0.52562    0.05628   9.339 < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Approximate significance of smooth terms:
##              edf Ref.df      F p-value
## s(as.numeric(eval(TIME))):year2010 1.034  1.057  8.904  0.00238 **
## s(as.numeric(eval(TIME))):year2012 1.026  1.051  9.156  0.00230 **
## s(as.numeric(eval(TIME))):year2013 1.848  1.968  5.132  0.00967 **
## s(as.numeric(eval(TIME))):year2015 1.000  1.000  9.802  0.00201 **
## s(as.numeric(eval(TIME))):year2016 1.000  1.000  9.790  0.00203 **
## s(eval(BIRD_DENSITY)):year2010      6.049  6.942 14.895 3.52e-16 ***
```