2024-08-16 skeeter forecast

Good afternoon! Here is your Skeeter report for August 16, 2024.

Today we counted 6 skeeter rafts. The closest prediction today was made by Angel with a prediction of 7. Get your predictions in before tomorrow's count for a chance to show off your prediction skills!

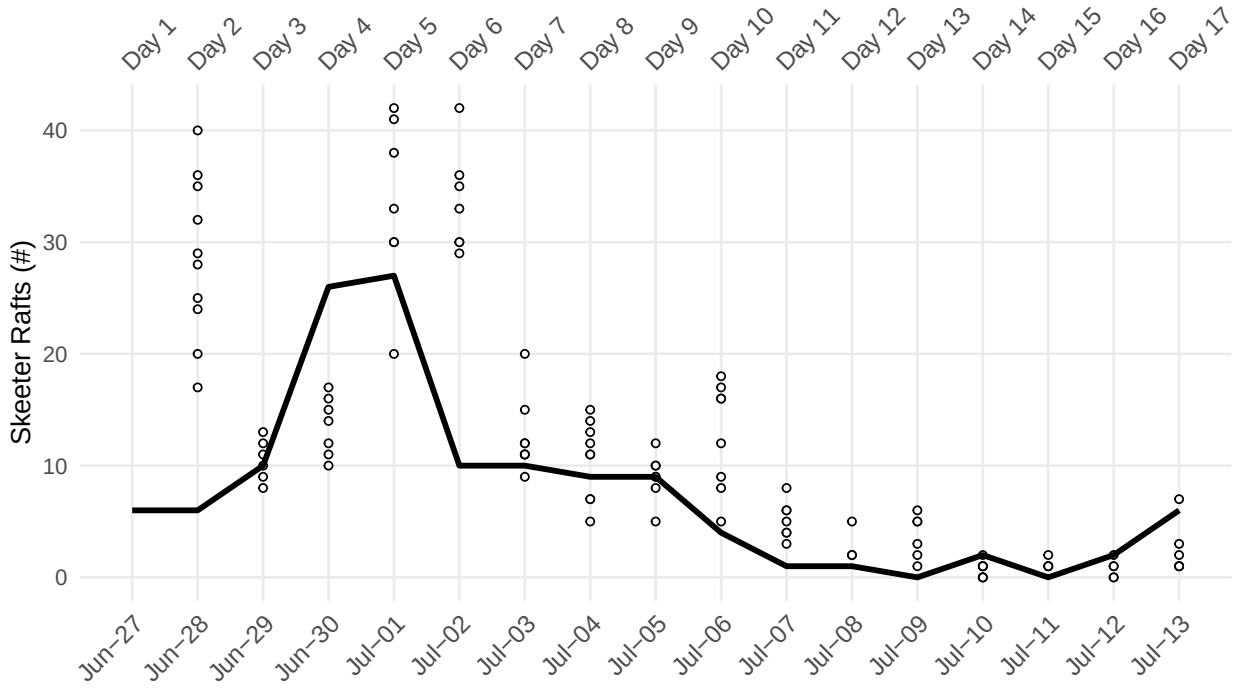


Figure 1: Daily predictions (past = grey circles, current = black circles) and observations (black line) of mosquito rafts counted in mesocosms.

To measure prediction accuracy, we will calculate the mean absolute error,

$$MAE = \frac{\sum_i^n |y_i - x_i|}{n}$$

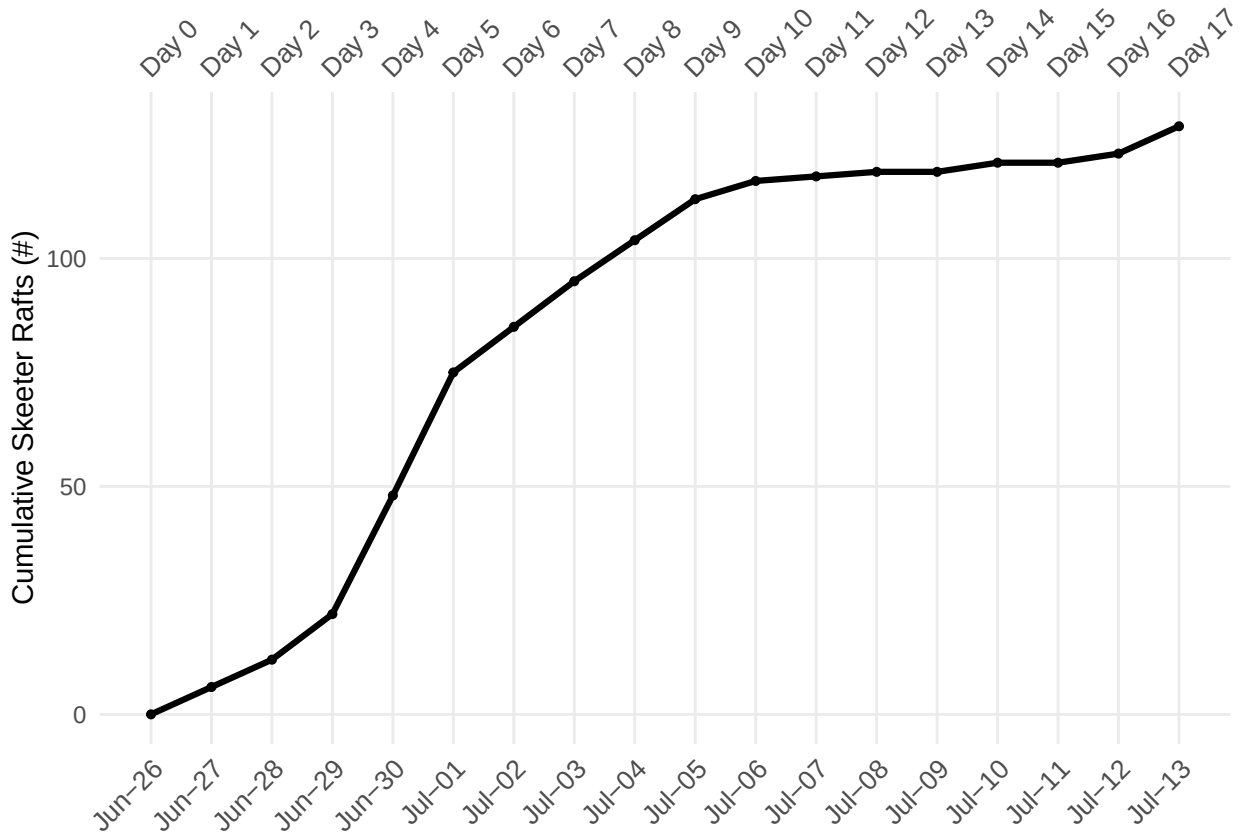
where, y_i is the prediction, x_i is the observed value, and n is the number of observations.

Rankings

Table 1: The rankings to

name	2024-06-28	2024-06-29	2024-06-30	2024-07-01	2024-07-02	2024-07-03	2024-07-04	2024-07-05	2024-07
JMR	26	1	NA	NA	NA	1	-2	NA	
JRB	29	2	-10	6	20	-1	-4	-4	
ZC	11	3	-14	3	25	2	5	0	
EAC	23	NA	-12	14	23	2	6	0	
ARM	18	NA	-16	-7	20	1	2	1	
JRJ	22	0	-9	15	32	10	3	3	
GD	14	NA	NA	NA	26	5	4	-1	
AM	30	-2	-15	11	19	1	2	1	
JD	34	-1	-11	3	NA	NA	-2	NA	
CRG	19	NA	NA	NA	NA	NA	NA	NA	

Cumulative patterns



Forecasts

Here are a few different models to forecast raft counts for 2024-08-17.

Previous value

The simplest prediction is to simply predict the previous raft count.

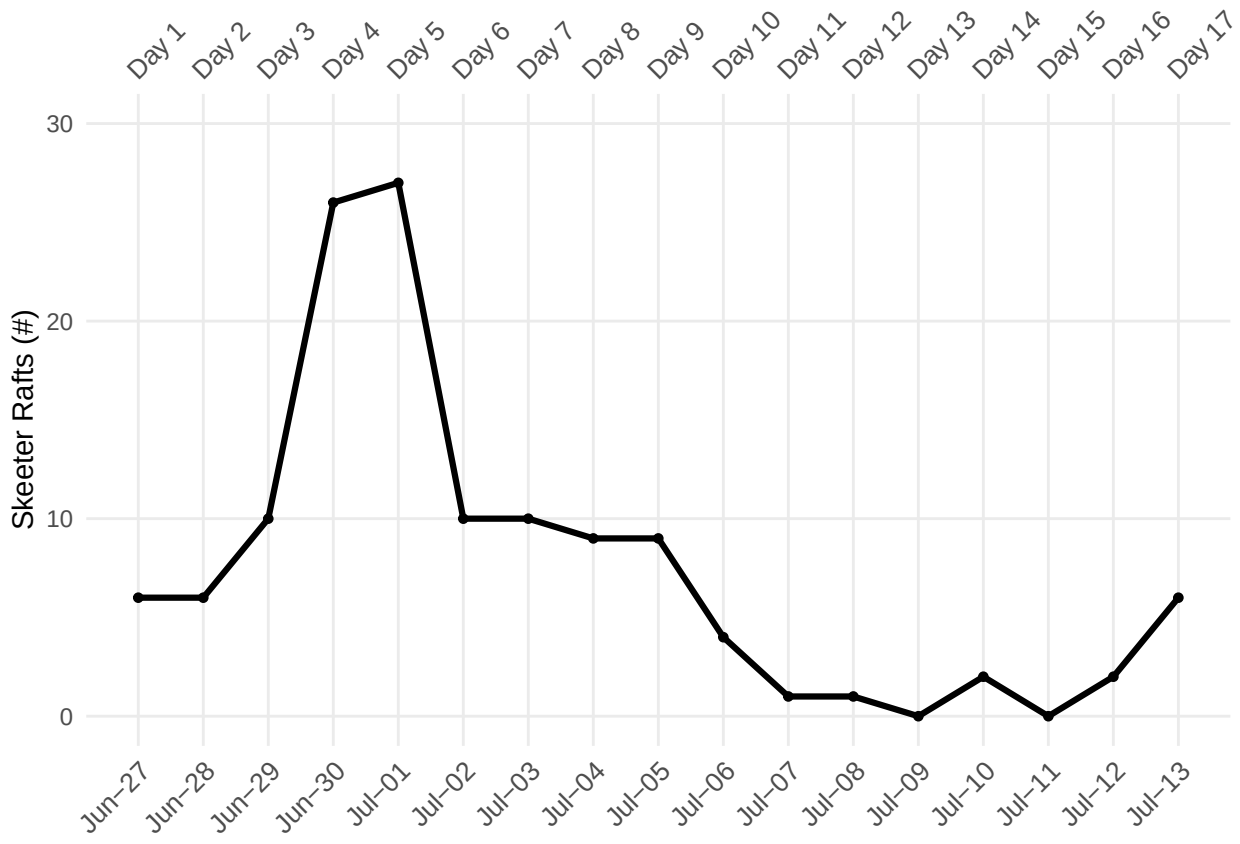


Table 2: Mean predictive deviation of last value approach

2024-06-28	0.000000
2024-06-29	-4.000000
2024-06-30	-16.000000
2024-07-01	-1.000000
2024-07-05	9.000000
2024-07-06	5.000000
2024-07-07	3.000000
2024-07-08	0.000000
2024-07-10	-2.000000
2024-07-12	-2.000000
2024-07-13	-4.000000
MAE	4.181818

Global Average

Another simple prediction is to use the global average. This method allows for a calculation of uncertainty based on the variation we observe over time. Importantly, day-to-day variability in egg raft numbers is not

related to any process, but arises from random noise centered around some relatively fixed mean value.

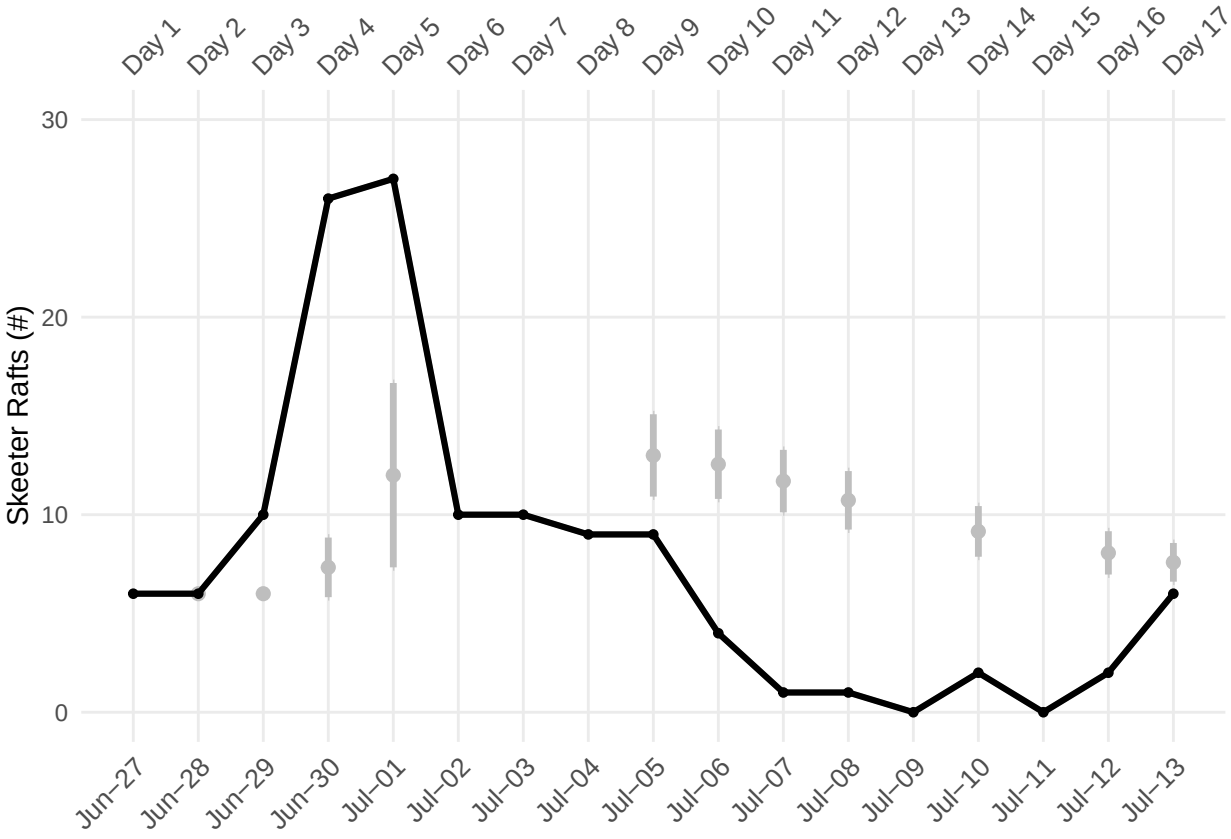


Table 3: Mean predictive deviation of global average approach

2024-06-28	0.000000
2024-06-29	-4.000000
2024-06-30	-18.666667
2024-07-01	-15.000000
2024-07-05	4.000000
2024-07-06	8.555556
2024-07-07	10.700000
2024-07-08	9.727273
2024-07-10	7.153846
2024-07-12	6.066667
2024-07-13	1.588235
MAE	7.768931

However, this approach ignores an important bit of information—the fact that egg rafts are counts and can only take whole numbers (i.e., 1,2,3,...).

More complex predictions

We can start to make more complex predictions. The best way to begin this is to switch to making predictions at the mesocosm-level and scale up to total counts. This will allow us to possibly include more specific information to the experiment. As the global average example above highlighted, we have to think about the type of data we are taking, in this case counts. There are a number of distributions available for use with count data such as the Poisson and Negative Binomial distributions. Let's take a look at these distributions compared to the most recent distribution of counts.

Figure 2: The distribution of egg raft counts from the most recent sampling (bars). We can see the difference in the predictions from the Poisson (blue line) and Negative Binomial (red line) distributions compared to the Guassian (black lines).

Poisson

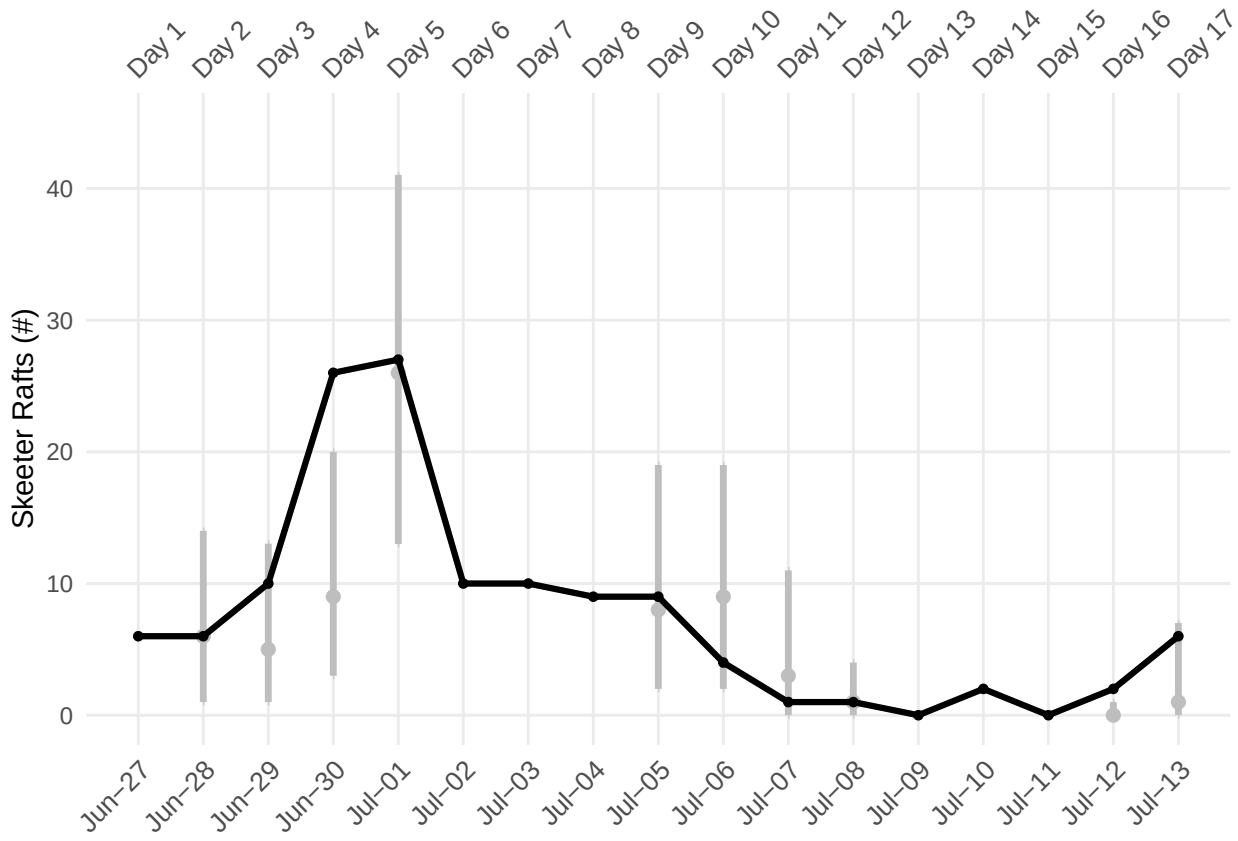


Table 4: Mean predictive error of a simple Poisson model

2024-06-28	0.0
2024-06-29	-5.0
2024-06-30	-17.0
2024-07-01	-1.0
2024-07-05	-1.0
2024-07-06	5.0
2024-07-07	2.0
2024-07-08	0.0
2024-07-12	-2.0
2024-07-13	-5.0
MAE	3.8

Negative Binomial

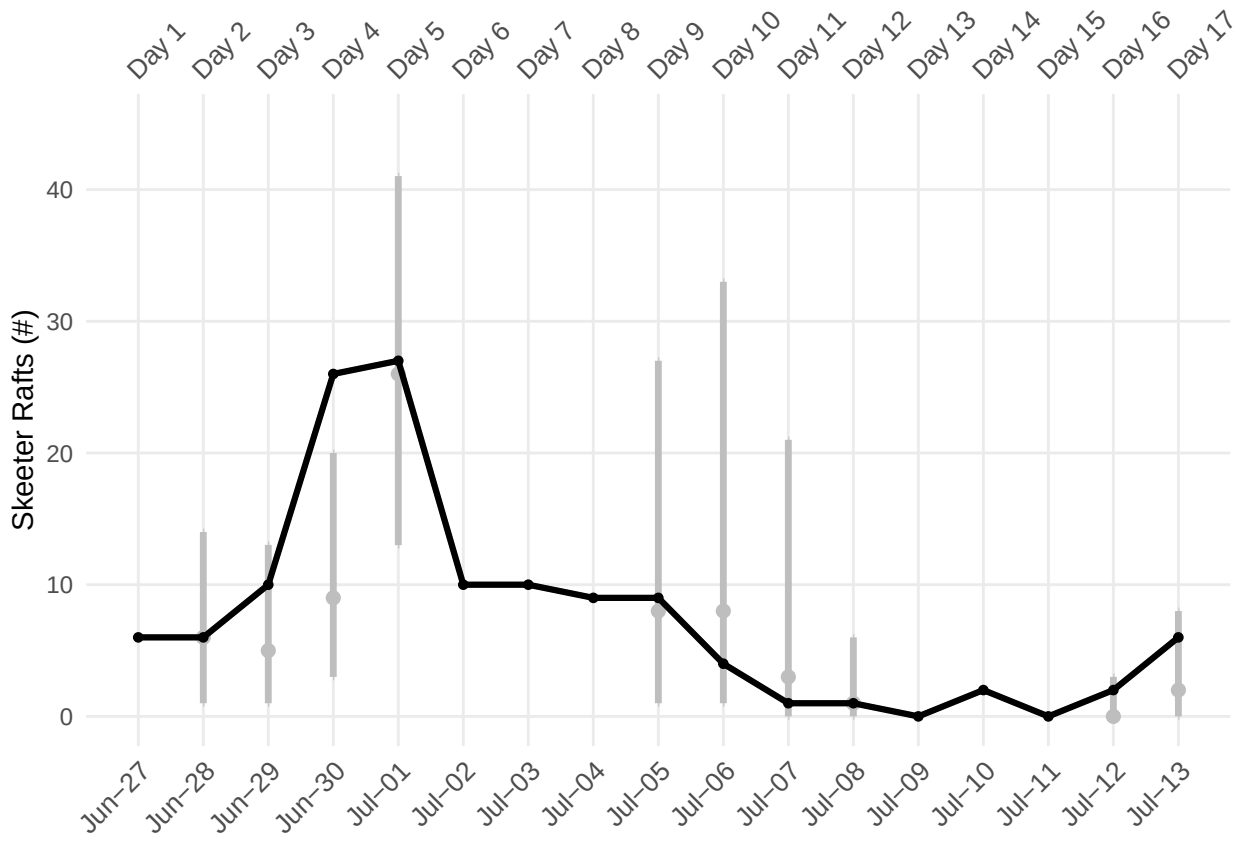


Table 5: Mean predictive error of a simple Negative Binomial model

2024-06-28	0.0
2024-06-29	-5.0
2024-06-30	-17.0
2024-07-01	-1.0
2024-07-05	-1.0
2024-07-06	4.0
2024-07-07	2.0
2024-07-08	0.0
2024-07-12	-2.0
2024-07-13	-4.0
MAE	3.6

Using our experimental design for prediction of skeeter rafts

Poisson

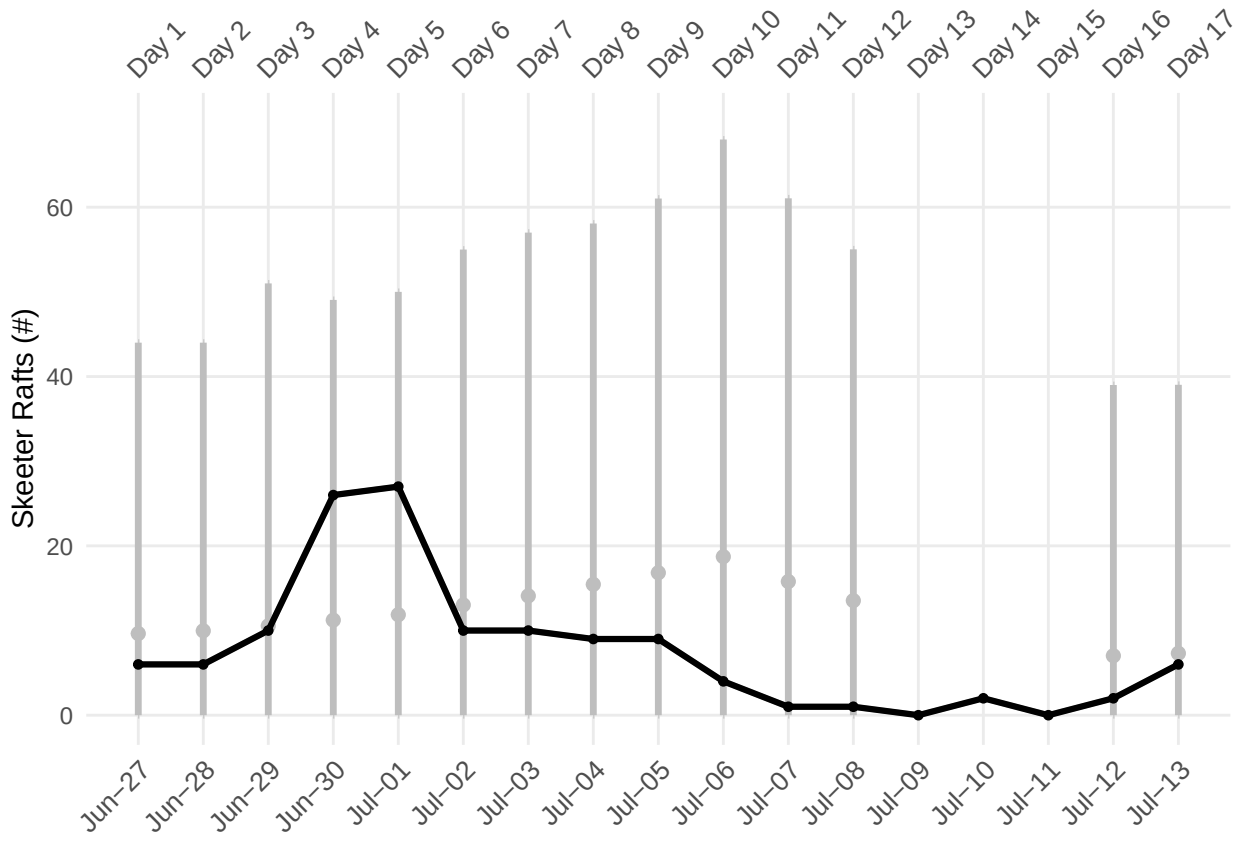


Table 6: Mean predictive error of a Poisson mixed-model

2024-06-27	3.647000
2024-06-28	3.969000
2024-06-29	0.552000
2024-06-30	-14.769000
2024-07-01	-15.127000
2024-07-02	3.026000
2024-07-03	4.097000
2024-07-04	6.453000
2024-07-05	7.828000
2024-07-06	14.722000
2024-07-07	14.789000
2024-07-08	12.534000
2024-07-12	5.023000
2024-07-13	1.312000
MAE	7.703429

Negative Binomial

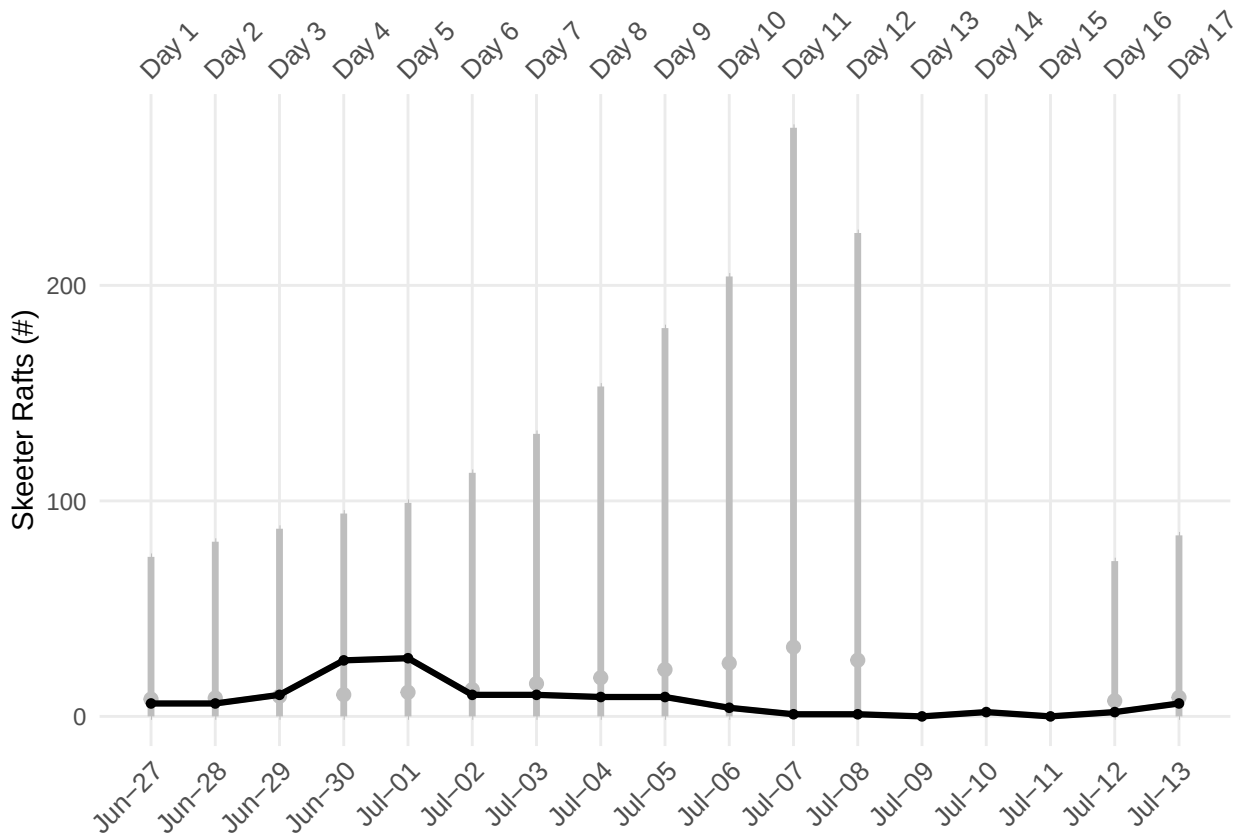


Table 7: Mean predictive error of a hierarchical Negative Binomial model

2024-06-27	2.02600
2024-06-28	2.54800
2024-06-29	-0.66000
2024-06-30	-15.92400
2024-07-01	-15.80200
2024-07-02	2.44400
2024-07-03	5.23000
2024-07-04	8.96300
2024-07-05	12.71100
2024-07-06	20.69400
2024-07-07	31.15400
2024-07-08	25.08100
2024-07-12	5.24600
2024-07-13	2.79600
MAE	10.80564

GAMM prediction

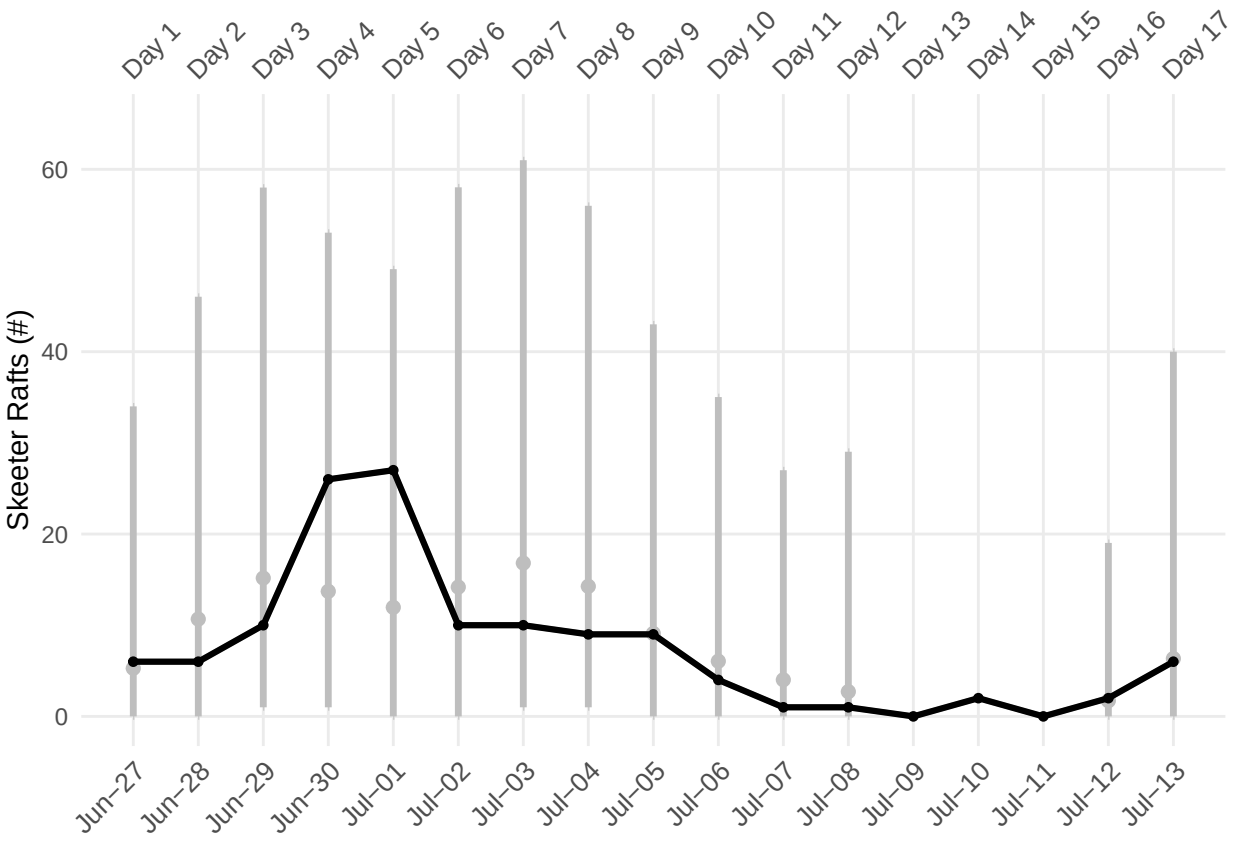


Table 8: Mean predictive error of a hierarchical poisson genearl additive model

2024-06-27	-0.723000
2024-06-28	4.675000
2024-06-29	5.173000
2024-06-30	-12.284000
2024-07-01	-15.040000
2024-07-02	4.185000
2024-07-03	6.817000
2024-07-04	5.266000
2024-07-05	0.094000
2024-07-06	2.055000
2024-07-07	3.015000
2024-07-08	1.716000
2024-07-12	-0.278000
2024-07-13	0.343000
MAE	4.404571