2024-07-06 skeeter forecast

Good afternoon! Here is your Skeeter report for July 06, 2024.

Today we counted 4 skeeter rafts. The closest prediction today was made by Dr. B with a prediction of 5. Get your predictions in before tomorrow's count for a chance to show off your prediction skills!

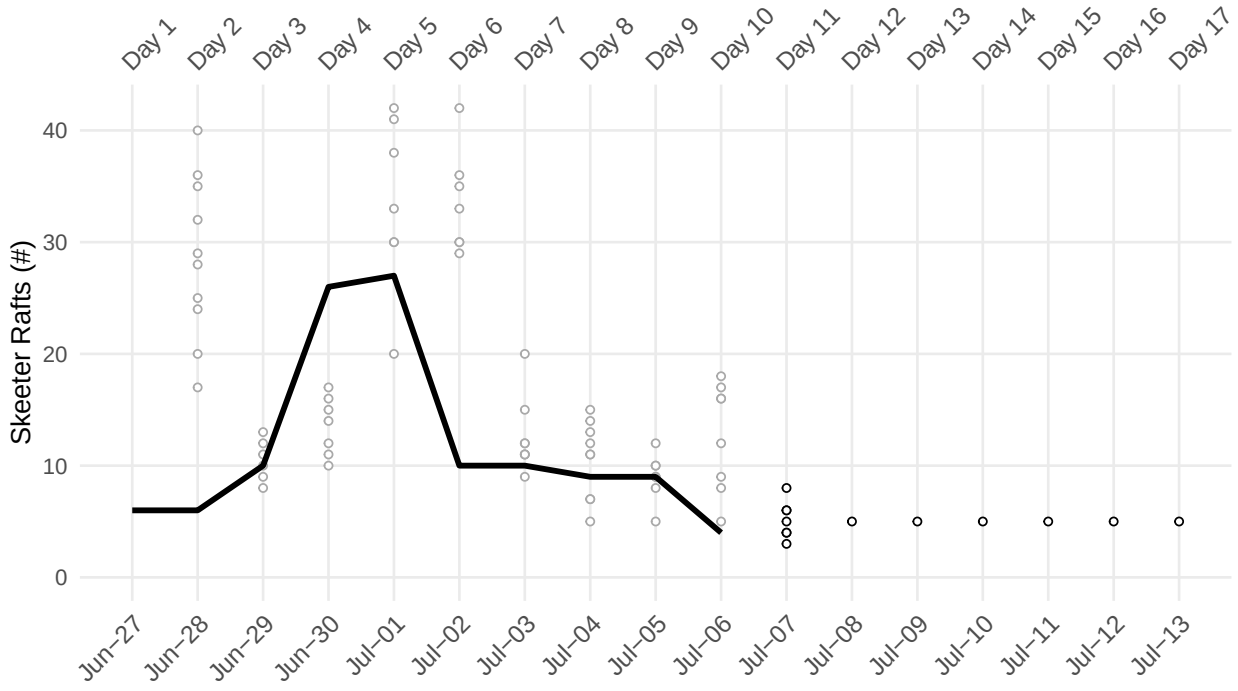


Figure 1: Daily predictions (past = grey circles, current = black circles) and observations (black line) of mosquito rafts counted in mesocosms.

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

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

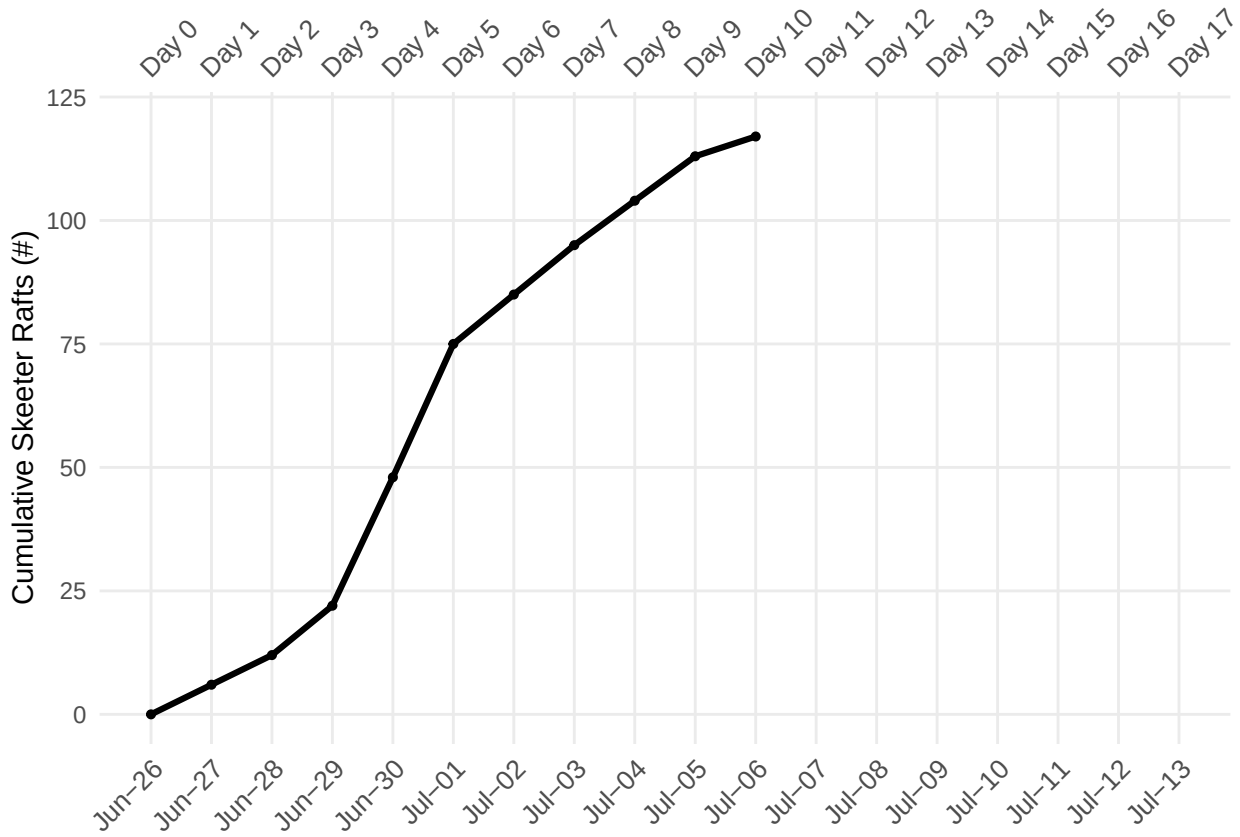
where, y_i is the prediction, x_i is the observed value, and n is the number of observations.

Rankings

Table 1: The rankings to date are:

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
ZC	11	3	-14	3	25	2	5	0	
JMR	26	1	NA	NA	NA	1	-2	NA	
JRB	29	2	-10	6	20	-1	-4	-4	
JD	34	-1	-11	3	NA	NA	-2	NA	
ARM	18	NA	-16	-7	20	1	2	1	
GD	14	NA	NA	NA	26	5	4	-1	
AM	30	-2	-15	11	19	1	2	1	
EAC	23	NA	-12	14	23	2	6	0	
JRJ	22	0	-9	15	32	10	3	3	
CRG	19	NA	NA	NA	NA	NA	NA	NA	

Cumulative patterns



Forecasts

Here are a few different models to forecast raft counts for 2024-07-07.

Previous value

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

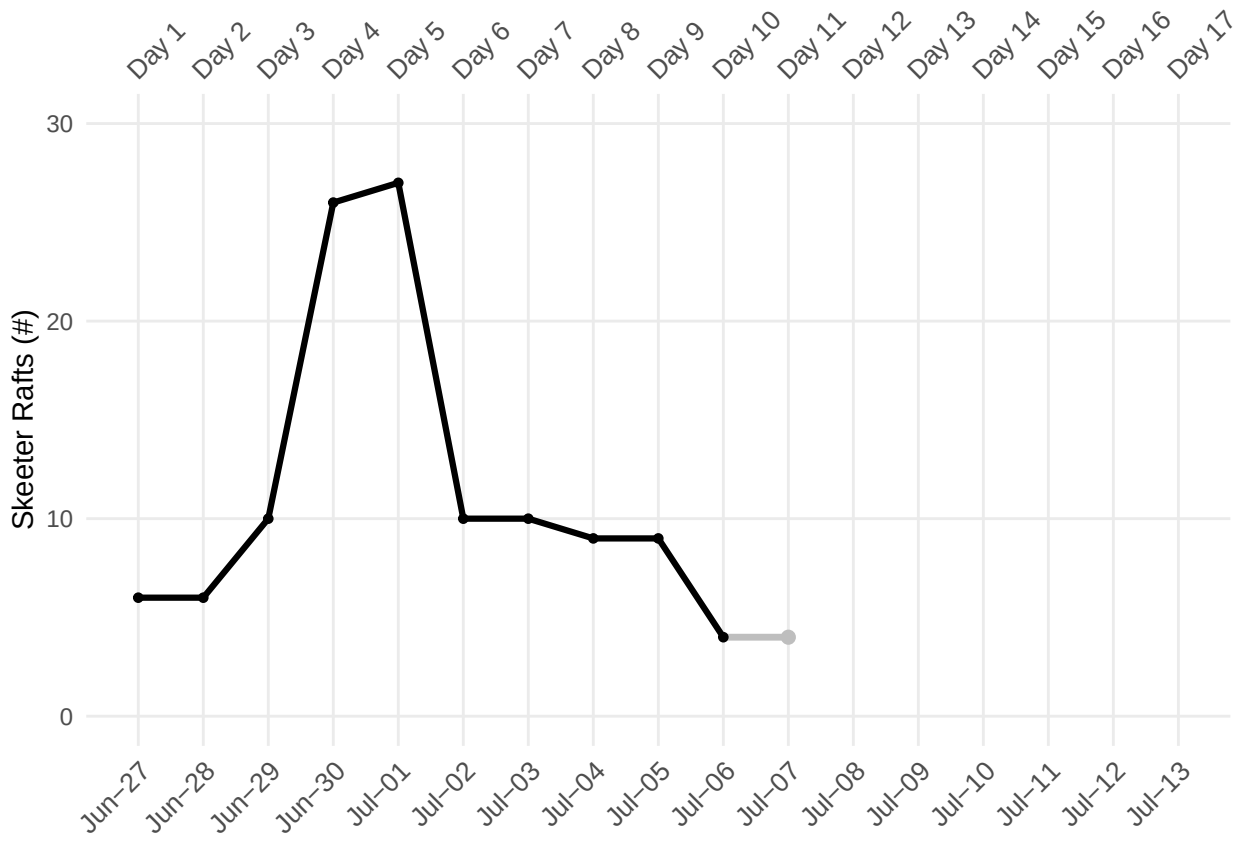


Table 2: Mean predictive deviation of last value approach

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
MAE	5.833333

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.

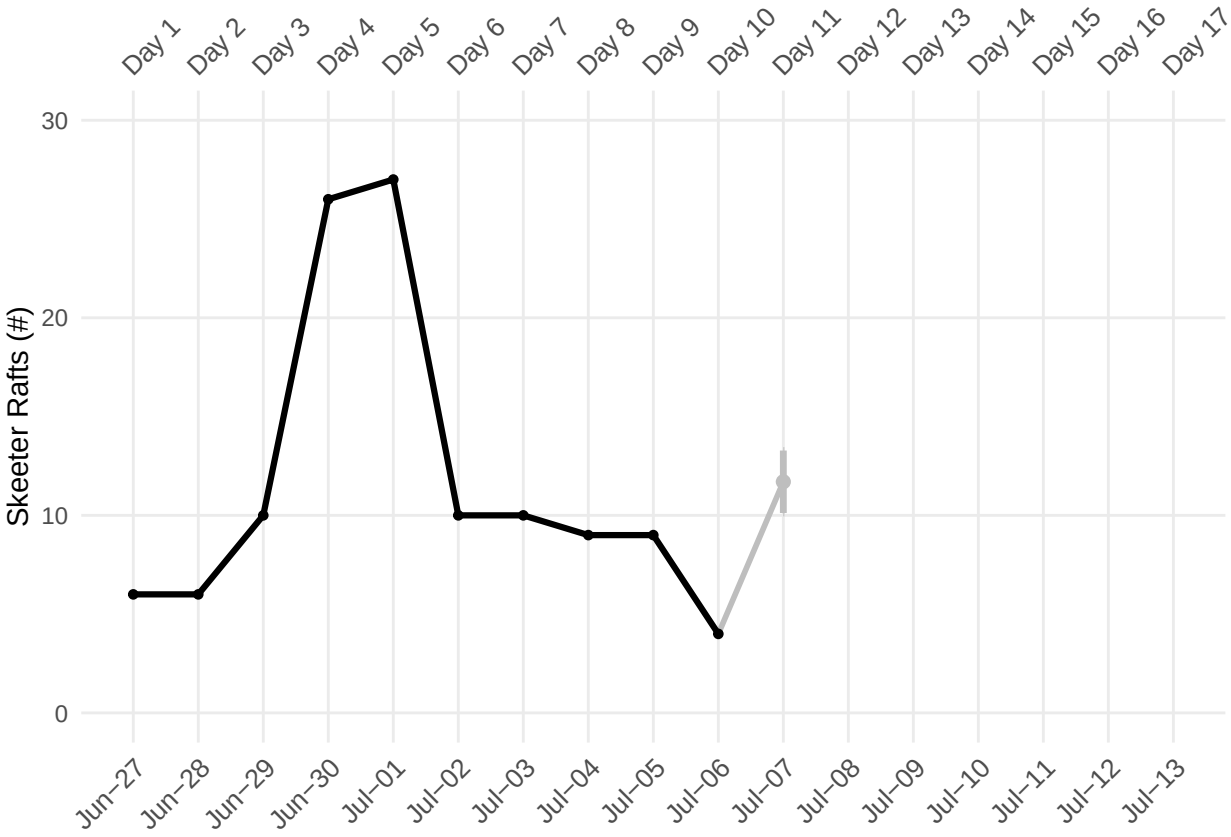


Table 3: Mean predictive deviation of global average approach

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
MAE	8.370370

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.

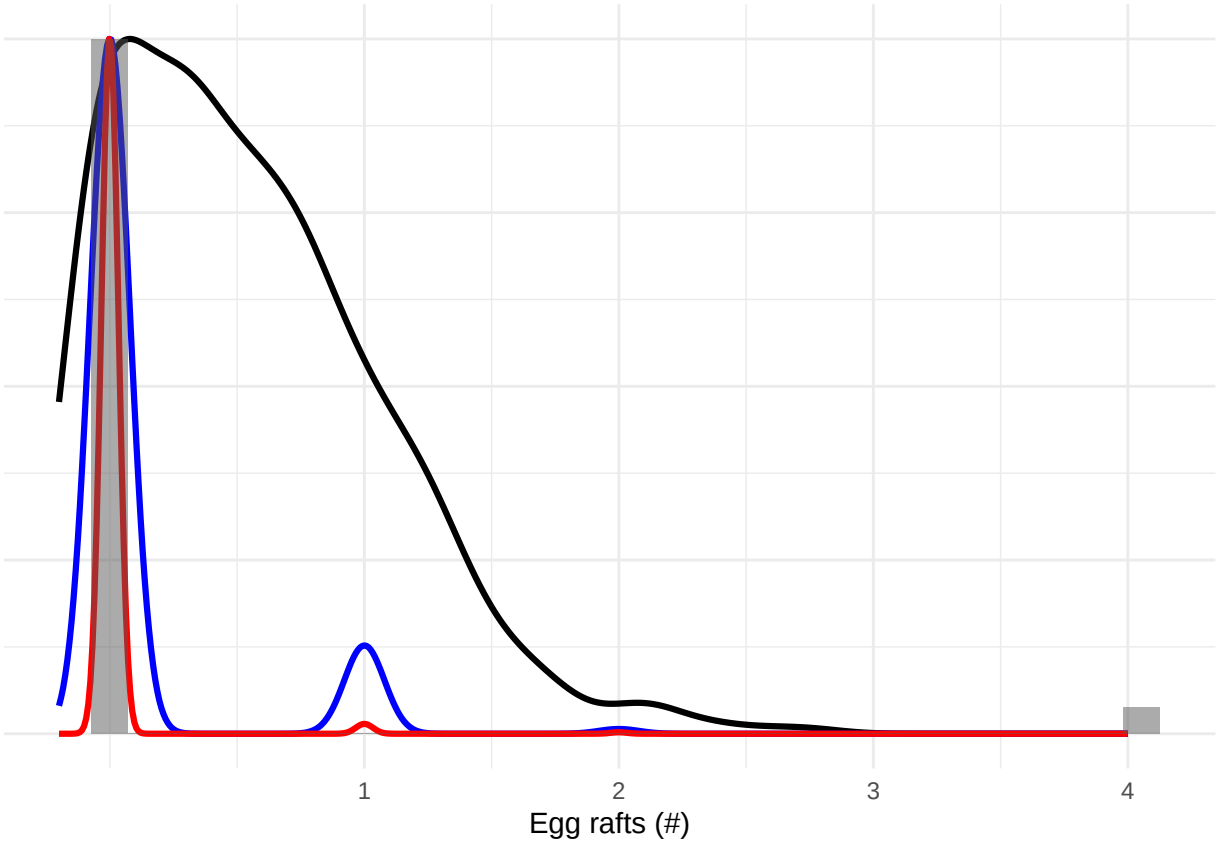


Figure 2: The distribution of egg raft counts from the most recent sampling (bars). We can see the difference in the predictions from the Poisson (blue line) and Negative Binomial (red line) distributions compared to the Guassian (black lines).

Poisson

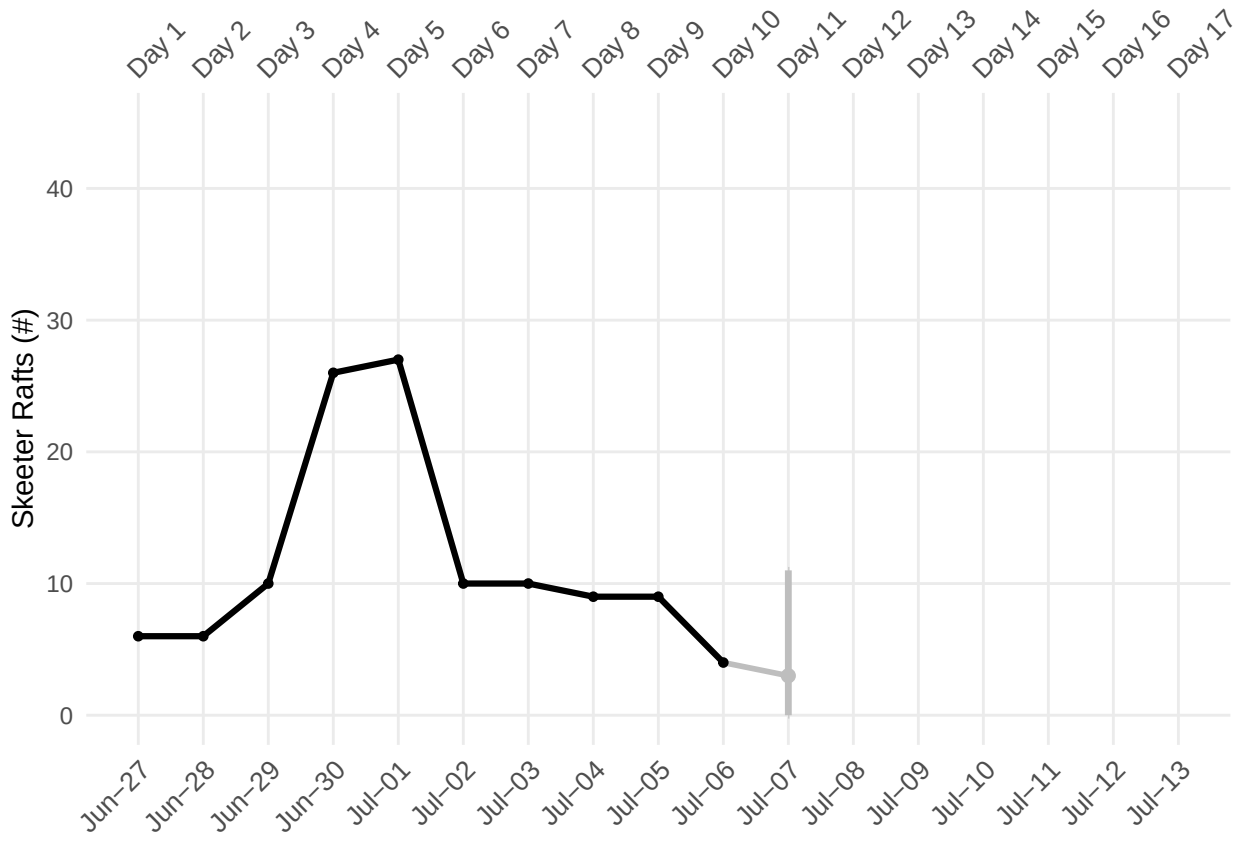


Table 4: Mean predictive error of a simple Poisson model

2024-06-28	0.000000
2024-06-29	-5.000000
2024-06-30	-17.000000
2024-07-01	-1.000000
2024-07-05	-1.000000
2024-07-06	5.000000
MAE	4.833333

Negative Binomial

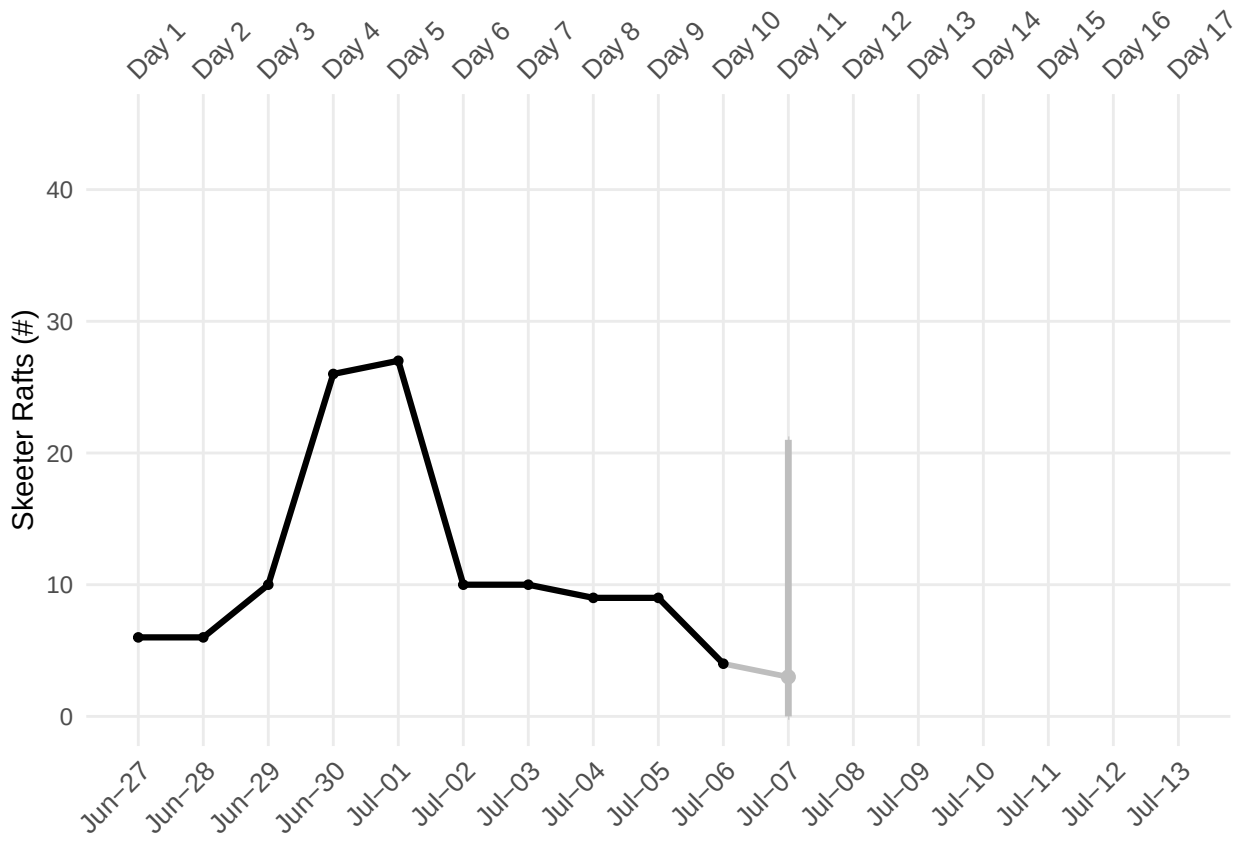


Table 5: Mean predictive error of a simple Negative Binomial model

2024-06-28	0.000000
2024-06-29	-5.000000
2024-06-30	-17.000000
2024-07-01	-1.000000
2024-07-05	-1.000000
2024-07-06	4.000000
MAE	4.666667

Using our experimental design for prediction of skeeter rafts

Poisson

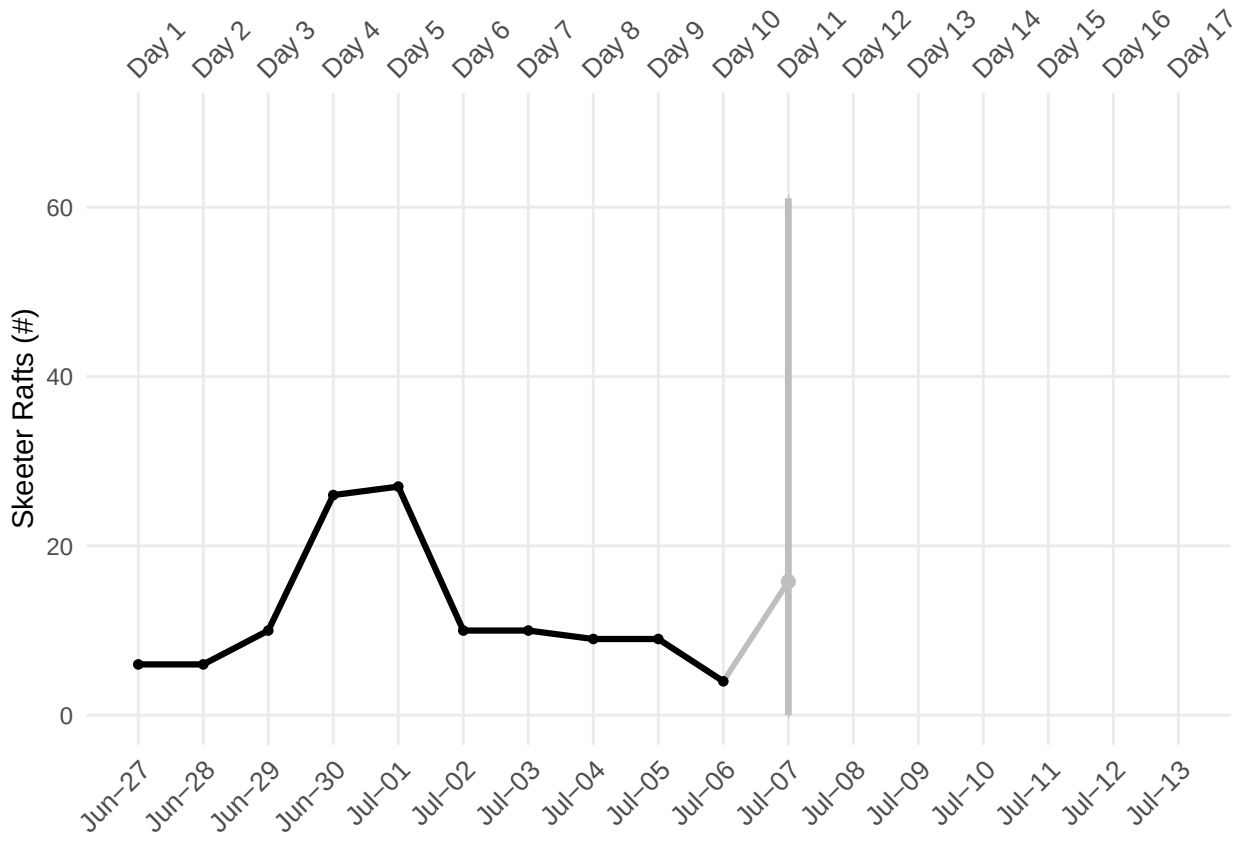


Table 6: Mean predictive error of a Poisson mixed-model

2024-06-27	3.647
2024-06-28	3.969
2024-06-29	0.552
2024-06-30	-14.769
2024-07-01	-15.127
2024-07-02	3.026
2024-07-03	4.097
2024-07-04	6.453
2024-07-05	7.828
2024-07-06	14.722
MAE	7.419

Negative Binomial

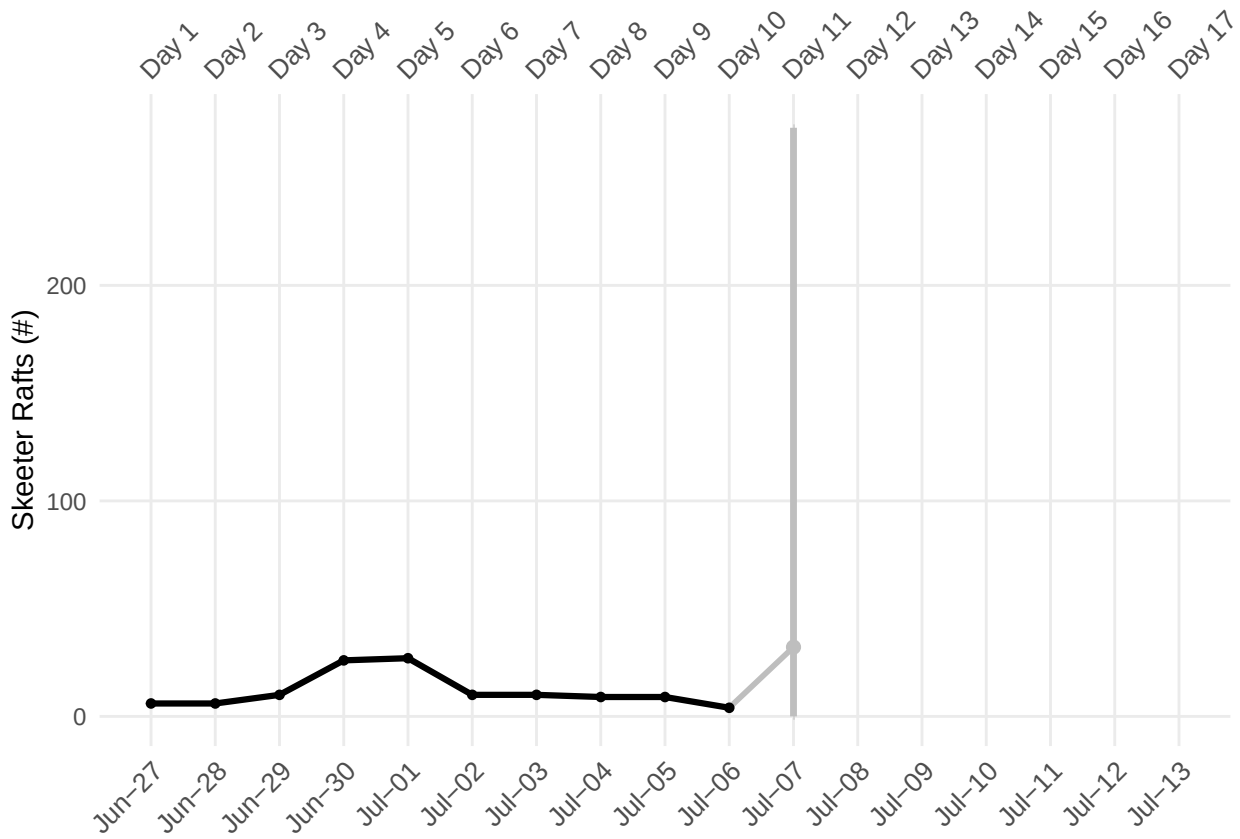


Table 7: Mean predictive error of a hierarchical Negative Binomial model

2024-06-27	2.0260
2024-06-28	2.5480
2024-06-29	-0.6600
2024-06-30	-15.9240
2024-07-01	-15.8020
2024-07-02	2.4440
2024-07-03	5.2300
2024-07-04	8.9630
2024-07-05	12.7110
2024-07-06	20.6940
MAE	8.7002

GAMM prediction

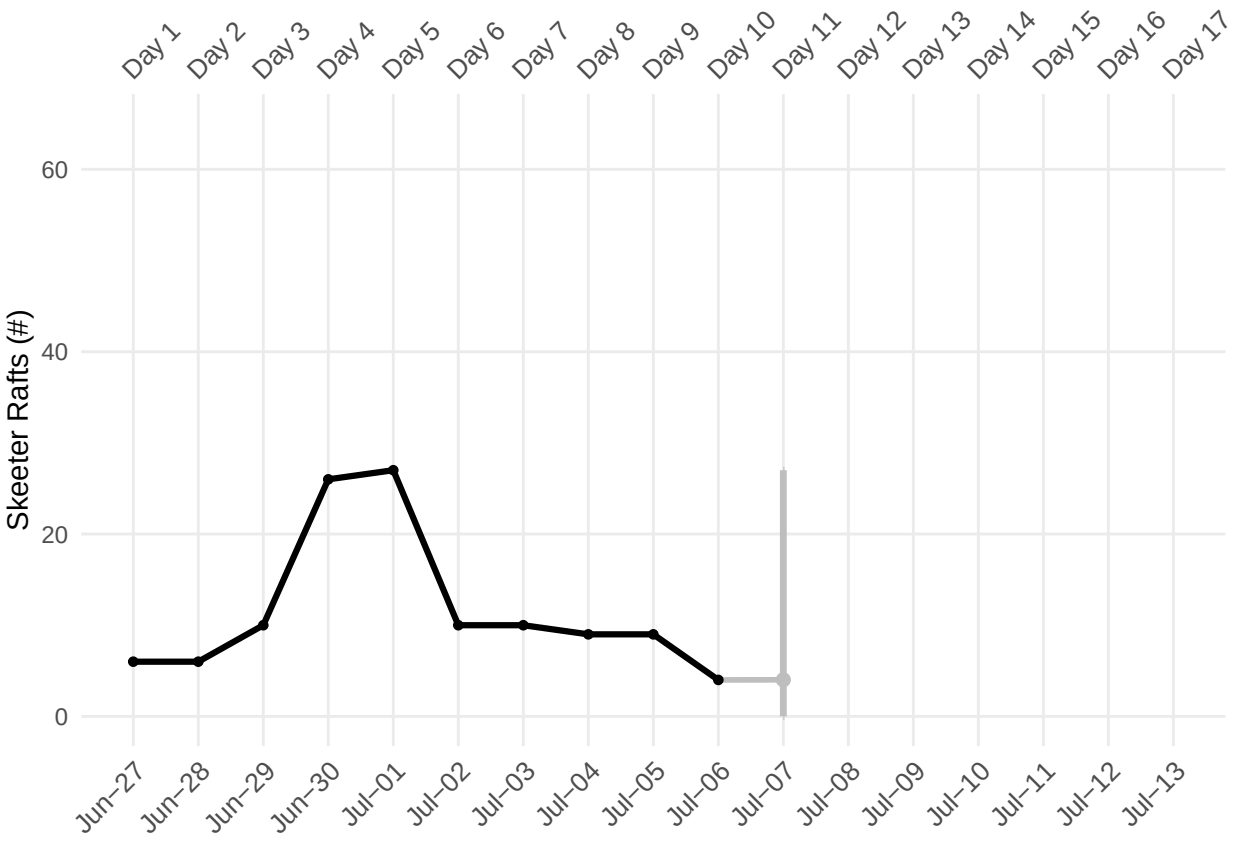


Table 8: Mean predictive error of a hierarchical poisson genearl additive model

2024-06-27	-0.7230
2024-06-28	4.6750
2024-06-29	5.1730
2024-06-30	-12.2840
2024-07-01	-15.0400
2024-07-02	4.1850
2024-07-03	6.8170
2024-07-04	5.2660
2024-07-05	0.0940
2024-07-06	2.0550
MAE	5.6312

more forecasts to come???