

Memorandum 02/07/06/2020 (rev. 0/working copy)

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To: Executive Administration of NSL

Introduction

This document contains an analysis of Marshmellow's accuracy over time. The original request from Executive Administration of NSL was for finding out whether during Marshmellow's League plays there was a moment in which happened a particularly high increase in his accuracy.

Due to the delicate nature of the request all opinions and interpretations contained in the document are marked with darker background.

Analysis setting

For the analysis we have used data gathered by AmarBot from NSL servers' Wonitors and the following software:

- PostgreSQL ver. 10.2 and 11.3 for preprocessing of the data,
- Excel and Google Charts for data analysis.

Rifle accuracy

To perform the requested examination we have used moving average method which smooths out rounds played within a month interval. The reason for doing it is that for single rounds accuracy may vary significantly due to their randomness. Accuracies for monthly intervals have been calculated daily, after that we have removed all the values that have been calculated from the lower number of rounds than 5.

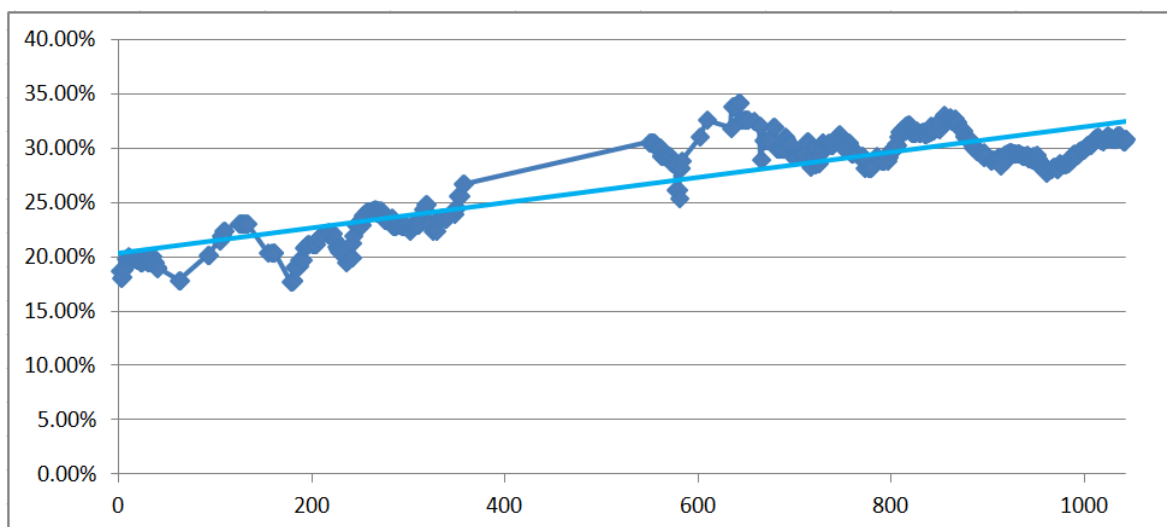


Fig. 1. Marshmellow's rifle accuracy calculated with use of moving average, day numbers on X axis.

The values on X axis denote the day of calculation of the moving average day 0 being the first day in which a round with Marshmellow has been registered by AmarBot. The lighter straight line going through the chart is a trend line.

For each of those days another calculation has been performed: difference between the average accuracy in the month interval *preceding* the day and the average accuracy in the month interval *following* the day. The results are depicted in the following chart:

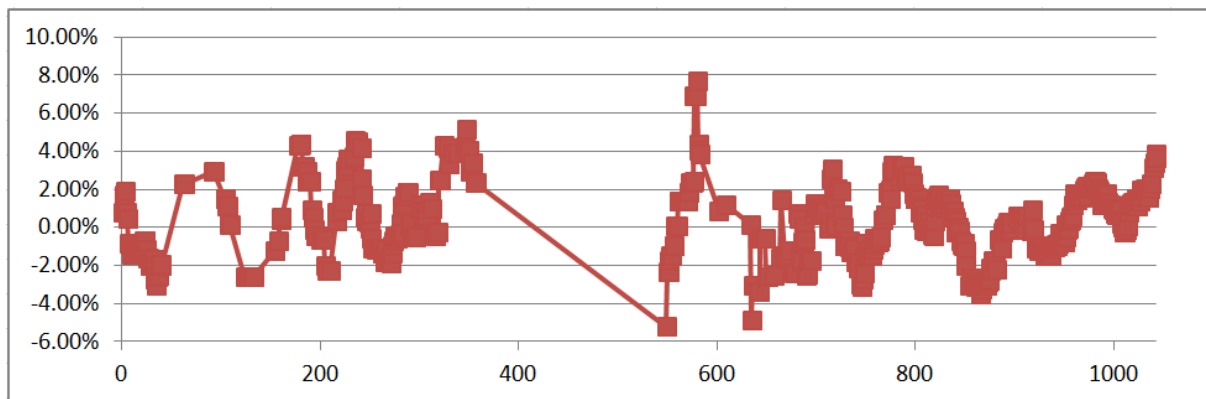


Fig. 2. For every day, difference between accuracy in the preceding month and the accuracy in the following month.

It is worth noting that there are only 5 data points in the chart that fall outside the range of $[-5\%, 5\%]$. All of those data point have been checked, 4 of these data point are consecutive ones, which basically means that we can identify two moments in time where an absolute difference of accuracy larger than 5% happened month-to-month. Both the moments can be characterized by rather low number of rounds played in the preceding and following month amounting to 11 (for the first moment) and 16 (for the second one).

The moments are relatively close in time so it is possible that they indicate a short series of unsuccessful rounds that lowered the accuracy for a while, and after which the accuracy returned to its normal level.

APPENDIX A

(for the the purposes of possible external review)

SQL query used for calculating the moving average and differences:

```
SELECT bef.refdate, EXTRACT( DAY FROM ( bef.refdate - '2017-07-09' ) ) daynum, bef.acc
bacc, bef.dacc bdacc, bef.cnt bcnt, aft.acc aacc, aft.dacc adacc, aft.cnt acnt, aft.acc -
bef.acc diff FROM
( SELECT refdate, AVG(acc) acc, STDDEV(acc) dacc, COUNT(*) cnt FROM ( SELECT rounddate, (
CAST( ( hits - onoshits ) AS REAL ) / (hits + misses + 1) ) acc FROM roundinfo r,
playerweaponstats p WHERE r.roundid = p.roundid AND p.steamid = 302984041 AND p.weapon =
'Rifle' ) ma, ( SELECT DISTINCT date_trunc( 'day', r.rounddate ) refdate FROM roundinfo r )
rd WHERE rounddate < refdate AND rounddate > refdate - interval '1 month' GROUP BY refdate
) bef,
( SELECT refdate, AVG(acc) acc, STDDEV(acc) dacc, COUNT(*) cnt FROM ( SELECT rounddate, (
CAST( ( hits - onoshits ) AS REAL ) / (hits + misses + 1) ) acc FROM roundinfo r,
playerweaponstats p WHERE r.roundid = p.roundid AND p.steamid = 302984041 AND p.weapon =
'Rifle' ) ma, ( SELECT DISTINCT date_trunc( 'day', r.rounddate ) refdate FROM roundinfo r )
rd WHERE rounddate >= refdate AND rounddate < refdate + interval '1 month' GROUP BY refdate
) aft
WHERE bef.refdate = aft.refdate ORDER BY 1
```