Fielders' In-Game Fatigue Figures in Their Batting Performance

Executive Summary

Within individual games in the period 1997-2022, when baseball players are playing defensive positions, they accumulate fatigue. Fatigue accumulates whether they are involved directly in defensive plays or not. Players who are in the field for a significantly lower number of plays perform significantly better at the plate, and players in the field for a significantly higher number of plays demonstrate a reduction in batting performance in the game, both in comparison to average numbers of plays by position.

Nomenclature

Retrosheet has a list of event types that happen routinely during single games[1]. These events are not evenly distributed of course, with "routine outs" (such as groundouts fielded by the shortstop with the ball thrown to first to prevent the batter reaching safely) accounting for approximately 46% of all events during a game. For the purposes of this study, an "event" is some action from the list below. Note that nearly all events result in a change in either the number of baserunners or the number of outs, or both. The few exceptions are truly rare events such as the "foul error" for example. But all events without exception extend the inning and therefore require mental and sometimes physical energy to be expended by the players in the field, which creates fatigue in the fielders.

Event Types for Classifying Action During a Baseball Game

Generic Out	Strikeout	Stolen Base	Defensive Indifference	Caught Stealing	Pickoff	Wild Pitch
Passed Ball	Balk	Other advance	Foul Error	Walk	Intentional Walk	Hit by Pitch
Interference	Error	Fielder's Choice	Single	Double	Triple	Home Run

We will measure the fatigue of the defensive players by position. We will count the number of events they "face" (that occur while they are in the field) prior to a given turn at bat, and we will call that number "**workload**". For example, an away team batter coming to bat in the leadoff spot for the first inning will have a workload of zero, since the away team (these days) bats first always. If all three batters in the first inning ground out to short on the first pitch seen (three quick outs, nothing unusual happens like a foul error), then the first home team batter (assuming he is not the designated hitter) will come to bat with 3 events faced, or a value of "3" for his workload.

Later in the game, when the visiting batter in the first line-up slot comes up again, we will assign a fatigue value to that turn at bat by counting all the events that happened in the game while he was in the field while playing the position he holds when he comes to bat. We will

[1] The information used here was obtained free of charge from and is copyrighted by Retrosheet. Interested parties may contact Retrosheet at "www.retrosheet.org".

count *all* events, not only the events in which he physically participated. For example, the right fielder who never touches the ball during a half inning where there are two walks followed by three strikeouts (without any other events) will be charged with 5 events faced for that half-inning in right field, *as will all other fielders*.

Note: Defensive positions can be changed during a game. For purposes of this study, if a player faced two events as a shortstop before moving to catcher (and facing one event), then when he comes to bat, we will regard him as a catcher who has faced *one* event. Late game defensive shifts among starters are not common, compared to defensive replacements from the bench. Therefore, the effect of this policy in evaluating workload by a batter's current defensive position's "events faced" (and not counting fatigue incurred while playing other positions) does not significantly distort the results.

Scope

This study will evaluate the seasons 1997 through 2022 and will cover both leagues and all batters at the plate except pitchers and designated hitters. We will evaluate all batters against all pitchers, regardless of whether they started the game. We will use wOBA as the single measure of batting performance, calculated using the average event values from 1997 through 2022 to assign weights to each turn's outcome. The standard formula for wOBA can be found here: wOBA | Sabermetrics Library

Home versus Away Workload

Baseball games contain a widely varying number of events, as defined above, and starting defensive players come to the plate having faced a widely varying number of fielding events. However, the away team batters always have a slight advantage as they bat first in each inning, as at least three away team batters come to the plate at the start of the game with zero fielding workload. In contrast, the home batters come to the plate almost always with at least three fielding events against them and often more (if the away team has gotten anyone on base or at least triggered any of the events from our list besides the three outs they accumulated).

Therefore, because of the naturally lower number of fielding events faced by the away team when at the plate, we must evaluate away team and home team batters separately. The average number of fielding events "seen" by batters, by fielding position and home/away status for the first three plate appearances, is presented in Table One.

AVERAGE EVENTS FACED by POSITION before each Turn at Bat

Home/Away	AWAY			HOME		
Turn at Bat	*1st*	*2nd*	*3rd*	*1st*	*2nd*	*3rd*
C	4.7	14.2	23.4	8.8	18.0	26.9
1B	2.3	11.9	21.4	6.5	15.7	24.9
2B	2.3	11.5	20.5	6.6	15.3	24.0
3B	2.8	12.3	21.6	7.0	16.2	25.2
SS	3.0	12.3	21.1	7.2	16.1	24.6
LF	2.3	11.7	20.9	6.5	15.5	24.5
CF	2.1	11.1	20.2	6.3	15.0	23.7
RF	2.2	11.7	21.0	6.4	15.6	24.6

TABLE 1

For example, the average shortstop on the away team during his first turn at bat has faced 3.0 events in the field before that turn. By his third time up, he has faced on average 21.1 events. His home team counterpart has faced an average of 7.2 events when he comes up the first time and an average of 24.6 events by his third time up. Notice the higher number of events faced by catchers compared to all other positions, which is likely a consequence of catchers batting lower in the order more often than any other position.

LOW versus HIGH Workload

We will define a LOW workload as a batter who has faced a number of events that ranks in the 33rd percentile or less, compared to all other fielders of his position across 1997-2022. See Table 2.

33rd Percentile Workload (# of events) by Position before Turn at Bat

Home/Away	AWAY			HOME		
Turn at Bat	*1st*	*2nd*	*3rd*	*1st*	*2nd*	*3rd*
C	3	12	21	7	16	24
1B	0	10	19	4	14	22
2B	0	9	18	4	13	21
3B	0	10	19	5	14	23
SS	0	9	18	5	13	22
LF	0	9	18	4	13	22
CF	0	9	17	4	12	21
RF	0	9	18	4	13	22

TABLE 2

For example, a catcher with a LOW workload on an away team has faced 3 or fewer events his first time at bat, 12 or fewer events his second time at bat, and 21 or fewer events his third time up.

A fielder with a HIGH workload has faced a number of events that rank in the 67th percentile or higher, compared to all fielders at bat for 1997-2022. For example, a home right fielder who has

faced 7 or more events his first time up, or 17 or more events his second time up, or 27 or more events his third time up is batting with a HIGH workload. See Table 3.

67th Percentile Workload (# of events) by Position before Turn at Bat

Team	AWAY			HOME		
Turn at Bat	1st	2nd	3rd	1st	2nd	3rd
C	6	16	26	10	20	29
1B	3	13	23	8	17	27
2B	3	13	23	7	17	26
3B	4	14	24	8	18	27
SS	4	14	23	8	18	27
LF	3	13	23	8	17	27
CF	3	13	22	7	17	26
RF	3	13	23	7	17	27

TABLE 3

Representative Results

Each defensive position experiences effects of both LOW and HIGH workloads on batting performance during a game. As can be seen in the tables above, the catcher routinely faces the largest workload of all defensive positions, as catchers are lower in the batting order more often than other positions except pitcher. We will begin by looking at the position of catcher individually before broadening our review of results to include all defenders.

Catchers	**wOBA AWAY**		**wOBA HOME**	
Workload	*LOW*	*HIGH*	*LOW*	*HIGH*
1st Turn	0.3013	0.2908	0.3193	0.3024
2nd Turn	0.3201	0.2997	0.3257	0.3083
3rd Turn	0.3190	0.3001	0.3321	0.3098
4th Turn	0.3086	0.2872	0.3074	0.2951
Average Difference	**0.0178**		**0.0172**	

TABLE 4

In all turns at bat, regardless of home or away status, catchers who have a LOW workload perform better than catchers who have experienced a HIGH workload by approximately 0.0175 wOBA. As a rule of thumb, 20 points (0.020) of wOBA over the course of a full season is worth approximately 10 runs. This workload effect is not insignificant.

By way of comparison, during the 1997-2022 seasons, the difference between batting performance of home and away catchers was 0.010 wOBA (Home catchers batted 0.3219 overall, while away catchers batted 0.3119.) So, we can see that the effect of workload in the field can be *greater* that of the home field advantage, as far as catchers are concerned. (The average wOBA difference between home and away performance across all positions from 1997-2022 was 0.0122.)

Now let's expand our analysis to include all defensive positions.

wOBA by Position, Team, and Workload

Position	*C*	*1B*	*2B*	*3B*	*SS*	*LF*	*CF*	*RF*
Away-ALL	0.3037	0.3421	0.3138	0.3230	0.3071	0.3291	0.3206	0.3338
Home-ALL	0.3133	0.3530	0.3259	0.3348	0.3172	0.3413	0.3311	0.3476
Away-LOW	0.3127	0.3497	0.3236	0.3327	0.3193	0.3378	0.3289	0.3393
Away-HIGH	0.2945	0.3356	0.3032	0.3127	0.2957	0.3218	0.3116	0.3268
Home-LOW	0.3223	0.3642	0.3376	0.3466	0.3325	0.3486	0.3385	0.3581
Home-HIGH	0.3044	0.3431	0.3133	0.3206	0.3037	0.3311	0.3235	0.3341
Low "Boost"	0.0090	0.0094	0.0107	0.0108	0.0137	0.0080	0.0078	0.0080
High "Cost"	-0.0091	-0.0083	-0.0116	-0.0123	-0.0124	-0.0088	-0.0084	-0.0103

TABLE 5

Table Five presents the advantage ("Boost") or the disadvantage ("Cost") of facing significantly low or high numbers of events in the field relative to wOBA versus all turns at bat by batters playing the same position. For example, a shortstop at home with LOW workload will perform with 0.3325 wOBA on average, but with a HIGH workload will bat only 0.3037. Both values can be compared to all home shortstops, who bat 0.3172.

Across all positions and for both home and away teams, the boost in wOBA is approximately 0.0097 wOBA for all batters with LOW workloads and the cost for batters with high workloads is 0.0101 wOBA. Notice that infielders and outfielders experience slightly different boosts and costs, with infielders trending higher by a couple points of wOBA in both boost and cost amounts.

The effects of fielding fatigue are not insignificant in terms of batting performance, whether the team is at home or on the road, or whether it is the first turn or later turns at bat. The absolute value of the difference between LOW and HIGH workload approaches that of the home field advantage. For all batters, excessive time in the field (which likely is caused by the opposing team scoring runs) makes catching up to the opponent more unlikely, as batting performance is reduced as described above. Therefore, while we might like to think that a given team's batting performance is dependent only on the opposing pitcher and fielders, in reality the *opposing team's batting actions* at the plate also affects every batter's outcomes.