

Baltimore Orioles - Batter Analysis for Optimized Player Development

I. Executive Summary

To optimize player development for the Baltimore Orioles, we will analyze the weaknesses of Orioles hitters to identify areas of improvement. By providing which pitch types in different areas of the strike-zone have low likelihood of contact for each hitter, coaches can better train their players depending on their individual profiles.

II. Problem Statement Background

In baseball, the pitcher is arguably the most important player. To begin each play, they throw the baseball towards the home plate with the goal of getting the batter from the opposing team out. The team that is batting is on offense and can score runs by making contact with the pitched ball and advancing runners around the bases to home plate. Batters can also score a run by drawing a 'walk', which is when they receive 4 pitches outside the strike zone and do not swing at them.

Hitting a baseball thrown by a professional pitcher is incredibly difficult. A professional pitcher will throw a fastball at an average velocity of 90 mph from 60 feet, 6 inches away from home plate. Which means it takes less than half a second for a ball to travel from the pitcher's hand to the catcher's mitt giving batters even less time to decide whether or not to swing. If the batter does choose to swing, they then must make another split-second decision on how to swing depending on the movement, trajectory, and speed of the pitch in order to launch the ball into play.

Pitchers throw many kinds of pitches in order to confuse the batter or make the ball more difficult to hit so as to improve the likelihood of getting them out. Pitches can vary in speed and movement and their success is usually based on deceiving the batter on how the ball will move. Faster pitches like the four-seam fastball or the two-seam fastball, for example, are similar in that the goal is to have the batter swing too late but since the two-seam fastball has more movement it can cause the hitter to also swing with the wrong trajectory if they can't recognize the difference.

This is why hitting a baseball is often said to be one of the most difficult tasks in all of sports; there's barely any time to process and react to a pitch. Batters use different cues to help predict what kind of pitch they are facing and where and how to swing. The best batters are hyper-attuned to the different ways pitchers pitch and how their movements in winding up can foreshadow the movements of the ball.

Because the success of any Major League Baseball team depends heavily on the offensive success of a batter being able to hit the ball to receive an out for their team, even a marginal improvement to a hitter's batting average is crucial for the overall success for their career and the team as a whole.

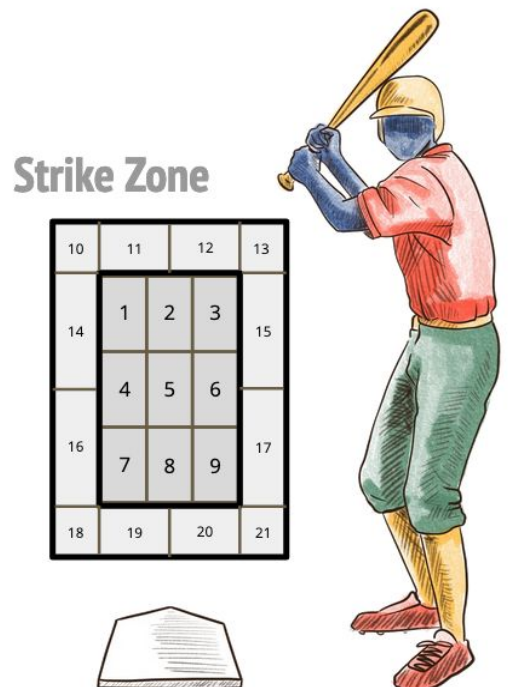
The universal tool for measuring hitter success is their batting average, the number of hits divided by the number of at bats. In the MLB, the average batting average for the 2019 season was 0.252. This means that at the professional level, hitters are generally only making contact with the ball 25% of the time. For MLB hitters, having a season batting average of 0.300 is considered to be excellent and below 0.200 is usually considered substandard, with very few players ever reaching anything above 0.400. In 2019, the Baltimore Orioles ranked 20th out of the 30 MLB teams with an average batting average of 0.246. This was an improvement from 2018 when they ranked 24th with a 0.239.

A lot of importance is placed in player development, where hitters are coached to improve their reaction to different pitches depending on trajectory extrapolation and pattern recognition to improve their success rate.

III. Data Metrics

Because hitters respond differently to different pitch types for all parts of the strike zone, metrics will be compared to the total times a batter swung for each pitch time in a specific region of the strike zone.

As shown in the two-dimensional representation to the right, a strike zone (zones 1 to 9) is defined as the volume in which a pitch must pass through to be called a strike. It has a width of the home plate (17 inches) and the height between the batter's knees and the middle of their torso. It is very common for batters to swing for pitches in the area around the strike zone (zones 10 to 21).



A weakness is defined for each pitch type in each zone as when the ratio of the number of fouls and misses to total number of times a batter swung exceeds 80%:

$$\frac{\text{number of fouls} + \text{number of misses}}{\text{total swings for that pitch type in that zone}} > 0.80$$

when the total number of swings for that pitch type in that zone is greater than 5.

By focusing on Orioles players with the most plate appearances and the lowest batting averages, we can focus on the most impactful weaknesses in order to best optimize for player development.

IV. Data Findings and Training Recommendations

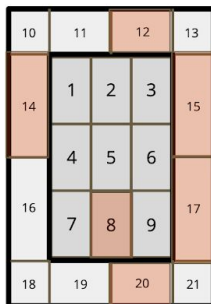
1. Renato Núñez

Renato Núñez had 541 at-bats for 2019 with only a 0.244 batting average. Núñez is predicted to be the Orioles' designated hitter for the upcoming 2020 season, which means he will be batting in place of the pitcher resulting in more at-bats and opportunities to score runs.

Núñez mostly has difficulty hitting fast pitches with the exception of changeups in zone 20 but this is likely due to the low positioning rather than the speed. Núñez's weakest region is zone 17, where he has difficulty hitting four-seam fastballs, two-seam fastballs, and sinkers.

Focusing on fast pitches on the lower-right, outer regions of the strike zone would greatly improve Núñez's success rate.

Strike Zone



Renato Núñez #39

2019 | AB: 541, BA: 0.244

Weaknesses:

Zone 8: (SL, 84mph)

Zone 12: (FF, 93mph)

Zone 14: (SL, 84mph)

Zone 15: (FC, 85mph)

Zone 17: (FT, 92mph), (FF, 94mph), (SI, 92mph)

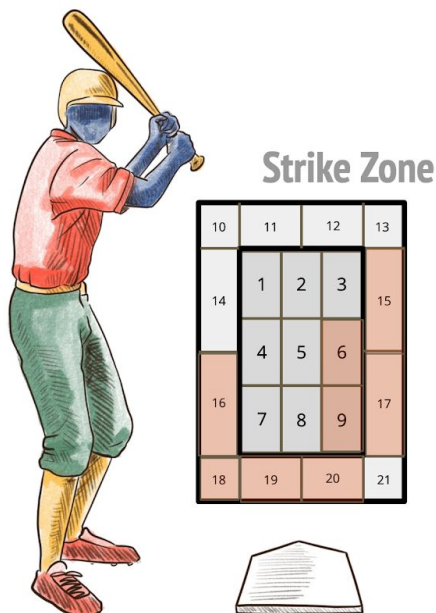
Zone 20: (CH, 85mph)

2. Rio Ruiz

Rio Ruiz had 370 at-bats for 2019 with only a 0.232 batting average. Ruiz has several weak zones, but his weakest is zone 19. Ruiz is swinging a lot on balls that are outside of the strike zone resulting in either a foul or a strike. If Ruiz chooses not to swing on pitches outside of the strike zone, they would be called a ball which would not be counted against him. Instead, four balls would allow the Ruiz to “walk” to first base.

Generally, Ruiz seems to have trouble with curveballs and sliders which are very similar pitches in terms of movement but differ in speed. They both are breaking balls meant to keep hitters off-balance as they chase the ball. However, curveballs are slow pitches and sliders are fast pitches which could be very deceptive since the windup is very similar for both. Similar to Núñez, Ruiz seems to have trouble with low-positioned changeups in the zones 19 and 20.

It would be beneficial for Ruiz to practice receiving curveballs and sliders to better tell the difference and recognize if they'll end up in the strike zone or not. This way, if Ruiz expects a curveball, he can swing later and if he expects a slider, he can swing sooner; if he expects it to be outside of the strike zone, he can not swing at all to not have it count as a ball and not a strike.



Rio Ruiz #14
2019 | AB: 370 , BA: 0.232

Weaknesses:

Zone 6: (CU, 78mph)

Zone 9: (FT, 92mph)

Zone 15: (FF, 93mph)

Zone 16: (SL, 84mph)

Zone 17: (CU, 79mph)

Zone 18: (SL, 86mph)

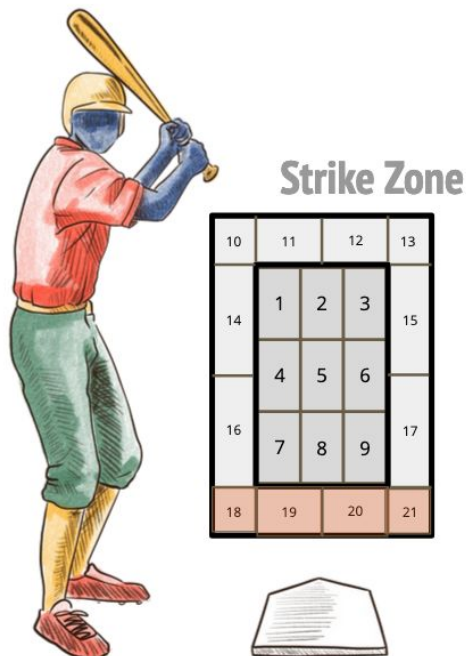
Zone 19: (CH, 86mph), (SL, 84mph), (CU, 79mph)

Zone 20: (CH, 87mph)

3. Dwight Smith Jr.

Dwight Smith Jr. had 357 at-bats for 2019 with only a 0.241 batting average. Similarly to Núñez and Ruiz, Smith has trouble with changeups, curveballs, and sliders. His weakest zones are all below the strike zone, meaning that if Smith didn't swing on these they would have likely counted as a ball rather than a foul or a strike.

Smith has trouble with changeups in zones 19 and 21. Changeups are generally a slow pitch that are thrown similarly to fastballs, by learning to recognize the differences between them Smith's batting average would improve since slower pitches are generally easier to hit. So, practicing batting against fastballs and changeups aimed low would be greatly beneficial to Smith.



Dwight Smith Jr. #35
2019 | AB: 357, BA: 0.241

Weaknesses:

Zone 18: (SL, 85mph)

Zone 19: (CH, 85mph)

Zone 20: (CU, 78mph)

Zone 21: (CH, 85mph)

V. Appendix

By analyzing MLB's Statcast database for the 2019 season, comparisons can be made for all MLB batters. A profile for every batter is created and contains all pitchers received during the 2019 season; all pitches that fall within the strike zone are then grouped by zone and pitch type.

- GitHub Repository:
https://github.com/CamilaCamacho/orioles_batter_analysis
- Jupyter Notebook Analysis:
https://github.com/CamilaCamacho/orioles_batter_analysis/blob/master/Orioles%20Batter%20Analysis.ipynb

Success rate of pitch type is dependent on whether or not the batter made contact with the ball:

- High Likelihood of Contact =
$$\frac{\text{(number of balls hit into play resulting in a single, double, triple, or homerun)}}{\text{(total number of pitches swung at)}}$$
- Medium Likelihood of Contact =
$$\frac{\text{(number of misses + fouls + number of balls hit into play NOT resulting in a single, double, triple, or homerun)}}{\text{(total number of pitches swung at)}}$$
- Low Likelihood of Contact =
$$\frac{\text{(number of misses and fouls)}}{\text{(total number of pitches swung at)}}$$