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Utah Hockey Club Analytics Challenge

What Statistics Differentiate Stanley Cup Champions?

Overview: This analysis identifies meaningful statistics that differentiate Stanley Cup Champions from other NHL teams. Findings are achieved by aggregating and analyzing statistical data from 2008-09 through 2023-24. The findings are then leveraged to evaluate the Utah Hockey Club.

Analysis: One-hundred and eleven (111) statistical categories, covering team-level metrics for each of the past 16 NHL regular seasons, were analyzed for the Stanley Cup Champions, runner-up, playoff teams, and non-playoff teams. The "mean-average" for each category and team-cohort was calculated and compared. The percentage variance between the means of Champions and non-playoff teams was then calculated. The analysis illuminated ten (10) key categories with the most significant percent variance between Champions and non-playoff teams.

Key Categories	**Variance**		
1-3. Goals Against (by 'Danger' level)	low = 30.1%	med. = 20.9%	high = 17.9%
4-6. Goals For (by 'Danger' level)	low = -10.9%	med. = -15.0%	high = -13.3%
7. Rebound Goals For	-12.1%		
8. Rebound Goals Against	11.9%		
9. Defensive Zone Giveaways For	-12.5%		
10. Defensive Zone Giveaways Against	11.1%		

**Read as "Non-playoff teams give up 30.1% more 'Low Danger' goals than Champions." See 'Analysis' under 'Project Details' for definitions.*

Application to the Utah Hockey Club: Defining the strengths and weaknesses of the 2023 team through comparison with Stanley Cup Champions.

Strengths:

- **missedShotsAgainst** (37.48%) - *good at forcing unblocked shots that miss the net*
- **reboundsFor** (37.07%) - *good at generating offensive rebounds resulting in a shot*
- **highDangerShotsFor** (32.43%) - *taking many shots from within the crease or in front of net*
- **reboundGoalsAgainst** (-12.25%) - *goalies are stopping scoring chances off of rebounds*

Weaknesses:

- **goalsAgainst** (40.33%) // **lowDangerGA** (78.87%) // **highDangerxGA** (60.36%) // **highDangerGA**(34.09%) // **highDangerShotsAgainst** (55.11%) // **shots/gp** (-13.47%)
  - *allowing significant number of shots and goals, esp. from 'high' & 'low' danger areas*
- **reboundsAgainst** (55.37%)
  - *Allowing an outsized number of rebound opportunities. This is very interesting when also considering that 'ReboundGoalsAgainst' is a strength. Good goaltending!*
- **reboundGoalsFor** (-28.21%) - *not scoring goals off the rebound in the offensive zone*
- **playContinuedInZoneAgainst** (31.47%) - *allowing ongoing play in dZone after a shot*
- **freezeFor** (-16.75%) - *goaltenders not freezing puck as often as the Champs mean*
- **dZoneGiveawaysAgainst** (-12.62%) - *not forcing turnovers in offensive zone*
- **fow%** (-11.10%) - *not winning faceoffs, impacting the ability to control play*
- **fenwickPercentage** (-9.72%) - *being outplayed in terms of generating offensive opportunity*
- **takeawaysFor** (-9.38%) - team is *not forcing enough turnovers*

Conclusion and Recommendations: The analysis shows that key statistics differentiate Stanley Cup Champions from non-Playoff teams and that there are also clear statistical strengths and weaknesses for the Utah Hockey Club compared to Champions. Given the findings, the conclusion is that the Utah Hockey Club must focus on improvement in the following areas to strengthen its chances at winning the Stanley Cup: **rebound control, defensive zone puck possession, offensive zone puck pressure, faceoffs,** and, of course, **goal scoring** and **goal defense.**

Project Details

Purpose: To win the Stanley Cup is the ultimate goal for every NHL team, and understanding what sets championship teams apart is crucial in building toward that end. So, as part of the collective goal to win the Stanley Cup for Utah, this analysis focuses on identifying key statistics that have historically set to Stanley Cup championship teams apart from the rest.

Hypothesis: The hypothesis is that specific and definable statistical characteristics differentiate Stanley Cup Champions from other NHL teams. These statistics reveal trends among Champions, which may then be applied to assess team performance and highlight improvement opportunities.

Methodology: To achieve the above-stated objectives, a “let the data do the talking” approach was adopted from the outset. Ultimately, six discrete datasets were created, encompassing hundreds of statistical categories, over 22,000 rows, and 4.2 million data points, segmenting goalie, skater, and team-level statistics for each of the past 16 regular seasons and playoffs. Raw data was compiled from four online sources totaling 182 datasets of varying formats. Custom Python programs were written to aggregate, clean, and merge the raw data into the six discrete datasets mentioned above. The comprehensive nature of these datasets, covering numerous complex & advanced stats from 2008-09 through 2023-24, allows for a robust analysis of historical trends and player performance.

All analyses were performed using Python in a local environment, leveraging libraries such as Pandas and Matplotlib for data manipulation and visualization. While Generative AI (specifically, ChatGPT) was leveraged while building Python programs, all analytical work, including data interpretation, trend identification, and conclusion drawing, was conducted independently without AI input. No documents were imported into AI tools for analysis purposes. This approach ensures that my findings are my own and are objective, robust, and actionable, providing a meaningful foundation for evaluating the Utah Hockey Club’s potential for success in the 2024-25 season.

Analysis: The Statistical Differentiators of Stanley Cup Champions

Strategy: Leveraging custom dataset with 111 statistical categories of team-level regular season statistics per year ranging from 2008-09 through 2023-24. For the entire dataset, group teams into four cohorts: [Stanley Cup Champions, runner-up, playoff, non-playoff]. Calculate the ‘mean’ per cohort for every statistic, then compare the ‘Champions’ group to each other cohort.

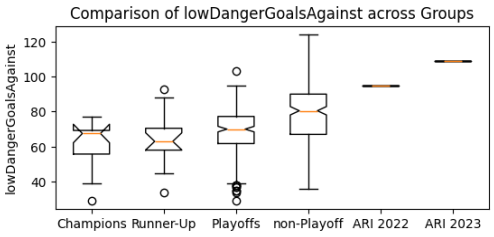
Outcome: The following statistics have the highest variance between the means of Champions and non-playoff teams, highlighting meaningful regular season statistical differentiators between these groups. The means for each of the four defined groups, and the past two seasons for Arizona (ARI), are plotted on the charts below. Read statistics as, for example, “*non-playoff teams give up 30.1% more Low Danger Goals Against goals than Champions”.*

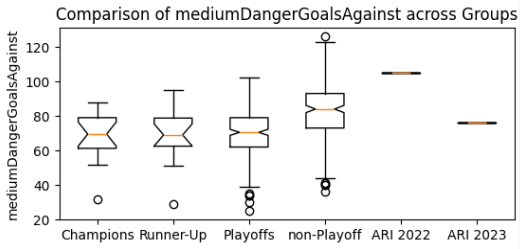
Utah Hockey Club Analytics Challenge

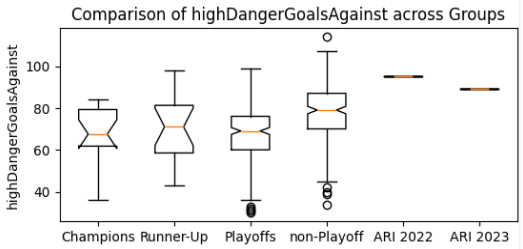
lowDangerGoals
Against: 30.1% // For: -11%
Goals from low-danger chances, typically shot from the perimeter or far from the net, with a lower chance of resulting in a goal.

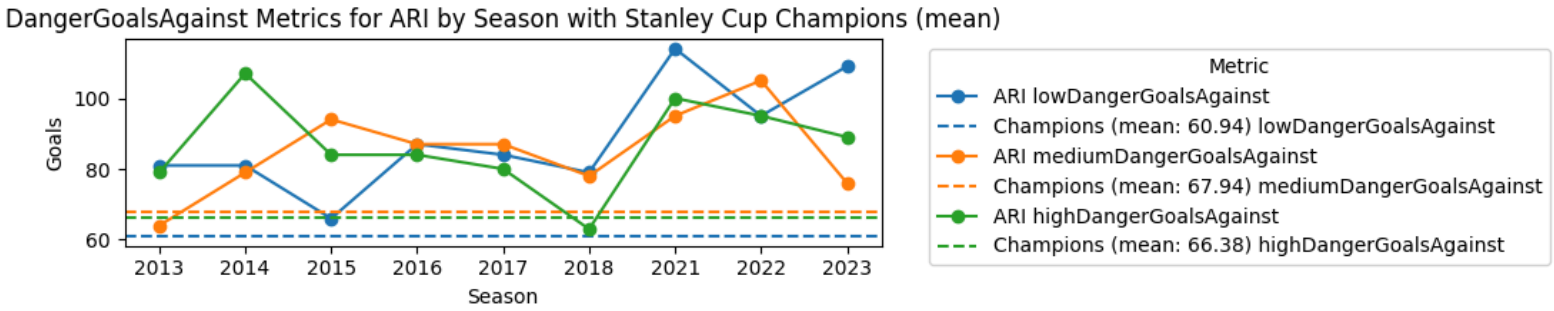
mediumDangerGoals
Against: **20.9% // For: -15%**
Goals from medium-danger chances, usually shot from a distance where the shot has a reasonable chance of scoring, such as from the slot or middle of the ice.

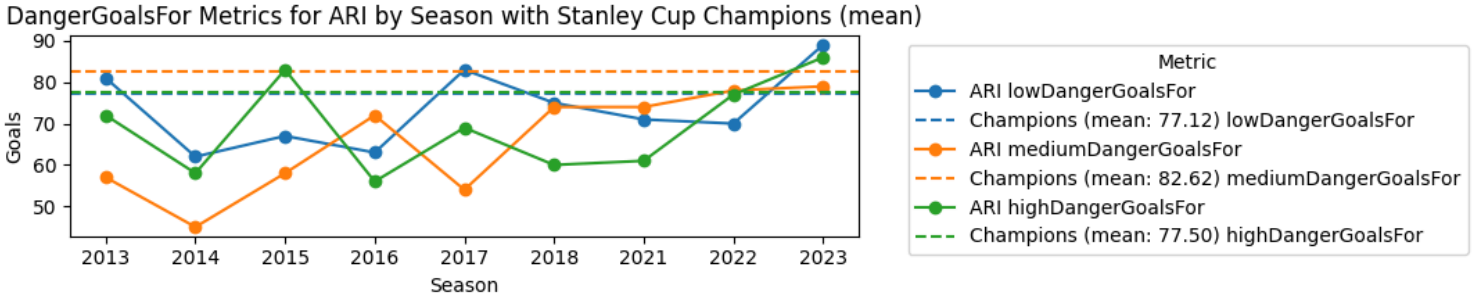
highDangerGoals
Against: **17.9% // For: -13%**
Goals from high-danger chances, shot from close to the net and have a higher chance of resulting in a goal, such as shots from within the crease or near the goalie.







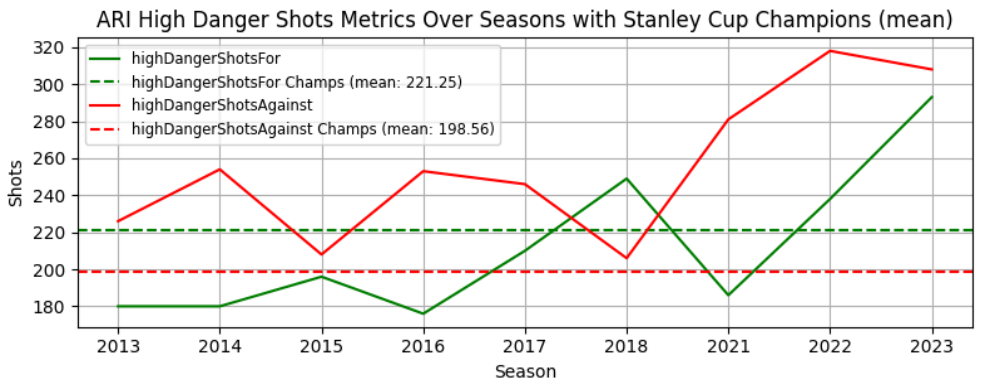




The chart above highlights that ARI has improved in goal scoring over the past few years, especially from the 'highDanger' area.

The chart on the right highlights that ARI has also sharply increased offensive 'highDanger' shot attempts in recent years.

ARI has often allowed more 'highDanger' shot attempts than Champions, and this metric has worsened the past few seasons for the team.

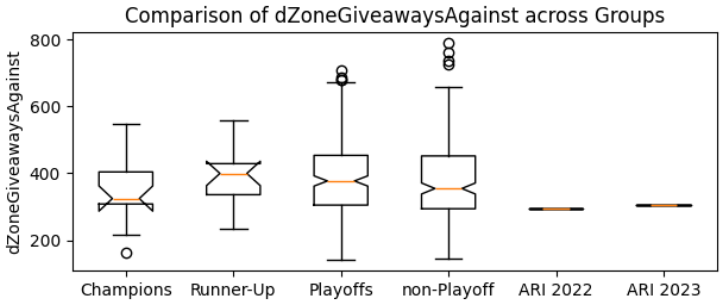


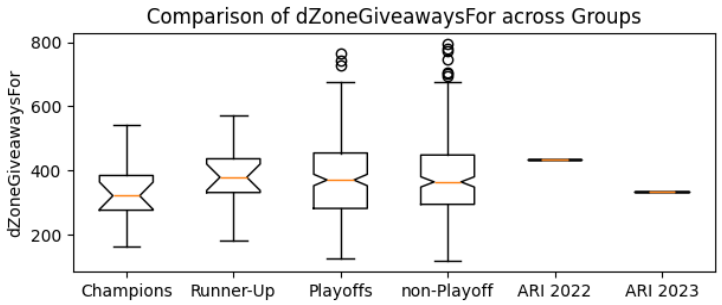
Utah Hockey Club Analytics Challenge

dZoneGiveaways

Against: 11.1% // For: -12.5

The number of giveaways committed by a team in their own defensive zone. These are dangerous because they can lead to high-quality scoring chances for the opposing team.

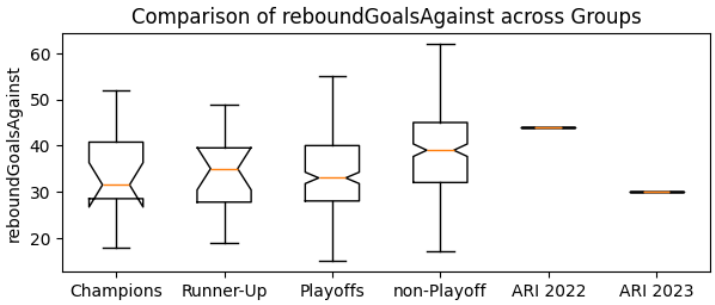


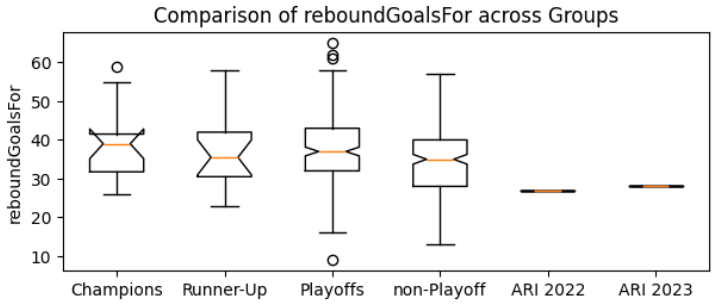


reboundGoals

Against: 12% // For: -12%

The number of goals created from rebounds. These goals are scored after a shot rebounds off the goalie or another player.



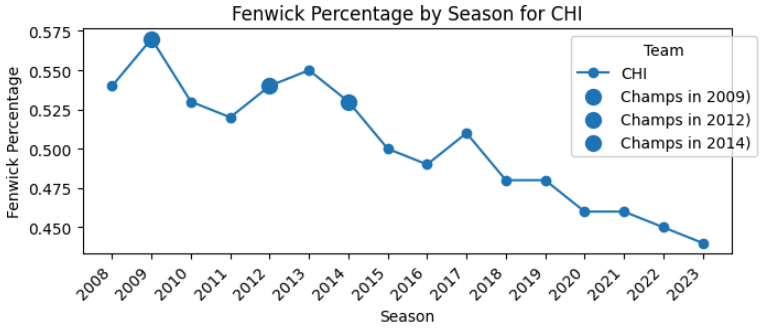


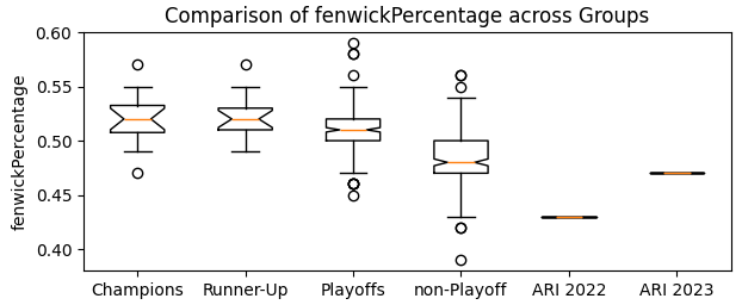
Case Study: Rise and Fall of a Stanley Cup Champion

The **Chicago Blackhawks:** 3x Cup winners in the first seven seasons of the dataset, and then missed the playoffs in all but one of the last 7 seasons. Analysis of Chigago's statistics has revealed a positive relationship between **Fenwick Percentage** and Stanley Cup success.

Fenwick Percentage is a statistic that measures the proportion of unblocked shot attempts (shots on goal and missed shots, but excluding blocked shots) a team takes compared to the total number of unblocked shot attempts by both teams during a game or over a specific period.

A Fenwick Percentage above 50% indicates that a team is controlling more of the unblocked shot attempts than their opponent, suggesting they are likely driving play and spending more time in the offensive zone. Conversely, a percentage below 50% suggests the team is being outplayed in terms of generating offensive opportunities.

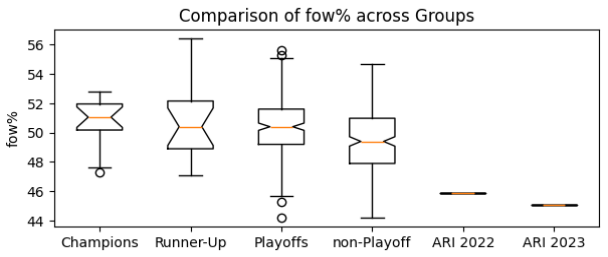




Utah Hockey Club Analytics Challenge

Analysis: Utah Hockey Club

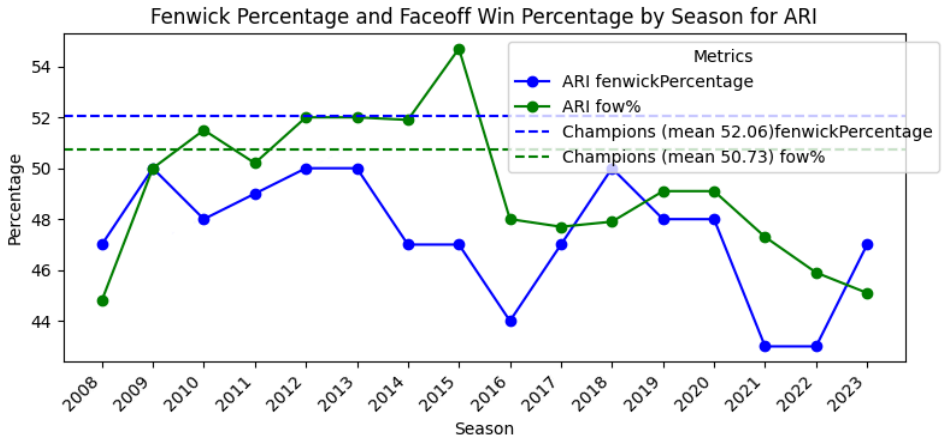
Table below displays statistics where the 2023 Arizona team had their largest differentiations with Champions (mean). Datapoints represent a subset of the 111 analyzed categories.
Ex. "team allows 78.87% more lowDangerGoals than Champs"
red = weaknesses ; green = strengths ; all definitions



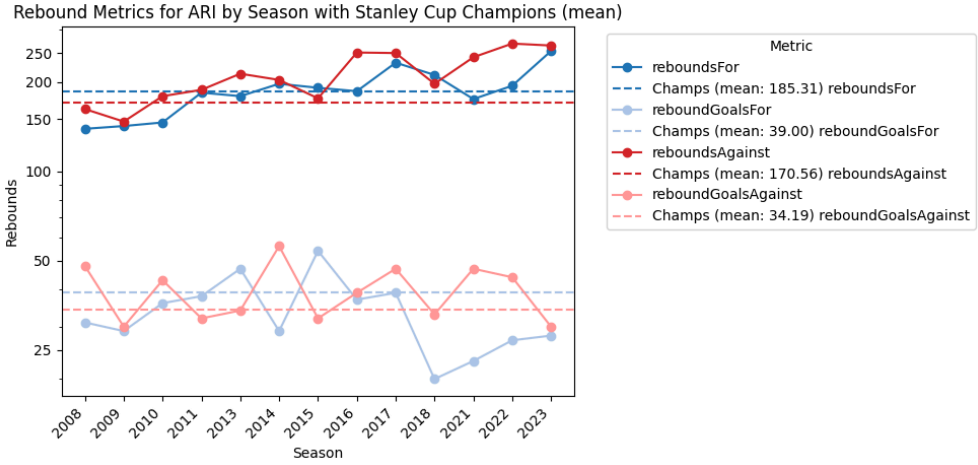
lowDangerGoalsAgainst	78.87%
highDangerxGoalsAgainst*	60.36%
reboundsAgainst	55.37%
highDangerShotsAgainst	55.11%
goalsAgainst	40.33%
missedShotsAgainst	37.48%
reboundsFor	37.07%
highDangerGoalsAgainst	34.09%
highDangerShotsFor	32.43%
playContinuedInZoneAgainst	31.47%
reboundGoalsFor	-28.21%
freezeFor	-16.75%
shots/gp	-13.47%
dZoneGiveawaysAgainst	-12.62%
reboundGoalsAgainst	-12.25%
fow%	-11.10%
fenwickPercentage	-9.72%
takeawaysFor	-9.38%

** xGoals calculates "expected goals" based on shot volume from each 'danger' zone*

ARI is consistently below the Champions mean for fow% (faceoff) & Fenwick%



(below) ARI has improved recently in collecting offensive rebounds (resulting in shots), however, is also allowing opponents a significant number of rebounds near ARI net.



Additional Analysis Opportunities

Analysis of Goalies and Defensemen as Differentiators for Champions
Analysis of Team / Player stats in playoffs to differentiate Champions
Relationship of 'player age' to key statistics and progressions.
Analysis of junior & minor leagues relating to key statistical areas.

Aids & Resources

ChatGPT (for Python Code)
MoneyPuck.com, QuantHockey.com, NHL.com, Hockey-Reference.com
project GitHub