

The NHL releases detailed play by play gamesheets for every game, allowing us to compute new and currently unreported metrics

The official gamesheets report ~300 distinct plays per game (faceoffs, shots, blocked shots, hits, goals, penalties).

The gamesheets contain a list of all players present on the ice for every play and distance to goal for every shot or goal.

- Play situation
- Description of play
- Players on ice

NHL official gamesheet example

VISITOR		HOME	
	2		1
Play By Play			
Tuesday, November 5, 2019 Attendance 15,435 at Nationwide Arena Start 7:08 EST; End 9:35 EST Game 0227 Final			
VEGAS GOLDEN KNIGHTS Game 16 Away Game 7		COLUMBUS BLUE JACKETS Game 15 Home Game 9	
#	Time: Per Str Elapsed Game	Event	Description
		VGK On Ice	CBJ On Ice
1 1	0:00 20:00	PGSTR	
2 1	0:00 20:00	PGEND	
3 1	0:00 20:00	ANTHEM	
4 1	0:00 20:00	PSTR	Period Start- Local time: 7:08 EST 71 81 19 15 22 29 14 28 18 3 8 70 C C R D D G C R L D D G
5 1 EV	0:00 20:00	FAC	CBJ won Neu. Zone - VGK #71 KARLSSON vs CBJ #18 DUBOIS 71 81 19 15 22 29 14 28 18 3 8 70 C C R D D G C R L D D G
6 1	0:19 19:41	STOP	PUCK IN BENCHES 71 81 19 15 22 29 14 28 18 3 8 70 C C R D D G C R L D D G
7 1 EV	0:19 19:41	FAC	CBJ won Neu. Zone - VGK #71 KARLSSON vs CBJ #18 DUBOIS 71 81 19 3 88 29 14 28 18 3 8 70 C C R D D G C R L D D G
8 1 EV	0:27 19:33	SHOT	CBJ ONGOAL - #14 NYQUIST, Wrist, Off. Zone, 29 ft. 71 81 19 3 88 29 14 28 18 3 8 70 C C R D D G C R L D D G
9 1 EV	0:30 19:30	BLOCK	CBJ #14 NYQUIST BLOCKED BY VGK #88 SCHMIDT, Wrist, Def. Zone 71 81 19 3 88 29 14 28 18 3 8 70 C C R D D G C R L D D G
10 1 EV	0:52 19:08	SHOT	VGK ONGOAL - #19 SMITH, Snap, Off. Zone, 46 ft. 26 19 67 15 22 29 38 28 71 3 58 70 C R L D D G C R L D D G
11 1 EV	1:26 18:34	SHOT	VGK ONGOAL - #22 HOLDEN, Wrist, Off. Zone, 52 ft. 26 61 67 15 22 29 38 28 71 3 58 70 C R L D D G C R L D D G
12 1	1:27 18:33	STOP	GOALIE STOPPED (AFTER SOG) 1:27 18:33
13 1	EV	FAC	VGK won Off. Zone - VGK #26 STASTNY vs CBJ #38... 1:27 18:33
14 1	EV	SHOT	VGK ONGOAL - #27 THEODORE, Wrist, Off. Zone, 5 ft. 1:30 18:30
15 1	EV	SHOT	VGK ONGOAL - #26 STASTNY, Wrist, Off. Zone, 7 ft. 1:31 18:29
16 1	EV	MISS	VGK #14 HAGUE, Wrist, Wide of Net, Off. Zone, ... 1:52 18:08
17 1	EV	PENL	VGK #14 HAGUE, Wrist, Wide of Net, Off. Zone, ... 1:58 18:02
18 1	SH	FAC	CBJ #77 ANDERSON Hooking(2 min), Def. Zone Dra... 1:58 18:02
19 1	PP	GIVE	CBJ won Def. Zone - VGK #21 EAKIN vs CBJ #10 W... 2:35 17:25
20 1	SH	BLOCK	VGK GIVEAWAY - #71 KARLSSON, Off. Zone 2:41 17:19
21 1	SH		VGK #81 MARCHESSAULT BLOCKED BY CBJ #58 SAVAR... 2:41 17:19
22 1	SH		

Game plays data extracted in Python Pandas

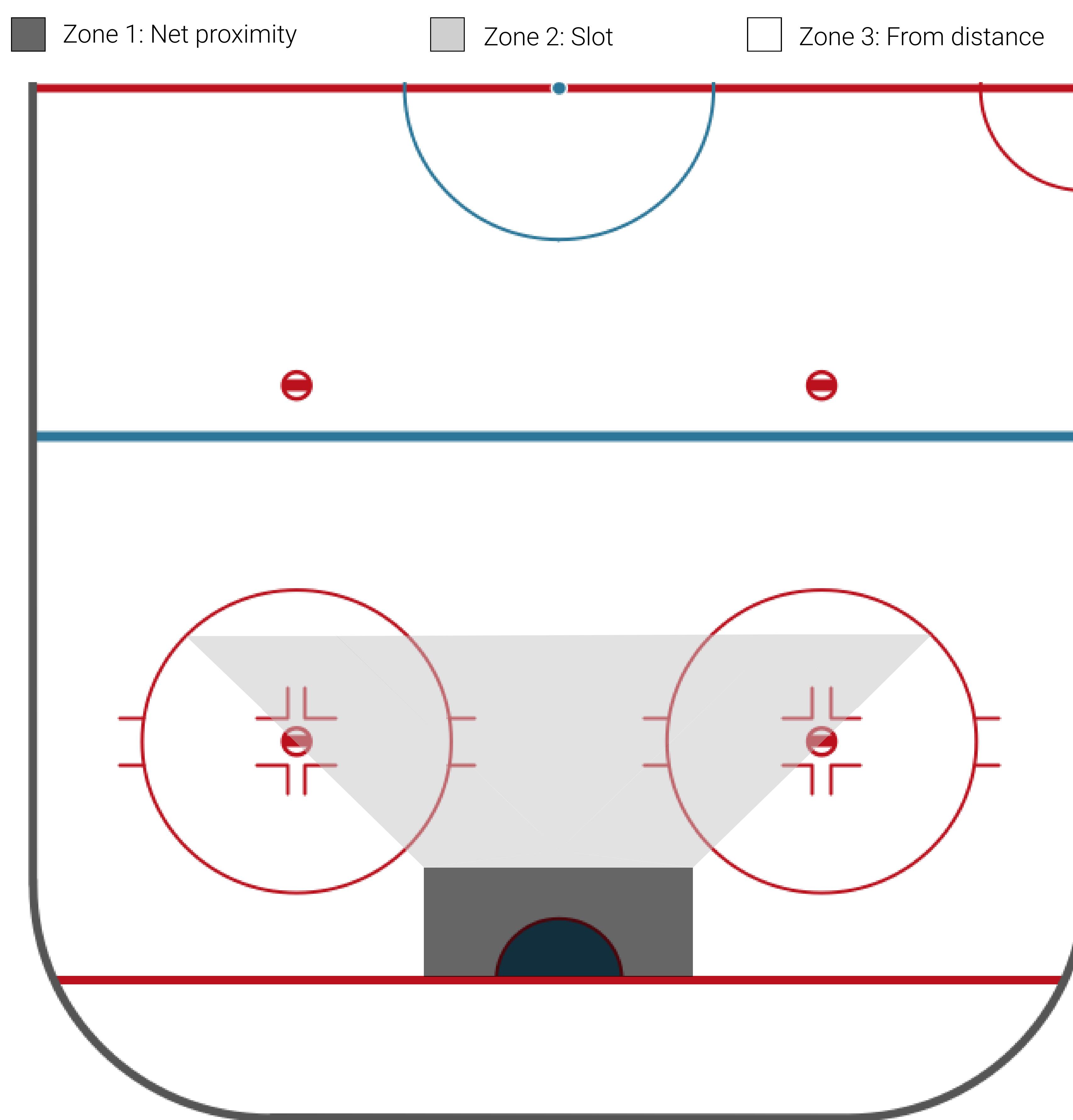
Event	Period	Strength	Start	End	Description	Details	Away p1 name	Away p1 pos	Away p1 num
0	4	1	0:00	20:00	PSTR	Period Start- Local time: 7:08 EST	WILLIAM KARLSSON	Center	71
1	5	1	EV	0:00	20:00	FAC CBJ won Neu. Zone - VGK #71 KARLSSON vs CBJ #1...	WILLIAM KARLSSON	Center	71
2	6	1		0:19	19:41	STOP PUCK IN BENCHES	WILLIAM KARLSSON	Center	71
3	7	1	EV	0:19	19:41	FAC CBJ won Neu. Zone - VGK #71 KARLSSON vs CBJ #1...	WILLIAM KARLSSON	Center	71
4	8	1	EV	0:27	19:33	SHOT CBJ ONGOAL - #14 NYQUIST, Wrist, Off. Zone, 29...	WILLIAM KARLSSON	Center	71
5	9	1	EV	0:30	19:30	BLOCK CBJ #14 NYQUIST BLOCKED BY VGK #88 SCHMIDT, W...	WILLIAM KARLSSON	Center	71
6	10	1	EV	0:52	19:08	SHOT VGK ONGOAL - #19 SMITH, Snap, Off. Zone, 46 ft.	PAUL STASTNY	Center	26
7	11	1	EV	1:26	18:34	SHOT VGK ONGOAL - #22 HOLDEN, Wrist, Off. Zone, 52 ft.	PAUL STASTNY	Center	26
8	12	1		1:27	18:33	STOP GOALIE STOPPED (AFTER SOG)	PAUL STASTNY	Center	26
9	13	1	EV	1:27	18:33	FAC VGK won Off. Zone - VGK #26 STASTNY vs CBJ #38...	PAUL STASTNY	Center	26
10	14	1	EV	1:30	18:30	SHOT VGK ONGOAL - #27 THEODORE, Wrist, Off. Zone, 5...	PAUL STASTNY	Center	26
11	15	1	EV	1:31	18:29	SHOT VGK ONGOAL - #26 STASTNY, Wrist, Off. Zone, 7 ft.	PAUL STASTNY	Center	26
12	16	1	EV	1:52	18:08	MISS VGK #14 HAGUE, Wrist, Wide of Net, Off. Zone, ...	PAUL STASTNY	Center	26
13	17	1	EV	1:58	18:02	PENL CBJ #77 ANDERSON Hooking(2 min), Def. Zone Dra...	PAUL STASTNY	Center	26
14	18	1	SH	1:58	18:02	FAC CBJ won Def. Zone - VGK #21 EAKIN vs CBJ #10 W...	CODY EAKIN	Center	21
15	19	1	PP	2:35	17:25	GIVE VGK GIVEAWAY - #71 KARLSSON, Off. Zone	CODY EAKIN	Center	21
16	20	1	SH	2:41	17:19	BLOCK VGK #81 MARCHESSAULT BLOCKED BY CBJ #58 SAVAR...	CODY EAKIN	Center	21

To fairly evaluate scoring chances across all NHL players, we began by investigating the difficulty of scoring in different situations

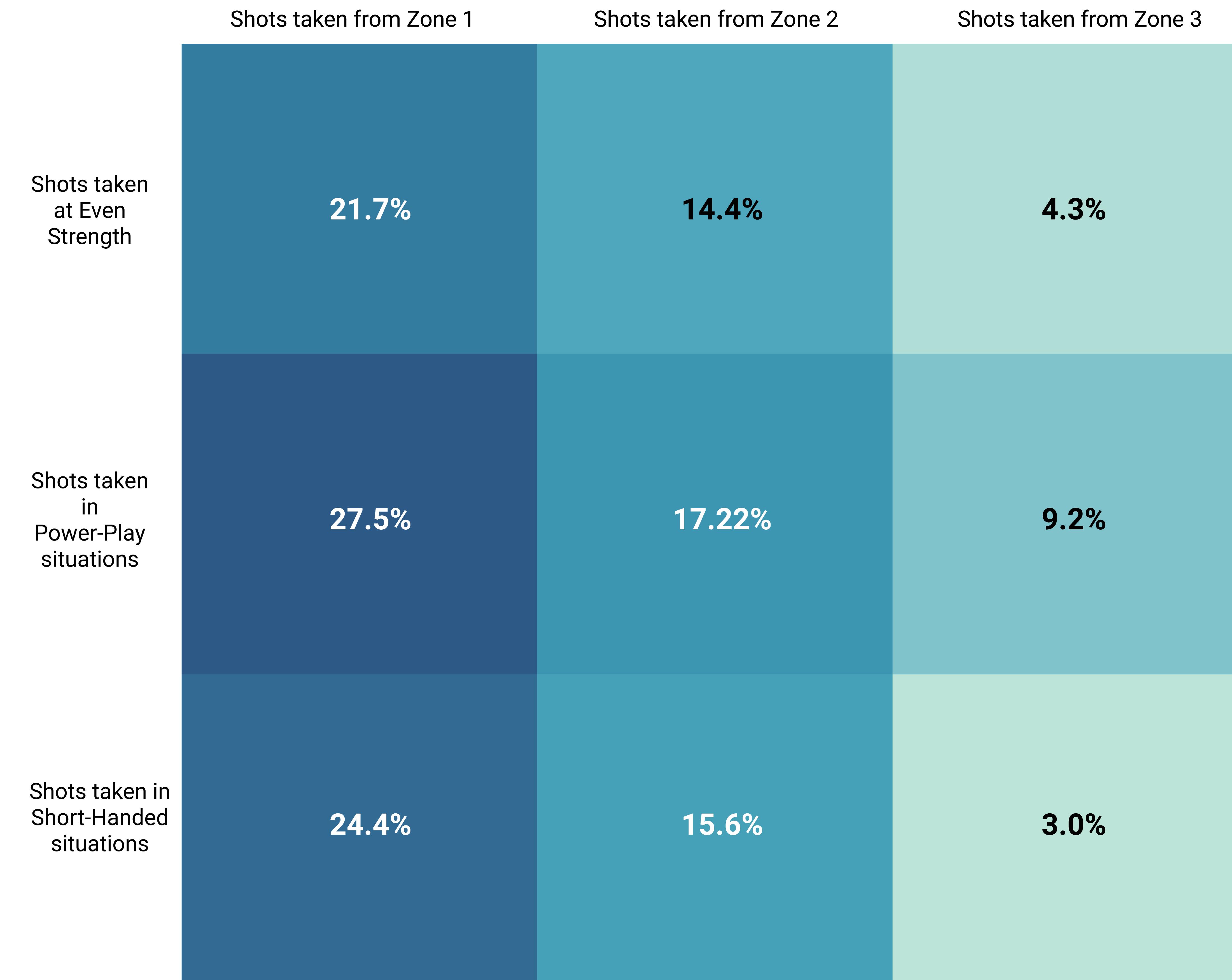
We aggregated the number of scoring chances and goals generated from different on-ice locations (goal proximity, slot, from distance) and in different phases of play (even-strength, power-play, short-handed).

Based on number of shots and goals generated, we computed the goal conversion rate across different play situations.

NHL ice and shot-zone representation



Conversion of shots to goals under different situations



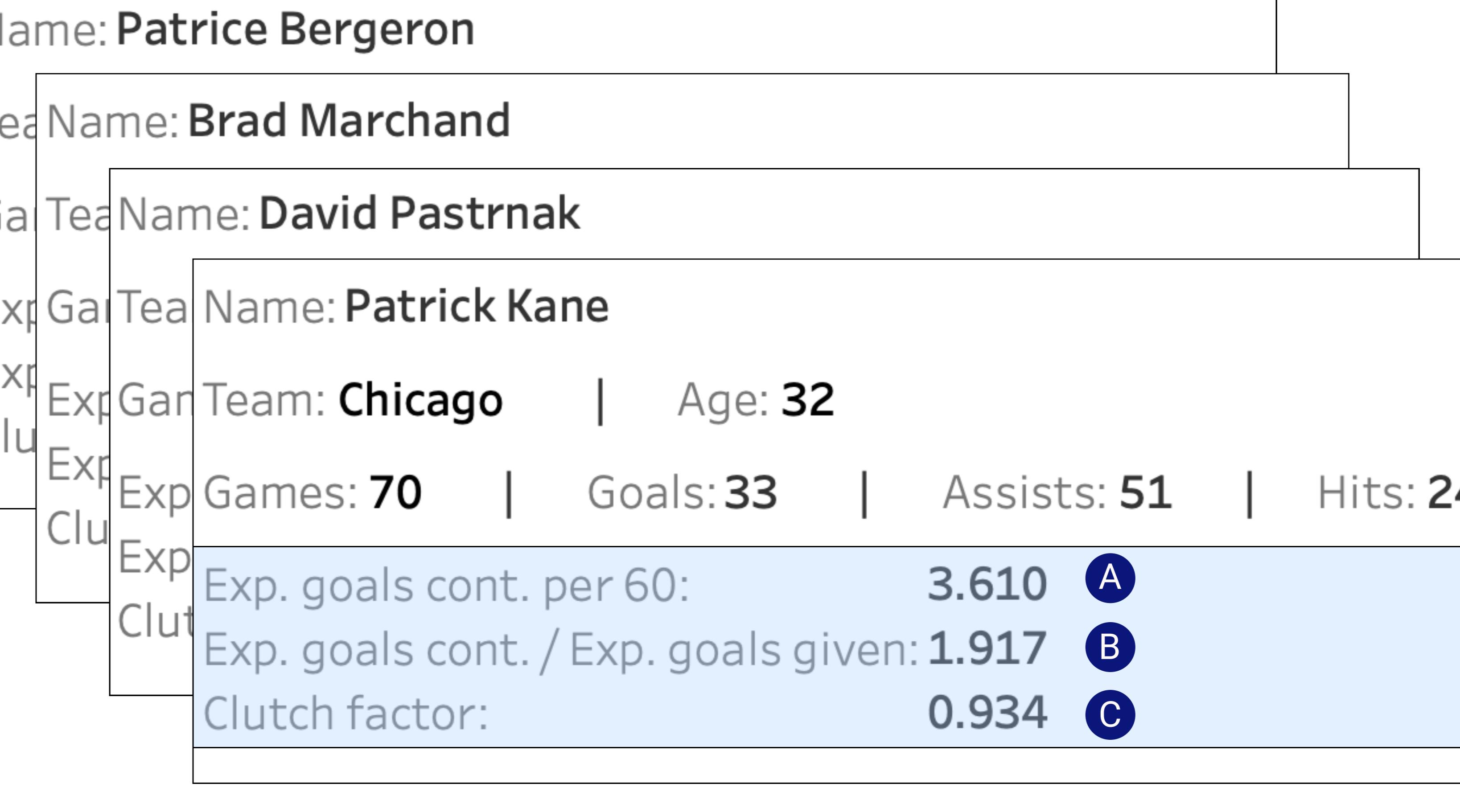
We analyzed each player's every shift to compute new metrics and gain a better understanding of their impact

Given our knowledge of location and context for any shot taken or given to the opponent while a player is on the ice, we can calculate expected contribution of said player. This allows us to see if there are discrepancies between expected and actual offensive production, but also gain insight into a player's defensive liability.

Details on new player evaluation metrics

Metric	Explanation	Interpretation
A Expected goals contributed to per 60 minutes played	Expected goals scored for team by 60 minutes of play for player X (based on location and context of each shot taken while player X is on ice)	A high expected goal created number indicates that a player generates a high number of scoring chances
Expected goals given per 60 minutes played	Expected goals scored by opposing team by 60 minutes of play for player X (based on location and context of shots by opposing team while player X is on the ice)	A high expected goal given number indicates that the player gives up many chances to opponents
B Expected goals contributed to over expected goals given	This is the ratio of expected goals contributed to and expected goals given	A number above 1 indicates that the player generates more offensive chances than he gives up (positive contributor to the team)
C Clutch Factor	Actual points produced (goals + assists) divided by expected goals contributed to	A high number can indicate "clutch" play, ability to perform under pressure, or pure luck (leading to higher conversion)

Example of player profiles produced by the tool



671 unique player profiles (one for each 2019-2020 skater) were created

By comparing expected vs actual offensive production, we see that traditional statistics fail to capture true value and may instead highlight luck

Bo Horvat and Mika Zibanejad, two standout players from the 2019-2020 campaign, provide a good example of “puck-luck’s” or “clutch play’s” impact on points produced. Based on volume and quality of scoring chances created, Horvat would be expected to produce more points than Zibanejad, but their conversion rates were close to NHL highs and lows. Given that long term sustained periods of high-luck are unlikely, statistics highlighting luck’s impact on points production are likely highly valuable to NHL front offices.

Name: **Bo Horvat**

Team: **Vancouver** | Age: **25**

Games: **69** | Goals: **22** | Assists: **31** | Hits: **55**

Exp. total goals cont.: **81.5**

Exp. goals cont. per 60: **3.590** A

Exp. goals cont. / Exp. goals given: **1.560** B

Clutch factor: **0.651** C

Name: **Mika Zibanejad**

Team: **NY Rangers** | Age: **27**

Games: **57** | Goals: **41** | Assists: **34** | Hits: **51**

Exp. total goals cont.: **69.2**

Exp. goals cont. per 60: **3.369** A

Exp. goals cont. / Exp. goals given: **1.806** B

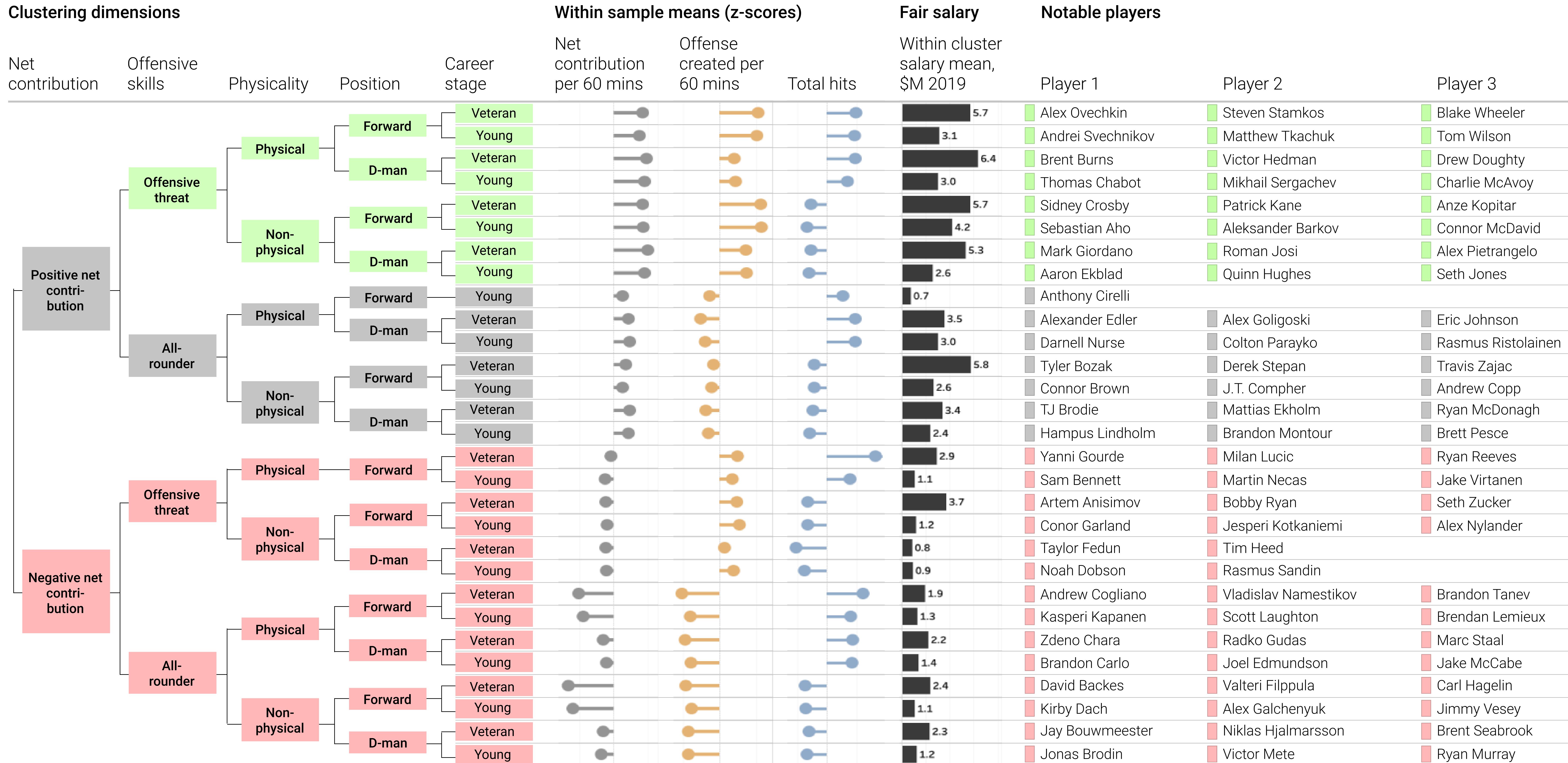
Clutch factor: **1.083** C

Using newly calculated metrics, we developed an approach to estimate each NHL player's fair salary based on comparables

We clustered all regular NHL skaters based on net contribution (difference between expected goals contributed to vs given), offensive output, physicality, position and age to identify groups of "comparable players" and observe mean salaries within each cluster.

- █ Value creating offensive player
- █ Value creating all around player
- █ Value destroying player

Clustering dimensions



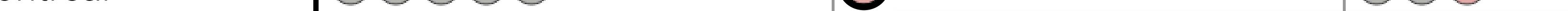
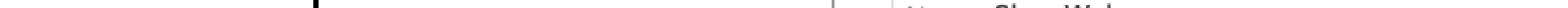
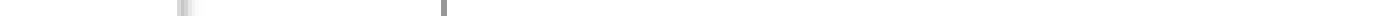
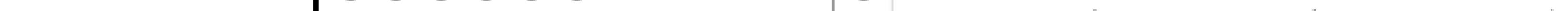
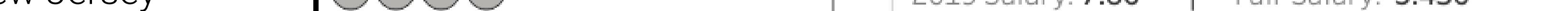
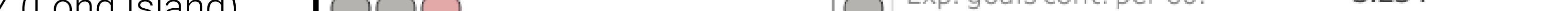
After having assigned players to each cluster, we can begin looking at team-level compositions

Each NHL player is displayed as a circle, assigned to a category within his team (based on clusters).

-  One fairly paid player
-  One over-paid player

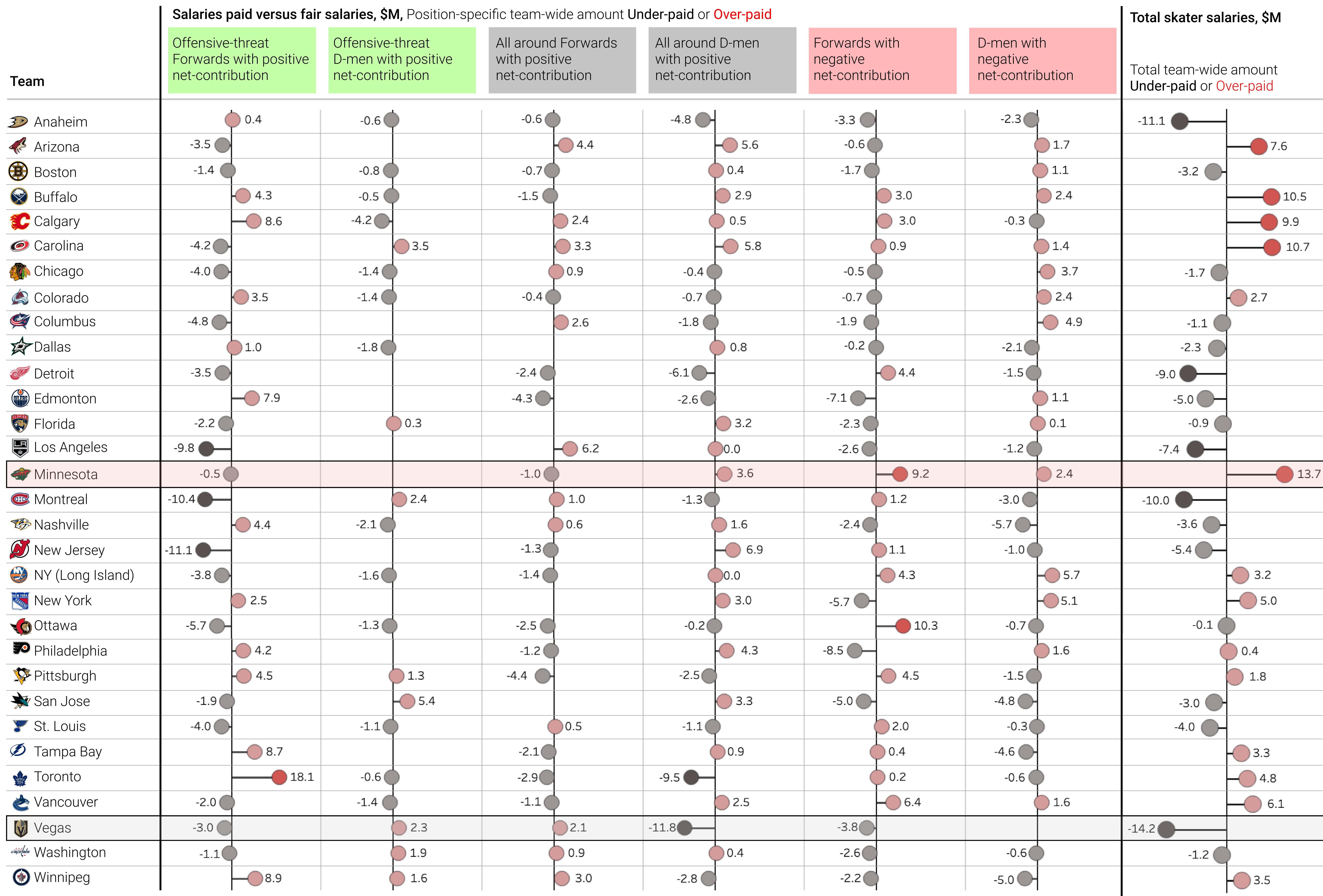
The tool's output in Tableau allows users to hover over every player, see key statistics and a comparison of fair salary to actual

In this example, details on Shea Weber are displayed.

 Montreal			
 Nashville			Name: Shea Weber
 New Jersey			Games: 65 Goals: 15 Assists: 21 Hits: 112
 NY (Long Island)			2019 Salary: 7.86 Fair Salary: 5.436
 New York			Exp. goals cont. per 60: 3.234 Exp. goals cont. / Exp. goals given: 1.850
			Clutch factor: 0.428

Based on estimates of each player's market value, we can assess General Managers' salary management performance

Comparing fair salary (based on player clustering) to actual salaries paid allows us to determine at which positions a GM is over/under paying his players. This can be aggregated across all players and positions to find the best and worst deal makers in the NHL.



To succeed in the NHL, GMs need not only to sign advantageous contracts, but also to spend all money available to them

Many GMs whose contract portfolios are beneficial to their teams do not spend to the salary cap, limiting their team's depth and performance.

8 of the top 10 teams in the 2019-2020 season spent all the money available with the salary cap.

7 of the top 10 teams displayed high spending combined with fair contracts (+/- \$5M difference between salaries paid and their fair value).

Franchise	Rank
Salary cap space available, \$M	Total salary over/under paid

How strong is the GM's deal-making ability?

Total salaries paid > total fair salaries

Total salaries paid < total fair salaries

Aggressive spending at cap
Poor deal-making ability

	Carolina	9
\$0.9 M available	\$10.7 M over-paid	

	Vancouver	17
\$0.1 M available	\$6.1 M over-paid	

	Calgary	19
\$0.9 M available	\$9.9M over-paid	

	Arizona	22
\$0.0M available	\$7.6M over-paid	

	Buffalo	25
\$0.8 M available	\$10.5M over-paid	

Aggressive spending at cap
Reasonable deal-making ability

	Boston	1
\$0.6 M available	\$3.1M under-paid	

	Philadelphia	6
\$0.1 M available	\$0.4M over-paid	

	Toronto	13
\$0.0 M available	\$4.8 M over-paid	

	Chicago	23
\$0.2 M available	\$1.7M under-paid	

	San Jose	29
\$0.6 M available	\$3.0 M under-paid	

Aggressive spending at cap
Exceptional deal-making ability

	Washington	5
\$0.2M available	\$1.2 M under-paid	

	Vegas	8
\$0.3 M available	\$14.2M under-paid	

	Dallas	10
\$0M available	\$2.3M under-paid	

	Edmonton	12
\$0.6M available	\$4.9M under-paid	

Does the GM spend the money he has available?

Conservative cap management
Poor deal-making ability

	Minnesota	21
\$2.9 M available	\$13.7M over-paid	

	New York	18
\$3.9 M available	\$5.0 M over-paid	

Conservative cap management
Reasonable deal-making ability

	Tampa Bay	4
\$1.3 M available	\$3.3M over-paid	

	Nashville	16
\$2.3M available	\$3.6M under-paid	

Conservative cap management
Exceptional deal-making ability

	Montreal	24
\$4.4 M available	\$10.0M under-paid	

	Anaheim	27
\$2.4M available	\$11.1M under-paid	

	Detroit	31
\$1.6M available	\$9.0 M under-paid	

Spends below salary cap

Severe-under spending of available cap
Poor deal-making ability

	Colorado	3
\$5.3 M available	\$2.7M over-paid	

	Ottawa	30
\$7.2 M available	\$0.1M under-paid	

Severe-under spending of available cap
Exceptional deal-making ability

	New Jersey	26
\$8.7 M available	\$5.4M under-paid	

	Los Angeles	28
\$7.0M available	\$7.4M under-paid	