

## WHY INTRODUCE A BONUS FOR ORDINARY OFFENSE IN WATER POLO

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### Abstract

By analyzing 23 official matches (13 matches of the Regional Triglav Water Polo League and 10 games of the LEN Euro Cup played in 2018) by registering 9 originally measured variables and 6 derived, we came to the information on the awarded and played slight offenses in the match or quarter of a game. Based on the obtained results, we suggest introducing the "Bonus" in the water polo. The bonus would be calculated for each quarter and the number of minor offenses for which the team time in the "bonus" would be 7. Any subsequent legal offense would be punished by a free shot from 6m. For a committed minor offense after the bonus expires, the offender would have been granted only a minor offense because we consider that a free-throw penalty from 6m is appropriate to the weightiness of the offense.

**Key words:** water polo, offense, bonus, variables.

### Introduction

The effects of a player on the water polo, and thus the value of his play value in today's water polo, are measured solely by the elements of severe misdemeanor in the sense of a positive and negative player's effect on the game (Penović 1982). Ordinary offenses' integral part of the game is neutral to the player's effect in the game and is not even included as a game element when evaluating the player's effect on the game and is not measured. It is clear why. The reason is that it does not penalize either the player who made it or the offending team. This fact, in the context of the rules of other collective sports (Handball, Basketball), has prompted us to consider the possibility of introducing "bonuses" in water polo (FINA Water Polo Rules 2019-2021, Official Basketball Rules, FIBA, 2018, International Handball Federation: Rules of the game 2016).

For this purpose, we conducted an experimental investigation on 13 official games of the Regional Triglav Water Polo League and 10 games of the LEN Euro Cup in 2018. Apart from direct recording of each committed offense on the match, we had the original record of the game and video of each game for control and credibility of the data. We've been collecting the statistical mass of 92 quarters on the 23 matches using a system of 8 originally measured variables that we have registered through the judges for the total number of ordinary and serious offenses earned on the match.

In this paper, according to the purpose of research, in the focus of our interest were only awarded offenses. In accordance with the results we will propose the introduction of "bonuses" in water polo. The original data obtained in this experimental procedure will be further analyzed by multi-criteria statistical-mathematical analyzes and published as separate scientific papers. The effect of the player on the match is estimated by the coach by direct observation, creating a judgment on this "eye-to-eye" effect.

It is clear that the trainer is in trouble because he has to memorize the data tree. In order for the trainee's evaluation to be objective and bringing reality closer to each other, it is necessary to make this rating corrected by exact indicators and thus become as close to the actual state. It is not necessary that the assessment of the play effect in the game as a current assessment of its quality is perfectly precise because it is impossible to do in much simpler sports with simple movable structures (Penović 1982, Pavičić, L., Lozovina, V., Šimenc, Z., 1987., Pavičić L., Lozovina M., Lozovina V., 2014). Waterpolo falls into the category of polystructural complex movements of acyclic dynamic structures with multitude water ballooning situations that occur at a vertiginous speed.

The observed individual never takes the previous position of the "circuit": "player, player, ball, space, time" (Pavičić, L., Lozovina, V., Šimenc, Z., 1987, Hraste, M., Bebić, M., Rudić R., 2013.). We will always be satisfied if the estimate is "sufficiently precise" so that through the predefined and previously made approximations, it is able, by simple procedure, to sufficiently present the state that can in practice satisfy us (Penović 1982, Pavičić at all 1987 and 2014).

The player's effect is an exact indicator of his effect on the game, acting independently without any appraisal based on the trainer's observation. Only a summary of these two estimates can give a complete picture of the player's effect in the game he played. This approach is necessary because all number of elements cannot be exactly measured. Overlapping and previously made approximations, the toy effect is the difference between all the exactly measured positive and negative elements of the game played by the players played on the match. Looking at this way the player's effect is the difference between all the exactly measured positive and negative elements of the game played by the players involved in the game.

Positive elements are:

$+ g' = g_i + g_{IV} + g_p + I + p$   
 where is  
 $g_i$  = goal from the play  
 $g_{IV}$  = goal with player more  
 $g_p$  = goal from penalty throw  
 $I$  = achieved exclusion  
 $p$  = achieved goal from penalty throw

Negative elements are:

$-g' = I_x + K_x + p_x$   
 where are  
 $I_x$  = cause dexclusion  
 $K_x$  = caused counter foul registered as a serious offense  
 $p_x$  = caused penalty throw

Both positive and negative elements are evaluated by coefficients:

$g_i$  -----  $k = 1.0$   
 $g_{IV}$  -----  $k = 0.5$   
 $g_p$  -----  $k = 0.3$   
 $I$  -----  $k = 0.6$

$p$  -----  $k = 0.8$   
 $I_x$  -----  $k = 0.5$   
 $K_x$  -----  $k = 0.5$   
 $p_x$  -----  $k = 0.8$

It follows that:

$+ g' = 1.0 g + 0.5 g_{IV} + 0.3 g_p + 0.6 I + 0.8 p$   
 $-g' = 0.5 I_x + 0.5 K_x + 0.8 p_x$

The player's effect (IE) is obtained by a relation  $IE = + g' - g'$ . In order to make the player's effects in a rating, it would be necessary to establish the practical boundaries of the player's effect, which was done after the examination of a large number of the games.

Established limits are:

The player's effect (minimum) = -1.72 which is rated at 1.0.  
 The player's effect (maximum) = +4.74 which is rated at 5.00.

Ratings between the above extreme values are given in the table in section Oie1.

Table 1. Evaluations for exactly measured player's effect in the game.

IE	Oie1	IE	Oie1	IE	Oie1	IE	Oie1	IE	Oie1
-1,72	1,0	-0,4	2,15	+0,9	2,95	+2,2	3,65	+3,5	4,35
-1,6	1,1	-0,3	2,2	+1,0	3,0	+2,3	3,7	+3,6	4,4
-1,5	1,2	-0,2	2,3	+1,2	3,1	+2,4	3,75	+3,7	4,45
-1,4	1,3	-0,1	2,4	+1,2	3,15	+2,5	3,8	+3,8	4,5
-1,3	1,4	0	2,5	+1,3	3,2	+2,6	3,85	+3,9	4,55
-1,2	1,45	+0,1	2,55	+1,4	3,25	+2,7	3,9	+4,0	4,6
-1,1	1,5	+0,2	2,6	+1,5	3,3	+2,8	3,95	+4,1	4,65
-1,0	1,6	+0,3	2,65	+1,6	3,35	+2,9	4,0	+4,2	4,7
-0,9	1,7	+0,4	2,7	+1,7	3,4	+3,0	4,1	+4,3	4,75
-0,8	1,8	+0,5	2,75	+1,8	3,45	+3,1	4,15	+4,4	4,8
-0,7	1,9	+0,6	2,8	+1,9	3,5	+3,2	4,2	+4,5	4,85
-0,6	2,0	+0,7	2,85	+2,0	3,55	+3,3	4,25	+4,6	4,9
-0,5	2,1	+0,8	2,9	+2,2	3,6+	+3,4	4,3	+4,74	5,0

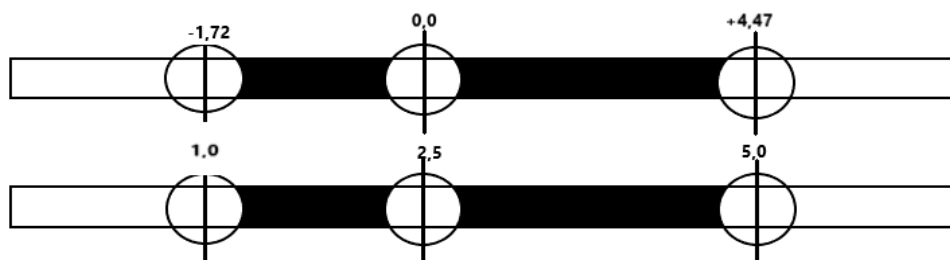


Image 1. The graph of the relationship between the exact measured player's effects registered in the game and evaluation from the coach on the proposed scale.

The final rating of each individual's playing performance will be obtained by the sum of Oie1 + Oie2 divided by 2 per formula:

$KO = (Oie1 + Oie2) / 2$   
 $KO =$  Final Score of Player Performance  
 $Oie1 =$  Score exactly the measured player's performance on the match

Oie2 = Score to the player's given from trainer immediately after the game (subjective unrealized part of the player's performance on that match).

All adduced, for all players of both teams, can do two well-trained and educed recorders, without any problems, by adding every event on the match in that prepared table A.

After that, and upon completion of the match, on the basis of Table A and the official record of the match is completed Table Band thus prepared gets Oie1 (a score of exactly measured player effect for each player in that match).

This approach in to match analysis in Croatian water polo has been present since the 1980s. In this mode of analyzing matches, according to previous experience, the outcome of the match determines the success of solving the players more and less, the goals from penalty throw and then the goals achieved from the game, so dominantly from serious offenses.

The ordinary offenses are not kept in the statistics, as if they did not exist. We are sure that ordinary violations also have an impact on the result but in existing Rules are not penalized. This is the reason why we conducted this research to suggest the introduction of "bonuses" in water polo (Lozovina, V., 2009, Lozovina, V, Lozovina, M., 2012.)

### Aim

The aim of this research was to determine the number of ordinary offenses awarded in one game and to propose the introduction of "bonuses" in the water polo on the basis of that data.

### Methods

The sample of respondents represented 13 matches of the Regional Triglav Water Polo League and 10 LEN Euro Cup matches played in 2018. Thus, in 23 matches, 92 quarters were collected, which represents statistically sufficient data for merit conclusion.

#### *Pattern of variables*

The sample of variables was composed of 9 originally measured and registered variables and six constructed variables:

CETVRTINA, OpO, IO, PO, KfO, OpD, ID, PD, KfD, LPO, LPD, LPO + LPD, TPO, TPD, LPO + LPD

### Description of variables

#### *Directly measured variables*

CETVRTINA = quarter, each judge judged four quarters. In the fifth line that is added, there is a sum of the frequencies of 4 quarters for all directly registered and constructed variables.

The original direct registered variables are:

OpO, IO, PO, KfO, OpD, ID, PD, KfD

OpO = ordinary (legal) offense awarded by a referee who is at that moment offensive

IO = exclusion (heavy) offense awarded by a judge who is at that moment offensive

PO = penalty throw (heavy offense) awarded by a judge who was at that moment offensive

KfO = counter foul (legal) offense awarded by a referee who was at that moment offensive

OpD = ordinary (legal) offense awarded by a referee who is at this point defensive

ID = exclusion (heavy) offense awarded by a judge who is at this point defensive

PD = penalty throw (heavy) offense awarded by a judge who is at this point defensive

KfD = counter foul (legal) offense awarded by a referee who is at this point defensive

#### *Constructs variables*

LPO = OpO + KfO = sum of the ordinary offenses that the referee awarded the match as an offensive referee

LPD = OpD + KfD = sum of the ordinary offenses that the referee awarded the match as defensive referee

LPO + LPD = the total amount of ordinary offenses awarded and in the offensive and defensive phase by the judge on that match

TPO = IO + PO = sum of the serious offenses that the referee awarded the match as an offensive judge

TPD = ID + PD = sum of heavy misdemeanors judged by the referee as defensive referee

TPO + TPD = total sum of heavy misdemeanors awarded in the offensive and defensive stage by the referee on that match

#### *Data analysis*

- A table of originally measured variables (OpO, IO, PO, KfO, OpD, ID, PD, KfD) has been constructed in which the original frequencies of the offenses of both judges were awarded on one match, either as offenses played as offensive or defensive judges in that quarter is shown in the first four lines.

- In the fifth line for each referee in the match, the total frequencies of the originally measured variables are calculated by all four quarters.

- The table contains the constructed variables that represent the sum of the minor misdemeanor values judged by the judges as offensive or defensive calculated by the formula  $LPO = OpO + KfO$ , respectively  $LPD = OpD + KfD$ , for each judge in each quarter and in the fifth row in aggregate.

- On the basis of the results obtained, the table shows the total number of minor offenses awarded in the match by the  $LPO + LPD$  formula for each quarter and fifth round in aggregate

- The same was made and the table entered for the serious offenses awarded in the game by the formula  $TPO = IO + PO$ ,  $TPD = ID + PD$  and for the total number of seriously awarded  $TPO + TPD$

- The total number of light and heavy violations awarded by judges in 13 official games of the Regional Triglav Water Polo League, 10 matches for LEN Euro Cup and for Total (23 analyzed matches) was calculated.

- The total number of light and heavy offenses awarded by judges per quarter for 13 official games of the Regional Triglav Water Polo League, 10 matches for LEN Euro Cup and for Total (23 matches analyzed) was calculated.

## Results

Table 2. List of results on originally and constructed variables measured on LEN Euro Cup matches.

UTAKMICA	CETVRTINA	OpO	IO	PO	KfO	OpD	ID	PD	KfD	LPO	LPD	LPO+LPD	TPO	TPD	TPO+TPD	UTAKMICA	CETVRTINA	OpO	IO	PO	KfO	OpD	ID	PD	KfD	LPO	LPD	LPO+LPD	TPO	TPD	TPO+TPD
14	1	2	1	0	0	12	1	0	0	2	12	14	1	1	2	19	1	3	1	0	1	4	1	0	0	4	4	8	1	1	2
14	2	3	1	0	1	2	0	0	1	4	3	7	1	0	1	19	2	4	3	0	0	8	2	0	0	4	8	12	3	2	5
14	3	0	1	1	2	3	0	1	0	2	3	5	2	1	3	19	3	7	2	1	0	6	1	0	0	7	6	13	3	1	4
14	4	6	2	0	2	3	1	0	0	8	3	11	2	1	3	19	4	6	1	0	1	9	0	0	0	7	9	16	1	0	1
14	5	11	5	1	5	20	2	1	1	16	21	37	6	3	9	19	5	20	7	1	2	27	4	0	0	22	27	49	8	4	12
14	1	3	2	0	1	6	1	0	0	4	6	10	2	1	3	19	1	1	1	0	0	6	1	0	1	1	7	8	1	1	2
14	2	4	1	0	2	4	1	0	0	6	4	10	1	1	2	19	2	0	0	0	0	1	0	0	0	0	1	1	0	0	0
14	3	7	2	0	0	3	1	0	1	7	4	9	2	1	5	19	3	1	2	1	0	3	0	0	0	1	3	4	3	0	3
14	4	2	4	0	0	7	1	0	0	2	7	9	4	1	5	19	4	1	1	0	0	2	0	0	1	1	2	3	1	0	1
14	5	18	9	0	3	20	4	0	1	19	21	40	9	4	13	19	5	3	4	1	0	12	1	0	2	5	13	18	5	1	6
15	1	1	2	0	1	10	0	0	0	2	10	12	2	0	2	20	1	6	0	0	1	0	0	0	0	7	0	7	0	0	0
15	2	7	0	0	0	4	0	0	0	7	4	11	0	0	0	20	2	1	1	0	2	5	1	0	1	3	6	9	1	1	2
15	3	5	1	0	0	2	0	0	0	5	2	7	1	0	1	20	3	4	0	0	0	1	0	0	0	4	1	5	0	0	0
15	4	0	3	0	0	9	1	0	0	0	9	9	3	1	4	20	4	5	3	0	0	5	1	0	0	5	5	10	3	1	4
15	5	13	6	0	1	25	1	0	0	14	25	39	6	1	7	20	5	16	4	0	3	11	2	0	1	19	12	31	4	2	6
15	1	2	3	0	1	6	1	0	2	3	8	11	3	1	4	20	1	2	2	0	2	3	0	0	2	4	5	9	2	0	2
15	2	1	1	0	0	6	1	0	0	1	6	7	1	1	2	20	2	0	1	0	0	0	0	0	0	0	0	0	1	0	1
15	3	1	6	0	1	9	1	0	0	2	7	9	6	1	7	20	3	5	4	0	0	0	0	0	2	5	2	7	4	0	4
15	4	2	3	0	1	6	0	0	0	3	6	9	3	0	3	20	4	0	0	0	0	2	0	0	0	0	2	2	0	0	0
15	5	6	13	0	3	27	3	0	2	9	27	36	13	3	16	20	5	7	7	0	2	5	0	0	4	9	9	18	7	0	7
16	1	1	0	0	0	4	0	0	1	1	5	6	0	0	0	21	1	1	1	1	1	8	1	0	1	2	9	11	2	1	3
16	2	2	2	1	1	3	0	0	1	3	4	7	3	0	3	21	2	5	3	0	0	2	1	0	0	5	2	7	3	1	4
16	3	6	2	1	1	3	0	0	1	7	4	11	3	0	3	21	3	2	2	0	1	5	2	0	0	3	5	8	2	2	4
16	4	6	2	0	0	5	0	0	0	6	5	11	2	0	2	21	4	4	3	0	1	3	0	0	0	5	3	8	3	0	3
16	5	15	6	2	2	15	0	0	3	17	18	35	8	0	8	21	5	12	9	1	3	18	4	0	1	15	19	34	10	4	14
16	1	5	2	0	0	4	0	0	0	5	4	9	2	0	2	21	1	4	2	0	1	7	1	0	0	5	7	12	2	1	3
16	2	7	2	0	0	4	1	0	0	7	4	11	2	1	3	21	2	4	3	0	0	14	0	0	0	4	14	18	3	0	3
16	3	1	4	0	2	7	1	0	0	3	7	10	4	1	5	21	3	8	2	0	0	2	0	0	0	8	2	10	2	0	2
16	4	4	3	0	0	4	0	0	0	4	4	8	3	0	3	21	4	5	3	0	0	4	2	0	0	5	4	9	3	2	5
16	5	17	11	0	2	19	2	0	0	19	19	38	11	2	13	21	5	21	10	0	1	27	3	0	0	22	27	49	10	3	13
17	1	2	2	0	0	1	0	0	0	2	1	3	2	0	2	22	1	2	1	0	2	5	0	0	0	4	5	9	1	0	1
17	2	1	3	0	1	4	0	0	1	2	5	7	3	0	3	22	2	2	1	1	2	3	0	0	0	4	3	7	2	0	2
17	3	0	0	1	1	4	0	0	0	1	4	5	1	0	1	22	3	0	0	1	1	8	1	0	0	1	8	9	1	1	2
17	4	6	2	1	1	0	0	0	0	7	0	7	3	0	3	22	4	0	2	0	2	2	0	0	1	2	3	5	2	0	2
17	5	9	7	2	3	9	0	0	1	12	10	22	9	0	9	22	5	4	4	2	7	18	1	0	1	11	19	30	6	1	7
17	1	4	1	0	0	3	0	0	0	4	3	7	1	0	1	22	1	5	0	1	0	5	0	0	1	5	6	11	1	0	1
17	2	2	0	0	1	3	0	0	0	3	3	6	0	0	0	22	2	2	0	0	0	3	0	0	1	2	4	6	0	0	0
17	3	3	2	0	0	3	0	0	0	3	3	6	2	0	2	22	3	0	0	1	0	3	0	0	0	0	3	3	1	0	1
17	4	0	2	0	3	3	0	0	0	3	3	6	2	0	2	22	4	2	1	0	1	7	0	0	0	3	7	10	1	0	1
17	5	9	5	0	4	12	0	0	0	13	12	25	5	0	5	22	5	9	1	2	1	18	0	0	2	10	20	30	3	0	3
18	1	4	3	0	1	5	0	1	2	5	7	12	3	1	4	23	1	8	2	0	0	2	0	0	0	8	2	10	2	0	2
18	2	2	0	0	2	6	0	0	0	4	6	10	0	0	2	23	2	2	0	0	1	6	1	0	0	3	6	9	0	1	1
18	3	4	0	0	1	4	0	0	0	5	4	9	0	0	0	23	3	7	3	0	1	1	0	0	0	8	1	9	3	0	3
18	4	3	3	0	0	4	0	0	0	3	4	7	3	0	3	23	4	6	2	0	0	4	0	0	0	6	4	10	2	0	2
18	5	13	6	0	4	19	0	1	2	17	21	38	6	1	7	23	5	23	7	0	2	13	1	0	0	25	13	38	7	1	8
18	1	0	2	0	1	5	1	0	1	1	6	7	2	1	3	23	1	1	4	0	1	5	0	0	1	2	6	8	4	0	4
18	2	2	1	1	0	6	2	0	2	2	8	10	2	2	4	23	2	2	0	0	0	4	0	0	1	2	5	7	0	0	0
18	3	4	1	0	0	6	0	0	0	4	6	10	1	0	1	23	3	3	1	0	0	3	0	0	1	3	3	6	1	0	1
18	4	3	2	0	0	5	0	0	0	3	5	8	2	0	2	23	4	3	1	0	2	8	0	0	0	5	8	13	1	0	1
18	5	9	6	1	1	22	3	0	3	10	25	35	7	3	10	23	5	9	6	0	3	20	0	0	3	12	22	34	6	0	6

(UTAKMICA – match number)

Table 3. List of results on originally and constructed variables measured on Regional Triglav League.

UTAKMICA	CETVRTINA	OpO	IO	PO	KFO	OpD	ID	PD	KFD	LPO	LPD	LPO+LPD	TPO	TPD	TPO+TPD	UTAKMICA	CETVRTINA	OpO	IO	PO	KFO	OpD	ID	PD	KFD	LPO	LPD	LPO+LPD	TPO	TPD	TPO+TPD
1	1	7	1	0	0	2	0	0	0	7	2	9	1	0	2	8	1	5	0	0	1	11	0	0	6	11	17	0	0	0	
1	2	5	1	0	0	5	1	0	0	5	5	10	1	1	2	8	2	4	0	0	1	4	1	0	0	5	4	9	0	1	1
1	3	9	3	1	0	2	1	0	0	9	2	11	4	1	5	8	3	9	3	0	0	3	0	0	9	3	12	3	0	3	
1	4	1	3	0	1	3	0	0	0	2	3	5	3	0	3	8	4	1	1	1	5	1	0	0	2	5	7	2	1	3	
1	5	22	8	1	1	12	2	0	0	23	11	35	9	4	12	8	5	19	4	1	3	23	2	0	0	22	23	45	5	2	7
1	1	1	3	0	0	10	0	0	0	1	10	11	3	0	3	8	1	3	2	0	0	9	0	0	0	3	9	12	2	0	2
1	2	4	4	0	1	7	0	0	0	5	7	12	4	0	4	8	2	5	2	1	1	5	1	0	0	6	5	11	3	1	4
1	3	0	4	0	0	2	0	0	1	0	3	3	4	0	4	8	3	11	4	0	0	3	0	0	0	11	3	14	4	0	4
1	4	3	1	1	0	1	0	0	0	3	1	4	2	0	2	8	4	5	2	0	1	3	0	0	0	6	3	9	2	0	2
1	5	8	12	1	1	20	0	0	1	9	21	30	13	0	13	8	5	24	10	1	2	20	1	0	0	26	20	46	11	1	12
2	1	5	1	0	1	14	0	0	0	6	14	20	1	0	1	9	1	2	1	0	2	5	0	0	1	4	6	10	1	0	1
2	2	7	0	1	2	7	0	0	0	9	7	16	1	0	1	9	2	7	5	0	1	0	0	0	0	8	0	8	5	0	5
2	3	9	2	0	1	7	0	0	0	10	7	17	2	0	2	9	3	0	0	0	0	8	0	0	0	0	8	8	0	0	0
2	4	7	0	0	0	8	0	0	0	7	8	15	0	0	0	9	4	4	2	0	0	6	1	0	1	4	7	11	2	1	3
2	5	28	3	1	4	36	0	0	0	32	36	68	4	0	4	9	5	13	8	0	3	19	1	0	2	16	21	37	8	1	9
2	1	8	2	0	4	10	0	0	1	12	11	23	2	0	2	9	1	8	3	0	1	0	0	0	0	9	3	12	3	0	3
2	2	4	1	0	2	3	0	0	0	6	3	9	1	0	1	9	2	3	3	1	0	5	1	0	0	3	5	8	4	1	5
2	3	6	0	0	1	18	0	0	0	7	18	25	0	0	0	9	3	1	1	0	0	9	0	0	1	1	10	11	1	0	1
2	4	7	1	0	2	2	0	0	1	9	3	12	1	0	1	9	4	2	1	1	1	5	0	0	0	3	5	8	2	0	2
2	5	25	4	0	9	33	0	0	2	34	35	69	4	0	4	9	5	14	8	2	2	19	1	0	1	16	23	39	10	1	11
3	1	3	1	0	1	6	2	0	0	4	6	10	1	2	3	10	1	8	2	0	2	3	1	0	0	10	3	13	2	1	3
3	2	1	2	0	1	9	0	0	0	2	9	11	2	0	2	10	2	1	4	0	1	6	2	0	1	2	7	9	4	2	6
3	3	2	2	0	3	3	0	0	0	5	3	8	2	0	2	10	3	3	1	0	0	6	0	0	0	3	6	9	1	0	1
3	4	2	1	0	1	8	1	0	0	3	8	11	1	1	2	10	4	3	0	0	0	8	0	0	0	3	8	11	0	0	0
3	5	8	6	0	6	26	3	0	0	14	26	40	6	3	9	10	5	15	7	0	3	23	3	0	1	18	24	42	7	3	10
3	1	5	1	0	0	1	0	0	0	5	1	6	1	0	1	10	1	4	3	1	3	11	0	0	0	7	11	18	4	0	4
3	2	1	2	0	1	2	0	0	0	2	2	4	2	0	2	10	2	6	4	1	1	6	1	0	0	7	6	13	5	1	6
3	3	1	2	0	2	2	1	0	0	3	2	5	2	1	3	10	3	1	2	0	0	18	3	0	1	1	19	20	2	3	5
3	4	3	4	0	1	2	0	0	0	4	2	6	4	0	4	10	4	5	2	0	0	4	0	0	0	5	4	9	2	0	2
3	5	10	9	0	4	7	1	0	0	14	7	21	9	1	10	10	5	16	11	2	4	39	4	0	1	20	40	60	13	4	17
4	1	8	1	0	1	4	1	0	0	9	4	13	1	1	2	11	1	4	3	0	0	2	1	0	0	4	2	6	3	1	4
4	2	2	1	0	1	8	2	0	1	3	9	12	1	2	3	11	2	0	1	0	1	8	0	0	1	1	9	10	1	0	1
4	3	4	1	0	0	6	0	0	2	4	8	12	1	2	3	11	3	4	1	1	0	0	0	0	0	4	0	4	2	0	2
4	4	3	1	0	0	1	1	0	1	3	2	5	1	1	2	11	4	2	2	0	0	6	0	0	0	2	6	8	2	0	2
4	5	17	4	0	2	19	4	0	4	19	23	42	4	6	10	11	5	10	7	1	1	16	1	0	1	11	17	28	8	1	9
4	1	7	2	0	2	9	0	0	0	9	9	18	2	0	2	11	1	3	2	0	0	2	0	0	0	3	2	5	2	0	2
4	2	4	1	0	1	3	1	0	0	5	3	8	1	1	2	11	2	4	0	0	1	4	0	0	0	5	4	9	0	0	0
4	3	5	0	0	1	12	0	0	0	6	12	18	0	0	0	11	3	1	0	0	2	7	0	0	0	3	7	10	0	0	0
4	4	2	1	0	3	5	0	0	0	5	5	10	1	0	1	11	4	2	1	1	1	2	0	0	1	3	3	6	2	0	2
4	5	18	4	0	7	29	1	0	0	25	29	54	4	1	5	11	5	10	3	1	5	15	0	0	1	14	16	30	4	0	4
5	1	8	1	0	2	3	0	0	0	10	3	13	1	0	1	12	1	8	3	0	0	4	1	0	0	8	4	12	3	1	4
5	2	5	1	0	2	5	1	0	1	7	6	13	1	1	2	12	2	5	2	0	0	7	0	0	0	5	7	12	2	0	2
5	3	3	4	0	1	6	0	1	0	4	6	10	4	1	5	12	3	5	3	0	0	9	1	0	0	5	9	14	3	1	4
5	4	4	1	1	0	4	1	1	0	4	4	8	2	2	4	12	4	2	2	0	2	4	3	1	0	4	4	8	2	4	6
5	5	20	7	1	5	18	2	2	1	25	19	44	8	4	12	12	5	20	10	0	2	24	5	1	0	22	24	46	10	6	16
5	1	5	2	0	1	9	0	0	2	6	11	17	2	0	2	12	1	7	2	1	2	9	0	0	0	9	9	18	3	0	3
5	2	6	3	0	0	10	2	0	0	6	10	16	3	0	3	12	2	6	0	0	3	2	0	0	0	9	2	11	0	0	0
5	3	6	4	0	1	1	0	0	0	7	8	15	4	0	4	12	3	4	2	0	0	9	0	0	0	4	9	13	2	0	2
5	4	6	3	0	1	10	0	0	0	7	10	17	3	0	3	12	4	8	0	1	3	1	0	0	0	11	1	12	1	0	1
5	5	23	12	0	3	30	2	0	2	26	39	65	12	0	12	12	5	25	4	2	8	21	0	0	0	33	21	54	6	0	6
6	1	7	0	0	1	5	0	0	0	8	5	13	0	0	0	13	1	5	2	0	0	5	0	0	0	5	5	10	2	0	2
6	2	4	1	0	0	5	1	0	0	4	5	9	1	1	2	13	2	3	1	0	0	5	0	0	0	3	5	8	1	0	1
6	3	3	2	0	0	1	0	0	0	3	1	4	2	0	2	13	3	5	1	0	0	8	0	0	0	5	8	13	1	0	1
6	4	6	2	0	1	8	1	0	0	7	8	15	2	1	3	13	4	7	2	0	1	4	0	0	0	8	4	12	2	0	2
6	5	20	5	0	2	19	2	0	0	22	19	41	5	2	7	13	5	20	6	0	1	22	0	0	0	21	22	43	6	0	6
6	1	4	0	0	0	9	0	0	0	4	9	13	0	0	0	13	1	8	2	0	0	3	0	0	0	8	3	11	2	0	2
6	2	5	0	0	0	3	1	0	0	5	3	8	0	1	1	13	2	6	2	0	0	7	1	0	0	6	7	13	2	1	3
6	3	2	2	0	0	8	1	0	0	2	8	10	2	1	3	13	3	6	5	1	1	5	0	0	0	6	5	11	5	0	5
6	4	6	1	0	0	9	1	0	2	6	11	17	1	1	2	13	4	5	0	1	0	6	1	0	0	5	6	11	1	1	2
6	5	17	3	0	0	29	3																								

Table 4. Ordinary fouls and heavy fouls in LEN Euro Cup and Regional Triglav Ligue.

	LP	LP	TP	TP	LP	TP
	LEN	RTL	LEN	RTL	TOTAL	TOTAL
	77	65	22	25	65	25
	75	137	23	8	137	8
	73	61	21	19	61	19
	47	96	14	15	96	15
	73	105	17	24	105	24
	67	89	18	13	89	13
	49	67	13	16	67	16
	83	91	27	19	91	19
	60	76	10	20	76	20
	72	102	14	27	102	27
		58		13	58	13
		100		22	100	22
		89		18	89	18
					77	22
					75	23
					73	21
					47	14
					73	17
					67	18
					49	13
					83	27
					60	10
					72	14
Fouls Total	676	1136	179	239	1812	418
Fouls/Average per game	67,6	87,4	17,9	18,4	78,9	18,2
Fouls/Average per quarter	16,9	21,8	4,48	4,6	19,7	4,6

(LP – ordinary foul, TP – heavy foul (exclusion foul and penalty foul), LEN - LEN Euro Cup, RTL – Regional Triglav Ligue, TOTAL – all analyzed games)

Obtained results show that the number of heavy fouls committed at the Regional Triglav Water Polo League matches and the LEN Euro Cup matches is even and practically equal. The number of ordinary fouls judged at the Regional Triglav Water Polo League matches and the LEN Euro Cup match varies considerably. While at Triglav Water Polo League, the ordinary fouls per quarter were judged 22 times in the LEN Euro Cup matches, the same fouls are judged 16 times. In order to reach the number of ordinary offenses, until one team remains in the bonus, analysis which we have made over the totals (all the observed games of the Regional Triglav Water Polo League and the LEN Euro Cup match, 23 or all quarters played in those matches). The number of ordinary offenses on all the games is 19.4 per quarter. Obtained result suggests the introduction of a bonus for ordinary offenses.

**Conclusion**

If arithmetic means of all ordinary fouls, on all observed games, we take over the totals (all matches included in the analysis) the average is 77.5 per game. We calculated over a quarter (19.4), with ranges ranging from 47 to 137. All referees are qualified for the job they perform and should judge equal. The obtained results showed a significant difference between the ordinary fouls in Regional Triglav Water Polo League and the LEN Euro Cup matches. Although the number of ball possession during one game is not crucial for the result of the match, it can still contribute and significantly affect the outcome. If we assume that

distribution of the ball possession is 50: 50 (in full time of the possible possession 30 s) in such and theoretical ideal conditions, each team would have 8 possessions in one quarter. At that time, defensive players make ordinary fouls more often than attackers. The before mentioned is not a realistic image of game because there has never been or will be the ideal distribution of the ball possession. In order to increase the flow of the game, which means to prevent defensive players to use unnecessary ordinary fouls to obstruct the attacker's play, we believe that they should be penalized in some way and that it is necessary to introduce a "bonus" in the water polo. The bonus would be calculated according to our proposal for each quarter and the number of ordinary fouls for which the team is in the "bonus" would be 7. Each subsequent ordinary foul of the team that came out of the bonus would be punished with a free shot at 6m. For committing ordinary foul after the bonus expires, only ordinary foul would be judged because we consider that a free shot from 6m is appropriate sanction to this kind of foul. If the proposed change of rule is accepted, the section 14 of the official record, which is largely vacant, it should be divided into four equal parts by a vertical line. Every ordinary foul in that quarter, including the seventh, for each team, would be recorded as vertical punch in game record and every next ordinary foul with (penalizing) point. The change we propose will substantially change the look of the game. The players will bring the situation to the point of their conceptuality, intelligent technical-tactical behavior and not the raw strength and ugliness defined in today's water polo.

## References

- FINA Water Polo Rules 2019 – 2021 Amendments, Additions, Interpretations and Explanations Effective as of 10. 02. 2019.
- Hraste, M., Bebić, M., & Rudić R. (2013). Where is today's Water Polo Heading? An Analysis of the Stages of Development of the Game of Water Polo, *Naše more*, 60(S1-2), 17-22.
- Lozovina, M., & Lozovina, V. (2009). Attractiveness Lost in the Water Polo Rules, *Sport Science*, 2, 82-88.
- Lozovina, V. (2009). *Vaterpolo, Tehnika, taktika i vratar u vaterpolu*. [Water polo, Technique, tactics and the goalkeeper. In Croatian.]. UDK Sveučilišni udžbenik.
- Lozovina, V., & Lozovina, M. (2012). *Theory and Mathematical Modulation of Sports Training (Paradigm Of Methodological Theory And Mathematical Modulation Of Sports Training)*, Scientific edition. Sarbrucken: Publisher: LAP LAMBERT Academic Publishing.
- Pavičić, L., Lozovina, M., & Lozovina, V. (2014). Model of Collective Sports Games, *Acta Kinesiologicala*, 8(S1), 1, 38-51.
- Pavičić, L., Lozovina, M., & Lozovina, V. (2014). Nev Concepts and Approaches to the Study of Collective Sports Games, *Acta Kinesiologicala*, 8(S1), 7-22.
- Pavičić, L., Lozovina, M., & Lozovina, V. (2014). Research of Collective Sport Games in the Field of Kinesiology and Sport Science in the World and in Croatia, *Acta Kinesiologicala*, 8(S1), 23-37.
- Pavičić, L., Lozovina, V., Šimenc, Z. (1987). *Kineziološka analiza vaterpola i tehnologija kompjutorske snimke utakmice*. [Kinesiological analysis of water polo and computer video game technology. In Croatian.]. Zagreb: Faculty of Physical Education.
- Penović, F. (1982). *Evropsko prvenstvo Split 1981. Vaterpolo Savez Hrvatske*. [European Championship Split 1981. Water Polo Federation of Croatia. In Croatian.]. *Stručni prilozi*, 5.
- [http://www.ihf.info/files/Uploads/NewsAttachments/0\\_RuleGame\\_GB.pdf](http://www.ihf.info/files/Uploads/NewsAttachments/0_RuleGame_GB.pdf): International Handball Federation: Rules of the game
- <https://www.fiba.basketball/documents/official-basketball-rules.pdf>: 2018. Official Basketball Rules, FIBA

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