

Time motion analysis of international rugby.

RIAAN SCHOEMAN
Departement Oefening en Sportwetenskappe
Department of Exercise and Sport Sciences
In fulfillment of the degree

**MAGISTER ARTIUM
(SPORT SCIENCE)**

In the

Faculty of Humanities

(Department of Exercise and Sport Sciences)

At the

University of the Free State

Study Leader: Dr F.F. Coetzee

Bloemfontein

November 2010



ACKNOWLEDGEMENTS

- I would like to thank Dr Derik Coetzee for all his help and motivation to finish this degree.
- I would also want to extend a word of thanks to Mr Willie Maree for the data collection from ProZone.
- Thank you to Miss Maryn Viljoen for the statistical analysis of the data.
- To my parents who always stand by me, help me and love me. I appreciate it and I will always be thankful for everything you have done for me.
- I would also thank Miss Ilse van Dyk who helped to linguistically correct the document.

TABLE OF CONTENT

List of tables	v
List of figures	vii
Declaration	viii
1. CHAPTER 1 – Introduction and problem statement	1
1.1. Background.....	1
1.2. Formulation of problem.....	2
1.3. Primary objective.....	3
2. CHAPTER 2 – Literature review	4
2.1. Description of time motion analysis.....	4
2.2. Description of rugby union.....	6
2.3. Physical capacities of rugby players.....	8
2.3.1 <i>Anthropometry</i>	11
2.3.2 <i>Maximal oxygen uptake</i>	14
2.3.3 <i>Anaerobic performance</i>	16
2.3.4 <i>Muscle strength and power</i>	17
2.3.5 <i>Speed</i>	18
2.3.6 <i>Seasonal variations in physiological and anthropometric characteristics</i>	24
2.3.7 <i>Positional profiling</i>	25

2.4. Components of importance for rugby fitness.....	27
2.4.1 <i>Distance covered</i>	30
2.4.2 <i>High-intensity distance covered</i>	33
2.4.2.1 <i>Utility movements</i>	39
2.4.2.2 <i>Rucking and mauling</i>	39
2.4.2.3 <i>Tackling</i>	40
2.4.2.4 <i>Scrummaging</i>	40
2.4.3 <i>Percentage work rate/ratio at high-intensity</i>	41
2.4.4 <i>Work-to-rest ratios</i>	42
2.4.5 <i>Implications for fitness training</i>	45
2.5. Differences between levels of competitions.....	48
2.6. Variables that affect player characteristics and match activities.....	50
2.6.1 <i>Magnitude of the game</i>	51
2.6.2 <i>Law variations</i>	51
2.6.3 <i>Game structure</i>	53
2.6.4 <i>Weather conditions</i>	53
2.6.5 <i>Home and away games</i>	53
2.6.6 <i>Competition structure</i>	55
3. CHAPTER 3 – Methodology	56
3.1. Method.....	56
3.2. Subjects.....	56
3.3. Protocol.....	56
3.4. Equipment.....	57
3.5. Procedure.....	57
3.6. Statistical analysis.....	57

4.	CHAPTER 4 – Results	58
4.1.	Introduction.....	58
4.2.	Results.....	58
5.	CHAPTER 5 – Discussion	67
5.1.	Introduction.....	67
5.2.	Discussion.....	67
5.2.1	<i>Home and away games.....</i>	<i>67</i>
5.2.2	<i>Distances covered.....</i>	<i>68</i>
5.2.3	<i>High intensity distance covered.....</i>	<i>69</i>
5.2.4	<i>The percentage work rate at high intensity.....</i>	<i>69</i>
5.2.5	<i>Correlation of variables with winning and losing.....</i>	<i>70</i>
5.2.5.1	<i>Team correlation with winning and losing.....</i>	<i>70</i>
5.2.5.2	<i>Positional correlation with winning and losing.....</i>	<i>70</i>
5.3.	Overview.....	71
5.4.	Recommendations.....	72
6.	CHAPTER 6 – Summary and conclusions	73
6.1.	Introduction.....	73
6.2.	Summary.....	73
6.3.	Conclusion.....	74
6.4.	Limitations.....	74
6.5.	Practical applications.....	75
	REFERENCES	76
	APPENDICES	85

LIST OF TABLES

Table 1:	Measures of match participation.....	11
Table 2:	Anthropometric characteristics of rugby players.....	13
Table 3:	Maximal oxygen uptake ($VO_{2\max}$) of rugby union players.....	16
Table 4:	Percentage sprints involving ball possession.....	20
Table 5:	Seasonal variations in physical capacities of rugby players.....	25
Table 6:	The effects on player stature and mass, (NZ players only) (mean changes with 90% confidence limits).....	27
Table 7:	Distances covered by positional groups, (mean \pm sxÅ)	35
Table 8:	Number of match activities for 1995 and 2004, (predicted values $n \pm$ standard deviation).....	36
Table 9:	Effects on the number of match activities, (mean changes with 90% confidence limits).....	41
Table 10:	Analysis of repeated high-intensity activity observed.....	44
Table 11:	Effects on points and penalty activities, (mean changes with 90% confidence limits).....	50
Table 12:	Super 12 home advantage estimates	55
Table 13:	Percentage of home and away games won or lost.....	58

Table 14:	Summary of all positions for the distance covered, high intensity distance covered and percentage work rate at high intensity for winning and losing teams.....	60
Table 15:	Team averages of losing and winning teams.....	61
Table 16:	Standard deviation and means for losing teams.....	62
Table 17:	Standard deviation and means for winning teams.....	63
Table 18:	Pearson correlation coefficients.....	64
Table 19:	Values of all variables between winning and losing.....	65
Table 20:	Components won versus the score.....	66

LIST OF FIGURES

Figure 1:	Rugby positions.....	7
Figure 2:	The percentage of sprints performed in offensive and defensive play for Super12 forwards and backs.....	22
Figure 3:	The percentage of sprints commenced from different starting speed for Super12 forwards and backs.....	22
Figure 4:	The percentage of sprints performed in relation to the proximity of the opposition for Super12 forwards and backs.....	23
Figure 5:	The percentage of sprints involving a change of direction for Super12 forwards and backs.....	23
Figure 6:	Distance travelled for 'running work' over each 10-min period of match-play.....	32
Figure 7:	Time spent performing work activities during each 10- min period of match-play.....	32
Figure 8:	Comparisons of total match time with player match time.....	37
Figure 9:	Comparisons of mean body mass of forwards and backs.....	37
Figure 10:	Frequency of scrums since 1975 – 2005.....	38
Figure 11:	Comparisons of line outs won on own throw from 1975 to 2005.....	38
Figure 12:	Frequeuncy of rucks and mauls from 1975 to 2005.....	39

DECLARATION

I, Riaan Schoeman, hereby declare that the work on which this dissertation is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university.

No part of this dissertation may be reproduced, stored in a retrieval system, or transmitted in any form or means without prior permission in writing from the author or the University of the Free State.

(Signature)

(Date)

CHAPTER 1

Introduction and problem statement

1.1 Background

Time motion analysis is an effective method of quantifying the demands of rugby and provides a conceptual framework for the specific physical preparation of players (Deutsch, Kearney, & Rehrer, 2002:160-166). Now more than ever, players need coaching in weaknesses and strengths to create an even more conditioned individual to perform in the professional era. It is no longer an opinion that the game of rugby has changed over the last 20 years, it is a fact, and the game today is quicker, more demanding and a lot more entertaining.

Calculating the frequency, mean duration and total time spent in activities is fundamental in time motion analysis. Another measure of interest is the distance covered during a game (McLean, 1992:285-296). Detailed information on the movements in a game provides comprehensive assessment of the demands of competition and assists in developing specific training regimes.

Recent research on Super 12 Rugby quantified the proportions of work activities into discrete movements (Deutsch, *et al.*, 2002:160-166). Previous investigators have not examined the total time, frequency and mean duration of movements of Super 12 players in competition. (Hughes & Blunt, 1998:184-190) advises that this lack of data on elite players and rule modifications since the publication of most previous studies make a comprehensive time motion analysis of elite rugby timely.

The methodology of establishing the physiological requirements of rugby competition warrants careful consideration because estimating distance covered and monitoring heart rate during competition pose logistical difficulties for investigators. Detailed descriptive analysis of the occurrence of these activities

during competition will assist coaches and conditioning staff in the prescription of training for forwards and backs. Furthermore, quantifying movement patterns over an entire game may provide insight into any fatigue-related changes in performance between the first and second half.

These trends have been driven by recent advances in physical preparation and highlight the need for a detailed analysis of contemporary rugby at the elite level. Therefore; it must be argued whether there is a correlation between the movement patterns, High Intensity distance covered or distances of jogging and walking, to the success and winning ratio of a team.

1.2 Formulation of problem

Calculating the frequency, mean duration and total time spent in activities are fundamental in time motion analysis (McLean, 1992:285-296). Involvement in professional rugby league competition requires intermittent bouts of complex high-intensity movements interspersed with periods of low-intensity activity (Brewer & Davis, 1995:129-135). The extent of these changes has, however, never been quantified. Van den Berg (2007:62-64) states: "What is even more important is that their impact on the playing of the game has not been evaluated". The question must be asked: "Which variable correlate the highest with success". All possible research is needed to provide adequate information to players in assisting them to perform well. Unfortunately, authors of previous studies did not analyze the whole game but only certain aspects of the game totaling only 35 minutes out of the 80 minutes.

1.3 Primary objective

This research will attempt to identify statistics in the game of rugby that discriminate between winning and losing teams, and provide a meaningful body of data to determine winning and losing components that jeopardize matches at senior international level through specific movement patterns that was provided by time motion analysis. The main focus will be on the distance covered, high-intensity distance covered, and the percentage work rate/ratio at high-intensity and which of these variables correlates the highest with success.

The purpose of this study is:

1. To determine the total distance covered, high – intensity distance covered and the percentage work rate/ ratio high intensity of the different positions (props, locks, hookers, loose forwards, inside backs and outside backs in an international game of rugby.
2. To determine if there are significant differences ($p < 0.05$) between these variables and the different positions.
3. To determine if there are significant differences ($p < 0.05$) in distance covered, high – intensity distance covered and the percentage work rate/ ratio at high intensity of the different positions (props, locks, hookers, loose forwards, inside backs and outside backs) between the winning and losing teams.
4. To determine which of these variables correlates the highest with success.

CHAPTER 2

Literature review

2.1 Description of time motion analysis

Time motion analysis involves video recording match play that is later analyzed by the researcher with the use of computer program software that can track several different movement categories. Video recording is optimal for complex movement pattern analysis as it can be slowed down or repeated as needed (Roberts, Trewartha, Higgitt, El-abd & Stokes, 2008:825-833). Individuals are normally filmed throughout an entire game providing a continuous recording of the frequencies, mean and total durations in each activity and allows for work rate and percent game calculations.

In rugby, however, the frequent bouts of physical contact make physiological data especially difficult to collect given the intrusive nature of blood sampling and the problems associated with players carrying instrumentation. Therefore, one of the most effective methods with which to quantify activity in rugby union is time – motion analysis. This technique can be used by the researcher to quantify the type, duration, and frequency of discrete movements making up the intermittent activity patterns in team sports. In addition to using time – motion data to improve training specificity, there is also a need to accurately quantify match demands for the purposes of designing more specific exercise protocols that allow the investigation of issues specific to rugby union (Roberts; *et al.*, 2008:825-833). Traditionally, time–motion analysis data have been presented in terms of mode, frequency, and duration of activity. These activities are most often classified as standing, walking, jogging, cruising, sprinting, and static intense activity (Deutsch, Maw, Jenkins, & Reaburn, 1998:160-166; Duthie, Pyne, & Hooper, 2003:973-991; McLean, 1992:285-296).

Time motion analysis is a time-consuming process inherently prone to measurement error. This is because observations are influenced by an observer's knowledge, perceived seriousness of competition, focus of attention, state of arousal and priming for anticipated events (McKenzie, Holmyard & Docherty, 1989:101-113). Researchers using time-motion analysis have typically reported the reliability of their methods, although none have reported the Typical Error of Measurement (TEM) that is a mandatory requirement in other physiological tests (Hopkins, 2000:1-15). Reliability is an assessment of the consistency of a measure and is usually determined by testing and then retesting individuals under the same conditions. In one time-motion analysis report, inter-tester reliability was established by analyzing 5 minutes of footage twice ($r = 0.98-0.99$). (Docherty, Wenger & Neary, 1988:269-277).

Rugby analysts have used the repeated measurement method for a single individual to identify within-observer reliability, reporting a standard deviation of 1.3m for distance travelled during the game; and 0.09 seconds for the duration of activity (McLean, 1992:285-296). Increasing the data on elite rugby players' movement patterns is essential for improved knowledge of the demands of the game.

The most recent time motion analysis study completed was by Roberts *et al.*, (2008:825-833) on elite English rugby match play ($n=29$). This study implemented a new system involving 5 stationary cameras that covered different areas of the field. The data was then reconstructed into a two dimensional plane where player movement was recognized and measured by a specific analysis program based on speed of movement. The purpose of the study was to assess the physical demands of the match specific to position but in a more accurate and reliable way than in previous studies. This is the first study to concentrate on changes in high intensity running through out an entire match with focus on distances covered. Results showed that the backs covered more total distance during a match as a result of more distance covered walking and high intensity

running than forwards. The whole match was separated into 10 minute intervals and compared for distances traveled in order to observe a possible fatigue factor. The first ten minutes was shown to cover more total distance than the 5th and 7th ten minute interval however the extra distance in the first ten minutes was completed at a lower intensity therefore not a factor of fatigue. In summary, male rugby time motion analysis studies all suggest significant variance between forwards and backs and a contribution from all three energy systems, with the majority of studies suggesting that the anaerobic systems played a more predominant role. Generally, backs covered more distance in a game, had longer rest periods and spend more time sprinting. Forwards performed more work activities due to intense non-running exertion and had shorter periods of recovery.

2.2 Description of rugby union

Since rugby union became professional in 1995, the science examining the sport and its participants have developed rapidly to meet the increased demand for knowledge on the requirements of the game and the characteristics of the players. Rugby is played throughout the world, with the International Rugby Board encompassing 92 national unions. The game is played over two 40-minute halves separated by a break no longer than 10 minutes. There are no stoppages, except in the event of an injury. Rugby is a field-based team sport eliciting a variety of physiological responses as a result of repeated high intensity sprints and a high frequency of contact. The physiological demands of rugby union, like other football codes, are complex when compared with individual sports (e.g. running, cycling, swimming), (Reilly, 1997:83-101). Detailed assessment of the demands of rugby are lacking despite investigations on the movement patterns during match play, physiological measurements taken during a match or simulated match play, and the assessment of physiological capacities of elite players.

Rugby is one of the most popular team sports in the world today. In spite of the popularity of the sport, very few researchers have until now focused on the characteristics of a competitive rugby match (Nicholas, 1997:375-396). Professional rugby union is an arena where the players have to exhibit not only skill but also a fitness level that is above normal for the general population. Each player in the team can be seen as performing a different role and therefore has different requirements for fitness and training levels.

Two teams contest play, each with 15 players on the field at one time, with the exception of players being sent off for misconduct. Each player has a designated position and number outlined by the International Rugby Board; (Also shown in figure 1), (1) loose head prop; (2) hooker; (3) tight head prop; (4) left lock; (5) right lock; (6) left flanker; (7) right flanker; (8) number eight; (9) scrum half; (10) fly half; (11) left wing; (12) left centre; (13) right centre; (14) right wing; (15) fullback.

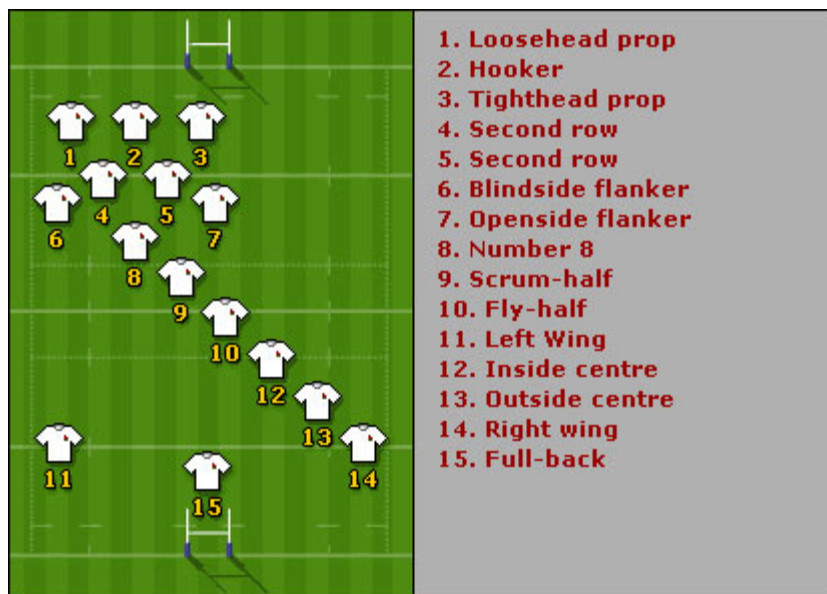


Figure 1: Rugby positions

According to Spamer, Pienaar & Van der Merwe (1998:61-75) different activities and movements of a rugby game can be divided into two categories, namely organized and general play. Line-outs, scrums, place and drop kicks are among other activities that are placed under the organizational play category. Facets that fall under the category of general play include broken play and tackling. Tackling is also regarded as a critical component for the success in the game of rugby. Rugby players are required to have well-developed physical performance and anthropometric qualities, combined with a wide range of offensive and defensive skills.

The different standards of competition have similar game-specific skills and physical demands during a match; there is however variation within a match according to standard.

2.3. Physical capacities of rugby players

Rugby players have a diverse range of physical attributes. A distinct physique will naturally orientate a player towards a particular position over others. This makes rugby an atypical sport when compared with a number of other team sports where homogeneity of physique and physical performance attributes are more common (Quarrie, Handcock. & Toomey, 1996:53).

The implementation of field and laboratory testing allows for the examination of adaptations to training, assessment of training programmes, evaluation of player qualities, talent identification, prescription of training, and prediction of performance (Van der Field, 1975:14). Such data also compliment information gathered from game analysis.

Since becoming a professional sport in 1995, the game of rugby union has changed and become more “open” with more sprints and fewer scrums (McLean, 1992:285-296). These trends have been driven by recent advances in physical

preparation and highlight the need for a detailed analysis of contemporary rugby at the elite level. Despite the international popularity of rugby, it is clear that there is a lack of understanding of the physiological requirements of contemporary rugby.

In the professional era of rugby, forwards and backs have had their traditionally very different roles, blurred by recent changes in the emphasis of the game that focus on the importance of ball retention and repeated recycling of the ball. Although there remain obvious position-specific jobs for each player position, there is a shift towards a blend of roles. Backs' traditional requirements of speed, direction change at pace, adept handling skills and complicated set move execution are unchanged. There is however an additional need for strength in securing the ball in broken play, and backing up of forwards in this role. The forwards' short duration/high intensity competition for the ball control in contact situations must now also incorporate more running with the ball in open play in conjunction with more adept handling skills. An attempt to define each position's physical output in terms of type, duration, intensity of activity and the relative recovery times in between has been made and documented but recent relevant studies specific to rugby union are lacking (Deutsch, *et al.*, 1998:561). Therefore Deutsch *et al.*, (1998:561) showed that forwards as a group show higher overall exercise intensity during a game in comparison to the backs. The backs however tended to work for short periods at high intensities, with longer periods of rest.

Team positions can also be classified according to the specific individual position played (i.e. prop, hooker, lock, loose forward, scrumhalf, fly half, centre, wing, and fullback), or according to subgroups reflecting positional commonality (i.e. front row, locks, loose forwards, inside backs, and outside backs) (Meir, Newton, Curtis, Fardell, & Butler, 2001:450-458).

More athletic forwards and fast, physical wingers are replacing the traditional, heavy forwards and the smaller, faster wings. Even with this crossover of roles,

there is still a relative clear difference in the breakdown of the type, duration and intensity of physical activity between forwards and backs, and even within these two broad groupings. A prop's role and body type is considerably different from a lock's, as a winger's is to a scrum half. So although training must address the player's common roles, there is a clear logic that there should be more emphasis on position-specific fitness for the individual roles of each position if peak performance is to be attained.

According to Roberts, Stokes; & Trewartha (2006:386-397) time-motion analysis has been used to assess movement patterns in a variety of team sports, including rugby union. However, there is little objective data available on the physical demands of elite rugby. Activities were categorized based on movement speeds as standing, walking, jogging, medium-intensity running (low-intensity activity), and high-intensity running, sprinting, and static exertion such as scrummaging, rucking, mauling, and tackling (high-intensity activity).

The game is intermittent in nature, requiring players to compete in a challenging contest, comprising intense bouts of sprinting and tackling, separated by short bouts of lower-intensity activity (recovery) (Gabbett, 2005:961-976). As a result of the physical demands of the game, the physiological qualities of players are highly developed with players requiring high levels of aerobic fitness, speed, muscular power and agility (Gabbett, 2005:961-976).

Quarrie & Hopkins (2007:895-903) indicates the measures of match participation under good conditions for 1995 (the last year prior to professionalism) and 2004 (Predicted values \pm standard deviation), (Table 1).

Table 1: Measures of match participation

	1995	2004
Total match time (min)	83.7 ± 1.8	85.5 ± 3.6
Time ball in play (min)	28.6 ± 2.2	34.5 ± 1.8
Mean time per player (min)	79.4 ± 2.6	64.3 ± 3.5
Number of players	31.5 ± 1.2	40.1 ± 2.5

Time motion studies have shown that rugby players perform different match-play activities during competition depending on playing position (Meir, Colla, & Mulligan, 2001:42-46), with forwards being involved in significantly more physical collisions and tackles than backs (Gissane, White, Kerr; & Jennings, 2001:137-146). It is also recognized that the ratio of high-intensity activity is higher for forwards (1:7 to 1:10) than backs (1:12 to 1:28), with forwards covering a greater distance during a match (9929 vs. 8458 m) (Meir *et al.*, 2001:42-46). These findings demonstrate that in rugby a wide range of skills and physiological demands exist for different playing positions.

2.3.1 Anthropometry

Nicholas (1997:375-396) reported that rugby players have unique anthropometric and physiological attributes which depend on positional role and the playing standard. These have important implications for team selection and highlight the necessity for individualized training programs and fitness attainment targets. The forwards are heavier but have a lower percentage of body fat than two decades ago (Olds; 2001:253-262).

Somatotypic descriptions of French, Italian and South African rugby players have identified forwards as being generally more endo-mesomorphic than backs (Boennec, Prevost & Ginet, 1980:309-318). Rigg & Reilly (1987:186-191) reported that the most consistent anthropometric differences between forwards and backs were in terms of body size (height and body mass), rather than type of physique (measured by somatotype).

A summary of the anthropometric characteristics of rugby players in other reports is given in table 2 (Quarrie, Handcock & Waller, 1995:263-270). As can be seen, most evaluations of the anthropometric characteristics of rugby players are descriptions of one or two teams from a given grade, largely precluding useful comparisons across grades.

Table 2: Anthropometric characteristics of rugby players

Country and authors	Position	n	Height (cm)	Mass (kg)	Endo	Meso	Ecto
Australia							
Withers, Craig and Norton	Forwards & Backs	16			2.7 (0.7)	6.0 (0.8)	2.0 (0.7)
France							
Boennec, Prevost and Ginet	Forwards	14			3	6	1
	Backs	8			2.5	5	2.5
Italy							
Casagrande and Viviani	Forwards	15	184.3 (9.2)	96.4 (16.9)	3.5 (1.2)	6.1 (1.0)	1.0 (1.0)
	Backs	13	180.4 (3.2)	81.3 (8.0)	2.6 (0.6)	4.9 (1.3)	1.0 (0.9)
Japan							
Ueno, Watai and Ishii	Forwards	44	176.5 (5.9)	80.6 (8.5)			
South Africa							
Smit, Daehne and Burger	Forwards	27	188.0 (5.3)	96.2 (11.5)	3.8	6.1	1.6
	Backs	20	178.5 (6.8)	78.2 (8.9)			
Jardine, Wiggins, Myburgh and Noakes	Forwards	15	187.5 (8.3)	98.0 (8.7)			
England							
Reilly and Hardiker	Forwards & Backs	28			3.6 (0.7)	5.4 (1.0)	2.1 (0.9)
Rigg and Reilly	Forwards (1st class)	14	185.3 (5.2)	91.5 (5.8)			
	Forwards (2nd class)	13	178.2 (3.2)	81.9 (7.2)			
	Backs (1st class)	10	177.4 (5.0)	78.9 (5.0)			
	Backs (2nd class)	11	176.8 (4.6)	75.4 (6.7)			
	Total	48	179.8 (4.6)	82.6 (6.3)	2.5	5	2
Holmyard and Hazeldine	Forwards (international)	9	184 (11)	100.3 (10.4)			
	Backs (international)	9	175 (2)	83.0 (5.2)			
United States							
Maud	Forwards	8	180.7 (8.7)	87.7 (7.7)			
	Backs	7	178.4 (7.3)	80.5 (6.1)			
Maud and Shultz	Forwards	10	187.3 (7.8)	94.4 (10.4)			
	Backs	10	174.9 (4.8)	78.2 (5.8)			

2.3.2 *Maximal oxygen uptake*

Maximal oxygen uptake (VO_{2max}) has been proposed as an indicator of aerobic fitness in rugby players (Reid & Williams, 1974:96-99). A high VO_{2max} facilitates the repetition of high-intensity efforts, and in soccer is positively related to the distance covered, level of work intensity, number of sprints, and involvements with the ball (Helgerud, Engen & Wisloff, 2001:1925-1931).

VO_{2max} values can be expressed absolutely as litres per minute (L/min) when total power output is important, or relative to body mass per minute (mL/kg/min) for activities where body mass should be considered. An alternative method is to use the logarithms of the power function ratio standard (i.e. mL/kg/min) (Nevill, Ramsbotton & Williams, 1992:110-117).

Given the variation in body mass across positions in rugby, it is suggested that researchers present these ratios to allow for accurate comparison. The forwards are taller and heavier players, with higher fat percentages, which could explain their lower peak VO_2 per kilogram. This is particularly the case in rugby given the large range of body mass between forwards and backs. Recent studies on aerobic performance in elite players have used the multi-stage shuttle run as an indication of VO_{2max} . [Using the multi-stage shuttle run test, 94 senior 'A' male rugby players were assessed for predicted VO_{2max} (Quarrie; *et al.*, 1996:53-56).]

The forwards, hookers had the highest score (58.7+- 15.2mL/kg/min), followed by the locks (55.1 +- 15.2mL/kg/min), loose forwards (55.1+- 15.2mL/kg/min), and props (50.8+- 15.2mL/kg/min). For the backs, the inside backs (62.5+- 16.9mL/kg/min) achieved the highest level, compared with the midfield backs (59.8+- 16.9mL/kg/min) and the outside backs (57.6+- 16.9mL/kg/min). These results indicate backs typically possess greater levels of endurance fitness than forwards. The absolute values for VO_{2max} for forwards are greater than 5.0 L/min. These levels indicate the capability for a very high aerobic power production.

This characteristic assists rugby forwards during repeated intense efforts involving scrummaging, rucking and mauling and explosive running (Jardine, Wiggins & Myburgh, 1988:529-532). This is especially the case in rugby where training generally does not include extensive steady-state exercise, rather players are required to perform frequent maximal intermittent efforts that stress the anaerobic energy systems and produce lactate levels in excess of 14 mmol/L (Duthie; *et al.*, 2003:973-991).

Similar to heart rate, oxygen consumption was higher during the long compared with the medium and short work-to-rest durations (approximately 68%, 60% and 55% $\text{VO}_{2\text{max}}$, respectively). This contrasts with the findings of Christmass, Dawson; & Arthur (1999:436-447), who reported lower % $\text{VO}_{2\text{max}}$ values for the long (65%) than the short work-to-rest trial (71%). These authors suggested that there was an extra oxygen cost during short work-to-rest durations, possibly due to more frequent transfers on and off the moving treadmill belt.

Bogdanis, Nevill, Boobis, & Lakomy; (1996:876-884) noted that aerobic metabolism contributed substantially to adenosine triphosphate re-synthesis during high-intensity exercise without a dramatic decline in power output. Although the protocol of Bogdanis *et al.*, (1996:876-884) consisted of a series of sprints, lasting much less than 40 min in duration, their results do demonstrate how aerobic metabolism can contribute to sprint performance of longer durations.

In Table 3, Duthie *et al.*, (2003:973-991) compared previous research to indicate a trend for forwards to have superior or absolute $\text{VO}_{2\text{max}}$ values compared with backs. When expressed relative to body mass, this trend was reversed with the backs showing higher values.

Table 3: Maximal oxygen uptake ($VO_2 \text{ max}$) of rugby union players

Study	Level	$VO_2 \text{ max}$ (L/min)		$VO_2 \text{ max}$ (ml/kg/min)	
		Forwards	Backs	Forwards	Backs
Cycle ergometer					
Bell	Second				
	Prop	4.06		44.0	
	Hooker	3.38		43.2	
	Lock	4.51		44.9	
	No.8	4.07		55.8	
	Flanker	4.49		50.9	
Maud	First	4.26	3.67	45.1	46.7
Ueno	College	4.37	3.74	54.7	55.2
Treadmill					
Jardine	Second	5.14	4.41	52.0	55.8
Maud	Second	4.73	4.77	54.1	59.5
Warrington	International	5.3		51.1	
Predicted (Shuttle run)					
Holmyard	First	5.82	4.95	58.0	59.6
Nicholas	First	5.04	4.46	51.8	56.3
	Second	4.85	4.51	53.3	57.7
Tong	First	5.65	4.75	53.8	57.5

2.3.3 Anaerobic performance

The energy contributions during the work periods in intermittent team activity are primarily anaerobic in nature. Power in rugby is required in the execution of tackles, explosive acceleration, scrummaging and forceful play during rucking and mauling (Cheetham, Hazeldine & Robinson 1988:206-10).

Forwards appear to be able to produce higher absolute peak and mean power outputs across a range (7 - 40 seconds) compared with backs. Players who have the capability to produce high power outputs also tend to have the greatest fatigue during tests of moderate (30 seconds) duration (Cheetham; *et al.*, 1988:206-210). Given the importance of the anaerobic system for supplying energy during rugby competition, it is surprising that there is limited information on these characteristics. This may be a result of the difficulty in performing these tests on large groups or players. Time motion analysis can help us to gather more information on the anaerobic systems use during rugby.

When , according to McLean (1992:285-296) the ball is in open play, the average running pace of players central to the action ranges from 5 to 8 m/s-1. This together with scrum, lineout, ruck and maul is classified as high-intensity exercise. The intensity of work is measured by timing the work : rest ratios (W:RRs) throughout a game. The mean duration of the work is 19 seconds and the most frequent W: RRs are in range of 1:1 to 1:1.9. On average, a scrum, lineout, ruck or maul occurs every 33s. The ball is in play for an average of 29 min during a scheduled time of play of 80 min.

McLean (1992:285-296) reported that the running speed, duration, blood lactate levels, physical confrontation and, most particularly, the density of work as illustrated by the work: rest ratios indicate that the game places greater demands on anaerobic glycolysis than previous reported. This has implications for the physical conditioning of rugby union players.

2.3.4 Muscle strength and power

Strength is the maximal force produced by a muscle or muscles at a given speed. Power is the product of force (strength) and velocity (speed); (Knuttgen & Kraemer, 1987:1-10). Rugby performance requires high levels of muscular strength and power for excellence, particularly for the forwards in scrums, rucks and mauls. For example, the mean pack force during scrummaging ranges from 6210 - 9090N (600-1000kg); (Mayes & Nuttall, 1995:13-14).

Given that muscle strength and power is required during the contact situations in rugby, forwards should possess greater strength than backs (Reilly, 1997:83-101). The notion that forwards require more strength and backs require speed was supported by Miller, Quievre & Gajer; (1996:494-495), who found that international forwards produced greater force at low isokinetic speeds compared to backs. In contrast, the backs produced greater force at the higher speeds and their results were similar to those of international sprinters.

The ability to generate high muscular power is an important attribute of rugby league players. Players are required to have high muscular power to perform the tackling, lifting, pushing, and pulling tasks that occur during a match (Meir; *et al.*, 2001:450-458). In addition, high muscular power is required to provide fast play-the-ball speed and leg drive in tackles (Gabbett, 2005:400-408).

2.3.5 Speed

Speed and acceleration are essential requirements, as players are often required to accelerate to make a position nearby or sprint over an extended distance. Backs achieve similar sprint times to track sprinters over distances of 15 and 35m. Rugby players typically sprint between 10 and 20m. (Docherty; *et al.*, 1988:269-277). First class backs and half-backs were the fastest over 40m, while front row forwards and second row forwards were the slowest. These results indicate that speed is a discriminating factor between backs and forwards, highlighting the need for specialized sprint training programmes (Rimmer & Slievert, 1996:111).

Specific speed training is a regular component in the training of elite rugby players. Time motion analysis has demonstrated that rugby backs can perform a large number of sprints within a game, with an average duration of 3 seconds and cover greater distance at a sprinting speed compared with the forwards (Deutsch; *et al.*, 1998:561-570). While the forwards are primarily engaged in non-running intense activity, the backs are typically walking, standing or waiting for the ball to be delivered from the contest (Docherty; *et al.*, 1988:269-277). Time motion analysis has provided a basis for rugby sprint training. This component of rugby is critical to both the forwards and the backs. By providing a more objective assessment of the sprints that occur in the game, greater knowledge on the demands can be developed and training programs planned accordingly.

Rugby players need to move quickly to position themselves in attack and defense. However, time-motion studies have shown that rugby players are rarely required to sprint distances more than 40 m in a single bout of intense activity (Meir; *et al.*, 2001:450-458). When in defense there are fewer sprinting efforts in comparison with attack. Defense involves more continuous activity of moving up to the advantage line then shuffling backwards. Speed is a priority in attack as the player attempt to get over the advantage line. Most sprinting efforts in attack do not involve a player receiving or passing the ball. The majority of sprinting efforts are performed as support play or running decoy lines, along with recovering in defense.

A runner who has the ability to pass while running at a slightly slower pace could be more effective than an individual running slightly faster who is carrying the ball in such a way that his opponents see that he cannot pass the ball (Brown, 1999:50,70-73).

Another important factor when examining rugby-specific sprinting is the type of sprint commonly performed in a competitive game. Brown (1999:50,70-73) reported that rugby players perform intensive efforts lasting 5 – 45 seconds. It was not made clear, however, what proportion of these efforts were sprints. Presumably, some of the longer efforts would include scrummages, rucks and mauls. Sayers (2000:26-27) reported that sprints performed during a field sport are rarely more than 30 m and that most of the time players cover less than 10 m at a time. It is accepted that speed is important for performance in rugby, but trying to quantify who is fast at short distances is different from determining who can achieve the greatest maximum speed.

Docherty; *et al.*, (1988:269-277) examined the results of a time analysis of international rugby games and reported that props performed about 20 sprints (10 ± 1.5 sprints in 40 min, every second 5-min period was observed) per game for a mean time of 1.75s per run, while centres sprinted 62 times (31.1 ± 2.4) for

a mean time of 2.3s per run. During these sprints, a player can cover between 10 and 20 m. Since that time, the laws of rugby have been changed to improve the flow of the game.

An analysis by Deutsch; *et al.*, (1998:561-570) of elite rugby players in under-19 competition reported that the forwards sprinted a mean of 4-6 times a game (props 4 ± 1 , back row 6 ± 2) for about 3 s (props 2.8 ± 0.0 seconds, back row 2.3 ± 0.6 seconds) per sprint, while centres sprinted 12 ± 3 times per game for 2.8 ± 0.4 s. This apparent decrease in sprinting can be explained by the methods of the assessments. Deutsch; *et al.*, (1998:561-570) defined sprinting as the players' running speed. Maximum accelerations over short distances might not produce peak sprinting speed and would therefore not be considered sprints. Although it is widely accepted that the rules changes have resulted in a more open game with more running, no other recent motion analysis of the game could be found.

Mero, Komi; & Gregor (1992:376-392) concluded that if the distances covered by the players in a rugby game are typically under 30 m, it is done at maximum effort.

In Table 4, Duthie; *et al.*, (2003:973-991) indicated the percentage of sprints involving ball possession and the subsequent involvement in play.

Table 4: Percentage sprints involving ball possession

Play involvement	Ball possession	
	Yes	No
Ball received	0	17
Ball passed	1	0
Both	0	9
Neither	6	67

In a study from Duthie; *et al.*, (2003:973-991) 28 players were assessed performing a total of 503 sprints. The 16 forwards performed a total of 215 sprints, with the mean \pm SD sprints per game being 14 ± 6 . The 12 backs performed 288 sprints, with a mean frequency of 19 ± 7 sprints per game. The mean duration of individual sprinting efforts was 2.50 ± 1.57 seconds for the forwards and 3.08 ± 1.64 seconds for the backs.

Figure 2, (p 22) demonstrates that both forwards and backs performed more sprints in offensive play in comparison with defensive play. The difference was greater for the backs (~45%) compared with the forwards (~30%). Table 4, (p 23) provides an analysis of players' activity while sprinting. The majority (67%) of sprints did not involve any contact with the ball. Of the remaining sprints, receiving the ball was most common along with receiving and then passing. Figure 3, (p 22) show that the forwards performed most sprints from a standing start, with very few (7%) from a striding start. The backs had a more even distribution between standing, walking and jogging starts, with only 14% of sprints performed from a striding start. When a forward sprinted the opposition were in close proximity (<5m) most often (46%; Figure 4) (p 23). The opposite was the case for the backs who had only 20% of sprints performed when the opposition was in close proximity. The majority of sprints performed by the backs were when the opposition was near (5 to 15 metres).

Figure 5, (p 23) provides a description of the percentage of sprints involving a change of direction. Sprints not involving a change of direction (forwards 92%, backs 78%) were excluded from the figure. The backs performed more sprints with a change of direction compared with the forwards. Of the sprints involving a change of direction, a greater amount involved changes of less than 90 degrees. It is important to note that these sprints represented a small amount of the total sprints performed by player per game.

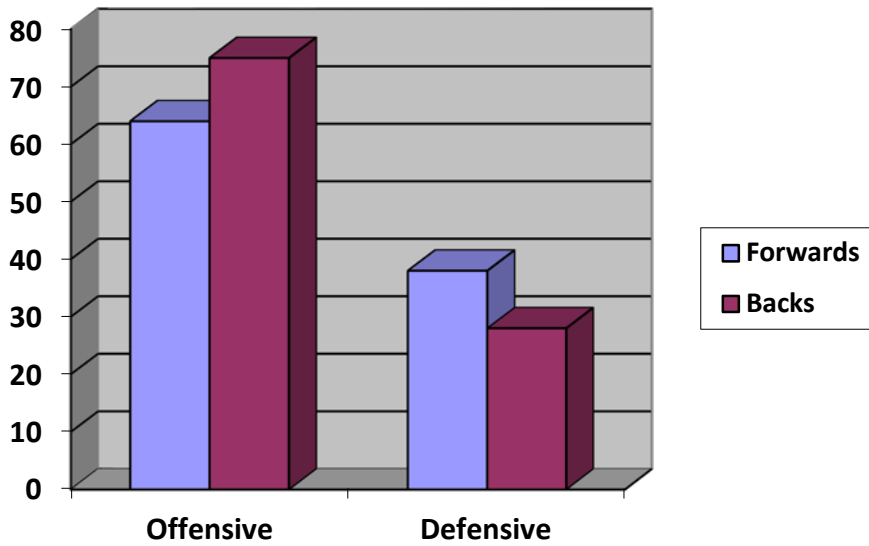


Figure 2: The percentage of sprints performed in offensive and defensive play for Super 12 forwards and backs

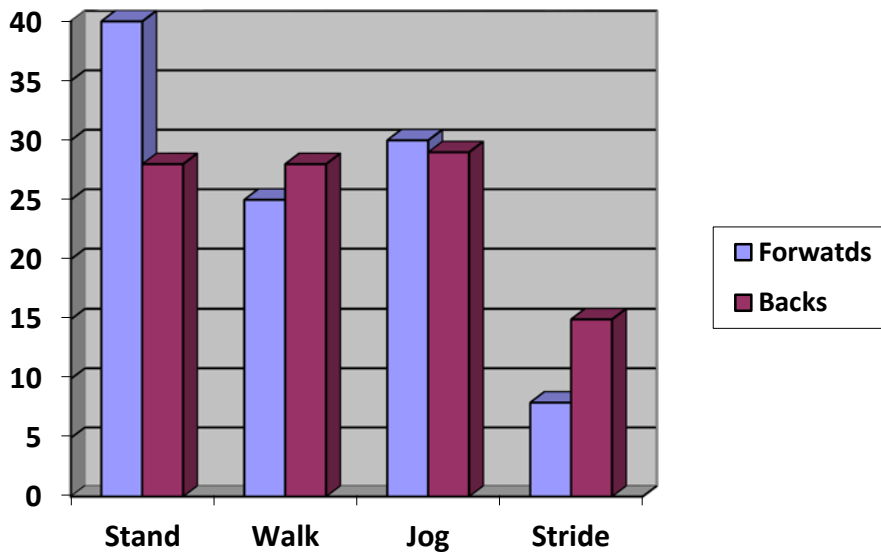


Figure 3: The percentage of sprints commenced from different starting speed for Super 12 forwards and backs

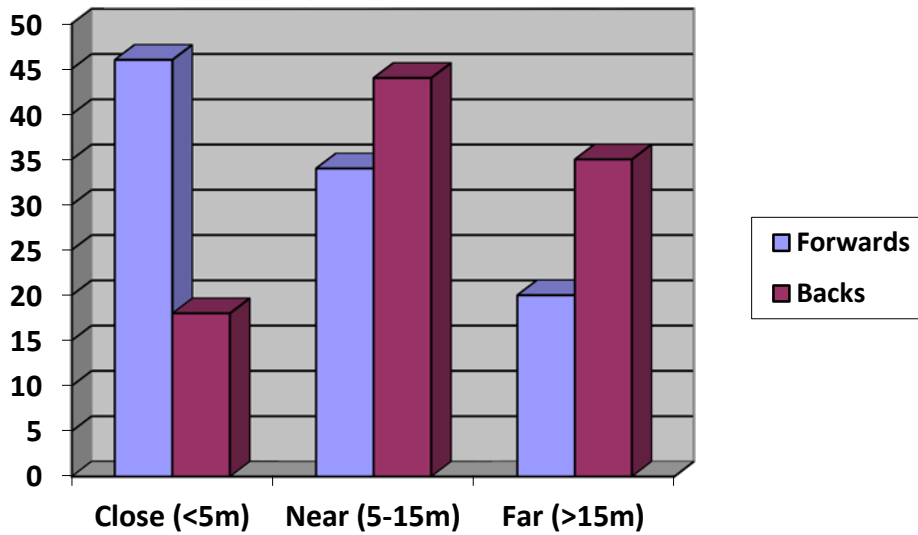


Figure 4: The percentage of sprints performed in relation to the proximity of the opposition for Super 12 forwards and backs

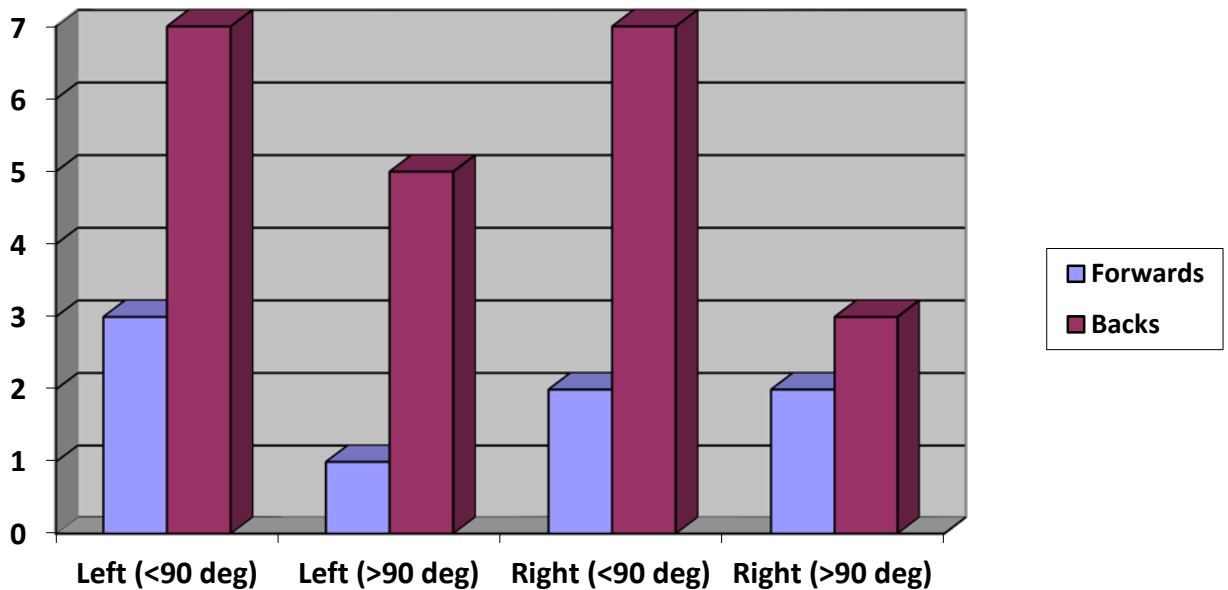


Figure 5: The percentage of sprints involving a change of direction for Super 12 forwards and backs

2.3.6 Seasonal variations in physiological and anthropometric characteristics

Changes in physiological and anthropometrical characteristics over the duration of a season have been detailed. Within a season, different dietary, conditioning and resistance-training strategies elicit variations in the physical status of players. National level rugby players may exhibit a marked reduction in body fat and an increase in aerobic power during the pre-season (Tong & Mayes, 1995:507). Within a competitive season, the changes are less noticeable, with slight improvements in speed and reduction in anaerobic threshold (Campi, Cuglielmini & Guerzoni, 1992:149-154).

The players also have high competition, training and travel demands that can affect physical well-being. Australian and New Zealand Super 14 players are regularly required to travel to South Africa and perform at moderate altitude. At this altitude, cognitive performance is maintained, yet physical performance is impaired for 48 hours, as measured by the multi-stage shuttle run (Weston, Mackenzie & Tufts, 2001:298-302).

Previous research done by Brady (1995:499) has investigated seasonal changes in parameters in professional footballers; there is a paucity of research with part-time, semi-professional players. The de-conditioning apparent in all fitness parameters in the off-season, in conjunction with progressive improvement in most players from post pre-season to mid-season, would support these parameters as sport-specific fitness requirements. According to Brady (1995:499) such improvements suggest that the short-term demands of playing and training in the first half of the season develop fitness and these trends are similar to those for professional players.

Gabbett (2005:675-680) reported increases in maximal aerobic power and muscular power and reductions in skinfold thickness were observed during the early phases of the season when training loads were the highest. However,

reductions in muscular power and maximal aerobic power and increases in skin fold thickness occurred toward the end of the season, when training loads were lowest and match loads and injury rates were highest. These findings suggest that high overall playing intensity and match loads in end-season matches increase in injury rates in the latter half of the season and residual fatigue associated with limited recovery between successive matches may compromise the physical development of rugby players.

Table 5: Seasonal variations in physical capacities of rugby players.

	End 04/05		Pre-Pre		Post-Pre		Mid		End 05/06
%Fat	14.3 ± 3.1	<	14.9 ± 3.0	>	14.5 ± 3.2	>	14.3 ± 3.2	>	14.0 ± 3.3
VO ₂ (ml/kg-1/min-1)	58 ± 1.9	>	56 ± 1.2	<	58 ± 1.6	<	59 ± 2.3	>	58 ± 2.2
SVJ (cm)	57 ± 4.0	>	54 ± 3.2	<	56 ± 3.7	<	57 ± 3.4	N	57 ± 3.4
15m sprint (s)	2.43 ± 0.09	<	2.51 ± 0.10	>	2.49 ± 0.10	>	2.44 ± 0.10	N	2.43 ± 0.08
Agility (s)	14.73 ± 0.73	<	14.97 ± 0.38	>	14.76 ± 0.38	N	14.68 ± 0.34	N	14.63 ± 0.37
Flexibility (cm)	27 ± 6	>	25 ± 6	<	26 ± 6	<	28 ± 6	N	27 ± 6

Note: > = significantly greater, < = significantly less, N = Non-significant ($P < 0.01$).

2.3.7 Positional profiling

Each player has a designated position and number outlined by the International Rugby Board. These positions are grouped, although there is some variation in terminology among researchers, according to the demands placed on the players in each of the individual positions. The two major groups are players numbered 1 to 8, the 'forwards' (ball winners), and 9 to 15, the 'backs' (ball carriers). Within these two groups, players 1 to 3 are referred to as the 'front row', while 1 to 5 are commonly called the 'tight 5'. The 'second row' is formed by the locks (players 4 and 5). The 'loose forwards' are players 6 to 8 and are also referred to as the 'back row'. Within the backs, 'half backs' are players 9 to 10, 'midfield backs' ('centre-three-quarters') are 12 and 13, and 'outside backs' are 11, 14 and 15.

Each positional group's broad physical requirements, skills and tasks can be identified. Quarrie; *et al.*, (1996:53-60) concluded that front-row positions demand strength and power as the players are required to gain possession of the ball, are in continual close contact with opposition, and have limited opportunities to run with the ball. The locks are generally tall, with a large body mass and power an additional advantage. The loose forwards require strength and power as a requirement of players in these positions is to gain and retain possession of the ball. It is a prerequisite for the loose forwards to be powerful and mobile in open play, have excellent speed, acceleration and endurance. A good level of endurance is required by the half backs as they control the possession of the ball obtained by the forwards. Good speed is also an important attribute for the half backs, as they need to accelerate away from the approaching defenders. Midfield backs require strength, speed and power as they have a high frequency of contact with the opposition. Outside backs require considerable speed to out-manoeuvre their opponents. They perform a large amount of support running, chasing down kicks and covering in defense.

Roberts; *et al.*, (2006:386-397) defined positional groups as forwards and backs. Backs covered more distance than forwards over the course of the match (6256m vs. 5852m) and covered greater distances during walking (2315m vs. 1969m) and high-intensity running (467m vs. 329m). Forwards spent more total time performing high-intensity activity than backs (9:40 min:s vs. 3:10 min:s) due to a longer time spent in static exertion (8:25 min:s vs. 1:16 min:s). Backs spent more time in high-intensity running (0:58 min:s vs. 1:22 min:s) and sprinting (0:18 min:s vs. 0:33 min:s). Despite no difference in the total number of discrete activities performed by forwards and backs, forwards performed more periods of high-intensity activity (139 vs. 87) and for longer mean durations (3.8 seconds vs. 2.5 seconds). The development of physical performance standards for individual playing positions and positional playing groups would allow coaches to identify

player weaknesses and develop specific training programmes for players according to their position (Meir, 1993:27-31).

Only two studies by O'Connor (1996:21-26) and Nicholas (1997:375-396) have examined the physiological and anthropometric characteristics of rugby league players, few have documented the influence of playing position on the fitness of these athletes. Previous studies of the physiological and anthropometric characteristics of elite rugby league players have shown significant differences among playing positions for height, body mass, skin fold thickness, estimated VO_2 max, speed, repeated sprint ability, and muscular strength (Meir, *et al.*, 2001:450-458).

Table 6: The effects on player stature and mass (NZ players only) (mean changes with 90% confidence limits; ↑, increase; ↓, decrease).

	Professionalism			10-year trend		
	Effect (%)	Magnitude		Effect (%)	Magnitude	
Stature, forwards (cm)	0.6; ± 0.5	Large	↓	0.5 ± 0.2	Large	↑
Stature, backs (cm)	1.1; ± 0.6	Very large	↑	0.5 ± 0.3	Moderate	↑
Mass, forwards (kg)	7.1 ± 2.1	Very large	↑	1.5 ± 1.0	Moderate	↑
Mass, backs (kg)	12.3 ± 3.0	Very large	↑	2.4 ± 1.5	Moderate	↑

2.4 Components of importance for rugby fitness

During an 80-minute game of rugby, the ball is typically in play for an average of 30 minutes, the remaining time is made up of injury time, conversions, penalty shots or when the ball is out of play (Gabbett, 2002:399-405).

Rugby union players have a diverse range of physical attributes. A distinct physique will naturally orientate a player towards a particular position. This makes rugby an atypical sport when compared with a number of other team sports where homogeneity of physique and physical performance attributes are

more common. Rugby union involves periods of high-intensity activity interspersed with periods of incomplete recovery, and players require qualities such as endurance, speed, agility, and power (Gabbett, 2002:399-405).

This implies that the game is intermittent in nature, requiring players to compete in a challenging contest, comprising intense bouts of sprinting and tackling, separated by short bouts of lower-intensity activity (recovery) (Gabbett, 2005:961-976). Previous studies done by Deutsch; *et al.*, (1998:561-570), categorized activities based on movement speeds as standing, walking, jogging, medium-intensity running (low-intensity activity), and high-intensity running, sprinting, and static exertion such as scrummaging, rucking, mauling and tackling (high-intensity activity). All of these components must be exercised to produce the elite rugby player.

The relative times spent standing still, walking and jogging, running, sprinting, shuffling, and engaged in intense static activity were analyzed, for props and centres (Docherty, *et al.*, 1988:269-277). The authors concluded that as only 5-10% of a match was spent performing high-intensity work, the creatine phosphate system was of major importance during intensive work bouts, the aerobic system was important for other movements, and the anaerobic glycolytic system was of little importance during rugby match-play (Docherty, *et al.*, 1988:269-277).

The movement classification system was based on that originally documented in the soccer literature (Reilly & Thomas, 1976:87-89) and recently modified for use in rugby (Deutsch *et al.*, 1998:561-570), (Docherty *et al.*, 1988:269-277). Each movement was coded as one of six speeds of locomotion (standing still, walking, jogging, cruising, sprinting, and utility), three states of non-running intensive exertion (rucking/mauling, tackling, and scrummaging), and three discrete activities (kicking, jumping and passing). These codes are further explained by the following operational definitions:

Standing still:

Standing or lying on the ground without being involved in pushing or any other game activities. This can include small movements when such movements are not purposeful (e.g. stumbling back and forth, turning sideways, etc.) (Deutsch *et al.*, 1998:561-570).

Walking:

Walking forwards or backwards slowly with purpose. One foot is in contact with the ground at all times (e.g. walking to a scrum following a breakdown in play) (Deutsch *et al.*, 1998:561-570).

Jogging:

Running forwards and backwards slowly to change field position, but with no particular haste or arm drive (e.g. jogging down-field to a lineout) (Deutsch *et al.*, 1998:561-570).

Cruising:

Running with manifest purpose and effort, accelerating with long strides, yet not at maximal effort (3/4 pace) (Deutsch *et al.*, 1998:561-570), (Docherty *et al.*, 1988:269-277). (E.g. running into a back line to receive the ball).

Sprinting:

Running with maximal effort. This is discernible from cruising by arm and head movements (Deutsch *et al.*, 1998:561-570).

Utility:

Shuffling sideways or backwards to change field position. Usually a defensive or repositioning movement. This does not include aimlessly walking slowly backwards (Deutsch *et al.*, 1998:561-570).

Jumping:

Jumping in a lineout or to catch a ball in play (Deutsch *et al.*, 1998:561-570).

Rucking / mauling:

Attached to an active ruck or maul. Once the ball exits the ruck or maul, or the referee calls the end of the play, the player is no longer considered to be engaged in rucking/ mauling, and is deemed to be standing still (Deutsch *et al.*, 1998:561-570).

Scrummaging:

Attached to an active scrum. As above, once the ball exits or the play is stopped, the scrum is no longer active (Deutsch *et al.*, 1998:561-570).

2.4.1 Distance covered

The distance covered during the game includes: walking, jogging, running, high-speed running and sprints. Walking in rugby can be considered as the rest phase and the time passing between set phases, walking back to your position after a high-intensity bout or walking to a scrum or lineout. Jogging can also be found between set phases or when moving back to your position either after the ball has gone dead or while the game is still underway. Running, high-speed running and sprints are while the game is underway to get to rucks and mauls, running with the ball, chasing a ball or when defending. The sum of all these activities will be the “distance covered” (Deutsch, *et al.*, 2002:160-166).

Early estimations on the distance covered during a rugby match indicated that a centre covered 5800m, of which 2200m was walking, 1600m jogging and 2000m

sprinting (Morton, 1978:4-9). Deutsch; *et al.*, (1998:561-570) monitored six players during four under-19 matches between different levels of play. Although backs had a lower overall exertion based on heart rate, they covered the greatest distance, with props and locks covering $4400 \pm 398\text{m}$, back row $4080 \pm 363\text{m}$, inside backs $5530 \pm 337\text{m}$, and outside backs $5750 \pm 405\text{m}$, respectively. Within elite under-19 colt's rugby, forwards spent a larger percentage of time standing still (46%) compared with the backs (39%), and covered a shorter distance in all gait movements except jogging (Deutsch, *et al.*, 1998:561-570).

The majority of recovery was passive (stationary) for forwards and active (walking or jogging) for backs. While the forwards are primarily engaged in non-running intense activity, the backs are typically walking, standing or static while waiting for the ball to be delivered from the contest. The backs ($253 \pm 45\text{m}$) cover greater distance at sprinting speed compared with the forwards ($94 \pm 27\text{m}$), and complete more backwards and sideways (utility) movements (backs 72 ± 7 , forwards 22 ± 4). The mean distance of individual sprints was similar for both the forwards and the backs ($17\text{m} \pm 2\text{m}$ and $21\text{m} \pm 3\text{m}$, respectively). Props and locks covered the greatest distance at a low-intensity pace, indicating more continuous activity and generally greater involvement for these players given their proximity to the contest (Deutsch; *et al.*, 1998:561-570).

Roberts; *et al.*, (2008:825-833) found no differences between 10-min time periods for distances travelled in high-intensity running, sprinting or "running work" (Figure 6). Furthermore, there were no differences between the total (Figure 7), average or maximum time spent in high-intensity activities or in static exertion over the 10-min periods.

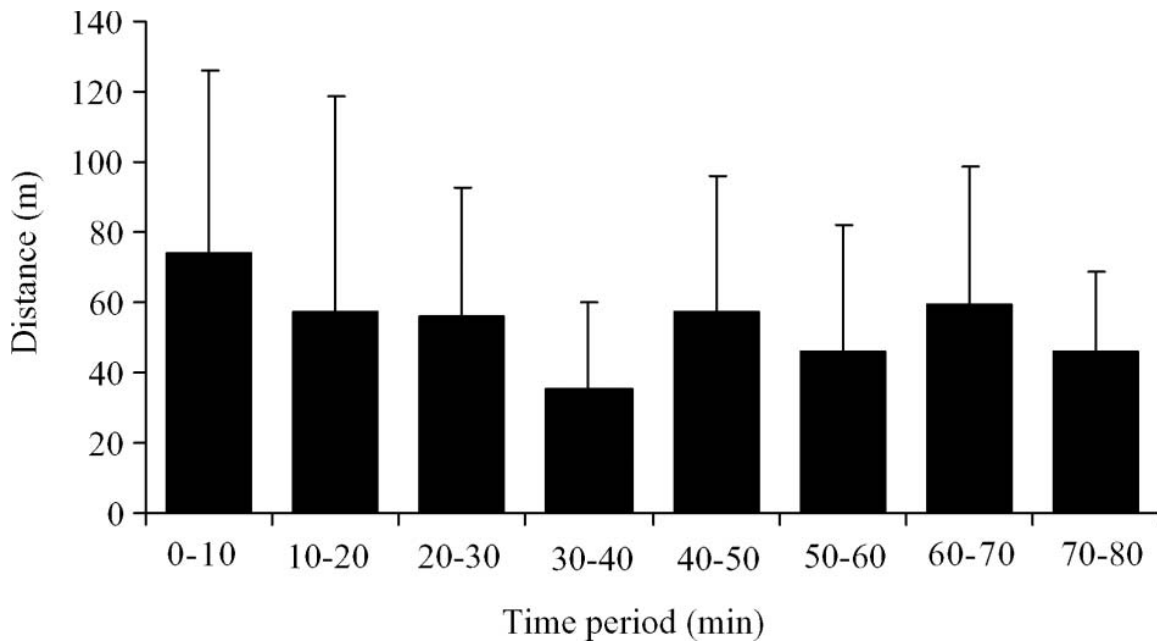


Figure 6: Distance travelled for 'running work' over each 10-min period of match-play.

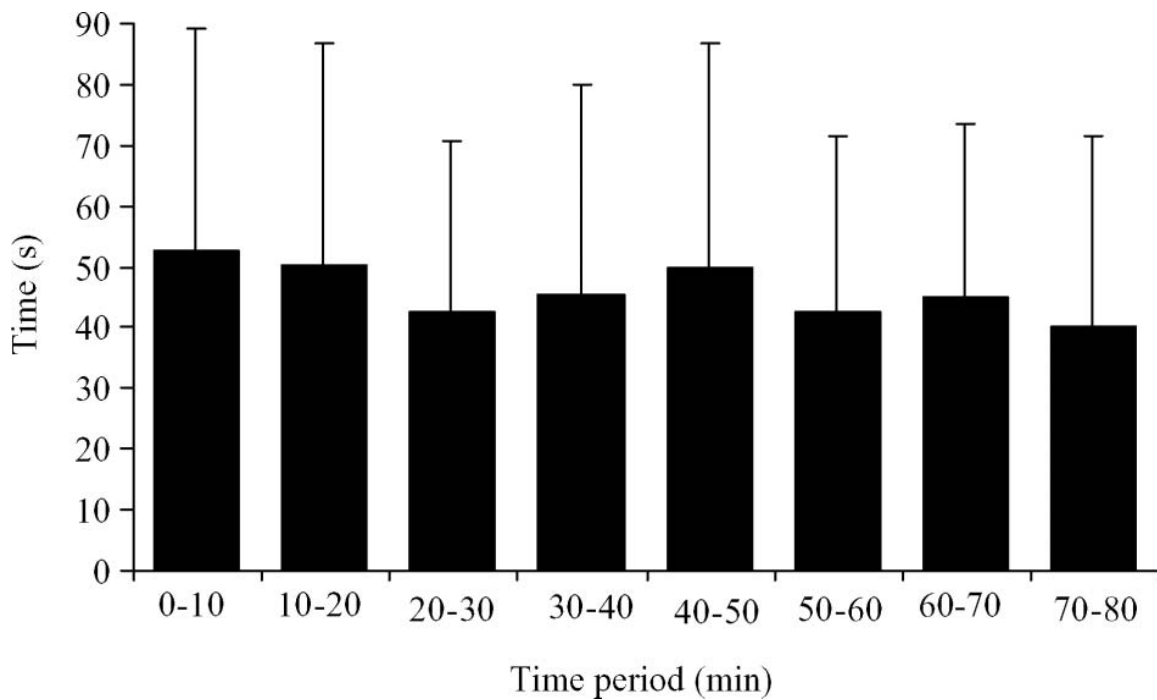


Figure 7: Time spent performing work activities during each 10-min period of match-play.

2.4.2 High-intensity distance covered

The high-intensity distance covered is represented by the distance covered during running, high-speed running and sprints. The high-intensity distance covered can be regarded as the actual playing intensity, because most activities are performed during this stage.

Outside backs are engaged in more sprints during a game than front row forwards (Figure 2, p 22, shows the percentage of sprints performed in offensive and defensive play for Super12 forwards and backs). As a result, outside backs spent

significantly more total time sprinting than front row forwards. An overall difference between forwards and backs were also observed. Mean sprint duration was longer for outside backs than for all other positional groups, which contributed to significantly longer mean sprint duration for backs than for forwards (Deutsch, *et al.*, 1998:561-570).

Time-motion analysis of first-class cricket fielding revealed a lower proportion of high-intensity activity than observed in team invasion sports such as soccer and hockey. This was due to large periods of rest involving walking or stationary activity. Despite this, players covered a large estimated distance during a day of first-class cricket. The current data upholds the previous views that cricket is undemanding (Rudkin & O'Donoghue, 2008:604-607).

According to Deutsch; *et al.*, (2002:160-166) during a rugby competition, 85% of the game time is typically spent in low-intensity activities, and 15% in high-intensity activities This distribution of high- and low-intensity activity appears unchanged in studies conducted between 1978 and 1998 despite casual observation that the overall intensity of rugby has increased. The high-intensity activity is made up of 6% running and 9% tackling, pushing and competing for the ball (Docherty; *et al.*, 1988:269-277). These periods of high-intensity activity

place considerable demands on anaerobic metabolism, with two-thirds of rest periods greater in duration than the preceding high-intensity effort (Deutsch; *et al.*, 1998:561-570).

During game stoppages, players switch to low-intensity activity. For players close to the ball, high-intensity exercise recommences upon the continuation of play (McLean, 1992:285-296). Morton (1978:4-9) reported a back will have the ball in hand for no more than 60 seconds and suggested that much of their contribution involves covering in defence, acting as a support player, or running decoy lines to distract the opposition. Early research by Morton (1978:4-9) reported 135 activity periods during international and regional matches, with 56% of activities lasting less than 10 seconds, 85% lasting less than 15 seconds, and only 5% lasting longer than 30 seconds. Similarly, in an analysis of 1986 Five Nations games there were 180 separate actions with 96 stoppages (Menchinelli, Morandini, & De Angelis, 1992:196-197). 70% of actions were 4-10 seconds in duration with single actions for forwards and centre three-quarters lasting 7 seconds. The mean duration of recovery periods has been reported to be 33 seconds during international matches with the majority of rest periods less than 40 seconds (Menchinelli; *et al.*, 1992:196-197).

Despite an overall lower exertion, backs covered significantly greater total distances (5640 m) than forwards (4240 m; $p < 0.01$), with the greatest difference being evident between the outside backs and back row forwards (5750 and 4080 m, respectively; Table 7, p 35).

Table 7: Distances covered by positional groups (mean \pm sxÅ) (Deutsch, et al. 1998:561-570).

Activity	Total distance			
	Props and locks	Back row	Inside Backs	Outside Backs
Total distance (m)				
Walking	1000 \pm 130	992 \pm 100	1740 \pm 100	1660 \pm 142
Jogging	3050 \pm 193	2940 \pm 156	2600 \pm 347	2110 \pm 271
Cruising	363 \pm 102	368 \pm 36	565 \pm 57	514 \pm 103
Sprinting	94 \pm 24	94 \pm 30	208 \pm 52	297 \pm 37
Utility	118 \pm 43	154 \pm 35	418 \pm 70	442 \pm 58
Total distance	4400 \pm 398	4080 \pm 363	5530 \pm 337	5750 \pm 405
Maximum distance (m)				
Walking	55.5 \pm 7.6	68.7 \pm 6.8	77.6 \pm 6.1	63.5 \pm 13.0
Jogging	65.3 \pm 8.7	62.9 \pm 4.0	56.5 \pm 4.6	63.8 \pm 3.6
Cruising	27.2 \pm 5.3	23.4 \pm 2.9	28.3 \pm 3.9	25.3 \pm 3.3
Sprinting	29.0 \pm 6.9	17.0 \pm 6.0	24.2 \pm 3.7	27.1 \pm 4.1
Utility	10.3 \pm 3.0	19.7 \pm 8.3	12.6 \pm 1.6	16.0 \pm 2.6
Average distance (m)				
Walking	14.0 \pm 1.8	13.1 \pm 0.6	13.6 \pm 1.3	22.4 \pm 1.1
Jogging	21.8 \pm 1.7	19.4 \pm 1.2	16.3 \pm 1.0	20.6 \pm 1.4
Cruising	13.5 \pm 1.6	11.2 \pm 0.7	12.9 \pm 0.8	11.3 \pm 1.0
Sprinting	19.8 \pm 1.0	14.5 \pm 3.7	18.8 \pm 2.7	23.6 \pm 1.2
Utility	6.0 \pm 3.3	6.2 \pm 2.1	5.4 \pm 0.9	8.0 \pm 1.3

The activities of scrummaging, rucking and mauling, lineouts and tackles are critical components in the game of rugby. On average, first-class forwards spend 8 minutes in intense static activity scrummaging during the game, and 5 minutes in rucks and mauls; representing 15% of the total time (Treadwell, 1988:282-287). Forward players carry the ball into contact on more occasions than backs and spend considerably more time in rucks and mauls than backs.

Table 8: Number of match activities for 1995 and 2004 (predicted values $n \pm$ standard deviation).

	1995	2004
Scrum	33 \pm 7	26 \pm 7
Lineouts	39 \pm 6	28 \pm 10
Rucks	72 \pm 18	178 \pm 27
Mauls	33 \pm 8	22 \pm 9
Passes	204 \pm 30	247 \pm 32
Kicks during play	66 \pm 8	46 \pm 13
Tackles	160 \pm 32	270 \pm 25

Although centres spend more time in intense running, the time spent in static exertion by the forwards contributes to a greater time spent in high-intensity activity (forwards; 11 minutes) compared with the backs (4 minutes) (Docherty; *et al.*, 1988:269-277). Each scrum lasts approximately 5-20 seconds, with each lineout approximately 15 seconds in duration. A back row forward performed 19 tackles during a first-grade rugby game, which is less than the 20-40 tackles made by national rugby league players per game (Brewer & Davis, 1995:129-135). For front row and back row forwards, rucking / mauling, scrummaging and tackling accounted for approximately 80-90% of their high-intensity work. For inside and outside backs, approximately 60-70% of high-intensity activities were either cruising or sprinting (Deutsch, *et al.*, 1998:561-570)

Utility movements, rucking/mauling, tackling and scrummaging can also be classified as high-intensity distance covered. Eaves & Hughes (2003:103-111), in a study of Five and Six Nations matches covering the period 1988-2002, found that rugby became a faster, ruck-dominated game that contained more phases of play following the introduction of professionalism.

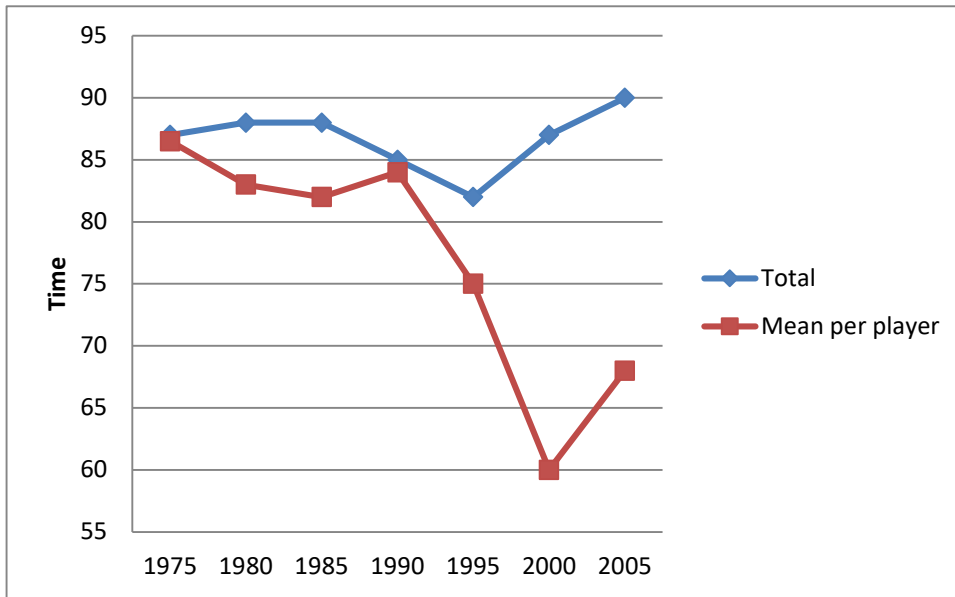


Figure 8: Comparisons of total match time with player match time

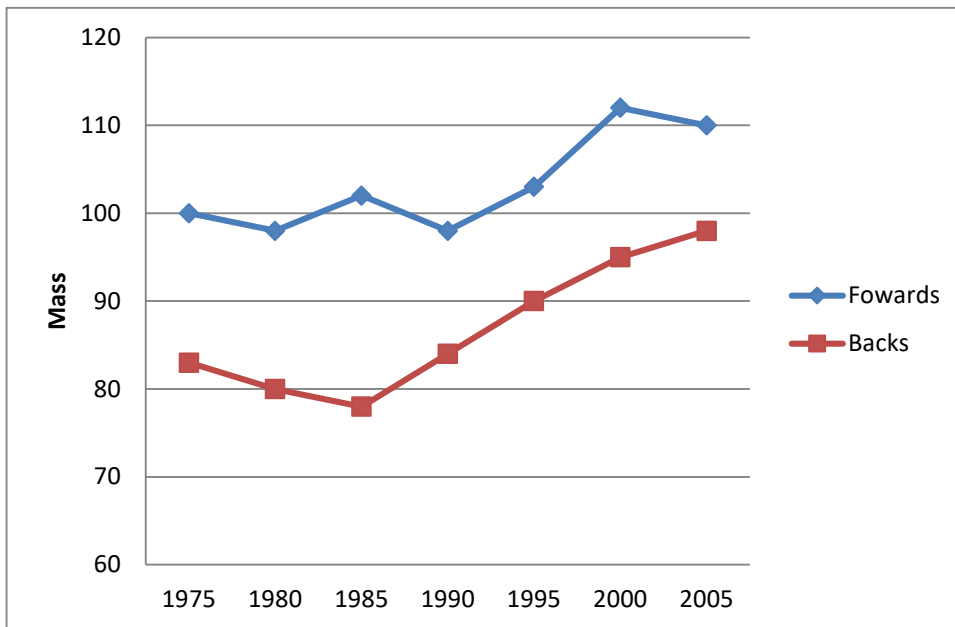


Figure 9: Comparisons of mean body mass of forwards and backs

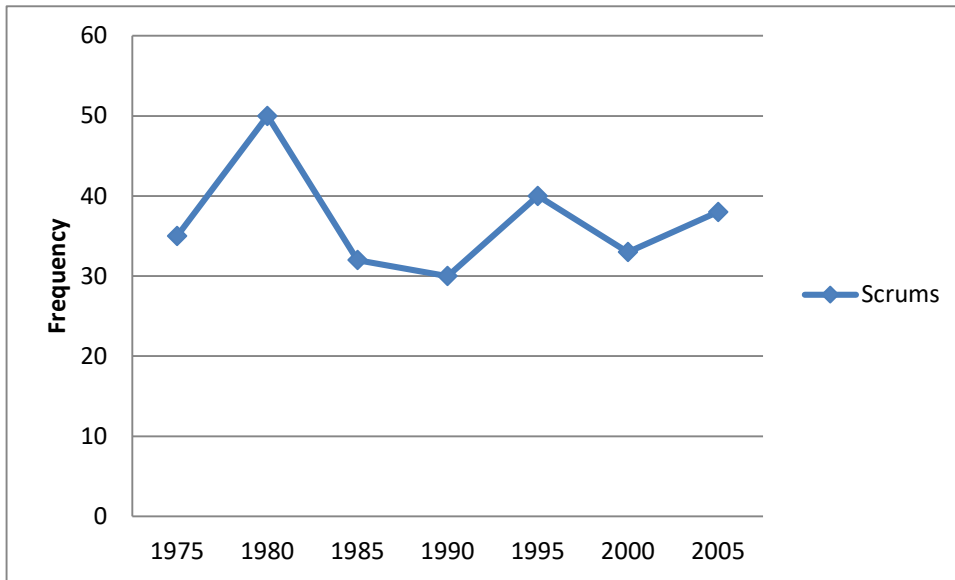


Figure 10: Frequency of scrums since 1975 – 2005

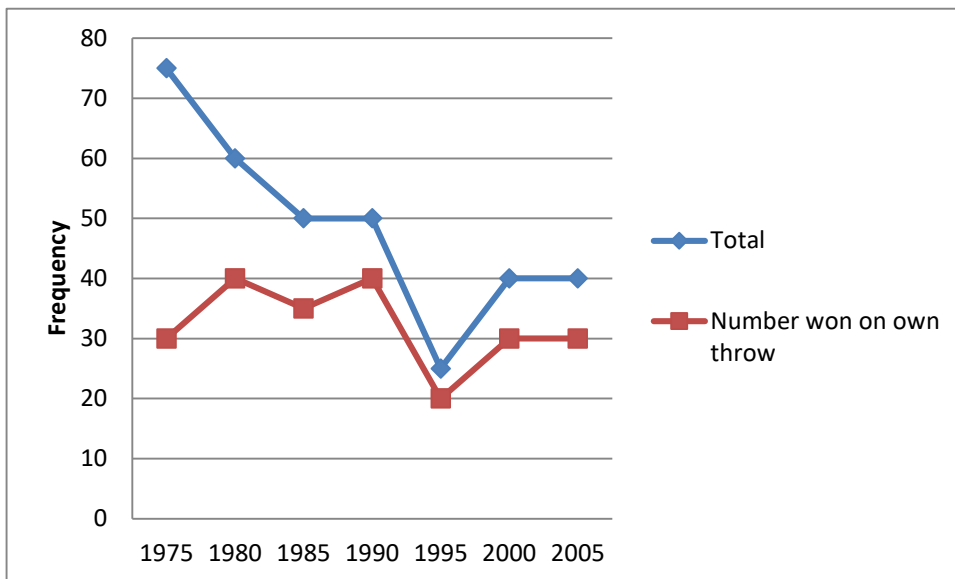


Figure 11: Comparisons of line outs won on own throw from 1975 to 2005

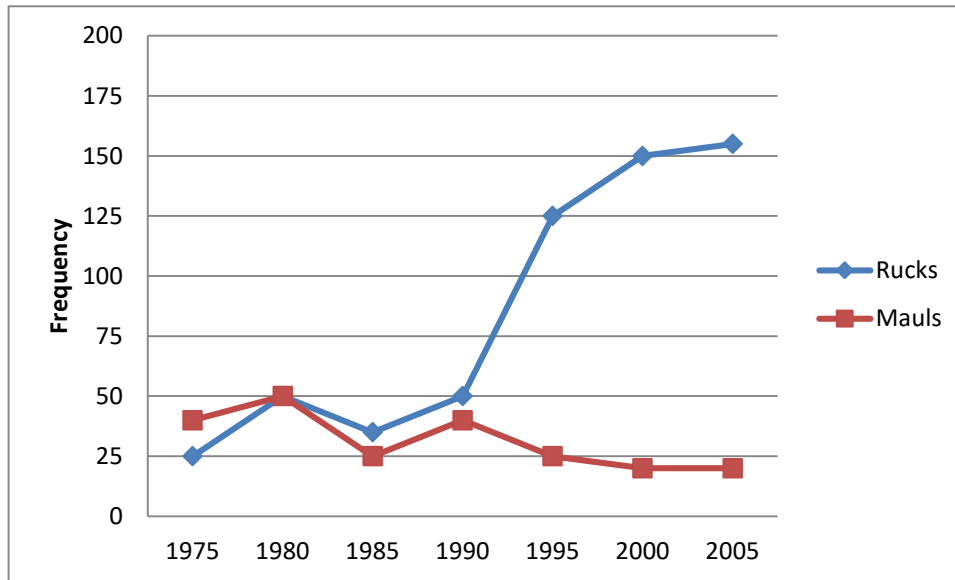


Figure 12: Frequency of rucks and mauls from 1975 to 2005

2.4.2.1 Utility movements

Inside backs perform more utility movements (p 29) (for a greater total time) than either front row or back row forwards. Backs performed more (and consequently spent a greater percentage of time in) utility movements than forwards (Deutsch, *et al.*, 1998:561-570)

2.4.2.2 Rucking and mauling

Front row forwards were involved in significantly more rucks and mauls than players in other positional groups, while back row forwards were also involved in significantly more rucks and mauls than inside and outside backs. Front row and back row forwards spend more time rucking and mauling than the inside and outside backs (Deutsch, *et al.*, 1998:561-570).

The number of rucks per match has increased almost four-fold since the introduction of professionalism. This marked increase in rucks is consistent with the changes in the patterns of play observed by (Eaves & Hughes, 2003:103-

111) The number of mauls per match has decreased during the same period, which also is in line with the patterns observed by (Eaves, Hughes & Lamb, 2005:58-86). Both of these changes are likely to be related to the introduction of the use-it-or-lose-it law in 1994. This law increased the risk of losing possession in mauls and made the option of a ruck preferable to that of a maul for the team in possession of the ball.



2.4.2.3 Tackling













Back row forwards and inside backs are involved in more tackles than front row forwards, while back row forwards also performed more tackles than outside backs. There is no trend for forwards to perform more tackles than backs; tackling seemed to be more a function of specific positional group (Deutsch, *et al.*, 1998:561-570).

While the number of tackles per match was already showing an upward trend, there was a large increase following the introduction of professionalism. The authors believed that this increase was a further consequence of the use-it-or-lose-it law. This led to players deliberately taking the tackle (Quarrie & Hopkins, 2007:895-903).

2.4.2.4 Scrummaging

There are no differences between front row forwards and back row forwards for any scrummaging variables (Deutsch; *et al.*, 1998:561-570).

Table 9: Effects on the number of match activities (mean changes with 90% confidence limits; , increase; , decrease).

	Professionalism			10-year trend			Good conditions	
	Effect (%)	Magnitude		Effect (%)	Magnitude		Effect (%)	Magnitude
Scrum	8; ± 22	Unclear		17; ± 10	Moderate		8; ± 19	Unclear
Lineouts	14; ± 17	Moderate		19; ± 8	Moderate		6; ± 16	Unclear
Rucks	63; ± 33	Very large		59; ± 18	Very large		4; ± 17	Unclear
Mauls	25; ± 21	Moderate		12; ± 12	Small		1; ± 25	Unclear
Passes	20; ± 17	Large		2; ± 8	Unclear		7; ± 13	Unclear
Kicks in play	30; ± 14	Large		0; ± 10	Unclear		24; ± 13	Large 
Tackles	51; ± 23	Very large		13; ± 9	Moderate		4; ± 9	Unclear

2.4.3 Percentage work rate/ratio at high-intensity

A considerable amount of research into exercise physiology and performance have employed continuous exercise protocols. Recently, the interest in intermittent exercise has increased due to its closer resemblance to that experienced in team sports (Reilly & Thomas, 1976:87-89). Many of the protocols used in these intermittent exercise studies are based on information from match analysis (Withers, Maricic, Wasilewski; & Kelly, 1982:159-176). This may also be employed with a range of work intensities and durations (Drust, Reilly, & Cable, 2000:885-892; Nicholas, Nuttal; & Williams, 2000:97-104).

Christmass, Dawson, Passeretto & Arthur (1999:423-435) compared the physiological responses of 90 min intermittent running and continuous running of similar energy expenditure in physically active individuals. The intermittent exercise, which involved repeated blocks of 12 s exercise and 18 s passive rest (12:18 s), demonstrated greater carbohydrate utilization and lower fat utilization than the continuous exercise. Furthermore, when work-rest durations of 6:9 s and 24:36 s were compared, the latter was observed to accentuate carbohydrate utilization (Christmass, *et al.*, 1999:436-447). Although the 24:36 s protocol

employed by Christmass; *et al.*, (1999:436-447) may not truly represent a work-rest duration in many team sports competitions, it is relatively close to that undertaken in a range of training scenarios for sports. An examination of the underlying physiological responses during different work-rest durations and a demonstration of the effects on performance will be of use to athletes and coaches alike.

Of particular interest would be the possible interaction of metabolic substrate utilization and the incidence of overtraining. For example, increased carbohydrate metabolism, such as that observed during periods of intense training, has been suggested to contribute to mechanisms underpinning overtraining (Petibois, Cazorla, Poortmans; & Deleris, 2002:867-878). Consequently, a comparison of the physiological and metabolic responses of different potential training practices (work-rest durations) may aid coaches in planning appropriate training sessions and in avoiding negative training adaptations.

Despite running speed and total exercise time (and therefore total work done) during each protocol being matched, heart rate tended to be higher during the long and medium work-rest trails than the short work-rest trial. This finding suggests that the medium and long work-rest trials were physiologically more demanding (Boyle, Mahoney & Wallace, 1994:235-241).

2.4.4 Work-to-rest ratio

Many of the protocols used in these intermittent exercise studies are based on information from match analysis and may employ a range of work intensities and durations (Drust; *et al.*, 2000:885-892). Rugby union involves periods of high-intensity activity interspersed with periods of incomplete recovery, and players require qualities such as endurance, speed, agility, and power (Gabbett, 2002:399-405).

Christmass, *et al.*; (1999:423-435) compared the physiological responses of 90 min intermittent running and continuous running of similar energy expenditure in physically active individuals. The intermittent exercise, which involved repeated blocks of 12 s exercise and 18 s passive rest (12:18 s), demonstrated greater carbohydrate utilization and lower fat utilization than the continuous exercise. Furthermore, when work-to-rest durations of 6:9 s and 24:36 s were compared, the latter was observed to accentuate carbohydrate utilization. In the study of Christmass; *et al.*, (1999:423-435) the main finding was that 40 min of intermittent exercise involving long and medium work-to-rest durations elicits greater physiological strain and carbohydrate utilization than the same duration of intermittent exercise with a short work-to-rest duration. Furthermore, performance duration was related to plasma glucose concentration and heart rate post intermittent exercise.

Despite running speed and total exercise time (and therefore total work done) during each protocol being matched, heart rate tended to be higher during the long and medium work-to-rest trials than the short work-to-rest trial. This finding suggests that medium and long work-to-rest trials were physiologically more demanding.

Table 10: Analysis of repeated high-intensity activity observed

No. Of bursts	Frequency	Menu burst duration (s)	Mean recovery duration (s)
3	13	1	17.1
4	13	1.3	16.6
5	4	1	18.1
6	1	1.8	20.5
7	0	N/A	N/A
8	1	1.2	20.4
3.9 ± 1.1	32	1.2 ± 0.5	17.2 ± 2.3

Work-to-rest ratios provide an objective means of quantifying the physiological requirements of an activity. The work-to-rest ratios of International Five Nations Rugby players were normally distributed, except for a high occurrence of work-to-rest ratios in the 1:>4 range due to stoppages for injuries or kicks at goal (McLean, 1992:285-296). The mean duration of work was 19 seconds with the work-to-rest ratios of 1:1-1.9 seconds and 1-1.9:1 seconds occurring most frequently. Sixty-three percent of the work-to-rest ratios had work periods less than the rest period (McLean, 1992:285-296).

Similarly, the mean work-to-rest ratio for under-19 colts (forwards and backs) was 1:1.4 seconds and 1:2.7 seconds respectively, with one-third of the work periods followed by rest periods equal to, or shorter than, the work duration. Short incomplete recoveries (less than 20 seconds) may not allow full replenishment of creatine phosphate stores, increasing the reliance on anaerobic glycolysis in the following work periods (Deutsch, *et al.*, 1998:561-570). Fatigue and reduction in performance may ensue, evidenced by the fact that, for rugby players, 30 seconds rest between maximal sprints elicits a marked reduction in sprint performance compared with 60 seconds rest (Holmyard, Cheetham; & Lakomy., 1988:134-142).

Front row and back row forwards performed more high-intensity work than inside and outside backs, as the result of performing work more frequently. This difference is reinforced by overall differences between backs and forwards for both variables. Although there is no difference in mean work duration between groups, front row and back row forwards have significantly longer maximum work periods during play than inside and outside backs. The mean rest period was significantly longer for inside and outside backs than for front row and back row forwards. Front row and back row forwards has significantly shorter maximum rest periods than inside and outside backs, which is reinforced by the overall backs versus forwards difference ($p < 0.0125$; Table 1) (Deutsch; *et al.*, 1998:561-570). As a result of a shorter mean rest period, the inside and outside backs has a significantly lower mean work-to-rest ratio than front row and back row forwards, which is again confirmed at the forwards versus backs level of comparison (Deutsch; *et al.*, 1998:561-570).

2.4.5 Implications for fitness training

Work-to-rest ratio data for backs in the previous studies (mean work of 5 seconds, mean rest of 80 – 110 seconds) indicates that the creatine phosphate system likely plays an important role in these positions (Balsom, Seyer, Sjodin; & Ekblom., 1992:528-533). While not statistically significant, the difference in mean rest period between inside and outside backs (-25s) has important physiological implications.

Despite a slightly longer mean sprint distance, the greater opportunity for outside backs to recover should be reflected in the design of fitness training sessions. With approximately 30% of work-to-rest periods being less than 1:7, however, there are still likely to be periods of play when the incomplete replenishment of creatine phosphate stores would result in an increased dependence on the anaerobic glycolytic pathway, in all positions. However, to develop maximal speed/ power, it may be necessary to incorporate some training in which

adequate recovery is provided between high-intensity sprints to allow the replenishment of creatine phosphate, particularly in outside backs.

In time-motion analysis, movement patterns, distance covered, average velocities, levels of exertion and work-to-rest ratios can be established by quantifying the time spent in different activities. The information obtained from these analyses allows coaches to structure training programmes specific to the requirements of the game, and facilitates more effective training and improved performance (Deutsch, *et al.*, 1998:561-570).

Results from Roberts; *et al.*, (2006:386-397) showed that in elite rugby union, high-intensity activity completed by backs was more sporadic and predominantly running based, whereas high-intensity activity performed by forwards was more frequent and static exertion based. Therefore, it is possible to identify position-specific performance parameters when developing programmes and protocols.

On the other hand, work-to-rest ratio data from forwards indicate that the creatine phosphate system may play a less significant role in energy provision in this group. While the mean work period for forwards was also 5s, the mean rest period of approximately 30-40s would in most cases result in only partial replenishment of creatine phosphate stores (Gaitanos, Casey, Hultman; & Sjöholm., 1993:712-719). Despite the similarities in mean work period between positional groups, the higher work rates characteristic of forwards' play was once again evidenced by the significantly longer maximum work periods. While forwards are often required to perform work bouts of approximately 20-25s, the corresponding figure for backs is only about half as long (12-14s). Although some non-significant differences were evident when comparing front and back row forwards, in practical terms these are less likely to impact on physiological consequences than the larger discrepancies noted between the inside and outside backs.

During intermittent, high-intensity sports such as rugby, anaerobic glycolysis represents an important source of energy for the repeated performance of high-intensity activities, as evidenced by the work-to-rest ratios in previous studies. The creatine phosphate system, when fully replenished, has been shown to contribute very little to work bouts of longer than 10s (Hultman, Greenhaft, Ren; & Soderland., 1991:347-353). When average work periods are approximately 5s, anaerobic glycolysis can be expected to contribute up to 50% of the energy required. Although the mean work duration in all positions are approximately 5s, forwards could expect to complete at least one work period lasting over 20s in duration. Furthermore, work-to-rest ratios determinate that over 20% of forwards' work bouts are followed by rest periods of equal or lesser duration. The implication of this finding is that forwards will have to rely almost solely on anaerobic glycolysis and aerobic sources for the latter parts of these periods of play, and may be more likely to experience fatigue as a result of hydrogen ion accumulation (Deutsch, *et al.*, 1998:561-570; Docherty, *et al.*, 1988:269-277; McLean, 1992:285-296). In backs, fatigue resistance is less likely to be a limiting factor, as these players perform shorter periods of maximum work (- 10 seconds), and approximately 90% of work periods were followed by equal or longer rest periods. It has been shown that performance during repeated sprints of 5 – 6 seconds duration can be maintained when separated by passive recovery periods of 120 seconds (Balsom, *et al.*, 1992:528-533).

Greater professionalism in rugby has increased the interest in sport science aspects of training and competition. Studies have investigated the seasonal variation in performance, effects of specific tactics, influence of climate and the consequences of acute altitude exposure (Duthie; *et al.*, 2003:973-991). Further research in these areas, coupled with more comprehensive studies of the physical characteristics of players, fitness requirements and movement patterns of rugby, will contribute to the development of more effective conditioning programmes (Duthie; *et al.*, 2003:973-991)

2.5. Differences between levels of competitions

Two studies have investigated the movement pattern differences among various levels of competition (Docherty, *et al.*, 1988:269-277). During Super 12 games, the premier Southern Hemisphere rugby competition, the total work (time spent cruising, sprinting, tackling, jumping, rucking / mauling, and scrummaging) for forwards (10 minutes) and backs (4 minutes) was similar to forwards and backs of club level (10 and 4 minutes, respectively) (Deutsch; *et al.*, 2002:160-166). The number of work efforts per game for Super 12 forwards (122 ± 18) and backs (47 ± 9) was similar to first-division players (forwards 118 ± 23 , backs 55 ± 11).

The mean work period for Super 12 forwards and backs were 5.1 and 4.7 seconds, respectively. The average rest period (inactive, walking, jogging, shuffling sideways or backwards) ranged from 34 seconds for first-division forwards to 100 seconds for Super 12 backs. During club and international-level games, differences were found in the time spent in running activities with centres of international standard spending more time per game in non-running intense activity (5.4%) than club centres (1.8%) (Docherty; *et al.*, 1988:269-277). Super 12 backs spent more time in utility movements (backwards and sideways walking, and jogging) when compared with the club backs ($3.7 \pm 2.0\%$ and $2.3 \pm 1.0\%$, respectively) (Deutsch, *et al.*, 2002:160-166). Overall, there appears to be only minor differences in movement patterns of players between international- and club-level rugby. It is possible that the game speed between these levels of competition is not apparent from the time-motion analysis data collected.

There has been a marked change in the body mass of elite rugby players over the last three decades. Differences in body mass also occur across different levels of competition. New Zealand senior A forwards ($98.5 \pm 11.5\text{kg}$) were significantly heavier than their senior B equivalents ($88.1 \pm 10.2\text{kg}$), and as

expected, senior players had substantially greater body mass compared with colt-level players. Increased professionalism in the physical preparation is a likely cause of the increased body mass of rugby players, with this increase greater in the forwards (Olds, 2001:253-262).

Differences in stature among the various positional groups in rugby are unclear. Recent literature has demonstrated that county and international forwards and backs have similar stature. Conversely others have shown that both first- and second-class forwards are markedly taller than backs in the same level (Tong, Bell; & Ball, 2001:289-297). At higher levels, there is a clearer distinction in stature between forwards and backs. The positional demands of rugby require certain characteristics and this is particularly evident for the lock position in which the overall jump height achieved during the lineout is crucial to success. Locks have similar relative vertical jump performance to other forwards and are inferior when compared with the backs (Maud, 1983:16-23).

A recent study examining frequencies of match activities in international matches played in the northern hemisphere found a decrease in scrum frequency over time (from 1988-1992 to 2000-2002) but no significant effect for the change from the pre-professional to the professional era (Eaves; *et al.*, 2005:58-86). Players in the professional era spend more time in organized team practices, and the rewards available to those players who are able to obtain professional contracts mean that the development of skills receives greater focus than previously.

Table 11: Effects on points and penalty activities (mean changes with 90% confidence limits; ↑, increase; ↓, decrease)

	Professionalism			10-year trend			Good conditions		
	Effect	Magnitude		Effect	Magnitude		Effect	Magnitude	
Points scored	31; ± 40	Moderate	↑	9.1; ± 20	Unclear		62; ± 57	Large	↑
Tries scored	72; ± 104	Large	↑	1; ± 32	Unclear		78; ± 100	Large	↑
Conversions	45; ± 125	Unclear		9; ± 48	Unclear		73; ± 144	Unclear	
Penalties awarded	1; ± 25	Unclear		5; ± 13	Unclear		10; ± 19	Unclear	
Penalties attempted	10 ± 37	Unclear		6; ± 22	Unclear		30; ± 52	Unclear	
Penalties successful	8; ± 50	Unclear		17; ± 33	Unclear		11; ± 53	Unclear	↓
Goals successful (%)	8; ± 27	Unclear		13; ± 18	Moderate	↑	16; ± 20	Moderate	

2.6. Variables that affect player characteristics and match activities

The changes in match activities and player characteristics observed are probably due to several factors, including law changes, developments in match analysis and tactics, modifications to player training and equipment technology. Eaves & Hughes (2003:103-111) reported that ball-in-play time increased by a mean of 4 min and 45 s following the introduction of professionalism. They observed a similar pattern, with predicted ball-in-play time in good conditions increasing by 5 min and 54 s between 1995 and 2004. The increase in ball-in-play time is related to the decrease in numbers of scrums and lineout's. Scrums are restarts in play after minor infringements, and lineout's are restarts when the ball travels over the sidelines. This increase in effective playing time has been offset to some extent for individual players through the introduction of three law changes to the sport: the ability to substitute players for tactical purposes in 1997, the "blood-bin" that allows players who have bleeding wounds to be temporarily replaced, and the introduction of red and yellow cards in 2000.

There was a rapid decrease in mean time spent on the field per player following the introduction of substitutes, and there was a corresponding increase in the number of players taking part in each match. Analysis of the effect of environmental conditions indicates that teams make more substitutions in matches played in better conditions (Eaves & Hughes, 2003:103-111).

According to Eaves & Hughes (2003:103-111) the following variables will play a important role on the distances and intensities of the game:

2.6.1 Magnitude of the game

In most finals the ball will rather be kicked for touch or take the penalty for goal rather than running the ball. These are all situation specific. Finals are always close affairs.

2.6.2 Law variations

In rugby, changes in the rules have made the play 'more open', faster and more attractive to spectators. For example, there is greater policing of the breakdown by referees in an attempt to ensure that the ball is quickly recycled and play continues (Hughes & Blunt, 1998:184-190). Because coaches and players seek a competitive advantage with respect to other teams and individual players, they tend to interpret and apply the laws in a manner that provides them with the maximum benefit. Thus law changes might or might not yield outcomes that were aligned with the intention of the law makers when the change was made (Hughes & Blunt, 1998:184-190).

The new Experimental Law Variations (ELV's) has given rugby new life. There are less kicking and more running of the ball. The ball is much longer in play thus increasing fitness required by players.

Analysis can also be conducted to quantify important game structures to indicate what effect law changes have had on the game. A significant change in the game from the 1991 to 1995 World Cup occurred in the number of second phase possessions, which rose 44% from 48 to 69 per match. The term second phase is possibly an inaccurate term, as the researchers are actually referring to all phases beyond the first. This type of possession can simply be called “phase play”, that is, all phases emanating from rucks and mauls rather than from the possession platform. In any case, the increase in phase play possession appears to be a positive outcome of the “use it or lose it law” the IRB implemented in 1994. The use it or lose it law discourages teams from letting play end in a maul or collapsed maul with the ball in their possession, by ruling that in this situation the ensuing scrum will be awarded to the opposition (Quarrie & Hopkins, 2007:895-903).

Carter & Potter (1996:187) analyzed time elapsed when ball is not in play during the 80 min of running time per match. Such analysis provides useful information for Rugby’s administrators, identifying which areas of the game lead to the greatest amount of wasted time. The wasted time during stoppages in play occurs mainly during preparation for 25 set pieces (scrums, lineouts and kickoffs) and shots at goal. Carter & Potter (1996:187) reported that in three matches during the 1995 World Cup, preparation for shots at goal took over twenty minutes, with the greatest amount of time wasted being 26 min 46 sec during the match between New Zealand and Scotland. Such information may have led to the introduction of the rule giving goal kickers a maximum of 1 min to take their shot at goal.

International Rugby Board (IRB) analysis has since shown that the average “ball in play” time per game has dramatically increased over the last 15 years. In 1991 it was 25 minutes, and has gradually increased through to an all time high in 2003 of 34 minutes (Williams, Hughes & O’Donoghue, 2005:1-11).

2.6.3 Game structure

The structure of play has also improved with teams having a set plan and definitive roles for each player. Few studies have detailed the movements of players during rugby either under the new or traditional rules and there is a need for further analysis on the current game at the elite level (Hughes & Clarke, 1994:180). Some teams play much more with their forwards and try to create more rucks and mauls that can continue for 30 – 60 sec. This will place a bigger demand on the fitness of the forwards than that of the backs.

2.6.4 Weather conditions

The weather can be a determining factor especially when playing in the rain. Kicks and handling errors are much more prominent, thus decreasing playing time. Games played in the rain are also low scoring games due the constraints of not being able to run the ball that often.

2.6.5 Home and away games

Courneya & Carron (1992:13-27) were the first researchers to synthesize the results of 16 studies and results indicating that home advantage definitely exists, yet varied significantly ranging from 52.3% in basketball to 69% in soccer. They also defined home advantage as “the term used to describe the consistent finding that home teams in sport competitions win over 50% of the games played under a balanced home and away schedule”.

The problem that has been of much debate has been to find the causes associated with this home advantage effect. Traditionally the causes of the home advantage were established under four subheadings: 1: Crowd support – in terms of size and density; 2: Familiarity with local conditions – associated with differing levels of intimacy with arena/ground facilities; 3: Travel factors – based

on the assumption that visiting teams experience greater fatigue and disruptions in preparation and routines; 4: Rule factor – Might extend special privileges explicitly favoring the home team (Courneya & Carron, 1992:13-27).

Clark (2005:375-385) indicated that the percentage of wins by the home team depends as much on the closeness of the competition and the variability of the results as on the home advantage. In teams equal in ability, only a small home advantage will result in the home team winning. If teams were wide apart in ability, home advantage would not overcome large ability differences.

Morton (2006:495-499) evaluated home advantage both for national (Super 12) and international (Tri-nations) rugby teams from South Africa, Australia and New Zealand, over a five-year period 2000-2004 using linear modeling. These home advantages were examined for statistical and practical significance, variability between teams, stability over time, and for inter-correlation. The data revealed that the overall home advantage in elite rugby union has a mean of +6.7 points, and that this changes little from year to year. Closer examination revealed a high degree of variability. Different teams can and do have different home advantages, which ranges from a low of -0.7 to a high of +28.3 points in any one year (Table 12).

Table 12: Super 12 home advantage estimates

Team	2000	2001	2002	2003	2004	Mean
Blues	-8.6	1.3	7.0	8.8	0.0	1.7
Brumbies	5.8	18.0	-8.5	22.9	18.4	11.3
Bulls	18.7	-3.5	-8.1	-7.6	14.4	2.8
Cats	30.6	1.9	17.8	14.7	6.7	14.3
Chiefs	6.5	12.4	-5.0	7.8	-0.7	4.2
Crusaders	9.3	9.0	20.5	5.9	1.6	9.3
Highlanders	16.4	21.4	-5.6	18.2	14.2	12.9
Hurricanes	11.8	0.9	-9.8	2.6	13.7	3.8
Reds	9.5	0.9	15.7	4.7	14.6	12.7
Sharks	-4.1	3.5	31.2	-5.3	-7.5	3.6
Stormers	-3.2	-1.2	-4.3	-9.0	-3.6	-4.3
Waratahs	4.3	28.3	6.9	-3.2	16.0	10.5
Common	8.3	7.7	4.7	5.1	7.3	6.7

2.6.6. Competition structure

The “Bonus point” determines the end of the game in many situations. Teams will continue play even after the sirens gone if there is the possibility for a bonus point. Games can continue well after the 40 or 80 minutes of play.

CHAPTER 3 – Methodology

3.1 Method

An empirical design was used during this study to determine if time motion analysis can be implemented as a variable in identifying rugby success to determine which variable in Time motion analysis correlates the highest with success and to determine if there are significant differences ($P < 0.05$) between positions in the different components in the Time motion analysis. Determination of the most important parameters included distance covered, high intensity distance covered and percentage work rate at high intensity.

3.2 Subjects

The participants varied from Super 14 level (Bulls, Sharks, Lions, Brumbies, Crusaders, Stormers and Waratahs) to international test playing nations, including South Africa, New Zealand and Australia.

Players from each of the positional groups were studied: Front rows (players 1,3), Locks (players 4,5), Loose forwards (players 2,6,7,8), Inside backs (players 9,10,12,13), and Outside backs (players 11,14,15). A total of (n=36) front rows were evaluated, (n=36) locks, (n=72) loose forwards, (n=72) inside backs and (n=54) outside backs.

3.3 Protocol

Time motion analysis was conducted on 18 games played during the 2005-2007 Super 14 competition, Tri-nations and International tours. Data was supplied by the ProZone Company to the South African Rugby Union and management team. The study did not involve any verbal or physical contact with the players, as data were collected with informed consent via the Springbok teams' analyzer and the ProZone analysis system.

3.4 Equipment

ProZone is an English company that offers a system for analyzing football matches. ProZone's match analysis consists of four parts: Animation, Game Analysis, Fitness and Statistics. In the animation part, an animation with players represented by circles gives an overview of the movements of the teams as a whole and of the individual players. In all four parts a large number of numerical and visual data is presented about the game. Distance covered by each player, passes made and work intensity are examples of statistics that the system provides.

3.5 Procedure

To obtain data about the game, ProZone uses eight cameras placed around the stadium in combination with manual operators. Computer vision technology is used to capture the movements of the players and the ball, but a lot of manual work is required, not only to register all the events that happen during the game, such as free kicks, corners and passes, but also to aid the automatic tracking (Mylvaganam, Ramsay & De Craica, 2002:334).

3.6 Statistical analysis

Data was captured electronically by the researcher in Microsoft Excel (Microsoft Office 2007). Any further analysis was done by a biostatistician using SAS Version 9.1.3. Means and standard deviations were calculated for numerical data of distance, high-intensity distance and percentage work rate at high intensity. Mean values between winning and losing sides and home and away games were compared using the t-test procedure. A significance level of 0.05 is used throughout. Correlation analysis was performed and the Pearson's correlation coefficient was calculated.

CHAPTER 4 – Results

4.1 Introduction

A total 270 rugby players was part of the time motion analysis. Players were grouped according to position (n=36) front rows, (n=36) locks, (n=72) loose forwards, (n=72) inside backs and (n=54) outside backs. Data collected was statistically analyzed to show the differences between winning and losing sides away from home and at home. The influence of each (distance covered, high intensity distance covered and the percentage work rate at high intensity) was also compared to both the winning and losing teams All analysis will be discussed subsequently.

4.2 Results

Table 13 indicates the percentage of games won or lost, either away from home or at home. Teams playing at home will have a 66.67% winning percentage and teams playing away from home will only have a 33.33% chance of winning the game.

Table 13: Percentage of home and away games won or lost

Home and away games			
Ground	Result		Total
	Loose	Win	
A	66.67	33.33	
H	33.33	66.67	
Total	270	270	540

Table 14 illustrates the distance covered, high intensity distance covered and percentage work rate at high intensity for winning and losing teams. During the games analyzed only the locks from the winning teams were unable to cover more distance than the losing teams (5958.2m vs. 6263.1m). All other positions (Front rows, loose forwards, inside backs, outside backs) from the winning teams covered more distance. All the positions (Front rows, locks, loose forwards, inside backs, and outside backs) from the winning teams were unable to achieve a higher percentage work rate at high intensity than that of the losing teams. Table 14 also indicates that losing teams also had a higher average percentage of work rates than winning teams (19 ± 5 vs. 18 ± 5).

Table 14: Summary of all positions for the distance covered, high intensity distance covered and percentage work rate at high intensity for winning and losing teams

Group	N	Variable	Mean Losing team	Mean Winning team	Averages of winning and losing teams
Front rows	36	Distance (m)	5802.6	5829.9	5816.3
		HI Distance (m)	812	789.6	800.8
		Percentage WR @ HI	12.9	11.8	12.5
Locks	36	Distance (m)	6263.1	5958.2	6110.6
		HI Distance (m)	1109.9	1016.7	1063.3
		Percentage WR @ HI	16.8	16.7	16.75
Loose forwards	72	Distance (m)	6329.8	6404.4	6367.1
		HI Distance (m)	1333.5	1331.3	1332.4
		Percentage WR @ HI	20.5	19.7	20.1
Inside backs	72	Distance (m)	7072.2	7260.7	7166.5
		HI Distance (m)	1715.8	1690.3	1703.1
		Percentage WR @ HI	23.7	22.8	23.3
Outside backs	54	Distance (m)	6976.2	7194.2	7085.2
		HI Distance (m)	1562.2	1549.5	1555.9
		Percentage WR @ HI	22.1	21.1	21.6

Table 15 demonstrates that all the positions (Front rows, locks, loose forwards, inside backs and outside backs) from the winning teams were unable to cover more distance in high intensity than that of the losing teams. The high-intensity activity is made up of 6% running, and 9% tackling, pushing and competing for the ball (Docherty; *et al.*, 1988:269-277). On average the losing teams also covered a greater high intensity distance (1307±500 vs. 1275±500)

Table 15: Team averages of losing and winning teams

Group	N	Variable	Mean	Mean
			Losing team	Winning team
Team average	270	Distance (m)	6489±700	6529±700
		HI Distance (m)	1307±500	1275±500
		Percentage WR @ HI	19±5	18±5

Table 16 presents the means and standard deviations and means for all position involved in the losing side for distance covered, high intensity distance covered and percentage work rate at high intensity. Table 16 also indicates the maximum and minimum values recorded in each position. It is also clear that backs covered more distance in a game in comparison to the forwards (Inside backs = 7072.29m and front rows = 5802.64m).

Table 17 show the standard deviations and means of the winning side for distance covered, high intensity distance covered and percentage work rate at high intensity. It can be concluded that in most positions the winning team covered more distance during the game and played at a higher intensity. The Inside backs covered the most distance with a maximum of 8497.43m and the front rows covered the least amount of distance with 6798.22m.

Table 16: Standard deviation and means for losing teams

Result	N Obs	Variable	Mean	Std Dev	Minimum	Maximum
Front row	36	Distance (m)	5802.64	698.0329	3229.98	6798.22
		HI Dist (m)	812.0986	287.8291	290.49	1479.52
		Perc WR HI	12.91156	4.118145	4.24	21.76
Inside backs	72	Distance (m)	7072.29	677.9053	4375.54	8497.43
		HI Dist (m)	1715.85	396.4054	776.37	3063.21
		Perc WR HI	23.72636	4.393132	10.13235	38.96
Locks	36	Distance (m)	6263.13	498.5196	5085.71	7277.14
		HI Dist (m)	1109.94	305.9056	749.65	2320.76
		Perc WR HI	16.83098	4.58602	8.14	31.89
Loose forwards	72	Distance (m)	6329.81	485.2042	4444.83	7682.68
		HI Dist (m)	1333.51	317.7267	655.95	2113.57
		Perc WR HI	20.52674	4.377938	8.747686	29.77
Outside backs	54	Distance (m)	6976.29	715.9704	5330.93	8126.42
		HI Dist (m)	1562.21	347.039	750	2257.65
		Perc WR HI	22.12272	3.592787	12.97	30.034459

Table 17: Standard deviation and means for winning teams

Result	N Obs	Variable	Mean	Std Dev	Minimum	Maximum
Front rows	36	Distance (m)	5829.93	547.3744	4533.61	6846.33
		HI Dist (m)	789.6025	318.4123	285.34	1450.71
		Perc WR HI	11.88468	4.891471	5.44	23.56
Inside backs	72	Distance (m)	7260.76	586.9603	4550.66	8813.97
		HI Dist (m)	1690.39	325.7852	1117.99	2460.72
		Perc WR HI	22.8672	3.602171	14.65187	32.56
Locks	36	Distance (m)	5958.21	679.7972	4176.41	6948.42
		HI Dist (m)	1016.75	242.5886	500.53	1499.94
		Perc WR HI	16.75524	3.365647	9.82	23.14
Loose forwards	72	Distance (m)	6404.44	421.0528	5229.04	7254.99
		HI Dist (m)	1331.32	276.8351	722.77	2233.95
		Perc WR HI	19.75467	3.770731	11.83	30.8
Outside backs	54	Distance (m)	7194.27	523.0664	6125.08	8549.1
		HI Dist (m)	1549.5	254.7495	950.29	2112.05
		Perc WR HI	21.11886	2.871532	15.07	28.722166

Table 18 indicates the Pearson correlation coefficients between the three variables (distance covered, high intensity distance covered and percentage work rate at high intensity) and winning and losing, front rows, locks, loose forwards, inside backs and outside backs.

Table 18: Pearson correlation coefficients

	Distance	HI Distance	% Work rate
Winning	0.67	0.62	0.54
Losing	0.54	0.56	0.53
Front rows	0.022	-0.037	-0.11
Locks	-0.25	-0.17	-0.01
Loose forwards	0.08	-0.003	-0.09
Inside backs	0.15	-0.035	-0.10
Outside backs	0.17	-0.021	-0.15

Table 19 compares the values of all variables with winning and losing. All positional groups were assessed. Four of the five positional groups won the distance covered. Not one of the groups was able to cover more high intensity distance or had a higher percentage work rate at high intensity.

Table 19: Values of all variables with winning and losing teams

Result	N Obs	Variable	Winning	Losing	p-value
Front rows	36	Distance	5829.9	5802.6	0.85
		HI_Dist	789.6	812.1	0.75
		Perc_WR_HI	11.9	12.9	0.33
Inside backs	72	Distance	7260.7	7072.3	0.07
		HI_Dist	1690.3	1715.8	0.67
		Perc_WR_HI	22.8	23.7	0.20
Locks	36	Distance	5958.2	6263.1	0.03*
		HI_Dist	1016.7	1109.9	0.15
		Perc_WR_HI	16.7	16.8	0.93
Loose forwards	72	Distance	6404.4	6329.8	0.32
		HI_Dist	1331.3	1333.5	0.96
		Perc_WR_HI	19.7	20.5	0.25
Outside backs	54	Distance	7194.2	6976.2	0.07
		HI_Dist	1549.5	1562.2	0.82
		Perc_WR_HI	21.1	22.1	0.11

P < 0.05 *

P < 0.01**

Table 20 compares the score of the each of the games to the components that the teams won. The home teams won 12 of the 18 matches, but did not win the overall tally of components. It is interesting to note that the losing teams won 31 of the game components to the 23 of the winning teams.

Table 20: Components won versus the score

Match and score	HI			HI			Components won by winning team
	DISTANCE	DISTANCE	%WR/RATIO	DISTANCE	DISTANCE	%WR/RATIO	
Match 1: 49-12	102576.9	20967.24	450.34	95388.65	18168.58	422.63	3
Match 2: 9-14	99738.27	22183.73	455.78	103889.3	22398.41	462.57	3
Match 3: 7-31	92833.15	18489.71	435.01	95955.45	18586.15	448.9	0
Match 4: 9-3	94364.15	19635.56	410.99	94428.32	18448.88	386.17	2
Match 5: 16-25	96881.88	20249.46	438.45	96692.14	17618.78	407.63	0
Match 6: 55-22	95833.95	18802.48	440.38	104710.9	23181.9	482.31	0
Match 7: 35-8	96421.43	19896.58	439.96	90692.04	17559.82	436.11	3
Match 8: 26-36	98048.03	22672.08	442.17	101551.4	22583.92	458.6	2
Match 9: 36-16	106632.6	21520.85	449.35	108448.4	23140.67	467.82	0
Match 10: 30-27	93002.54	18794.85	417.79	92989.57	16433.23	410.14	3
Match 11: 22-19	101295.2	19842.07	381.2	102054.1	20973.95	484.24	0
Match 12: 21-26	103067.8	22453.54	424	104438.7	20954.13	412.95	1
Match 13: 34-18	103587.8	22503.74	479.95	104413.8	22504.45	485.26	0
Match 14: 10-21	96931.41	19568.14	432.34	99499.49	19691.35	482.79	3
Match 15: 17-3	100154.7	19119.22	439.9	98281.88	19706.31	393.71	2
Match 16: 27-26	100850.3	20533.64	430.99	99295.93	21236.43	379.81	2
Match 17: 33-3	103286.3	22914	477.09	102012.2	23893.32	463.4	2
Match 18: 30-8	96941.18	19892.66	470.15	98919.74	22891.22	474.74	0 = 26
Home team won		12					
Away team won					6		
Components won by home team		23					
Components won by away team					31		
	Won component		Lost component				

CHAPTER 5 – Discussion

5.1 Introduction

The study set out to determine if time motion analysis can be implemented as a variable in identifying rugby success, to determine which variable in time motion analysis correlates the highest with success and to determine if there are significant differences ($P < 0.05$) between positions in the different components in the time motion analysis. This chapter will comprise and discuss results obtained through this investigation, as well as the comparison with research already done on this subject.

5.2 Discussion

5.2.1 Home and away games

The results of this study showed that 66.67% of all home games are won. The data shows a significant difference between home and away games ($p < 0.0001$). The results of this study also supports the findings of Courneya and Carron (1992: 13-27) who showed 52.3% home win records in basketball and up to 69% in soccer. They also describe home advantage as having a higher than 50% win record at home, which the sides in this study also achieved. During this study, no variables such as crowd size or dynamics were taken into account but purely the physiological attributes of the teams, yet there is some evidence to support that teams performed worse at home. In Table 20, p 66, it shows that teams playing away from home performed much better physiologically, but still lost the game. Reasons for this can be attributed to travel times and weather (Courneya & Carron, 1992:13-27). Losing teams had to play harder to overcome the home advantage.

5.2.2 Distances covered

The distances that were covered by teams were compared in Table 16 (p 62), 17 (p 63) and 20 (p 66). Of the 18 games that were played, 12 were won by the home team. Only 7 of the 12 winning teams were able to cover greater distances than the losing teams. Early estimations on the distance covered during a rugby match indicated that a centre covered 5800m, of which 2200m was walking, 1600m jogging and 2000m sprinting (Morton, 1978:4-9). The average distance by the inside backs during this study was 7300m which is greater than what Morton estimated. This increase can be that it is no longer an opinion that the game of rugby has changed over the last 20 years, and the game today is quicker, more demanding and a lot more entertaining (Deutsch; *et al.*, 2002:160-166). The team averages indicates that the winning team covers a greater distance than losing team averages (6529±700 vs. 6489±700).

Deutsch; *et al.*, (1998: 561-570) monitored six players during four under-19 matches between different teams. Although backs had a lower overall exertion based on heart rate, they covered the greatest distance, with props and locks covering 4400 ± 398m, back row 4080 ± 363m, inside backs 5530 ± 337m, and outside backs 5750 ± 405m, respectively. This study showed average distances ranging from 5829.9m (front rows) and 7260.7m (outside backs). The distances covered between positional groups of both winning and losing teams showed no significant difference. By comparing the distance covered by inside backs, the winning team covered more distance than their losing opponents (7187.4m vs 7056.2m) but no significant difference was found $p=0.398$. The distance covered by front rows varied from 5914.2m when the game was lost to 6110.1m when the game was won. However, only the distance covered by the locks ($p= 0.03$) showed a significant difference between the winning and losing teams. Locks had a decrease in distance from winning a game to losing (winning = 6258.9m, losing = 6326.9).

This can be due to the fact that forwards spent a larger percentage of time standing still (46%) compared with the backs (39%), and covered a shorter distance in all gait movements except jogging (Deutsch; *et al.*, 1998:561-570).

5.2.3 High intensity distance covered

There were no significant difference between the high intensity distance covered between winning and losing teams. In fact the losing teams covered a greater distance in high intensity (1307m vs. 1275m). It must be noted that the difference is only 32m in an 80min game of rugby. When the winning and losing teams are compared, there are some differences between playing positions. Only seven of the 12 winning teams managed to win the high intensity distance covered at home. When comparing the positional groups to winning or losing games played, only the outside backs showed a significant difference when playing at home, but in only one variable (percentage work rate at high intensity), ($p=0.0281$). This study also supports the findings of other studies done. Deutsch; *et al.*, (1998:561-570) found that outside backs are engaged in more sprints during a game than front row forwards. The results of this study also supports the findings of Deutsch; *et al.*, (1998:561-570), which also showed that outside backs spent more total time sprinting than front row forwards (1549.5m vs. 789.6m).

5.2.4 The percentage work rate at high intensity

The percentage work rate at high intensity also showed no significant differences between playing positions or winning and losing teams (Table 19). Team averages show that the losing teams had a higher percentage work rate at high intensity than that of the winning teams ($19\% \pm 5$ vs. $18\% \pm 5$). Within the winning and losing teams, the forwards had a lower work rate than that of the backs and can be due to higher distances performed in high intensity and not just the involvement in high activity actions like scrumming or rucking. (Front row 11.88%, locks 16.75%, loose forwards 19.75%, inside backs 22.88%, outside

backs 21.11%). In contrast to this finding Holmyard; *et al.*, (1988:134-142) found that front row and back row forwards performed more high-intensity work than inside and outside backs, as the result of performing work more frequently. Another study by Docherty, *et al.*, (1988:269-277) declared that centres spend more time in intense running and that the time spent in static exertion by the forwards contributes to a greater time spent in high-intensity activity (forwards; 11 minutes) compared with the backs (4 minutes) (Docherty; *et al.*, 1988:269-277).

5.2.5 Correlation of variables with winning and losing

5.2.5.1 Team correlation with winning and losing.

The aim of this study was also to determine which of these variables correlates the highest with success. The mean values of the teams (distance covered, high intensity distance covered and percentage work rate at high intensity) were compared to winning and losing. When correlating the variables to winning games, a correlation of great practical value was found between distances covered ($r = 0.67$), high intensity distance covered ($r=0.62$) and percentage work rate at high intensity ($r = 0.54$) by the teams.

5.2.5.2 Positional correlation with winning and losing

Teams playing at home or away from home showed no correlation with winning or losing in any of the five positional groups or variables (front rows $r= 0.022$, locks $r= 0.17$, loose forwards $r= 0.08$, inside backs $r=0.15$, outside backs $r= -0.25$).

5.3 Overview

A thorough understanding of the physical demands of rugby via information on player work rates is required so that optimal training and preparation strategies can be constructed. As shown in the present review, an ever-increasing number of scientific investigations based on motion analysis techniques are providing important information on elite rugby play. These investigations have identified the activity profiles and physical requirements of elite rugby as well as the demands of individual playing positions.

In this study, no positional group showed any promise of possible correlations between the variables applicable in winning and losing a game. However, team averages show moderate correlations with distance covered, high intensity distance covered and percentage work rate at high intensity.

Fitness for rugby will remain an important component for any team who wishes to play well or win. Time motion analysis will remain a useful tool to investigate rugby and any other sport for determining the demands of the sport.

Home and away games remain the biggest challenge to overcome with a 66.67% winning home record for most Super rugby, Tri-nations and International games. Fitness trainers and coaches alike have to spend time on increasing the skill and fitness levels of players and leave no stone unturned. Despite a slightly longer mean sprint distance, the greater opportunity for outside backs to recover should be reflected in the design of fitness training sessions. With approximately 30% of work-to-rest periods being less than 1:7, however, there are still likely to be periods of play when the incomplete replenishment of creatine phosphate stores would result in an increased dependence on the anaerobic glycolytic pathway, in all positions (Balsom; *et al.*, 1992:528-533).

However, to develop maximal speed/ power, it may be necessary to incorporate training in which adequate recovery is provided between high-intensity sprints to allow the replenishment of creatine phosphate, particularly in outside backs. In time-motion analysis, movement patterns, distance covered, average velocities, levels of exertion and work-to-rest ratios can be established by quantifying the time spent in different activities. The information obtained from these analyses allows coaches to structure training programmes specific to the requirements of the game, and facilitates more effective training and improved performance (Deutsch; *et al.*, 1998:561-570).

The attention to detail in the conditioning programs of teams will assure that every possible influence on the winning or losing of a game are minimized.

5.4 Recommendations

There are; possibilities to link fitness data to work rate assessments and to determine the effects of training interventions on match performance. Furthermore, conducting research into how these technologies are actually being put into use within coaching contexts would be pertinent, as there is little appreciation about how effectively and efficiently they are being translated and adopted by practitioners to prepare and develop members of their squad.

CHAPTER 6 – Summary and conclusion

6.1 Introduction

This chapter will discuss the trends seen in the analyzed data and conclude the findings of this study. It will also discuss further recommendations concerning this particular subject matter.

6.2 Summary

The questions subsequently answered were firstly if time motion analysis can be implemented as a variable in identifying rugby success, to determine which variable in time motion analysis correlates the highest with success and to determine if there are significant differences ($p < 0.05$) between positions in the different components in the time motion analysis. Answers to this research regarding these questions provide groundbreaking results – not only towards the scientific literature but also for implementation:

- Rugby consists of many different components like skills (passing, kicking and catching), fitness (aerobic, anaerobic, endurance, speed, agility, strength and power) and game phases (scrums, line outs, rucks and mauls). It will be impossible to recognize one or two specific components that influenced the result, especially in professional rugby.
- Distances covered, high intensity distance covered and percentage work rate at high intensity correlate with the success of the team. (Distance covered by winning teams, $r = 0.67$ and losing teams, $r = 0.54$), (High intensity distance covered by winning teams, $r = 0.62$ and losing teams, $r = 0.56$) (Percentage work rate at high intensity by winning teams, $r = 0.54$ and losing teams, $r = 0.53$). These variables for the team seem to be of practical value in the outcome of the game. These variables may also be influenced during play. The game plan, weather conditions and

competition structure may be some reasons for different distances covered.

- No assumption can be made that one specific positional group or variable will influence success.

6.3 Conclusion

The following conclusions can be obtained from this study

6.3.1 Time motion analysis is an effective method of quantifying the demands of rugby and provides a conceptual framework for the specific physical preparation of players.

6.3.2 The results of this study showed no significant difference ($p < 0.05$) between the variables (distance covered, high intensity distance covered and percentage work rate at high intensity) in the winning and losing team.

6.3.3 Correlation between all the variables (distance covered, high intensity distance covered and percentage work rate at high intensity) and winning show practical implications.

6.4 Limitations

Time motion systems that are used in sport today are very expensive and are also limited to the data that each can record. No club or rugby province can currently afford the expenses of a system like ProZone. Therefore, quality data are very difficult to find or would be very expensive.

6.5 Practical Applications

It is recommended to do research on the differences between winning and losing games in regards to the skill or structure of a team.

REFERENCES

Balsom, P.D, Seger, J.Y, Sjodin, B, & Ekblom, B. 1992. Maximal-intensity intermittent exercises: Effect of recovery duration. *International Journal of Sports Medicine*, 13: 528-533.

Boennec, P, Prevost, M. & Ginet, L. 1980. Somatotype de sportif de haut niveau. Resultats dans huit disciplines differentes. *Medecine du Sport*. 54:309-318.

Bogdanis, G.C, Neville, M.E, Boobis, L.H & Lakomy, H.K. 1996. Contribution of phosphocreatine and aerobic metabolism to energy supply during repeated sprint exercise. *Journal of applied physiology*. 80:876-884.

Boyle, M.A, Mahoney, C.A. & Wallace, W. 1994. The competitive demands of elite male field hockey. *Journal of sports medicine and physical fitness*. 34:235-241.

Brady, 1995. Short-term demands of of playing and traing in the first half of the season. [abstract]. *Journal of sports science*. 13:499.

Brewer, J. & Davis, J. 1995. Applied physiology of rugby league. *Sports medicine*. 20: 129-135.

Brown, D. 1999. Tackling sport specific training. *Rugby special ultra fit*. 50, 70-73.

Campi, S, Cuglielmini, C. & Guerzoni, P. 1992. Variations in energy-producing muscle metabolism during the competitive season in 60 elite rugby players. *Sports Medicine*. 33 (3): 149-54.

Carter, A. & Potter, G. 1996. The 1995 rugby world cup finals. Where does all the time go? Paper presented at the third world conference of notational analysis of sport, Antalya, Turkey. 187.

Cheetham, M.E, Hazeldine, R.J. & Robinson, A. 1988. Power Output of rugby forwards. *Science and Football*. London: E and FN Spon. 206-210.

Christmass, M.A., Dawson, B. & Arthur, P.G. 1999. Effect of work and recovery duration on skeletal muscle oxygenation and fuel use during sustained intermittent exercise. *European Journal of applied Physiology*. 80:436-447.

Christmass, M.M, Dawson, B, Passeretto, P & Arthur, P.G. 1999. A comparison of skeletal muscle oxygenation and fuel use in sustained continuous and intermittent exercise. *European journal applied physiology*. 80:423-435.

Clarke, S.R. 2005. Home advantage in the Australian football league. *Journal of sports science*. 23:375-385.

Courneya, K.S. & Carron, A.V. 1992. The home advantage in sport competitions: A literature review. *Journal of sport and exercise physiology*. 14:13-27.

Deutsch, M.U., Kearney, G.A., & Rehrer, N.J. 2002. A comparison of competition work rates in elite club and Super 12 rugby. In: W. Spinks, T. Reilly, & A. Murphy (Eds.), *Science and football IV*. Cambridge University Press. 160-166.

Deutsch, M.U, Maw, G.J, Jenkins, D. & Reaburn, 1998. Heart rate, blood lactate and kinematic data of elite colts rugby union players during competition. *Journal of Sports Science*. 16: 561-570.

Docherty, D, Wenger, H.A. & Neary, P. 1988. Time motion analysis related to physiological demands of rugby. *Journal of Human Movement Studies*. 14: 269-277.

Drust, B, Reilly, T. & Cable, N.T. 2000. Physiological responses to laboratory-based soccer-specific intermittent and continuous exercise. *Journal of sports science*. 18:885-892.

Duthie, G, Pyne, D. & Hooper, S. 2003. Applied physiology and game analysis of rugby union. *Sports Medicine*. 33:973-991.

Eaves, S. & Hughes, M. 2003. Patterns of play of international rugby union teams before and after the introduction of professional status. *International journal of performance analysis in sport*. 3:103-111.

Eaves, S, Hughes, M. & Lamb, K.L. 2005. The consequences of the introduction of professional playing status on game action variables in international northern hemisphere rugby union football. *International journal of performance analysis in sport*. 5:58-86.

Gabbett, T.J. 2002: Influence of physiological characteristics on selection in a semi-professional rugby league team: a case study. *Journal of Sports Sciences*, 20, 399-405.

Gabbett, T.J. 2005. Science of rugby league football: a review. *Journal of Sport Sciences*. 23:961-976.

Gabbett, T.J. 2005. Changes in physiological and anthropometric characteristics of rugby league players during a competitive season. *Journal of strength conditioning*. 19(2):400-408.

Gabbett, T.J. 2005. A comparison of physiological and anthropometric characteristics among playing positions in junior rugby league players. *British journal of sports medicine*. 39:675-680.

Gaitanos, G.C, Casey, W, Hultman B.L. & Sjöholm, B. 1993. Human muscle metabolism during intermittent maximal exercise. *Journal of Applied Physiology*, 75: 712-719.

Gissane, C., White, J., Kerr, K. & Jennings, D. 2001. Physical collisions in professional super league rugby, the demands on different player positions. *Cleveland Medical Journal*. 4:137-146.

Helgerud, J, Engen, L.C. & Wisloff, U. 2001. Aerobic endurance training improves soccer performance. *Medical Science and Sports Exercise*, 33 (11):1925-31.

Holmyard, D.J, Cheetham, M.E. & Lakomy, H.K.A. 1988. Effect of recovery duration on performance during multiple treadmill sprints. In: Reilly T, Lees A, Davids K, et al, editors. *Science and football*. London: E and FN Spon. 134-142.

Hopkins, W.G. 2000. Measures of reliability in sports medicine and science. *Sports Medicine*. 30 (1): 1-15.

Hultman, E, Greenhaff, P, Ren, J.M. & Soderlund, K. 1991. Energy metabolism and fatigue during intense muscle contraction. *Biomechanical Society Transactions*, 19: 347-353.

Hughes, M. & Blunt, R. 1998. Work rate of rugby union referees. In: Hughes, M & Tavares, F, editors. IV World congress of notational analysis in sport; 1998 Sep 22-25; Porto. Porto: Centre for team sport studies, Faculty of sport sciences and physical education, 184-190.

Hughes, M. & Clarke, A. 1994. Computerised notation analysis of rugby union to examine the effects of law changes upon the patterns of play by international teams [abstract]. *Journal of sport science*. 12:180.

IRB, 2003b. Annual analysis of rugby union. International Rugby Board.

Jardine, M.A, Wiggins, T.M. & Myburgh, K.H. 1988. Physiological characteristics of rugby players. *South African Medical Journal*, 73: 529-532.

Knuttgen. HG & Kraemer. WJ. 1987. Terminology and measurement in exercise performance. *Journal of Applied Sport Sciences* 1: 1-10

Maud, P.J. 1983. Physiological and anthropometric parameters that describe a rugby union team. *British journal of sports medicine*. 17(1):16-23.

Mayes. R. & Nuttall. F.E. 1995. A comparison of the physiological characteristics of senior and under 21 elite rugby union players [abstract]. *Journal of Sports Science*. 13:13-14.

McKenzie, A.D, Holmyard, D.J. & Docherty, D. 1989. Quantitative analysis of rugby: factors associated with success in contact. *Journal of Human Movement Studies*. 17:101-13.

McLean, D.A. 1992. Analysis of the physical demands of international rugby union. *Journal of Sports Science*. 10: 285-96.

Meir, R. 1993. Seasonal changes in estimates of body composition in professional rugby league: implications for training. *Sport health*. 11:27-31.

Meir. R, Newton. R, Curtis. E, Fardell. M & Butler, B. 2001. Physical fitness qualities of professional rugby league football players: determination of positional differences. *Journal of strength conditioning*.15:450-458.

Meir, R, Colla, P, & Mulligan, C. 2001. Impact of the 10-meter rule change on professional rugby league: implications for training. *Strength conditioning Journal*. 23:42-46.

Menchinelli, C, Morandini, C. & De Angelis, M. 1992. A functional model of rugby: determination of the characteristics of sports performance [abstract]. *Journal of Sports Science*. 10: 196-7.

Mero, A, P, Komi, & Gregor, R.J. 1992. Biomechanics of sprint running. *Sports medicine*, 13:376-392.

Miller, C, Quievre, J. & Gajer, B. 1996. Characteristics of force/ velocity relationships and mechanical power output in the French national rugby team. In: Marconnet P, First annual congress, *Frontiers in sport science*, 12: 494-495.

Morton, A.R. 1978. Applying physiological principles to rugby training. *Sports Coach*. 2:4-9.

Morton, R.H. 2006. Home advantage in southern hemisphere rugby union: national and international. *Journal of Sport science*, 24 (5):495-499

Mylvaganam, R, Ramsay, N. & De Craca, F. 2002. Sports analysis system and method. International application published under the Patent Cooperation treaty. 334.

Nevill, A.M, Ramsbotton, R. & Williams, C. 1992. Scaling physiological measurements for individuals of different body size. *European Journal of Applied Physiology*, 65: 110-117.

Nicholas, C.W, 1997. Anthropometric and physiological characteristics of rugby union football players. *Journal of Sports medicine*. 6:375-396.

Nicholas, C.W, Nuttal, F.E. & Williams, C. 2000. The Loughborough intermittent shuttle test: A field test that simulates the activity pattern in soccer. *Journal of sports science*. 18:97-104.

O'Connor, D. 1996. Physiological characteristics of professional rugby league players. *Strength conditioning coach*. 4:21-26.

Olds, T. 2001. The evolution of physique in male rugby union players in the twentieth century. *Journal of Sport Science*. 19:253-262.

Petibois, C, Cazorla, G, Poortmans, J.R. & Deleris, G. 2002. Biomechanical aspects of overtraining in endurance sports: A review. *Sport medicine*. 32:867-878.

Quarrie. K.L, Handcock, P. & Toomey. M.J. 1996. The New Zealand rugby injury and performance project. *British Journal of Sports Medicine*, 30: 53-60.

Quarrie. K.L, Handcock, P. & Waller, A.E. 1995. The New Zealand rugby injury and performance project. III. Anthropometric and physical performance characteristics of players. *British Journal of Sports Medicine*. 29:263-270.

Quarrie, K.L. & Hopkins, W.G. 2007. Changes in player characteristics and match activities in Bledisloe Cup rugby union from 1972 to 2004. *Journal of Sports Sciences*. 25(8):895-903.

Reid, R.M. & Williams, R. 1974. A concept of fitness and its measurement in relation to rugby football. *British Journal of Sports Medicine*, 8:96-99.

Reilly, T. 1997. The physiology of rugby union football. *Biol Sport*. 12(2): 83-101.

Reilly, T. & Thomas, V. 1976. A motion analysis of work rate in different positional roles in professional football match-play. *Journal of human movement studies*. 2:87-89.

Rigg, P. & Reilly, T. 1987. A fitness profile and anthropometric analysis of first and second class rugby union players. In: Reilly T, Lees A, Davids K & Murphy WJ, eds. *Science and football*. London: E and FN Spon, 186-191.

Rimmer, E.F. & Slievert, G.G. 1996. The effects of pliometric intervention programme on sprint performance. In: National Conference of Coaching, Wellington. New Zealand. *Sports Medicine and Sport Science New Zealand*, 11(12): 111.

Roberts, S., Stokes, K., Trewartha, G. 2006. A comparison of time-motion analysis methods for field-based sports. *International Journal of Sports Physiology and Performance*. 1:386-397.

Roberts, S, Trewartha, G, Higgitt, R.J, El-abd, J. & Stokes, K.A. 2008. The physical demands of elite English rugby union. *Journal of sports sciences*. 26(8):825-833.

Rudkin, S.T & O'Donoghue, P.G. 2008. Time-motion analysis of first-class cricket fielding. *Journal of science and medicine in sport*. 11:604-607.

Sayers, M. 2000. Running techniques for field sport players. *Sports coach*. 2:26-27.

Spamer, E.J, Pienaar, A.E. & Van Der Merwe, C.A. 1998. The effect of an age-specific rugby development program on the performance skill of talented young players. *South African Journal of Sport, Physical Education and Recreation*. 21:61-75.

Tong, R.J, Bell, W. & Ball, G. 2001. Reliability of power output measurements during repeated treadmill sprinting in rugby players. *Journal of sports science*. 19:289-297.

Tong, R.J. & Mayes, R. 1995. The effect of pre-season training on the physiological characteristics of international rugby union players. [abstract]. *Journal of sports science* 13:507.

Treadwell, P.J. 1988. Computer-aided match analysis of selected ball games (soccer and rugby union). In: Reilly, T & Lees, A & Davids K, editors. *Science and football*. London: E and FN Spon, 282-287.

Van den Berg, C. 2007. Tri-nations 2007: South African review. *SA Rugby*, Oct, 125: 62-64.

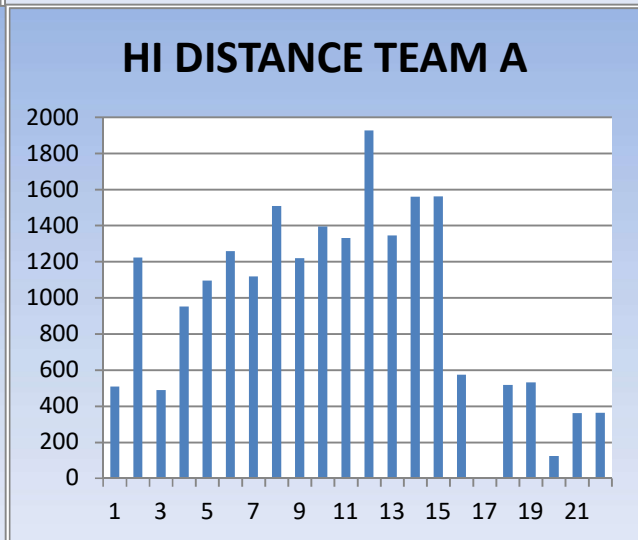
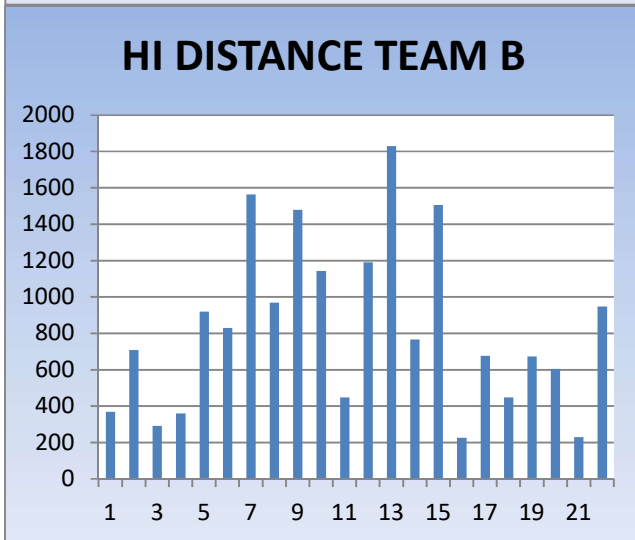
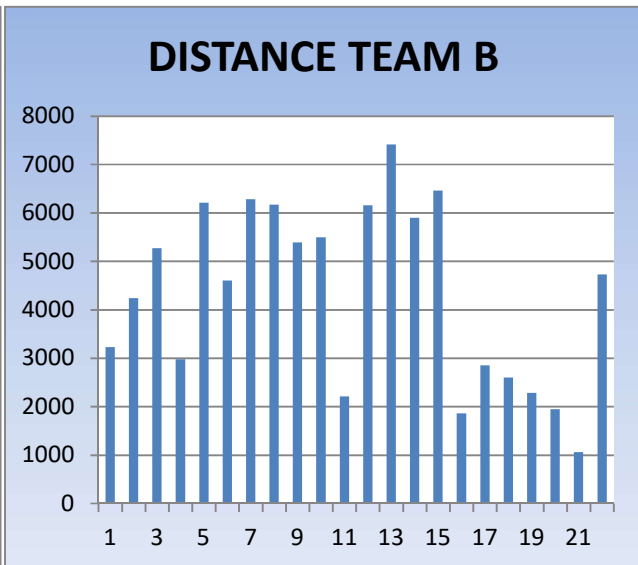
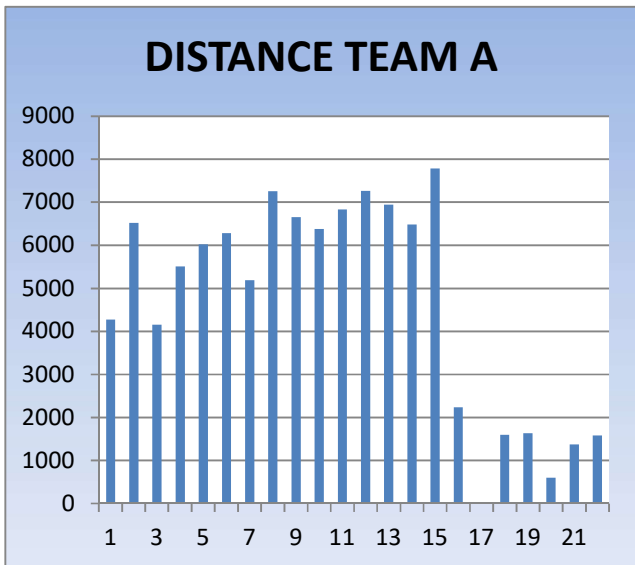
Van der Field, G. 1975. Fitness testing for rugby players. *Australian Journal of Sports Medicine*, 14:14.

Weston, A.R, Mackenzie, G. & Tufts, A. 2001. Optimal time of arrival for performance at moderate altitude (1700m). *Medical Science and Sports Exercise*. 33(2): 298-302.

Williams. J.,Hughes. M & O'Donoghue. P. 2005. The effect of rule changes on match and ball in play time in rugby union. *International journal of performance analysis in sport*. 5 (3):1-11

Withers, R.T, Maricic, Z, Wasilewski, S. & Kelly, L. 1982. Match analysis of Australian professional soccer players. *Journal of human movement studies*. 8:159-176.

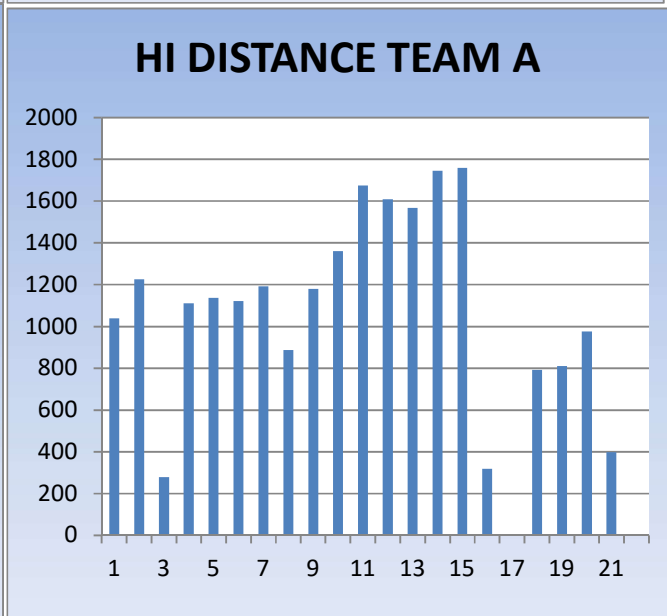
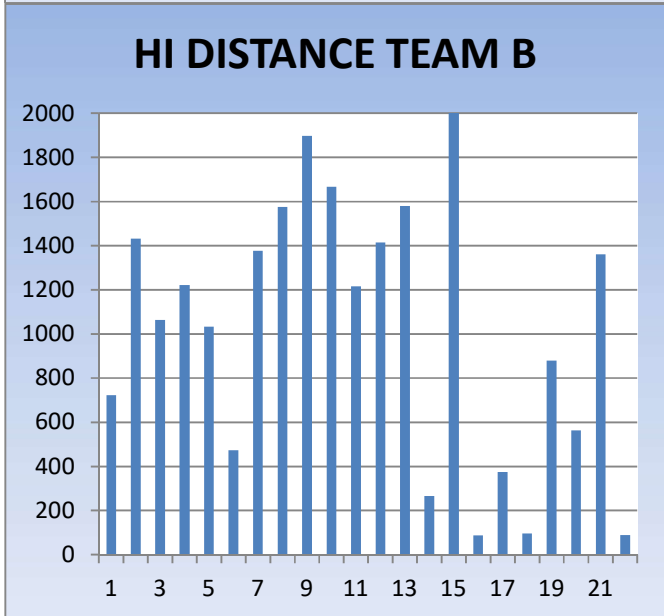
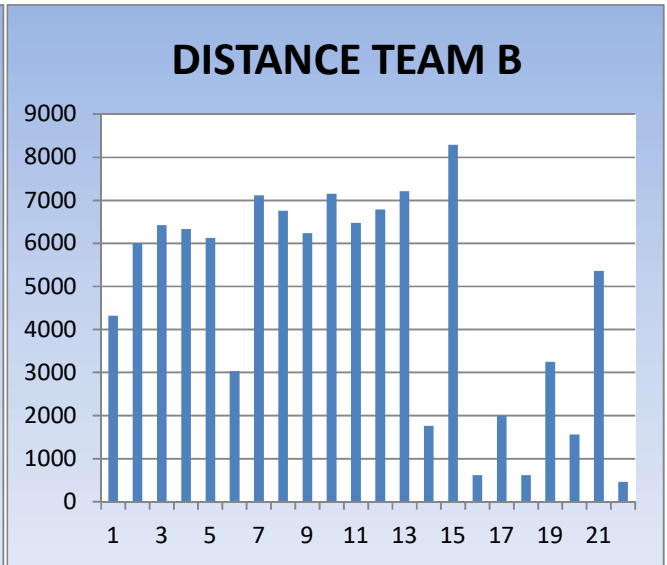
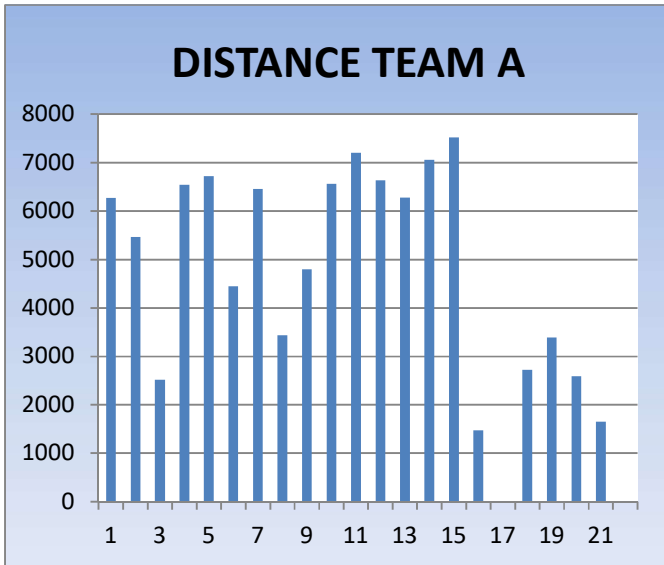
MATCH 1											
TEAM A				Score	49	12	Score	TEAM B			
	No	Time	Distance	HI Dist	% WR @ HI	% WR @ HI	HI Dist	Distance	Time	No	
	1	3844	4273.02	507.33	11.87	11.41	368.38	3229.98	3135	1	
	2	5714	6516.76	1223.39	18.77	16.65	706.39	4241.59	3839	2	
	3	3834	4157.19	488.34	11.75	5.51	290.49	5269.6	5714	3	
	4	5041	5508.23	951.96	17.28	12.04	358.93	2980.66	3129	4	
	5	5232	6025.7	1095.27	18.18	14.81	919.72	6209.54	5714	5	
	6	5714	6286.59	1259.51	20.03	17.99	828.98	4609.17	3868	6	
	7	4404	5190.8	1119.56	21.57	24.88	1564.34	6286.63	5714	7	
	8	5714	7254.99	1509.1	20.8	15.7	969.64	6175.16	5714	8	
	9	5178	6653.44	1218.74	18.32	27.43	1478.91	5391.27	4169	9	
	10	4777	6375.5	1395.47	21.89	20.77	1142.3	5499.69	4825	10	
	11	5503	6835.46	1330.81	19.47	20.22	447.48	2212.78	1555	11	
	12	5666	7264.39	1926.94	26.53	19.31	1189.96	6162.25	5714	12	
	13	5714	6942	1346.31	19.39	24.69	1830.47	7413.63	5714	13	
	14	4772	6482	1561.2	24.09	12.97	765.28	5899.18	5714	14	
	15	5714	7785.72	1563.65	20.08	23.29	1505.36	6462.3	5714	15	
	16	1906	2236.01	573.11	25.63	12.12	225.63	1861.67	1891	16	
	17	0	0	0	0	23.71	676.08	2851.71	2640	17	
	18	1218	1595.01	516.88	32.41	17.2	447.48	2601.74	2634	18	
	19	1338	1635.75	531.52	32.49	29.44	672.38	2283.93	1890	19	
	20	557	601.25	123.62	20.56	30.99	604.13	1949.69	1567	20	
	21	969	1376.3	361.83	26.29	21.47	228.5	1064.14	924	21	
	22	1243	1580.78	362.7	22.94	20.03	947.75	4732.34	4181	22	
		3821	4662.586	953.056	20.47	19.2104545	825.845	4335.848	3907		
			WON	WON	WON	LOST	LOST	LOST			



MATCH 1

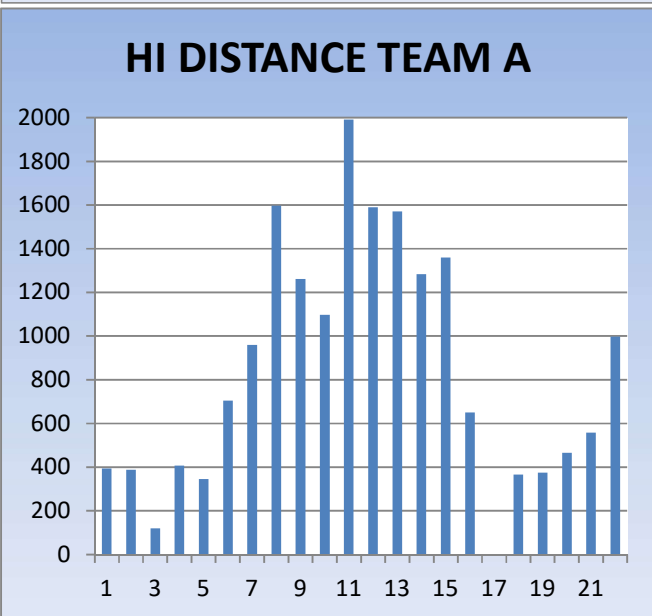
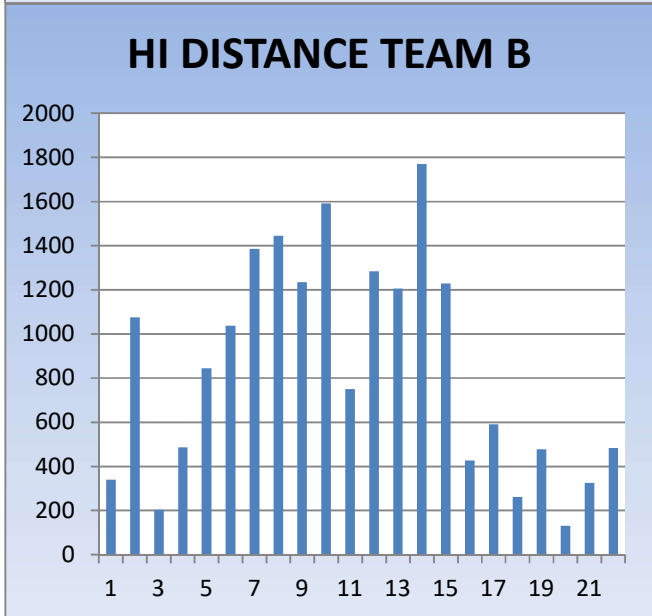
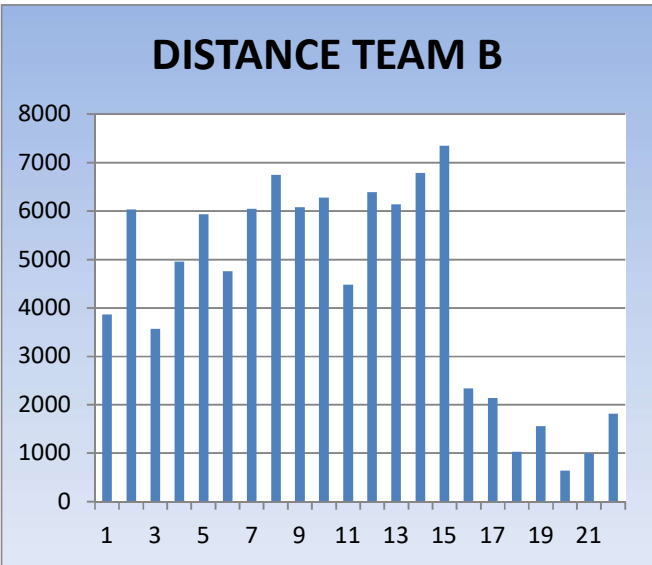
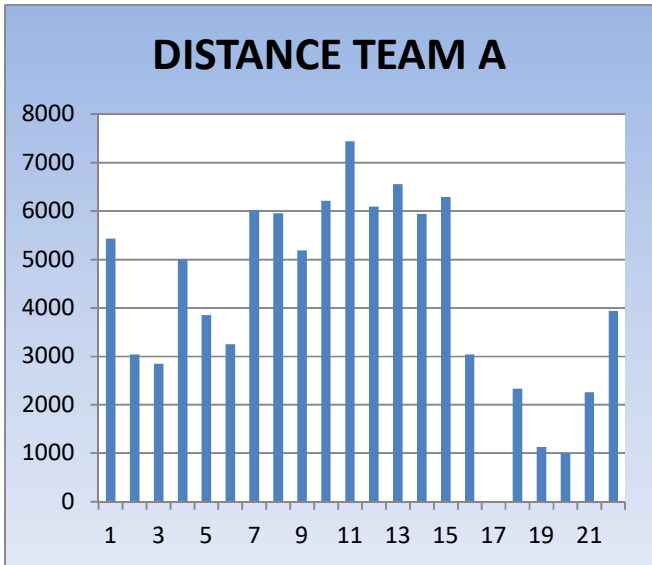
		Winning Team				Losing Team				
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No
Props	1	3844	4273.02	507.33	11.87	11.41	368.38	3229.98	3135	1
	3	3834	4157.19	488.34	11.75	5.51	290.49	5269.6	5714	3
		3839	4215.105	497.835	11.81	8.46	329.435	4249.79	4425	
Locks	4	5041	5508.23	951.96	17.28	12.04	358.93	2980.66	3129	4
	5	5232	6025.7	1095.27	18.18	14.81	919.72	6209.54	5714	5
		5137	5766.965	1023.62	17.73	13.425	639.325	4595.1	4422	
Loosies	2	5714	6516.76	1223.39	18.77	16.65	706.39	4241.59	3839	2
	6	5714	6286.59	1259.51	20.03	17.99	828.98	4609.17	3868	6
	7	4404	5190.8	1119.56	21.57	24.88	1564.34	6286.63	5714	7
	8	5714	7254.99	1509.1	20.8	15.7	969.64	6175.16	5714	8
		5387	6312.285	1277.89	20.39	19.5233333	1120.99	5690.32	5099	
Inside Backs	9	5178	6653.44	1218.74	18.32	27.43	1478.91	5391.27	4169	9
	10	4777	6375.5	1395.47	21.89	20.77	1142.3	5499.69	4825	10
	12	5666	7264.39	1926.94	26.53	19.31	1189.96	6162.25	5714	12
	13	5714	6942	1346.31	19.39	24.69	1830.47	7413.63	5714	13
		5334	6808.833	1471.87	21.5325	23.05	1410.41	6116.71	5106	
Outside Backs	11	5503	6835.46	1330.81	19.47	20.22	447.48	2212.78	1555	11
	14	4772	6482	1561.2	24.09	12.97	765.28	5899.18	5714	14
	15	5714	7785.72	1563.65	20.08	23.29	1505.36	6462.3	5714	15
		5330	7034.393	1485.22	21.213333	18.8266667	906.04	4858.087	4328	

MATCH 2											
TEAM A				Score	9	14	Score				TEAM B
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No	
	1	5409	6268.81	1040.31	16.6	16.72	722.9	4322.97	3512	1	
	2	4146	5468.16	1226.33	22.43	23.83	1431.8	6008.56	4790	2	
	3	2073	2511.83	279.25	11.12	16.54	1063.22	6426.37	5409	3	
	4	5409	6539.55	1111.47	17	19.29	1221.59	6331.32	4819	4	
	5	5409	6719.57	1136.28	16.91	16.86	1033.72	6129.64	5409	5	
	6	3334	4444.83	1121.23	25.23	15.63	473.66	3029.52	2728	6	
	7	5409	6458.1	1191.94	18.46	19.36	1376.59	7112.29	5409	7	
	8	2728	3432	887.06	25.85	23.32	1575.44	6757.14	5409	8	
	9	3621	4801.51	1179.76	24.57	30.43	1897.81	6236.88	4288	9	
	10	5409	6562.55	1360.56	20.73	23.33	1667.38	7146.89	5409	10	
	11	5409	7203.5	1674.98	23.25	18.75	1215.17	6479.59	5020	11	
	12	5409	6641.48	1610.02	24.24	20.84	1414.07	6784.47	5409	12	
	13	4298	6278.35	1567.27	24.96	21.9	1579.28	7212.01	5409	13	
	14	5409	7055.81	1745.42	24.74	15.07	266.01	1765.65	1535	14	
	15	5409	7518.81	1757.96	23.38	24.23	2009.04	8290.3	5409	15	
	16	1356	1473	319.61	21.7	14.3	87.91	614.81	619	16	
	17	0	0	0	0	18.76	373.97	1993.08	1938	17	
	18	2116	2721.88	791.62	29.08	15.57	96.09	617.1	620	18	
	19	2681	3392.01	810.28	23.89	27.1	879.84	3246.49	2681	19	
	20	1793	2595.05	974.68	37.56	36.08	562.91	1560.32	1139	20	
	21	1164	1651.44	397.7	24.08	25.38	1360.95	5361.92	3891	21	
	22	0	0	0	0	19.28	89.06	461.95	395	22	
				1008.3513	20.717272	21.02590	1018.109			##	
		3545	4533.56	6	7	9	5	4722.2	3693	#	
			LOST	LOST	LOST	WON	WON	WON			



MATCH 2	Losing Team					Winning Team				
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No
Props	1	5409	6268.81	1040.31	16.6	16.72	722.9	4322.97	3512	1
	3	2073	2511.83	279.25	11.12	16.54	1063.22	6426.37	5409	3
		3741	4390.32	659.78	13.86	16.63	893.06	5374.67	4460.5	
Locks	4	5409	6539.55	1111.47	17	19.29	1221.59	6331.32	4819	4
	5	5409	6719.57	1136.28	16.91	16.86	1033.72	6129.64	5409	5
		5409	6629.56	1123.875	16.955	18.075	1127.655	6230.48	5114	
Loosies	2	4146	5468.16	1226.33	22.43	23.83	1431.8	6008.56	4790	2
	6	3334	4444.83	1121.23	25.23	15.63	473.66	3029.52	2728	6
	7	5409	6458.1	1191.94	18.46	19.36	1376.59	7112.29	5409	7
	8	2728	3432	887.06	25.85	23.32	1575.44	6757.14	5409	8
		3904.3	4950.77	1106.64	22.04	19.4366667	1141.89667	5632.98	4515.3	
In Backs	9	3621	4801.51	1179.76	24.57	30.43	1897.81	6236.88	4288	9
	10	5409	6562.55	1360.56	20.73	23.33	1667.38	7146.89	5409	10
	12	5409	6641.48	1610.02	24.24	20.84	1414.07	6784.47	5409	12
	13	4298	6278.35	1567.27	24.96	21.9	1579.28	7212.01	5409	13
		4684.3	6070.97	1429.4025	23.625	24.125	1639.635	6845.06	5128.8	
Out Backs	11	5409	7203.5	1674.98	23.25	18.75	1215.17	6479.59	5020	11
	14	5409	7055.81	1745.42	24.74	15.07	266.01	1765.65	1535	14
	15	5409	7518.81	1757.96	23.38	24.23	2009.04	8290.3	5409	15
		5409	7259.37	1726.12	23.79	19.35	1163.40667	5511.85	3988	

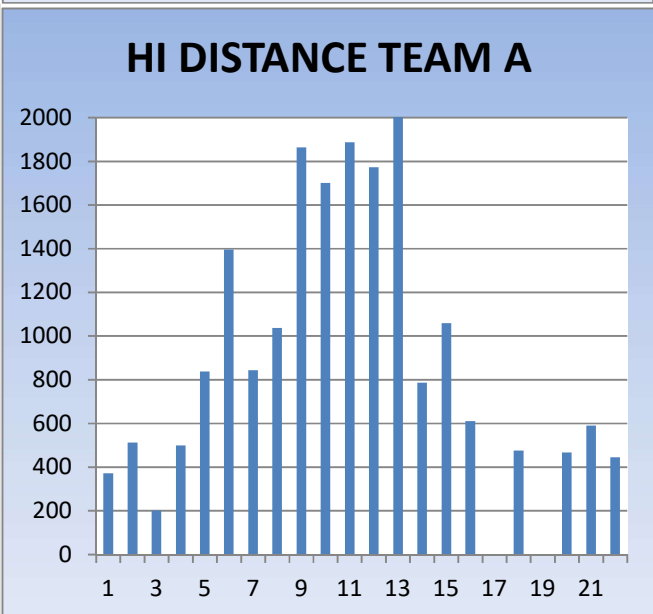
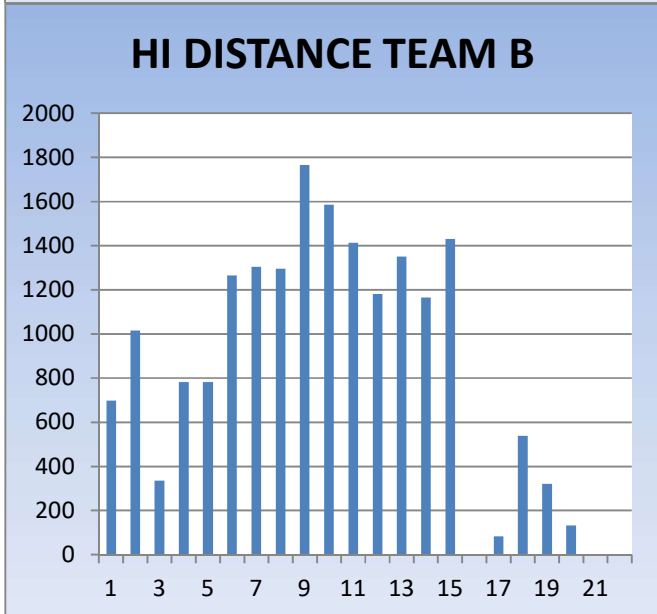
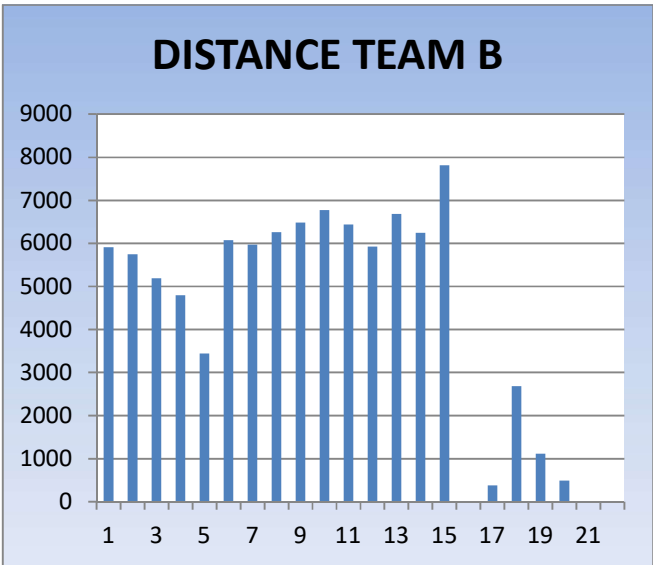
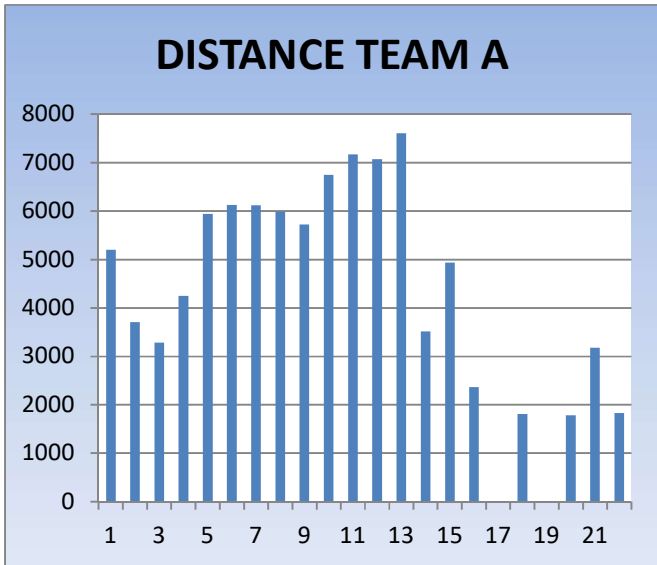
MATCH 3											TEAM B
TEAM A			Score		7	31	Score				
No	Time	Dist	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Dist	Time	No	Name	
1	5525	5436.69	394.46	7.26	8.81	340.61	3866.91	3444	1		
2	2815	3045.18	388.98	12.77	17.82	1075.35	6034.46	5525	2		
3	2815	2846.96	120.63	4.24	5.69	203.16	3567.42	3444	3		
4	4695	5005.09	407.53	8.14	9.82	487.36	4961.78	4701	4		
5	3367	3853.06	346.56	8.99	14.22	844.12	5937.06	5525	5		
6	2815	3246.27	705.94	21.75	21.81	1038.32	4760.87	4198	6		
7	5525	6021.83	960.03	15.94	22.92	1385.38	6044.7	5471	7		
8	5071	5954.73	1596.39	26.81	21.41	1445.1	6748.51	5525	8		
9	4265	5190.9	1261.76	24.31	20.33	1235.37	6077.08	5016	9		
10	5525	6211.66	1097.83	17.67	25.35	1591.34	6278.55	4838	10		
11	5525	7443.21	1991.78	26.76	16.78	751.75	4481	4171	11		
12	4708	6092.52	1589.31	26.09	20.09	1284.25	6391.58	5525	12		
13	5525	6552.84	1571	23.97	19.65	1205.63	6134.04	5525	13		
14	5525	5942.82	1282.42	21.58	26.09	1770.04	6784.19	5525	14		
15	4840	6292.47	1360.79	21.63	16.75	1230.35	7345.03	5525	15		
16	2710	3040.63	651.07	21.41	18.24	426.87	2340.6	2132	16		
17	0	0	0	0	27.59	591.32	2143.34	2107	17		
18	2198	2337.45	365.77	15.65	25.47	261.69	1027.54	865	18		
19	864	1130.82	375.2	33.18	30.52	477.78	1565.46	1390	19		
20	712	997.16	466.19	46.75	20.45	131.92	645.16	544	20		
21	1549	2257.35	558.89	24.76	32.56	325.45	999.55	710	21		
22	3185	3933.51	997.18	25.35	26.53	482.99	1820.62	1393	22		
	3625.4	4219.69	840.441364	19.7731818	20.404545			3777.2			
			LOST	LOST	LOST	WON	WON	WON			



MATCH 3

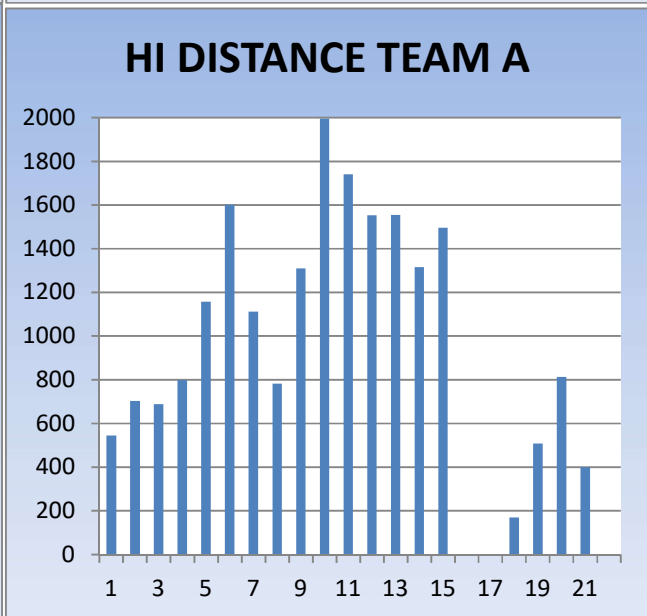
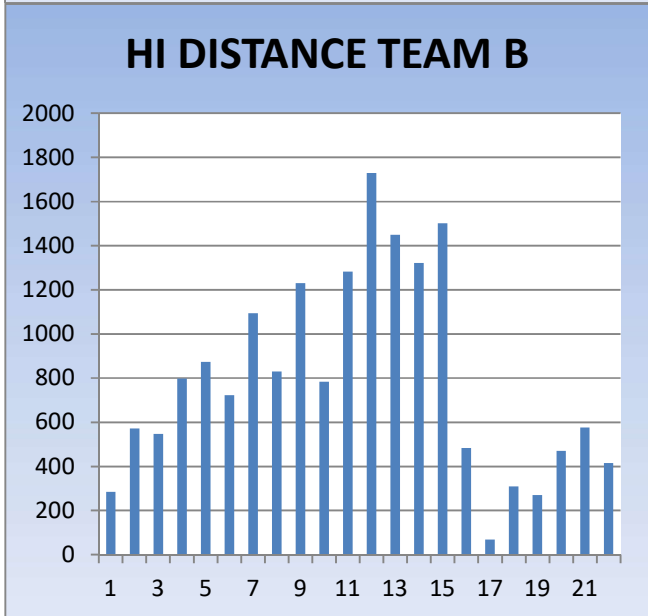
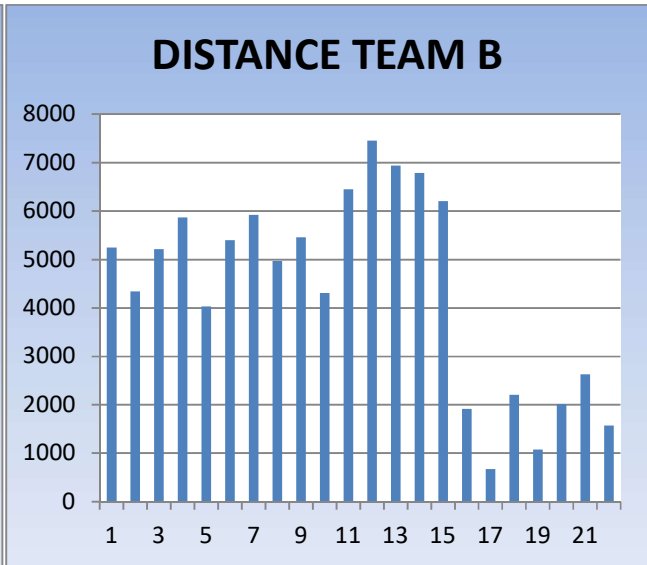
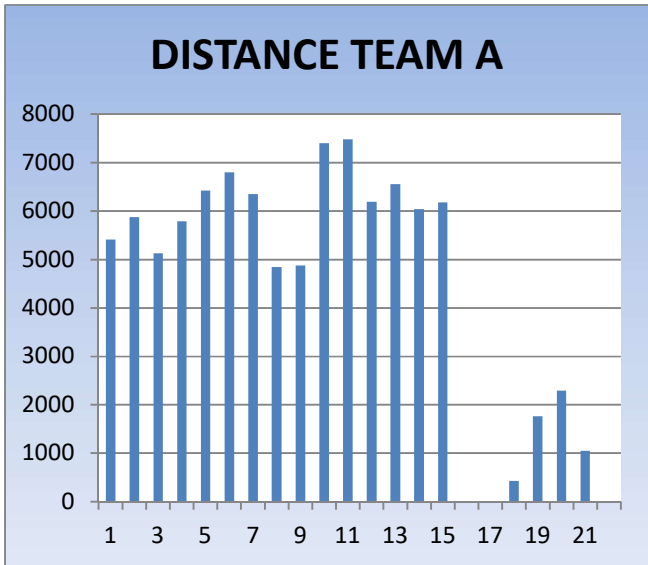
	Losing Team					Winning Team				
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No
Props	1	5525	5436.69	394.46	7.26	8.81	340.61	3866.91	3444	1
	3	2815	2846.96	120.63	4.24	5.69	203.16	3567.42	3444	3
		4170	4141.83	257.545	5.75	7.25	271.885	3717.17	3444	
Locks	4	4695	5005.09	407.53	8.14	9.82	487.36	4961.78	4701	4
	5	3367	3853.06	346.56	8.99	14.22	844.12	5937.06	5525	5
		4031	4429.08	377.045	8.565	12.02	665.74	5449.42	5113	
Loosies	2	2815	3045.18	388.98	12.77	17.82	1075.35	6034.46	5525	2
	6	2815	3246.27	705.94	21.75	21.81	1038.32	4760.87	4198	6
	7	5525	6021.83	960.03	15.94	22.92	1385.38	6044.7	5471	7
	8	5071	5954.73	1596.39	26.81	21.41	1445.1	6748.51	5525	8
		4056.5	4567	912.835	19.31	22.0466667	1289.6	5851.36	5064.7	
In Backs	9	4265	5190.9	1261.76	24.31	20.33	1235.37	6077.08	5016	9
	10	5525	6211.66	1097.83	17.67	25.35	1591.34	6278.55	4838	10
	12	4708	6092.52	1589.31	26.09	20.09	1284.25	6391.58	5525	12
	13	5525	6552.84	1571	23.97	19.65	1205.63	6134.04	5525	13
		5005.8	6011.98	1379.975	23.01	21.355	1329.1475	6220.31	5226	
Out Backs	11	5525	7443.21	1991.78	26.76	16.78	751.75	4481	4171	11
	14	5525	5942.82	1282.42	21.58	26.09	1770.04	6784.19	5525	14
	15	4840	6292.47	1360.79	21.63	16.75	1230.35	7345.03	5525	15
		5296.7	6559.5	1544.9967	23.323333	19.8733333	1250.71333	6203.41	5073.7	

MATCH 4											
TEAM A				Score	9	3	Score	TEAM B			
No	Time	Dist	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Dist	Time	No		
1	5552	5204.73	371.39	7.14	11.81	698.48	5913.12	5541	1		
2	3597	3703.43	512.85	13.85	17.66	1014.97	5748.33	5552	2		
3	3444	3287.34	202.26	6.15	6.47	335.7	5188.99	5217	3		
4	4063	4251.23	500.53	11.77	16.3	782.45	4799.79	4647	4		
5	5552	5943.5	837.9	14.1	22.74	782.8	3442.09	3150	5		
6	5552	6125.51	1395.67	22.78	20.82	1264.31	6071.57	5552	6		
7	5552	6114.95	843.38	13.79	21.84	1304.08	5972.25	5552	7		
8	5552	5989.41	1037.95	17.33	20.71	1296.03	6258.45	5552	8		
9	4210	5725.98	1864.15	32.56	27.24	1766.2	6484	5216	9		
10	5552	6745.05	1700.79	25.22	23.42	1585.71	6771.53	5552	10		
11	5552	7174.24	1888.5	26.32	21.95	1413.86	6442.28	5552	11		
12	5552	7069.82	1772.96	25.08	19.95	1182	5924.33	5552	12		
13	5552	7609.84	2271.08	29.84	20.19	1350.61	6688.92	5552	13		
14	2708	3517.36	786.56	22.36	18.65	1164.56	6243.15	5552	14		
15	4253	4934.89	1059.45	21.47	18.31	1430.46	7813.78	5552	15		
16	1977	2367.86	610.69	25.79	0	0	0	0	16		
17	0	0	0	0	22.17	83.57	376.94	365	17		
18	1535	1812.61	476.44	26.28	20.09	539.38	2684.61	2416	18		
19	0	0	0	0	28.84	320.8	1112.2	933	19		
20	1364	1779.46	466.96	26.24	27.01	132.91	491.99	353	20		
21	2844	3174.74	590.48	18.6	0	0	0	0	21		
22	1329	1832.2	445.57	24.32	0	0	0	0	22		
	3695.1	4289.28	892.5254 5	18.68136 4	17.553181 8	838.58545 5	4292.2	3789			
			LOST	WON	WON	LOST	LOST	WON			



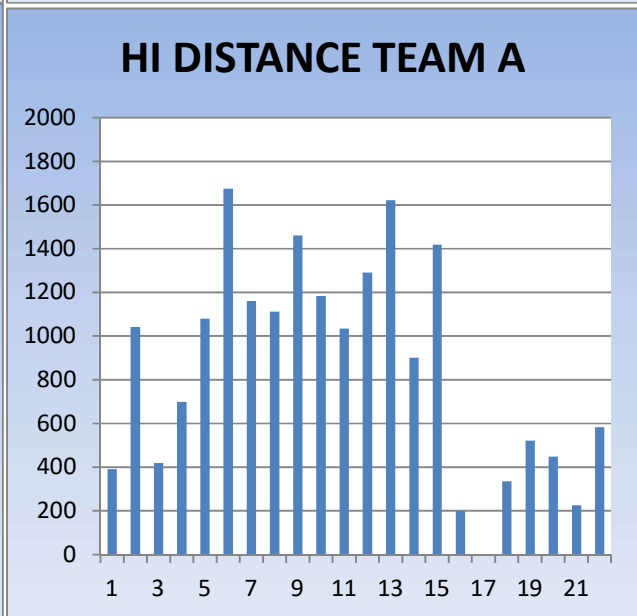
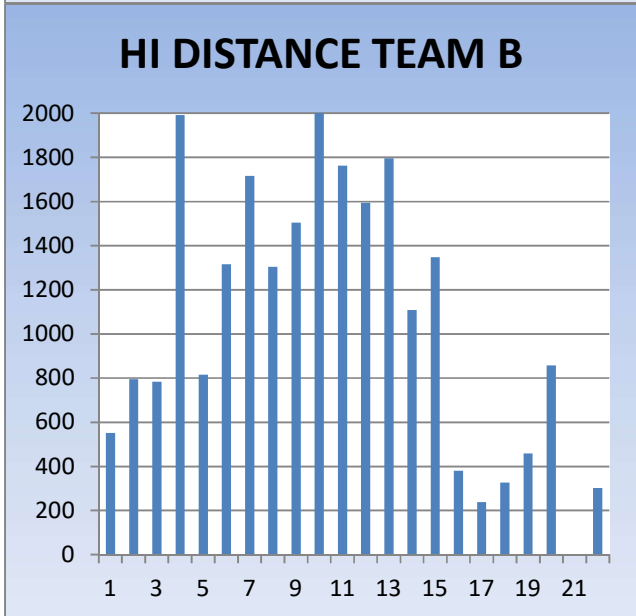
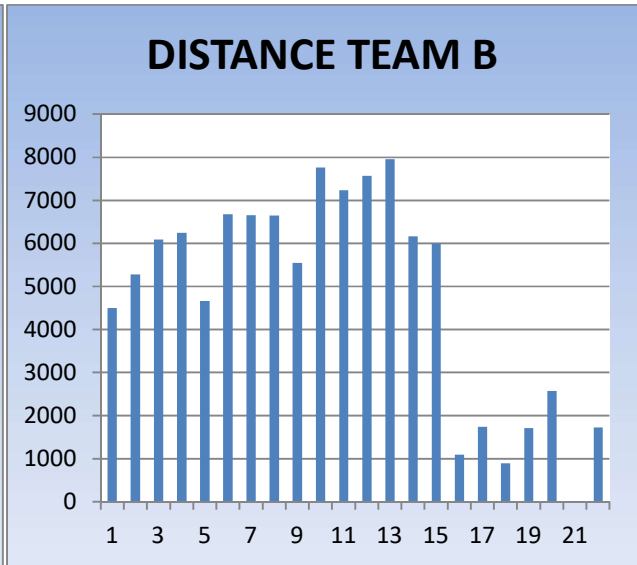
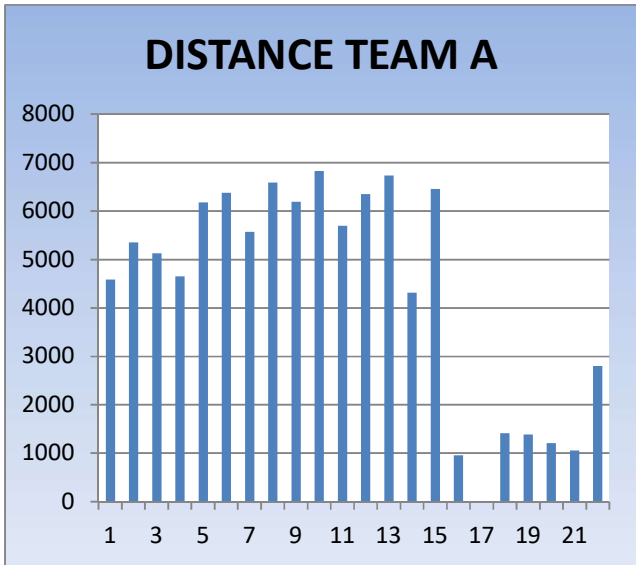
MATCH 4	Winning Team					Losing Team				
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No
Props	1	5552	5204.73	371.39	7.14	11.81	698.48	5913.12	5541	1
	3	3444	3287.34	202.26	6.15	6.47	335.7	5188.99	5217	3
		4498	4246.04	286.825	6.645	9.14	517.09	5551.06	5379	
Locks	4	4063	4251.23	500.53	11.77	16.3	782.45	4799.79	4647	4
	5	5552	5943.5	837.9	14.1	22.74	782.8	3442.09	3150	5
		4807.5	5097.37	669.215	12.935	19.52	782.625	4120.94	3898.5	
Loosies	2	3597	3703.43	512.85	13.85	17.66	1014.97	5748.33	5552	2
	6	5552	6125.51	1395.67	22.78	20.82	1264.31	6071.57	5552	6
	7	5552	6114.95	843.38	13.79	21.84	1304.08	5972.25	5552	7
	8	5552	5989.41	1037.95	17.33	20.71	1296.03	6258.45	5552	8
		5063.3	5483.33	947.4625	16.93	21.123333	1288.14	6100.76	5552	
In Backs	9	4210	5725.98	1864.15	32.56	27.24	1766.2	6484	5216	9
	10	5552	6745.05	1700.79	25.22	23.42	1585.71	6771.53	5552	10
	12	5552	7069.82	1772.96	25.08	19.95	1182	5924.33	5552	12
	13	5552	7609.84	2271.08	29.84	20.19	1350.61	6688.92	5552	13
		5216.5	6787.67	1902.245	28.175	22.7	1471.13	6467.2	5468	
Out Backs	11	5552	7174.24	1888.5	26.32	21.95	1413.86	6442.28	5552	11
	14	2708	3517.36	786.56	22.36	18.65	1164.56	6243.15	5552	14
	15	4253	4934.89	1059.45	21.47	18.31	1430.46	7813.78	5552	15
		4171	5208.83	1244.83667	23.383333	19.6366667	1336.29333	6833.07	5552	

MATCH 5											
TEAM A				Score	16	25	Score	TEAM B			
No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No		
1	5634	5409.3	545.68	10.09	5.44	285.34	5247.34	5634	1		
2	5634	5874.69	702.41	11.96	13.17	571.68	4342.12	4068	2		
3	4804	5124.86	688.27	13.43	10.5	547.63	5213.54	4973	3		
4	5317	5786.32	798.43	13.8	13.61	798.08	5865.34	5634	4		
5	5634	6423.22	1157.93	18.03	21.68	873.79	4030.67	3524	5		
6	5624	6797.35	1601.79	23.56	13.4	722.77	5395.64	5634	6		
7	5634	6351.82	1111.58	17.5	18.48	1094.73	5925.37	5624	7		
8	4247	4842.22	782.77	16.17	16.69	829.55	4971.53	4739	8		
9	3912	4878	1310.82	26.87	22.53	1230.87	5462.78	4079	9		
10	5634	7405.68	1996.59	26.96	18.2	783.71	4307.27	3507	10		
11	5634	7480.23	1741.01	23.27	19.89	1283.5	6453.39	5634	11		
12	5634	6192.38	1551.96	25.06	23.19	1728.98	7455.79	5634	12		
13	4905	6553.32	1554.68	23.72	20.9	1450.45	6938.54	5634	13		
14	5634	6041.81	1316.53	21.79	19.47	1321.76	6786.96	5634	14		
15	4972	6183.25	1495.98	24.19	24.21	1501.91	6204.48	4432	15		
16	0	0	0	0	25.19	483.18	1918.14	1594	16		
17	0	0	0	0	10.28	69.09	671.9	679	17		
18	345	429.13	170.05	39.63	14.06	309.99	2205.05	2140	18		
19	1418	1762.07	508.89	28.88	25.13	270.46	1076.41	923	19		
20	1757	2295.22	814.02	35.47	23.33	469.83	2013.9	1593	20		
21	682	1051.01	400.07	38.07	21.88	575.98	2632.12	2136	21		
22	0	0	0	0	26.4	415.5	1573.86	1281	22		
	3775.2	4403.72	920.43	19.929545	18.5286364	800.853636	4395.1	3851.4			
		WON	WON	WON	LOST	LOST	LOST				



MATCH 5		Losing Team				Winning Team				
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No
Props	1	5634	5409.3	545.68	10.09	5.44	285.34	5247.34	5634	1
	3	4804	5124.86	688.27	13.43	10.5	547.63	5213.54	4973	3
		5219	5267.08	616.975	11.76	7.97	416.485	5230.44	5303.5	
Locks	4	5317	5786.32	798.43	13.8	13.61	798.08	5865.34	5634	4
	5	5634	6423.22	1157.93	18.03	21.68	873.79	4030.67	3524	5
		5475.5	6104.77	978.18	15.915	17.645	835.935	4948.01	4579	
Loosies	2	5634	5874.69	702.41	11.96	13.17	571.68	4342.12	4068	2
	6	5624	6797.35	1601.79	23.56	13.4	722.77	5395.64	5634	6
	7	5634	6351.82	1111.58	17.5	18.48	1094.73	5925.37	5624	7
	8	4247	4842.22	782.77	16.17	16.69	829.55	4971.53	4739	8
		5284.8	5966.52	1049.63	17.29	16.19	882.35	5430.85	5332.3	
In Backs	9	3912	4878	1310.82	26.87	22.53	1230.87	5462.78	4079	9
	10	5634	7405.68	1996.59	26.96	18.2	783.71	4307.27	3507	10
	12	5634	6192.38	1551.96	25.06	23.19	1728.98	7455.79	5634	12
	13	4905	6553.32	1554.68	23.72	20.9	1450.45	6938.54	5634	13
		5021.3	6257.35	1603.5125	25.6525	21.205	1298.5025	6041.1	4713.5	
Out Backs	11	5634	7480.23	1741.01	23.27	19.89	1283.5	6453.39	5634	11
	14	5634	6041.81	1316.53	21.79	19.47	1321.76	6786.96	5634	14
	15	4972	6183.25	1495.98	24.19	24.21	1501.91	6204.48	4432	15
		5413.3	6568.43	1517.84	23.083333	21.19	1369.05667	6481.61	5233.3	

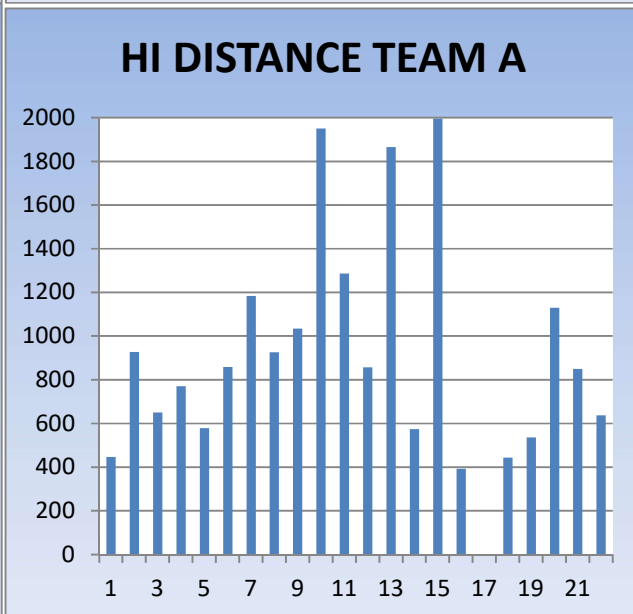
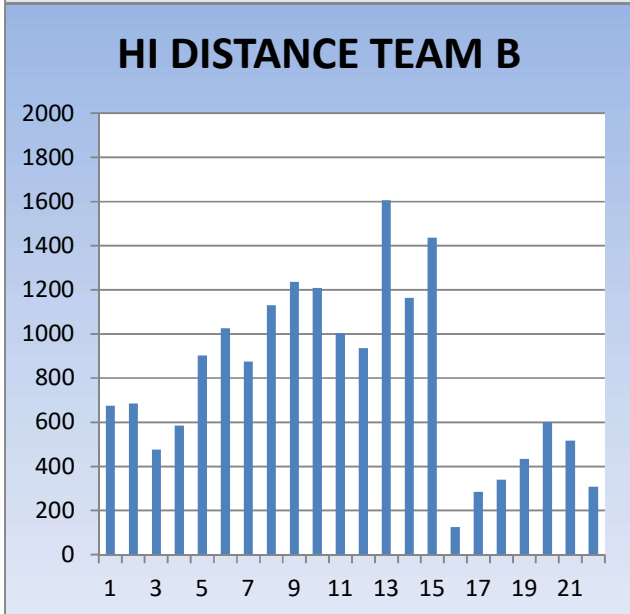
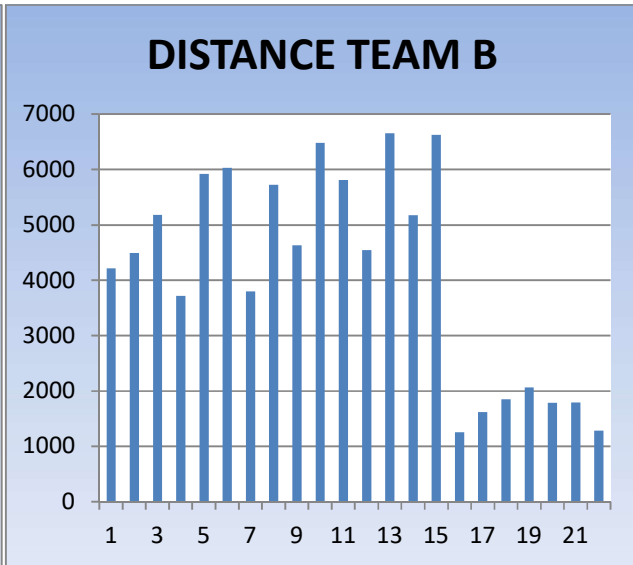
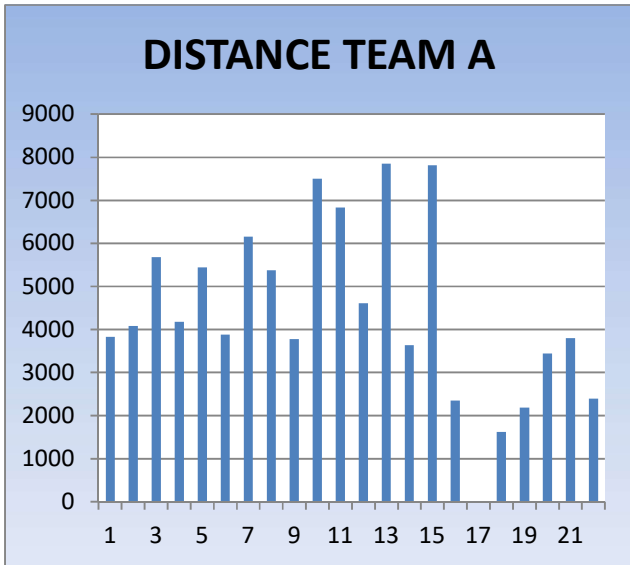
MATCH 6											
TEAM A				Score	55	22	Score	TEAM B			
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No	
	1	4365	4587.02	391	8.52	12.28	552.57	4498.23	3795	1	
	2	4581	5354.15	1042.04	19.46	15.08	795.03	5271.73	4591	2	
	3	4709	5127.63	418.51	8.16	12.88	783.84	6087.56	5323	3	
	4	4152	4652.12	698.73	15.02	31.89	1992.59	6248.47	4764	4	
	5	5313	6182.89	1079.93	17.47	17.52	816.07	4657.71	4092	5	
	6	5323	6373.68	1675.74	26.29	19.69	1315.6	6681.04	5323	6	
	7	4617	5569.86	1160.83	20.84	25.78	1716.22	6656.33	5323	7	
	8	5323	6588.16	1111.47	16.87	19.62	1304.11	6645.99	5323	8	
	9	4586	6193.61	1461.1	23.59	27.14	1505.21	5546.25	3585	9	
	10	5323	6827.84	1182.79	17.32	28.65	2224.19	7764.35	5323	10	
	11	4548	5699.11	1034.73	18.16	24.36	1763.05	7238.69	5323	11	
	12	5323	6346.55	1290.86	20.34	21.06	1594.48	7570.92	5323	12	
	13	5323	6734.01	1622.24	24.09	22.58	1795.62	7953.7	5323	13	
	14	3406	4314.19	900.78	20.88	17.97	1108.26	6168.31	5323	14	
	15	4605	6457.28	1418.91	21.97	22.46	1347.81	6000.24	4086	15	
	16	751	958.99	199.49	20.8	34.99	380.97	1088.93	748	16	
	17	0	0	0	0	13.76	239.3	1738.55	1541	17	
	18	1181	1414.88	335.64	23.72	36.86	328.17	890.22	584	18	
	19	980	1389.17	520.88	37.5	26.91	459.4	1707.05	1266	19	
	20	750	1208.76	448.43	37.1	33.29	857.84	2577.08	1770	20	
	21	733	1051.65	226.12	21.5	0	0	0	0	21	
	22	1938	2802.4	582.26	20.78	17.54	301.57	1719.53	1265	22	
		3537.7	4356.089	854.65818	20.0172727	21.923182	1053.7227	4759.59	3636.1		
			LOST	LOST	LOST	WON	WON	WON			



**MATCH
6**

		Winning Team				Losing Team				
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No
Props	1	4365	4587.02	391	8.52	12.28	552.57	4498.23	3795	1
	3	4709	5127.63	418.51	8.16	12.88	783.84	6087.56	5323	3
		4537	4857.325	404.755	8.34	12.58	668.205	5292.9	4559	
Locks	4	4152	4652.12	698.73	15.02	31.89	1992.59	6248.47	4764	4
	5	5313	6182.89	1079.93	17.47	17.52	816.07	4657.71	4092	5
		4732.5	5417.505	889.33	16.245	24.705	1404.33	5453.09	4428	
Loosies	2	4581	5354.15	1042.04	19.46	15.08	795.03	5271.73	4591	2
	6	5323	6373.68	1675.74	26.29	19.69	1315.6	6681.04	5323	6
	7	4617	5569.86	1160.83	20.84	25.78	1716.22	6656.33	5323	7
	8	5323	6588.16	1111.47	16.87	19.62	1304.11	6645.99	5323	8
		4961	5971.463	1247.52	20.865	21.696667	1445.31	6661.12	5323	
In Backs	9	4586	6193.61	1461.1	23.59	27.14	1505.21	5546.25	3585	9
	10	5323	6827.84	1182.79	17.32	28.65	2224.19	7764.35	5323	10
	12	5323	6346.55	1290.86	20.34	21.06	1594.48	7570.92	5323	12
	13	5323	6734.01	1622.24	24.09	22.58	1795.62	7953.7	5323	13
		5138.8	6525.503	1389.2475	21.335	24.8575	1779.875	7208.81	4888.5	
Out Backs	11	4548	5699.11	1034.73	18.16	24.36	1763.05	7238.69	5323	11
	14	3406	4314.19	900.78	20.88	17.97	1108.26	6168.31	5323	14
	15	4605	6457.28	1418.91	21.97	22.46	1347.81	6000.24	4086	15
		4186.3	5490.193	1118.14	20.3366667	21.596667	1406.37333	6469.08	4910.7	

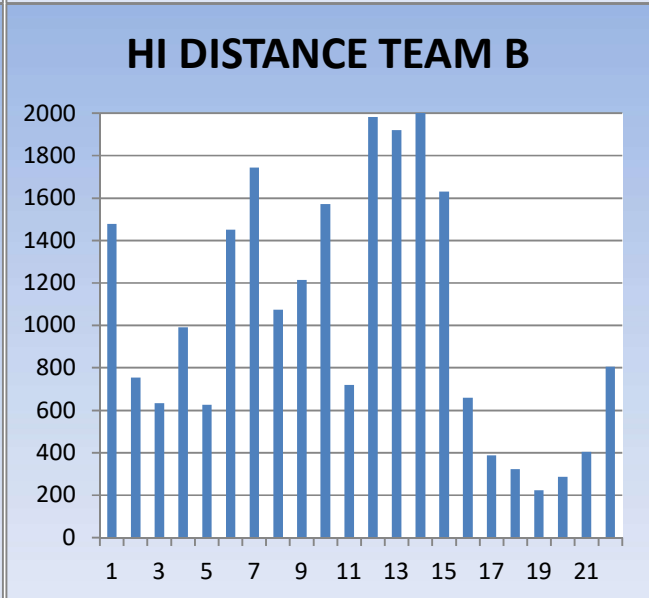
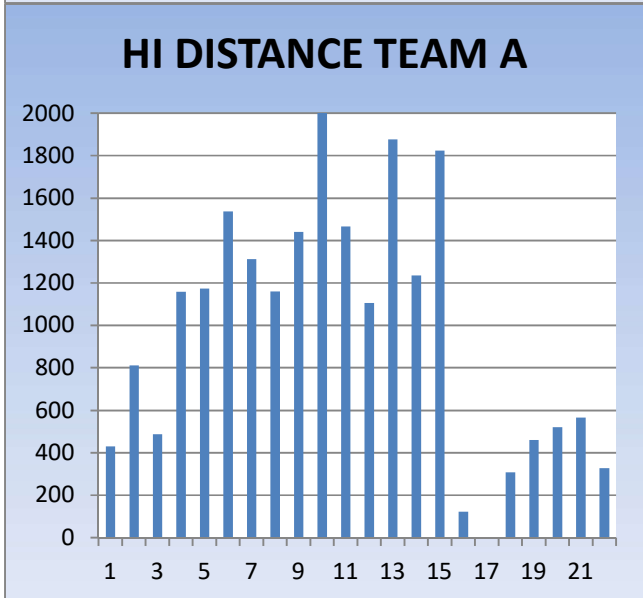
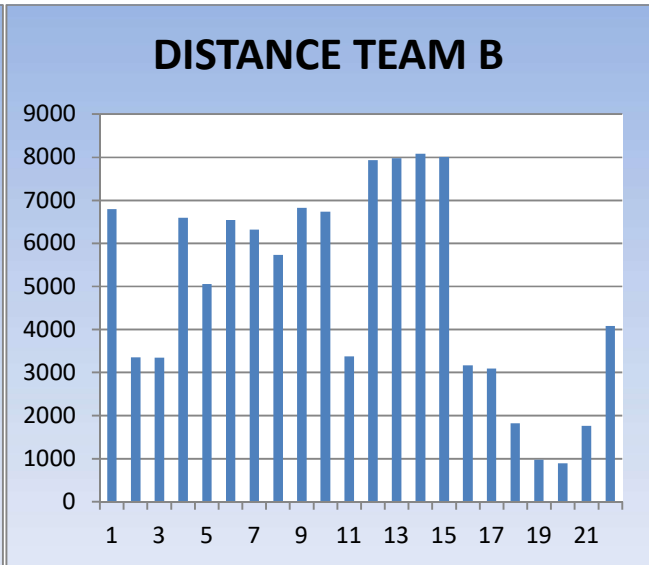
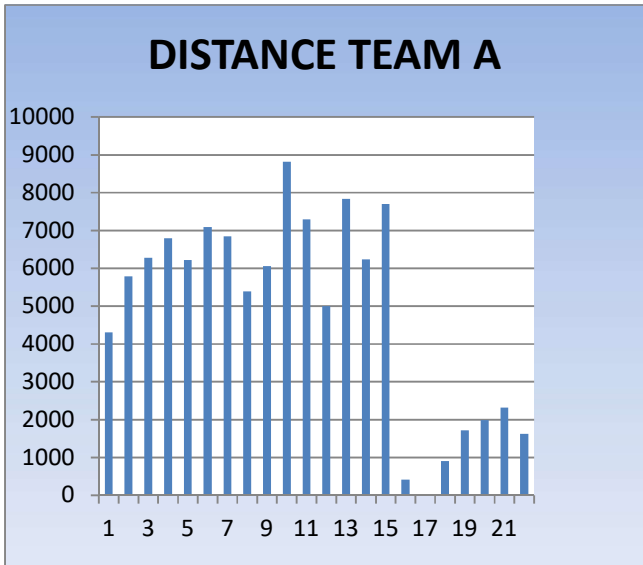
MATCH 7											
TEAM A				Score	35	8	Score	TEAM B			
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No	Name
	1	3884	3824.99	447.7	11.7	16.02	675.19	4213.65	4272	1	
	2	3695	4082.04	928.63	22.75	15.25	685.29	4493.15	4574	2	
	3	5769	5682.4	651.81	11.47	9.19	476.06	5182.19	5871	3	
	4	4346	4176.41	771.2	18.47	15.71	584.13	3718.4	4131	4	
	5	5871	5442.16	577.88	10.62	15.23	902.39	5923.32	5871	5	
	6	3621	3876.12	858.3	22.14	17.03	1027.01	6031.52	5871	6	
	7	5871	6156.53	1182.82	19.21	23.05	876.02	3800.67	3399	7	
	8	5430	5375.59	926.82	17.24	19.74	1130.34	5726.01	5871	8	
	9	3089	3778.89	1035.6	27.4	26.72	1237.09	4630.17	3964	9	
	10	5871	7501.09	1950.31	26	18.64	1209.2	6485.72	5871	10	
	11	5871	6834.49	1285.75	18.81	17.26	1003.46	5814.87	5871	11	
	12	4147	4608.05	857.35	18.61	20.59	936.09	4547.32	4402	12	
	13	5871	7851.62	1864.63	23.75	24.12	1606.37	6661.2	5871	13	
	14	2760	3629.29	574.24	15.82	22.46	1163.49	5180.12	5021	14	
	15	5871	7812.19	1995.79	25.55	21.67	1435.57	6624.54	5871	15	
	16	2405	2352.46	393.4	16.72	10.05	125.99	1253.12	1317	16	
	17	0	0	0	0	17.58	284.85	1620.07	1506	17	
	18	1556	1618.28	443.77	27.42	18.35	339.73	1850.89	1763	18	
	19	2257	2187.48	535.97	24.5	21.09	435.44	2064.94	1947	19	
	20	2787	3443.93	1128.86	32.78	33.62	601.07	1787.63	1301	20	
	21	3111	3795.83	848.98	22.37	28.74	516.68	1797.65	1526	21	
	22	1786	2391.59	636.77	26.63	24	308.36	1284.89	868	22	
		3903.1	4382.79	904.39	19.998182	19.8231818	798.173636	4122.37	3953		
			WON	WON	WON	LOST	LOST	LOST			



MATCH 7

		Winning Team				Losing Team				
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No
Props	1	3884	3824.99	447.7	11.7	16.02	675.19	4213.65	4272	1
	3	5769	5682.4	651.81	11.47	9.19	476.06	5182.19	5871	3
		4826.5	4753.7	549.755	11.585	12.605	575.625	4697.92	5072	
Locks	4	4346	4176.41	771.2	18.47	15.71	584.13	3718.4	4131	4
	5	5871	5442.16	577.88	10.62	15.23	902.39	5923.32	5871	5
		5108.5	4809.29	674.54	14.545	15.47	743.26	4820.86	5001	
Loosies	2	3695	4082.04	928.63	22.75	15.25	685.29	4493.15	4574	2
	6	3621	3876.12	858.3	22.14	17.03	1027.01	6031.52	5871	6
	7	5871	6156.53	1182.82	19.21	23.05	876.02	3800.67	3399	7
	8	5430	5375.59	926.82	17.24	19.74	1130.34	5726.01	5871	8
		4654.3	4872.57	974.1425	20.335	19.94	1011.12333	5186.07	5047	
In Backs	9	3089	3778.89	1035.6	27.4	26.72	1237.09	4630.17	3964	9
	10	5871	7501.09	1950.31	26	18.64	1209.2	6485.72	5871	10
	12	4147	4608.05	857.35	18.61	20.59	936.09	4547.32	4402	12
	13	5871	7851.62	1864.63	23.75	24.12	1606.37	6661.2	5871	13
		4744.5	5934.91	1426.9725	23.94	22.5175	1247.1875	5581.1	5027	
Out Backs	11	5871	6834.49	1285.75	18.81	17.26	1003.46	5814.87	5871	11
	14	2760	3629.29	574.24	15.82	22.46	1163.49	5180.12	5021	14
	15	5871	7812.19	1995.79	25.55	21.67	1435.57	6624.54	5871	15
		4834	6091.99	1285.26	20.06	20.463333	1200.84	5873.18	5588	

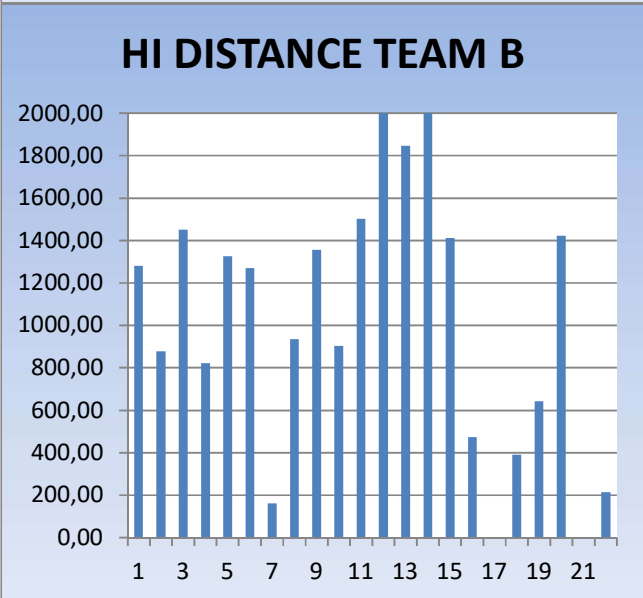
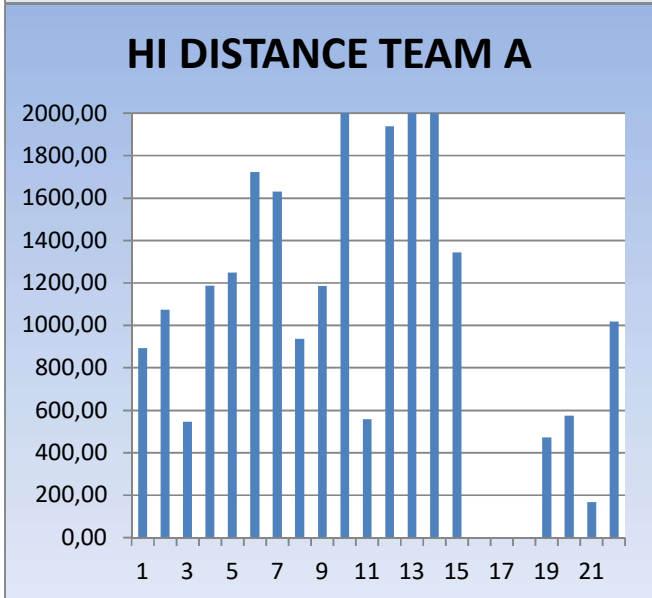
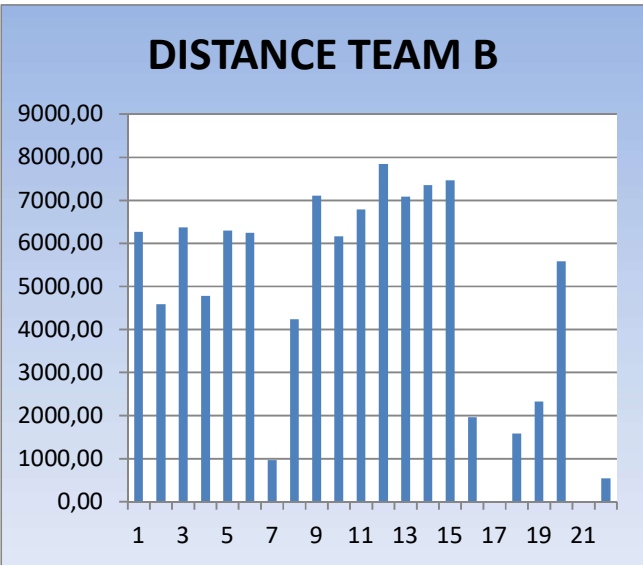
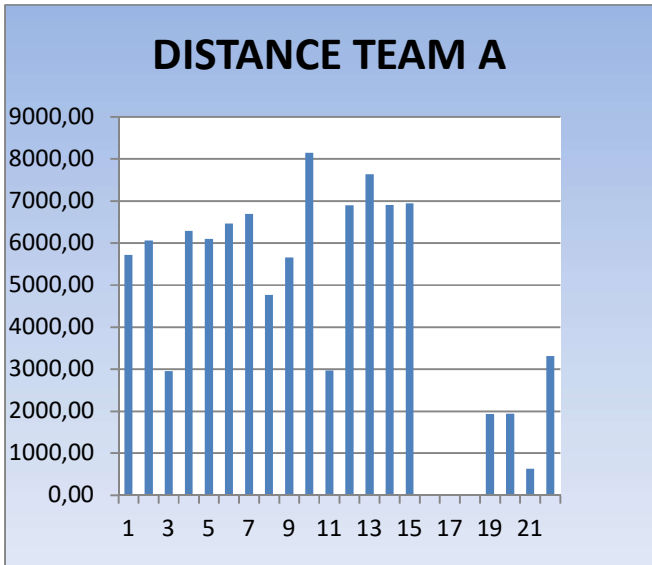
MATCH 8											
TEAM A				Score	36	16	Score	TEAM B			
Name	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No	Name
	1	4020	4308.36	430.95	10	21.76	1479.52	6798.22	5607	1	
	2	5331	5783.24	812.95	14.06	22.50	753.56	3349.67	3020	2	
	3	5607	6279.35	487.78	7.77	18.92	633.09	3345.99	3020	3	
	4	5607	6800.82	1158.39	17.03	15.05	992.13	6594.22	5607	4	
	5	5001	6224.29	1173.72	18.86	12.39	626.46	5056.04	4241	5	
	6	5607	7095.04	1538.25	21.68	22.18	1451.07	6543.19	5607	6	
	7	5607	6846.28	1313.30	19.18	27.59	1742.98	6317.22	5607	7	
	8	4365	5386.83	1160.11	21.54	18.73	1073.19	5730.22	4796	8	
	9	4368	6054.16	1440.57	23.79	17.80	1214.19	6822.59	5070	9	
	10	5607	8813.97	2195.01	24.90	23.34	1571.82	6734.51	4546	10	
	11	5607	7293.25	1466.04	20.10	21.34	720.00	3374.38	2962	11	
	12	3923	5006.37	1106.60	22.10	25.01	1983.32	7928.73	5607	12	
	13	5607	7840.98	1877.21	23.94	24.08	1920.44	7974.51	5607	13	
	14	4481	6236.17	1235.45	19.81	27.94	2257.65	8081.32	5607	14	
	15	5607	7697.54	1823.80	23.69	20.36	1630.43	8006.89	5607	15	
	16	289	410.02	121.42	29.61	20.82	660.02	3170.79	2587	16	
	17	0	0.00	0.00	0.00	12.58	388.42	3086.69	2587	17	
	18	639	907.36	306.65	33.80	17.73	323.72	1825.87	1393	18	
	19	1279	1716.73	460.19	26.81	22.83	223.26	977.73	825	19	
	20	1279	1987.75	519.67	26.14	32.23	286.03	887.46	568	20	
	21	1696	2319.93	565.27	24.37	22.91	403.82	1762.92	1083	21	
	22	1143	1624.18	327.52	20.17	19.75	805.55	4079.28	2674	22	
			LOST	WON	LOST	WON	LOST	WON			



MATCH 8

		Losing Team				Winning Team				
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No
Props	1	5607	6798.22	1479.52	21.76	10.00	430.95	4308.36	4020	1
	3	3020	3345.99	633.09	18.92	7.77	487.78	6279.35	5607	3
			5072.11	1056.31	20.34	8.89	459.37	5293.86		
Locks	4	5607	6594.22	992.13	15.05	17.03	1158.39	6800.82	5607	4
	5	4241	5056.04	626.46	12.39	18.86	1173.72	6224.29	5001	5
			5825.13	809.30	13.72	17.95	1166.06	6512.56		
Loosies	2	3020	3349.67	753.56	22.50	14.06	812.95	5783.24	5331	2
	6	5607	6543.19	1451.07	22.18	21.68	1538.25	7095.04	5607	6
	7	5607	6317.22	1742.98	27.59	19.18	1313.30	6846.28	5607	7
	8	4796	5730.22	1073.19	18.73	21.54	1160.11	5386.83	4365	8
			5485.08	1255.20	22.75	19.12	1206.15	6277.85		
In Backs	9	5070	6822.59	1214.19	17.80	23.79	1440.57	6054.16	4368	9
	10	4546	6734.51	1571.82	23.34	24.90	2195.01	8813.97	5607	10
	12	5607	7928.73	1983.32	25.01	22.10	1106.60	5006.37	3923	12
	13	5607	7974.51	1920.44	24.08	23.94	1877.21	7840.98	5607	13
			7365.09	1672.44	22.56	23.68	1654.85	6928.87	4876.3	
Out Backs	11	2962	3374.38	720.00	21.34	20.10	1466.04	7293.25	5607	11
	14	5607	8081.32	2257.65	27.94	19.81	1235.45	6236.17	4481	14
	15	5607	8006.89	1630.43	20.36	23.69	1823.80	7697.54	5607	15
			6487.53	1536.03	23.21	21.20	1508.43	7075.65		

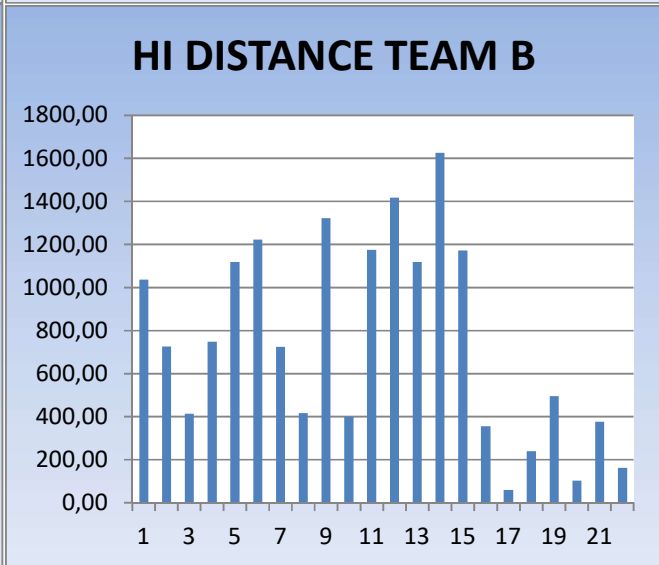
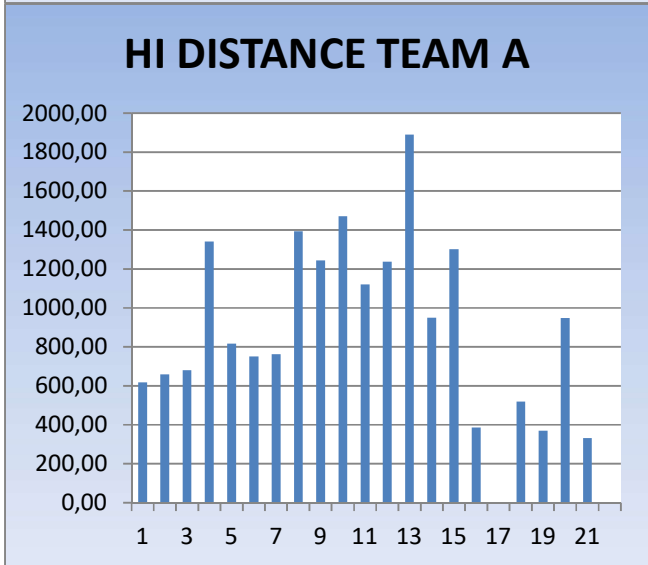
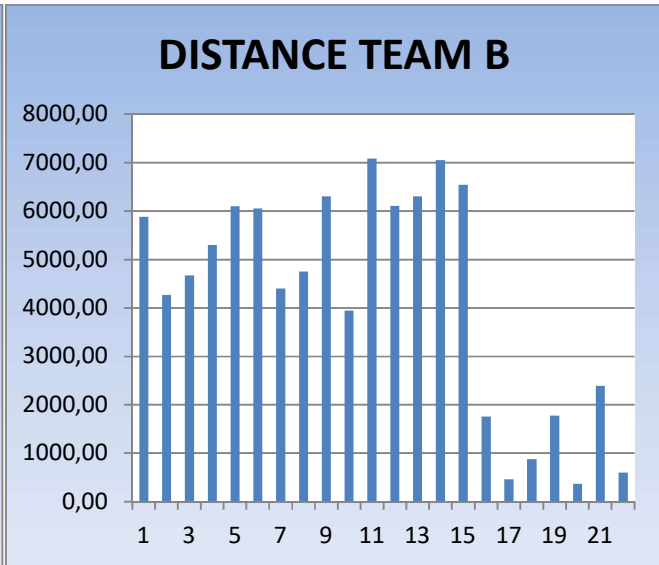
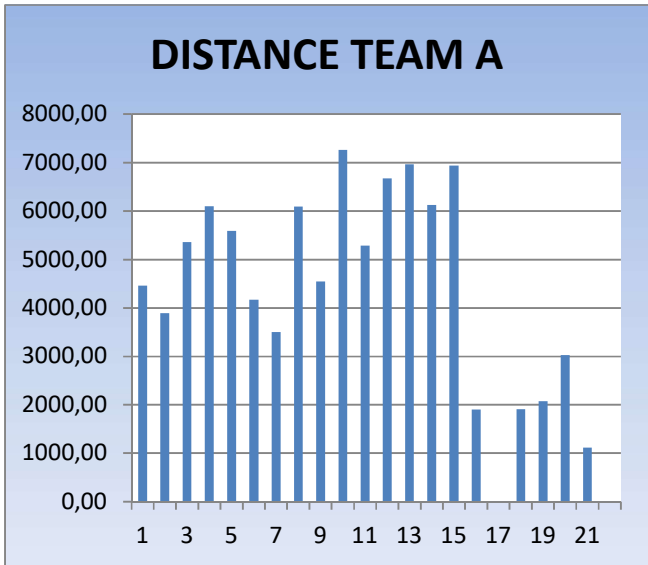
MATCH 9											
TEAM A			Score		26	36	Score		TEAM B		
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No	
	1	5354	5720.98	892.85	15.61	20.45	1281.37	6265.02	5354	1	
	2	5354	6058.98	1073.14	17.71	19.15	878.74	4589.08	3873	2	
	3	2587	2949.94	546.70	18.53	22.78	1450.71	6367.95	5354	3	
	4	5354	6289.74	1186.13	18.86	17.21	823.14	4783.24	4024	4	
	5	5354	6101.06	1248.55	20.46	21.07	1326.07	6293.26	5354	5	
	6	5354	6464.81	1723.47	26.66	20.36	1270.82	6242.48	5354	6	
	7	5354	6701.07	1630.81	24.34	16.59	161.22	971.54	911	7	
	8	3870	4768.89	937.69	19.66	22.07	936.32	4242.73	3509	8	
	9	4006	5657.54	1185.73	20.96	19.06	1355.11	7109.00	5354	9	
	10	5354	8151.52	2011.80	24.68	14.65	903.61	6167.20	5027	10	
	11	2883	2971.50	558.07	18.78	22.14	1502.22	6784.40	5354	11	
	12	5354	6897.09	1938.18	28.10	27.82	2182.07	7842.72	5354	12	
	13	5354	7636.11	2091.07	27.38	26.07	1846.21	7082.78	5354	13	
	14	4818	6903.77	2073.51	30.03	28.72	2112.05	7353.38	5354	14	
	15	5354	6946.16	1344.44	19.36	18.92	1410.89	7458.89	5354	15	
	16	0	0.00	0.00	0.00	24.19	473.66	1958.38	1511	16	
	17	0	0.00	0.00	0.00	0.00	0.00	0.00	0	17	
	18	0	0.00	0.00	0.00	24.62	390.51	1586.04	1350	18	
	19	1516	1936.37	471.51	24.35	27.52	641.25	2330.29	1864	19	
	20	1382	1945.67	573.95	29.50	25.50	1423.57	5583.21	4465	20	
	21	554	630.13	167.15	26.53	0.00	0.00	0.00	0	21	
	22	2568	3316.70	1017.33	30.67	39.72	214.38	539.76	352	22	
		3532.9	4456.73	1030.55	20.10	20.85	1026.54	4615.97	3655.7		
			LOST	WON	LOST	WON	LOST	WON			



MATCH 9

		Losing Team				Winning Team				
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No
Props	1	5354	5720.98	892.85	15.61	20.45	1281.37	6265.02	5354	1
	3	2587	2949.94	546.70	18.53	22.78	1450.71	6367.95	5354	3
		3970.5	4335.46	719.78	17.07	21.62	1366.04	6316.49	5354	
Locks	4	5354	6289.74	1186.13	18.86	17.21	823.14	4783.24	4024	4
	5	5354	6101.06	1248.55	20.46	21.07	1326.07	6293.26	5354	5
		5354	6195.40	1217.34	19.66	19.14	1074.61	5538.25	4689	
Loosies	2	5354	6058.98	1073.14	17.71	19.15	878.74	4589.08	3873	2
	6	5354	6464.81	1723.47	26.66	20.36	1270.82	6242.48	5354	6
	7	5354	6701.07	1630.81	24.34	16.59	161.22	971.54	911	7
	8	3870	4768.89	937.69	19.66	22.07	936.32	4242.73	3509	8
		4983	5998.44	1341.28	22.09	19.67	789.45	3818.92	3258	
In Backs	9	4006	5657.54	1185.73	20.96	19.06	1355.11	7109.00	5354	9
	10	5354	8151.52	2011.80	24.68	14.65	903.61	6167.20	5027	10
	12	5354	6897.09	1938.18	28.10	27.82	2182.07	7842.72	5354	12
	13	5354	7636.11	2091.07	27.38	26.07	1846.21	7082.78	5354	13
		5017	7085.57	1806.70	25.28	21.90	1571.75	7050.43	5272.3	
Out Backs	11	2883	2971.50	558.07	18.78	22.14	1502.22	6784.40	5354	11
	14	4818	6903.77	2073.51	30.03	28.72	2112.05	7353.38	5354	14
	15	5354	6946.16	1344.44	19.36	18.92	1410.89	7458.89	5354	15
		4351.7	5607.14	1325.34	22.72	23.26	1675.05	7198.89	5354	

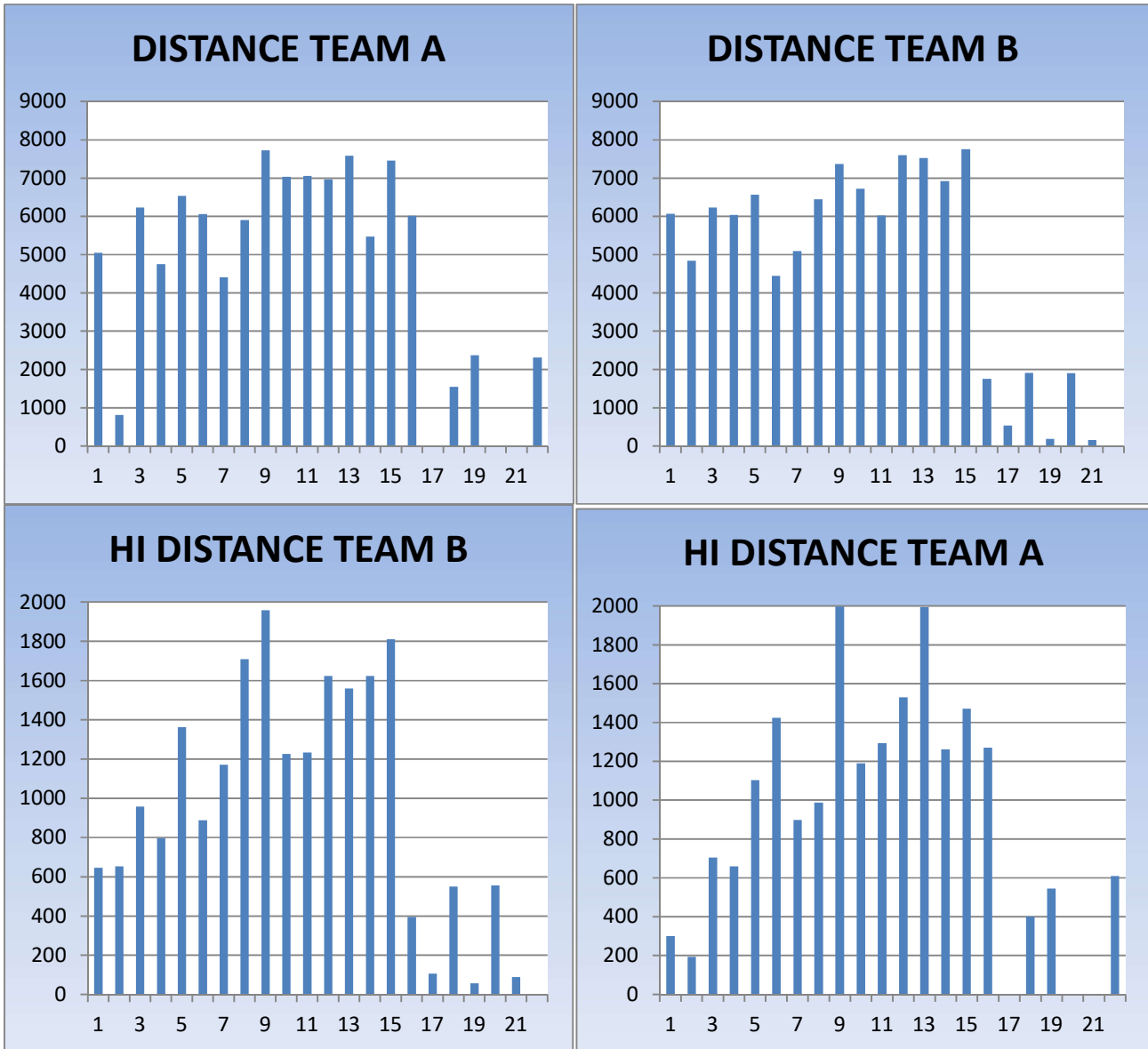
MATCH 10													
TEAM A				Score		30	27	Score		TEAM B			
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No			
	1	4338	4456.35	617.72	13.86	17.64	1037.25	5879.60	5462	1			
	2	3599	3890.89	659.69	16.95	17.02	726.56	4269.95	3862	2			
	3	5462	5355.30	679.84	12.69	8.85	413.40	4668.77	5039	3			
	4	5462	6098.22	1342.04	22.01	14.14	749.65	5302.35	5462	4			
	5	5462	5592.38	817.11	14.61	18.35	1118.72	6096.96	5462	5			
	6	3601	4166.74	750.75	18.02	20.19	1222.63	6054.74	5462	6			
	7	3000	3505.56	761.54	21.72	16.47	724.26	4398.50	3853	7			
	8	5462	6088.74	1393.37	22.88	8.75	415.76	4752.80	4680	8			
	9	3266	4550.66	1244.74	27.35	20.97	1321.58	6301.09	5145	9			
	10	5470	7263.99	1471.63	20.26	10.13	399.64	3944.20	3284	10			
	11	4552	5285.19	1120.77	21.21	16.58	1174.63	7083.56	5462	11			
	12	5462	6676.40	1237.00	18.53	23.24	1418.09	6101.42	5064	12			
	13	5462	6969.70	1890.34	27.12	17.73	1117.80	6303.41	5462	13			
	14	5462	6125.08	950.29	15.51	23.07	1626.53	7050.97	5462	14			
	15	5469	6937.81	1301.68	18.76	17.91	1171.80	6543.10	5462	15			
	16	1886	1902.43	385.63	20.27	20.23	355.48	1756.95	1628	16			
	17	0	0.00	0.00	0.00	12.97	59.66	459.90	430	17			
	18	1807	1912.71	519.02	27.14	27.35	240.19	878.11	811	18			
	19	1887	2076.74	370.38	17.83	27.96	496.11	1774.67	1628	19			
	20	2216	3031.56	949.42	31.32	27.82	103.66	372.56	314	20			
	21	917	1116.09	331.89	29.74	15.75	376.73	2392.21	2199	21			
	22	0	0.00	0.00	0.00	27.01	163.10	603.75	430	22			
		3647.4	4227.39	854.31	18.99	18.64	746.97	4226.80	3730.1				
			WON	WON	WON	LOST	LOST	LOST					



MATCH 10

		Winning Team				Losing Team				
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No
Props	1	4338	4456.35	617.72	13.86	17.64	1037.25	5879.60	5462	1
	3	5462	5355.30	679.84	12.69	8.85	413.40	4668.77	5039	3
		4900	4905.83	648.78	13.28	13.25	725.33	5274.19	5250.5	
Locks	4	5462	6098.22	1342.04	22.01	14.14	749.65	5302.35	5462	4
	5	5462	5592.38	817.11	14.61	18.35	1118.72	6096.96	5462	5
		5462	5845.30	1079.58	18.31	16.24	934.19	5699.66	5462	
Loosies	2	3599	3890.89	659.69	16.95	17.02	726.56	4269.95	3862	2
	6	3601	4166.74	750.75	18.02	20.19	1222.63	6054.74	5462	6
	7	3000	3505.56	761.54	21.72	16.47	724.26	4398.50	3853	7
	8	5462	6088.74	1393.37	22.88	8.75	415.76	4752.80	4680	8
		3915.5	4412.98	891.34	19.90	15.14	787.55	5068.68	4665	
In Backs	9	3266	4550.66	1244.74	27.35	20.97	1321.58	6301.09	5145	9
	10	5470	7263.99	1471.63	20.26	10.13	399.64	3944.20	3284	10
	12	5462	6676.40	1237.00	18.53	23.24	1418.09	6101.42	5064	12
	13	5462	6969.70	1890.34	27.12	17.73	1117.80	6303.41	5462	13
		4915	6365.19	1460.93	23.32	18.02	1064.28	5662.53	4738.8	
Out Backs	11	4552	5285.19	1120.77	21.21	16.58	1174.63	7083.56	5462	11
	14	5462	6125.08	950.29	15.51	23.07	1626.53	7050.97	5462	14
	15	5469	6937.81	1301.68	18.76	17.91	1171.80	6543.10	5462	15
		5161	6116.03	1124.25	18.49	19.19	1324.32	6892.54	5462	

MATCH 11											
TEAM A			Score 22				Score 19				TEAM B
No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No		
1	4744	5052.29	299.95	5.94	10.66	646.13	6062.55	5652	1		
2	702	807.73	193.54	23.96	13.51	654.29	4842.59	4175	2		
3	5037	6232.49	705.06	11.31	15.37	957.79	6232.35	5282	3		
4	4187	4755.31	659.85	13.88	13.19	796.14	6035.68	5652	4		
5	5652	6534.74	1103.89	16.89	20.75	1361.77	6563.98	5652	5		
6	5652	6060.06	1424.83	23.51	20.02	888.57	4439.39	3824	6		
7	3589	4410.01	897.77	20.36	22.97	1169.77	5093.5	3834	7		
8	5003	5902.78	988.54	16.75	26.53	1710.06	6445.15	5521	8		
9	5652	7724.95	1998.25	25.87	26.59	1958.51	7365.53	5652	9		
10	5652	7031.74	1191.01	16.94	18.23	1224.8	6719.76	5652	10		
11	5652	7053.01	1295.21	18.36	20.5	1233.51	6017.28	5652	11		
12	5652	6967.96	1529.89	21.96	21.38	1623.96	7597.39	5634	12		
13	5652	7584.75	1995.26	26.31	20.73	1560.61	7528.4	5571	13		
14	4042	5472.87	1261.62	23.05	23.48	1623.99	6915.2	5652	14		
15	5652	7456.93	1470.8	19.72	23.34	1810.27	7756.02	5652	15		
16	4970	6014.72	1269.93	21.11	22.59	394.92	1748.3	1494	16		
17	0	0	0	0	20.04	106.53	531.55	387	17		
18	1484	1548.99	401.36	25.91	28.83	550.07	1907.85	1833	18		
19	2091	2371.01	546.07	23.03	30.07	56.83	188.99	154	19		
20	0	0	0	0	29.21	556.15	1903.88	1830	20		
21	0	0	0	0	56.25	89.28	158.73	101	21		
22	1659	2312.89	609.24	26.34	0	0	0	0	22		
	3760.2	4604.329	901.912273	17.3272727	22.010909	953.36136	4638.821	3857.1			
		LOST	LOST	LOST	WON	WON	WON				

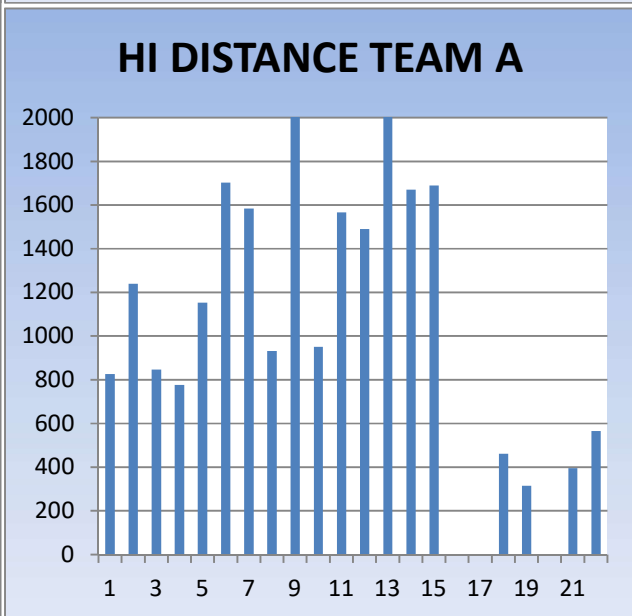
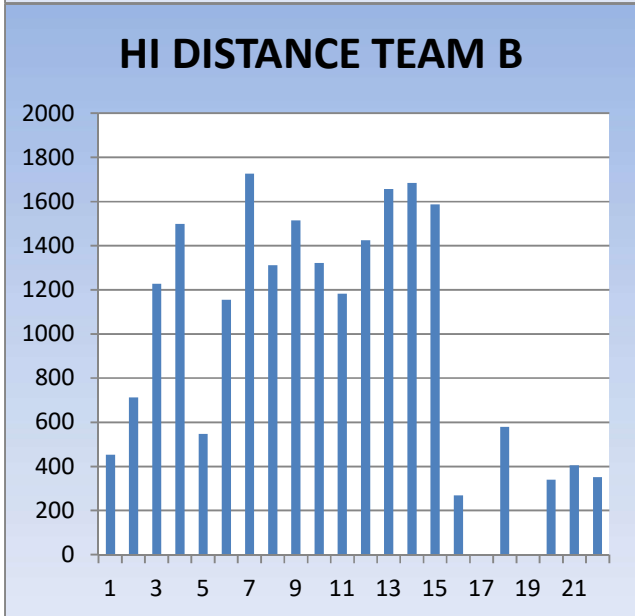
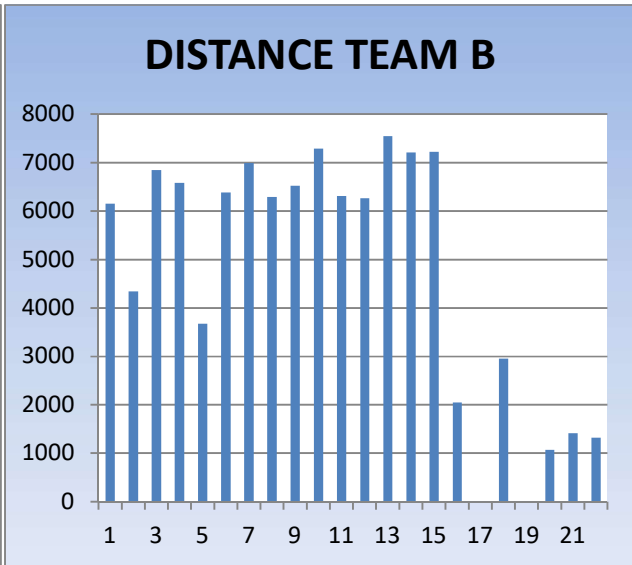
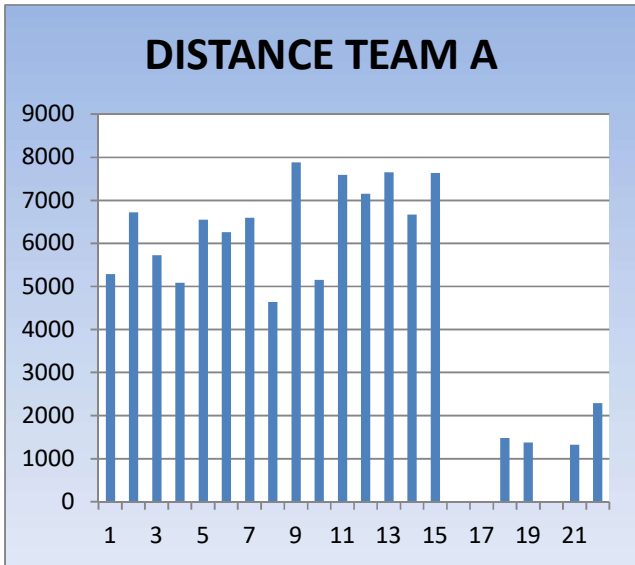


MATCH 11

		Winning Team				Losing Team				
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No
Props	1	4744	5052.29	299.95	5.94	10.66	646.13	6062.55	5652	1
	3	5037	6232.49	705.06	11.31	15.37	957.79	6232.35	5282	3
		4890.5	5642.39	502.505	8.625	13.015	801.96	6147.45	5467	
Locks	4	4187	4755.31	659.85	13.88	13.19	796.14	6035.68	5652	4
	5	5652	6534.74	1103.89	16.89	20.75	1361.77	6563.98	5652	5
		4919.5	5645.025	881.87	15.385	16.97	1078.955	6299.83	5652	
Loosies	2	702	807.73	193.54	23.96	13.51	654.29	4842.59	4175	2
	6	5652	6060.06	1424.83	23.51	20.02	888.57	4439.39	3824	6
	7	3589	4410.01	897.77	20.36	22.97	1169.77	5093.5	3834	7
	8	5003	5902.78	988.54	16.75	26.53	1710.06	6445.15	5521	8
		3736.5	4295.145	876.17	21.145	23.173333	1256.13333	5326.013	4393	
In Backs	9	5652	7724.95	1998.25	25.87	26.59	1958.51	7365.53	5652	9
	10	5652	7031.74	1191.01	16.94	18.23	1224.8	6719.76	5652	10
	12	5652	6967.96	1529.89	21.96	21.38	1623.96	7597.39	5634	12
	13	5652	7584.75	1995.26	26.31	20.73	1560.61	7528.4	5571	13
		5652	7327.35	1678.6025	22.77	21.7325	1591.97	7302.77	5627.3	
Out Backs	11	5652	7053.01	1295.21	18.36	20.5	1233.51	6017.28	5652	11
	14	4042	5472.87	1261.62	23.05	23.48	1623.99	6915.2	5652	14
	15	5652	7456.93	1470.8	19.72	23.34	1810.27	7756.02	5652	15
		5115.3	6660.937	1342.54333	20.3766667	22.44	1555.92333	6896.167	5652	

MATCH 12

TEAM A				Score	21	26	Score				TEAM B
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No	
	1	4438	5291.76	826.59	15.62	7.37	453.91	6155.78	5433	1	
	2	5433	6723.8	1239.63	18.44	16.43	713.5	4343.01	3580	2	
	3	4802	5720.86	846.73	14.8	17.95	1228.66	6846.33	5433	3	
	4	4609	5085.71	777.25	15.28	22.79	1499.94	6581.25	5433	4	
	5	5433	6549.4	1153.6	17.61	14.93	548.17	3670.38	3060	5	
	6	5433	6261.46	1702.01	27.18	18.09	1154.57	6383.34	5433	6	
	7	5433	6589.4	1583.5	24.03	24.69	1726.4	6993.68	5433	7	
	8	3713	4639.53	932.74	20.1	20.85	1311.07	6288.64	5433	8	
	9	5433	7882.68	2221.23	28.18	23.23	1514.71	6521.18	4798	9	
	10	3736	5154.72	950.36	18.44	18.14	1321.88	7286.69	5423	10	
	11	5433	7590.23	1566.54	20.64	18.75	1183.38	6311.07	5433	11	
	12	5423	7150.07	1490.06	20.84	22.74	1424.25	6263.13	4758	12	
	13	5433	7651.94	2064.29	26.98	21.97	1657.92	7546.7	5433	13	
	14	4621	6675.51	1671.59	25.04	23.36	1684.42	7211.47	5433	14	
	15	5433	7632.73	1689.18	22.13	21.97	1586.81	7221.5	4757	15	
	16	0	0	0	0	13.08	268.44	2052.49	1900	16	
	17	0	0	0	0	0	0	0	0	17	
	18	876	1482.86	462.17	31.17	19.62	579.56	2953.36	2399	18	
	19	1098	1370.6	314.83	22.97	0	0	0	0	19	
	20	0	0	0	0	31.87	340.28	1067.64	666	20	
	21	876	1326.73	395.8	29.83	28.63	404.64	1413.41	833	21	
	22	1755	2287.76	565.44	24.72	26.49	351.62	1327.6	720	22	
		3609.6	4684.898	1020.6155	19.272727	18.7704545	952.460455		3717.8		
			LOST	WON	WON	LOST	LOST	WON			

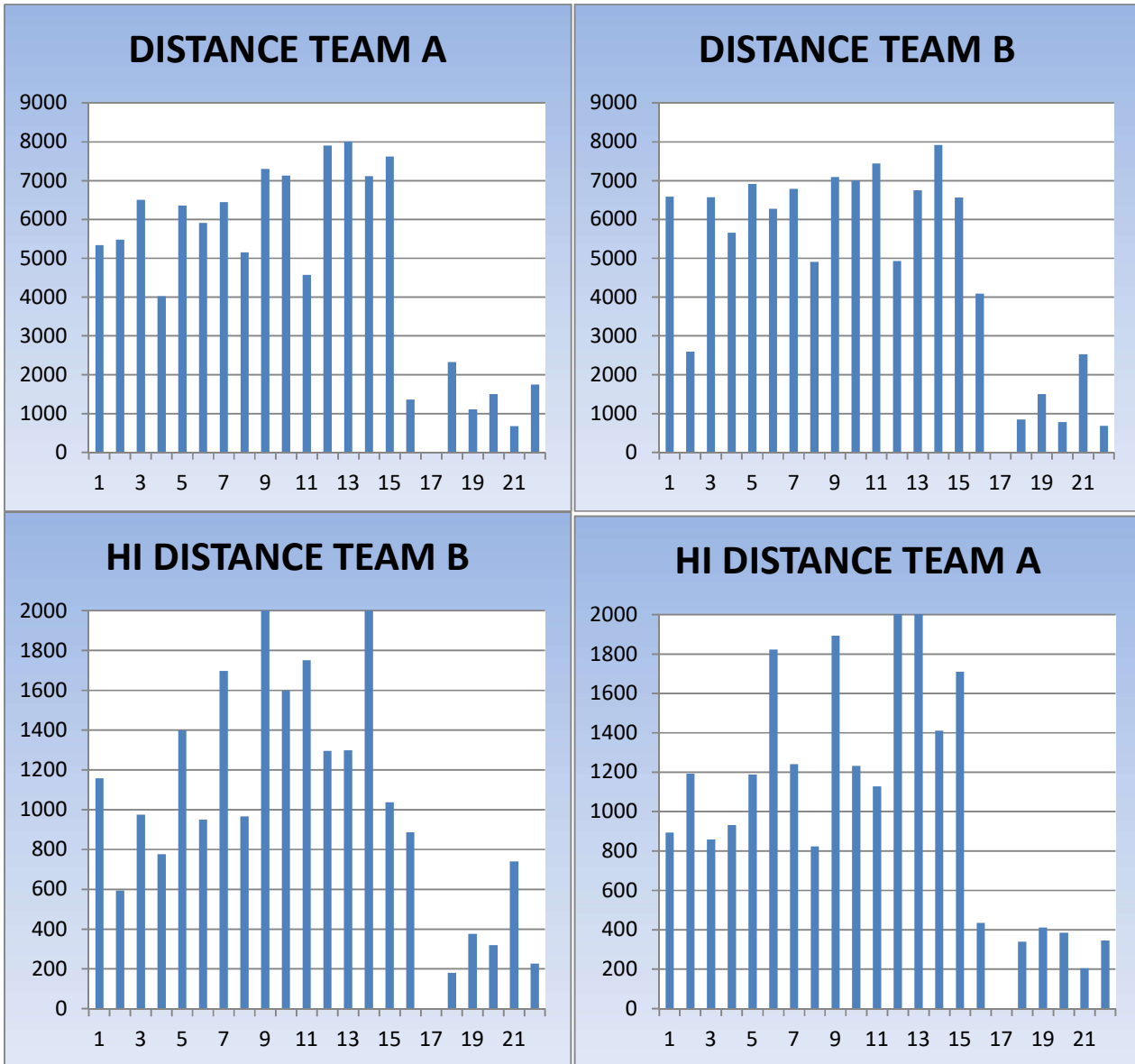


MATCH 12

		Losing Team				Winning Team				
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No
Props	1	4438	5291.76	826.59	15.62	7.37	453.91	6155.78	5433	1
	3	4802	5720.86	846.73	14.8	17.95	1228.66	6846.33	5433	3
		4620	5506.31	836.66	15.21	12.66	841.285	6501.055	5433	
Locks	4	4609	5085.71	777.25	15.28	22.79	1499.94	6581.25	5433	4
	5	5433	6549.4	1153.6	17.61	14.93	548.17	3670.38	3060	5
		5021	5817.555	965.425	16.445	18.86	1024.055	5125.815	4246.5	
Loosies	2	5433	6723.8	1239.63	18.44	16.43	713.5	4343.01	3580	2
	6	5433	6261.46	1702.01	27.18	18.09	1154.57	6383.34	5433	6
	7	5433	6589.4	1583.5	24.03	24.69	1726.4	6993.68	5433	7
	8	3713	4639.53	932.74	20.1	20.85	1311.07	6288.64	5433	8
		5003	6053.548	1364.47	22.4375	21.21	1397.34667	6555.22	5433	
In Backs	9	5433	7882.68	2221.23	28.18	23.23	1514.71	6521.18	4798	9
	10	3736	5154.72	950.36	18.44	18.14	1321.88	7286.69	5423	10
	12	5423	7150.07	1490.06	20.84	22.74	1424.25	6263.13	4758	12
	13	5433	7651.94	2064.29	26.98	21.97	1657.92	7546.7	5433	13
		5006.3	6959.853	1681.485	23.61	21.52	1479.69	6904.425	5103	
Out Backs	11	5433	7590.23	1566.54	20.64	18.75	1183.38	6311.07	5433	11
	14	4621	6675.51	1671.59	25.04	23.36	1684.42	7211.47	5433	14
	15	5433	7632.73	1689.18	22.13	21.97	1586.81	7221.5	4757	15
		5162.3	7299.49	1642.43667	22.603333	21.36	1484.87	6914.68	5207.7	

MATCH 13

TEAM A											TEAM B
No	Time	Distance	Score HI Distance	34 % WR @ HI	18 % WR @ HI	Score HI Distance	Distance	Time	No		
1	4664	5337.6	893.22	16.73	17.59	1158.12	6582.7	5447	1		
2	4348	5477.83	1193.16	21.78	22.85	594.27	2600.44	2083	2		
3	5447	6506.3	857.49	13.18	14.84	975.6	6572.42	5447	3		
4	3307	4025.22	931.61	23.14	13.74	777.25	5655.29	4755	4		
5	5447	6352.44	1189.37	18.72	20.24	1398.97	6911.66	5447	5		
6	4667	5914.78	1821.99	30.8	15.16	950.42	6271.11	5447	6		
7	5447	6447.69	1241.61	19.26	25.01	1697.46	6786.24	5447	7		
8	4354	5148.67	823.43	15.99	19.71	966.72	4904.76	4203	8		
9	5447	7301.87	1894.16	25.94	29.29	2076.78	7089.26	4934	9		
10	5447	7128.51	1232.1	17.28	22.84	1600.08	7005.8	5447	10		
11	3702	4570.69	1127.15	24.66	23.53	1750.19	7437.82	5031	11		
12	5447	7906.13	2027.38	25.64	26.3	1296	4928.52	3673	12		
13	5447	8003.59	2025.33	25.31	19.24	1299.26	6751.35	5447	13		
14	5447	7117.13	1411.81	19.84	27.74	2196.77	7920.4	5447	14		
15	5447	7622.89	1710.24	22.44	15.8	1037.12	6565.45	5447	15		
16	1147	1362.95	434.29	31.86	21.68	886.82	4090.1	3406	16		
17	0	0	0	0	0	0	0	0	17		
18	2181	2327.41	340.27	14.62	21.44	180.67	842.65	708	18		
19	800	1108.69	411.96	37.16	24.98	375.59	1503.78	1258	19		
20	1135	1501.54	385.64	25.68	41.06	319.41	777.91	549	20		
21	454	682.26	205	30.05	29.28	740.1	2527.55	1787	21		
22	1333	1743.6	346.53	19.87	32.94	226.85	688.6	451	22		
			1022.8972	21.815909	22.05727	1022.929					
	3687	4708.536	7	1	3	5	4746.08	3721			
		LOST	LOST	LOST	WON	WON	WON				

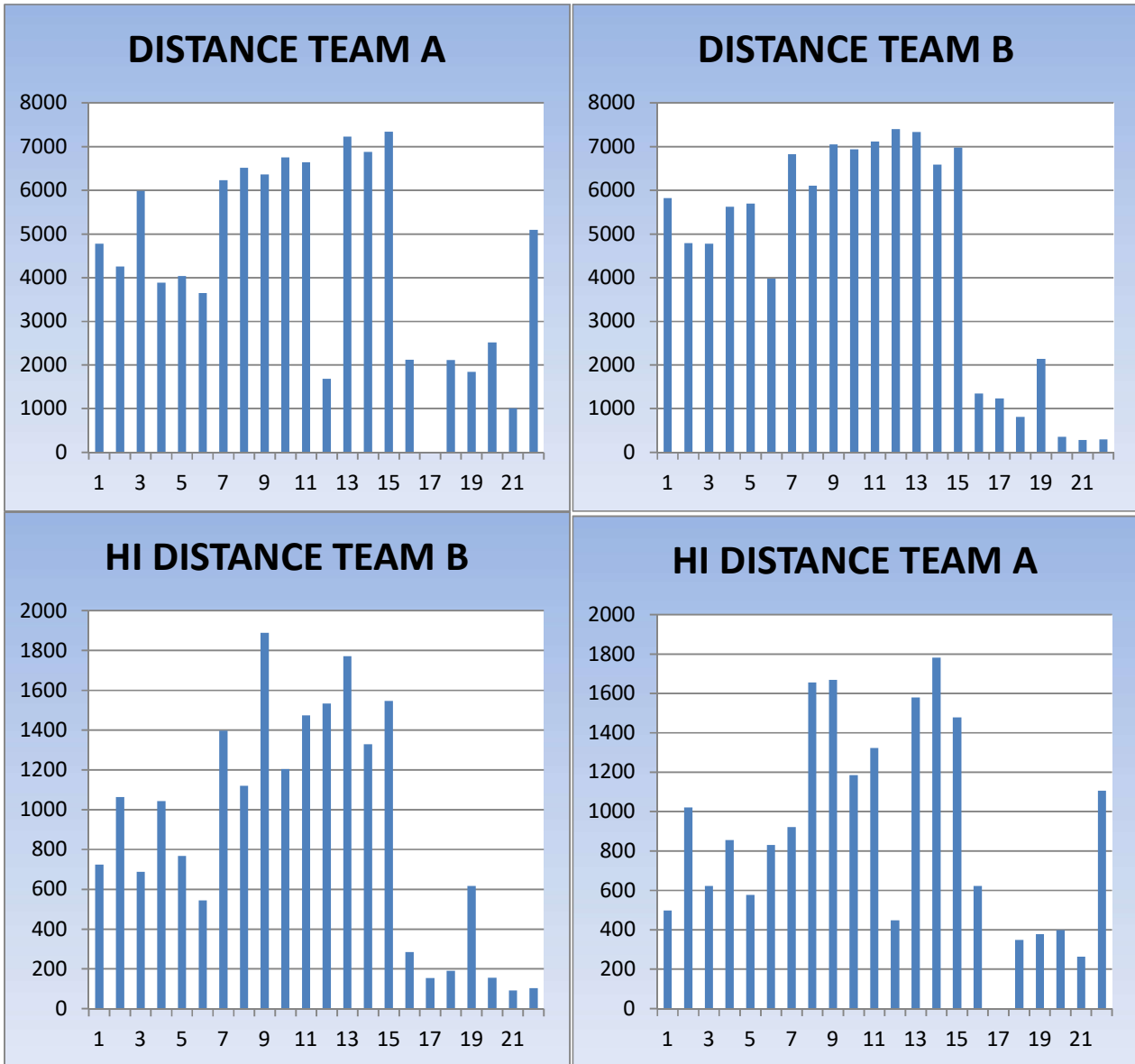


MATCH 13

		Winning Team				Losing Team				
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No
Props	1	4664	5337.6	893.22	16.73	17.59	1158.12	6582.7	5447	1
	3	5447	6506.3	857.49	13.18	14.84	975.6	6572.42	5447	3
		5055.5	5921.95	875.355	14.955	16.215	1066.86	6577.56	5447	
Locks	4	3307	4025.22	931.61	23.14	13.74	777.25	5655.29	4755	4
	5	5447	6352.44	1189.37	18.72	20.24	1398.97	6911.66	5447	5
		4377	5188.83	1060.49	20.93	16.99	1088.11	6283.475	5101	
Loosies	2	4348	5477.83	1193.16	21.78	22.85	594.27	2600.44	2083	2
	6	4667	5914.78	1821.99	30.8	15.16	950.42	6271.11	5447	6
	7	5447	6447.69	1241.61	19.26	25.01	1697.46	6786.24	5447	7
	8	4354	5148.67	823.43	15.99	19.71	966.72	4904.76	4203	8
		4704	5747.243	1270.0475	21.9575	19.96	1204.86667	5987.37	5032.3	
In Backs	9	5447	7301.87	1894.16	25.94	29.29	2076.78	7089.26	4934	9
	10	5447	7128.51	1232.1	17.28	22.84	1600.08	7005.8	5447	10
	12	5447	7906.13	2027.38	25.64	26.3	1296	4928.52	3673	12
	13	5447	8003.59	2025.33	25.31	19.24	1299.26	6751.35	5447	13
		5447	7585.025	1794.7425	23.5425	24.4175	1568.03	6443.733	4875.3	
Out Backs	11	3702	4570.69	1127.15	24.66	23.53	1750.19	7437.82	5031	11
	14	5447	7117.13	1411.81	19.84	27.74	2196.77	7920.4	5447	14
	15	5447	7622.89	1710.24	22.44	15.8	1037.12	6565.45	5447	15
		4865.3	6436.903	1416.4	22.3133333	22.356667	1661.36	7307.89	5308.3	

MATCH 14

MATCH 14										TEAM B
TEAM A	Score			10	21	Score				
No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No	
1	4526	4777.16	498.95	10.44	12.43	723.7	5824.15	5439	1	
2	3663	4258.53	1020.17	23.96	22.21	1063.54	4788.93	4154	2	
3	5439	5987.14	622.85	10.4	14.41	688.17	4776.5	4154	3	
4	3379	3884.37	855.84	22.03	18.54	1043.16	5625.14	4684	4	
5	3877	4041.8	576.92	14.27	13.49	768.35	5697.66	5439	5	
6	3020	3647.19	830.52	22.77	13.71	545.75	3980.4	3607	6	
7	5439	6234.56	922.23	14.79	20.46	1396.99	6827.06	5439	7	
8	5439	6514.55	1655.56	25.41	18.36	1120.25	6102.28	5439	8	
9	4765	6362.58	1667.59	26.21	26.81	1889.22	7047.11	5299	9	
10	5439	6756.69	1184.24	17.53	17.34	1204.32	6943.76	5439	10	
11	5439	6642.93	1322.75	19.91	20.71	1473.41	7115.69	5323	11	
12	1294	1687.82	448.47	26.57	20.7	1532.78	7404.06	5439	12	
13	5439	7227.73	1580.23	21.86	24.16	1771.17	7332.5	5286	13	
14	5439	6873.35	1782.85	25.94	20.17	1328.3	6585.89	5439	14	
15	5439	7338.47	1478.63	20.15	22.15	1545.33	6976.91	5439	15	
16	1804	2120.49	623.23	29.39	21.12	284.71	1347.92	1300	16	
17	0	0	0	0	12.48	154.41	1237.39	1293	17	
18	2086	2114.92	349.41	16.52	23.43	190.11	811.32	772	18	
19	1566	1844.38	378.13	20.5	28.8	616.34	2140.34	1870	19	
20	2424	2514.69	399.43	15.88	43.2	155.66	360.3	159	20	
21	699	1009.92	263.38	26.08	32.98	92.47	280.37	161	21	
22	4179	5092.14	1106.76	21.73	35.13	103.21	293.81	158	22	
	3672.5	4405.973	889.460909	19.6518182	21.945	895.06136	4522.704	3715.1		
		LOST	LOST	LOST	WON	WON	WON			

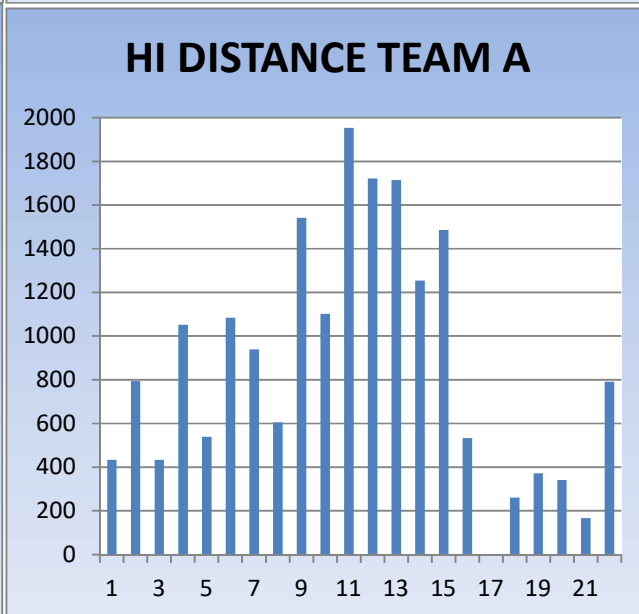
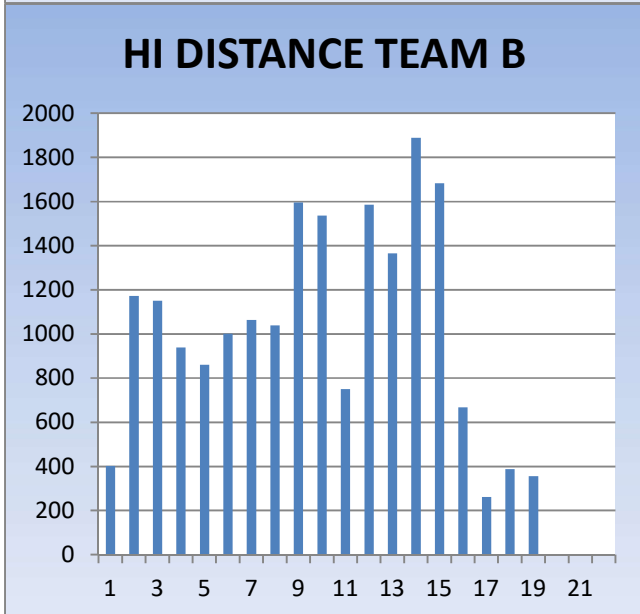
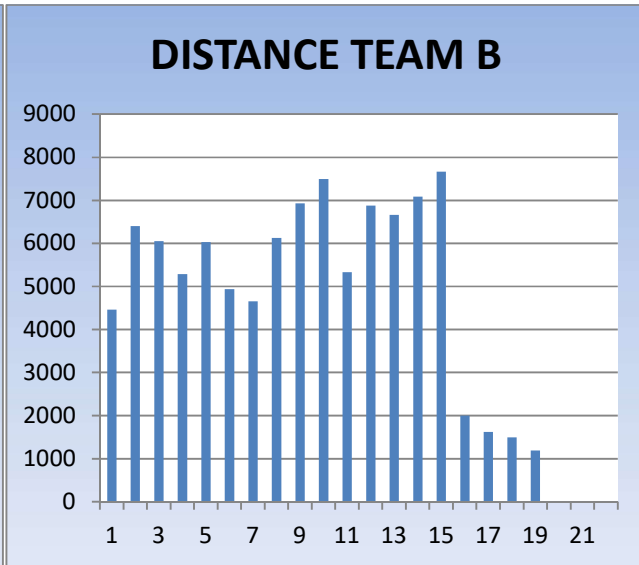
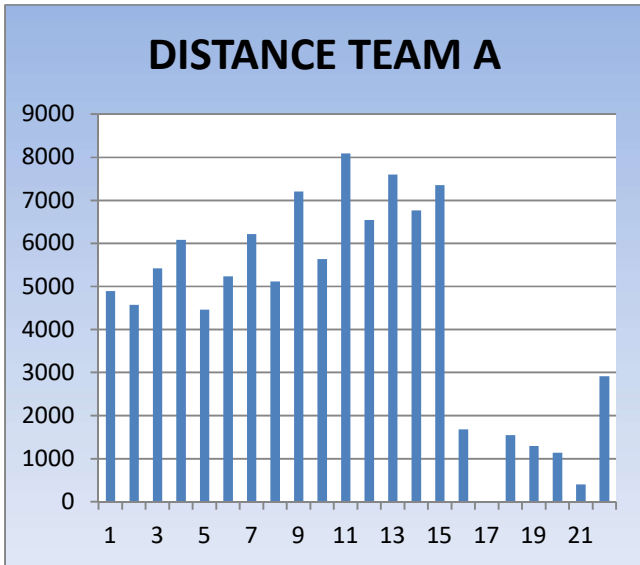


MATCH 14

		Losing Teams				Winning Teams				
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No
Props	1	4526	4777.16	498.95	10.44	12.43	723.7	5824.15	5439	1
	3	5439	5987.14	622.85	10.4	14.41	688.17	4776.5	4154	3
		4982.5	5382.15	560.9	10.42	13.42	705.935	5300.325	4796.5	
Locks	4	3379	3884.37	855.84	22.03	18.54	1043.16	5625.14	4684	4
	5	3877	4041.8	576.92	14.27	13.49	768.35	5697.66	5439	5
		3628	3963.085	716.38	18.15	16.015	905.755	5661.4	5061.5	
Loosies	2	3663	4258.53	1020.17	23.96	22.21	1063.54	4788.93	4154	2
	6	3020	3647.19	830.52	22.77	13.71	545.75	3980.4	3607	6
	7	5439	6234.56	922.23	14.79	20.46	1396.99	6827.06	5439	7
	8	5439	6514.55	1655.56	25.41	18.36	1120.25	6102.28	5439	8
		4390.3	5163.708	1107.12	21.7325	17.51	1020.99667	5636.58	4828.3	
In Backs	9	4765	6362.58	1667.59	26.21	26.81	1889.22	7047.11	5299	9
	10	5439	6756.69	1184.24	17.53	17.34	1204.32	6943.76	5439	10
	12	1294	1687.82	448.47	26.57	20.7	1532.78	7404.06	5439	12
	13	5439	7227.73	1580.23	21.86	24.16	1771.17	7332.5	5286	13
		4234.3	5508.705	1220.1325	23.0425	22.2525	1599.3725	7181.858	5365.8	
Out Backs	11	5439	6642.93	1322.75	19.91	20.71	1473.41	7115.69	5323	11
	14	5439	6873.35	1782.85	25.94	20.17	1328.3	6585.89	5439	14
	15	5439	7338.47	1478.63	20.15	22.15	1545.33	6976.91	5439	15
		5439	6951.583	1528.07667	22	21.01	1449.01333	6892.83	5400.3	

MATCH 15

TEAM A				Score	17	3	Score			TEAM B	
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No	
	1	4713	4889.81	433.05	8.86	9.02	401.83	4456.04	3949	1	
	2	4044	4571.7	793.73	17.36	18.31	1172.47	6402.25	5484	2	
	3	4819	5417.65	433.02	7.99	19.01	1150.67	6051.46	5484	3	
	4	5484	6080.46	1052.25	17.31	17.79	939.45	5279.61	4542	4	
	5	4043	4456.24	538.83	12.09	14.29	860.99	6024.38	5484	5	
	6	4393	5229.04	1085.02	20.75	20.28	1000.37	4933.38	4260	6	
	7	5484	6217.62	939.66	15.11	22.83	1062.65	4654.59	3951	7	
	8	4678	5116.19	605.02	11.83	16.96	1039.56	6129.98	5484	8	
	9	5297	7210.06	1541.17	21.38	23.03	1595.47	6929.15	5484	9	
	10	4337	5639.77	1101.85	19.54	20.49	1536.69	7499.84	5484	10	
	11	5484	8089.62	1953.42	24.15	14.07	750	5330.93	5454	11	
	12	4828	6539.4	1721.19	26.32	23.06	1585.48	6875.97	5484	12	
	13	5474	7599.03	1714.44	22.56	20.49	1365.83	6666.18	5484	13	
	14	5484	6764.31	1255.03	18.55	26.67	1888.54	7082.19	5484	14	
	15	5474	7353.04	1485.12	20.2	21.96	1682.42	7660.95	5484	15	
	16	1469	1678.25	532.65	31.74	33.4	667.97	1999.7	1566	16	
	17	0	0	0	0	16.12	261.1	1619.88	1559	17	
	18	1468	1549.08	260.9	16.84	25.99	389.01	1496.93	1233	18	
	19	1118	1292.45	372.42	28.82	29.94	355.81	1188.47	960	19	
	20	818	1138.82	342.44	30.07	0	0	0	0	20	
	21	212	403.25	166.61	41.32	0	0	0	0	21	
	22	1881	2918.91	791.4	27.11	0	0	0	0	22	
		3681.9	4552.486	869.055455	19.995455	17.8959091	895.74136	4467.358	3741.5		
			WON	LOST	WON	LOST	WON	LOST			

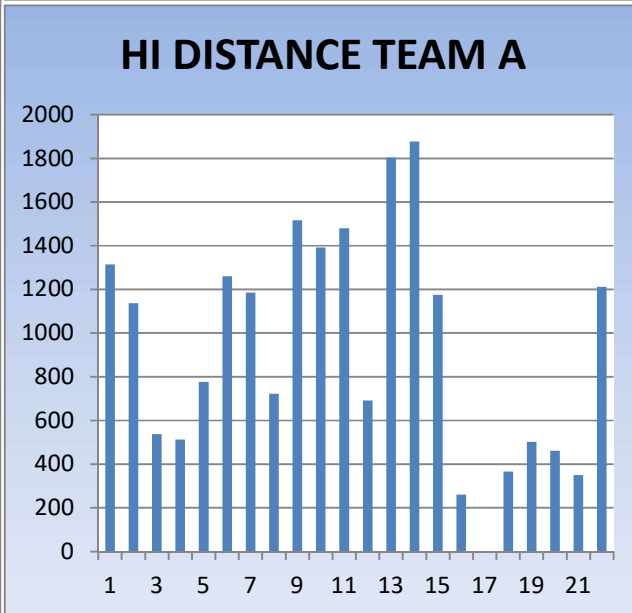
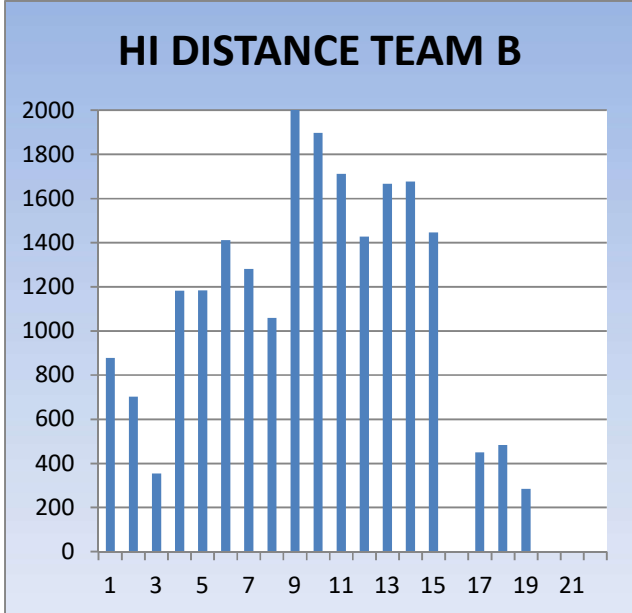
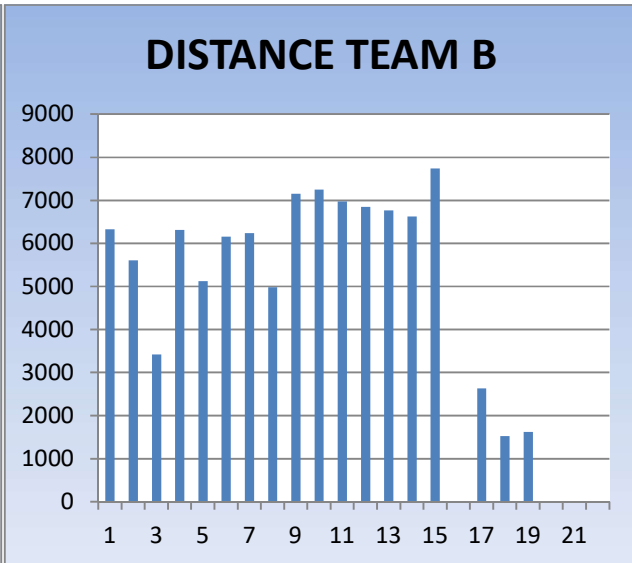
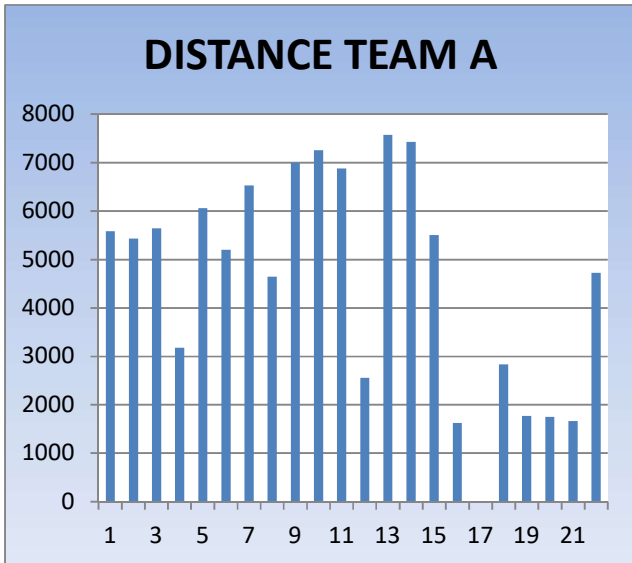


MATCH 15

		Winning Team				Losing Team				
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No
Props	1	4713	4889.81	433.05	8.86	9.02	401.83	4456.04	3949	1
	3	4819	5417.65	433.02	7.99	19.01	1150.67	6051.46	5484	3
		4766	5153.73	433.035	8.425	14.015	776.25	5253.75	4716.5	
Locks	4	5484	6080.46	1052.25	17.31	17.79	939.45	5279.61	4542	4
	5	4043	4456.24	538.83	12.09	14.29	860.99	6024.38	5484	5
		4763.5	5268.35	795.54	14.7	16.04	900.22	5651.995	5013	
Loosies	2	4044	4571.7	793.73	17.36	18.31	1172.47	6402.25	5484	2
	6	4393	5229.04	1085.02	20.75	20.28	1000.37	4933.38	4260	6
	7	5484	6217.62	939.66	15.11	22.83	1062.65	4654.59	3951	7
	8	4678	5116.19	605.02	11.83	16.96	1039.56	6129.98	5484	8
		4649.8	5283.638	855.8575	16.2625	20.023333	1034.19333	5239.317	4565	
In Backs	9	5297	7210.06	1541.17	21.38	23.03	1595.47	6929.15	5484	9
	10	4337	5639.77	1101.85	19.54	20.49	1536.69	7499.84	5484	10
	12	4828	6539.4	1721.19	26.32	23.06	1585.48	6875.97	5484	12
	13	5474	7599.03	1714.44	22.56	20.49	1365.83	6666.18	5484	13
		4984	6747.065	1519.6625	22.45	21.7675	1520.8675	6992.785	5484	
Out Backs	11	5484	8089.62	1953.42	24.15	14.07	750	5330.93	5454	11
	14	5484	6764.31	1255.03	18.55	26.67	1888.54	7082.19	5484	14
	15	5474	7353.04	1485.12	20.2	21.96	1682.42	7660.95	5484	15
		5480.7	7402.323	1564.52333	20.966667	20.9	1440.32	6691.357	5474	

MATCH 16

TEAM A				Score	27	26	Score			TEAM B	
No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No		
	1	4671	5580.83	1314.57	23.56	13.9	878.58	6322.28	5653	1	
	2	4762	5436.42	1137.8	20.93	12.52	702.53	5610.08	5653	2	
	3	5653	5638.61	536.96	9.52	10.35	354.52	3425.02	2801	3	
	4	2576	3175.22	512.3	16.13	18.75	1183.61	6312.17	5653	4	
	5	5653	6056.33	776.27	12.82	23.13	1184.37	5120.57	4047	5	
	6	3934	5200.9	1260.82	24.24	22.92	1411.09	6157.64	5653	6	
	7	5653	6532.3	1185.07	18.14	20.53	1281.48	6241.44	5653	7	
	8	3751	4646.58	722.26	15.54	21.29	1059.51	4977.31	4207	8	
	9	5653	6996.63	1516.51	21.67	29.87	2135.08	7148.65	5653	9	
	10	5653	7256.24	1391.95	19.18	26.16	1896.79	7251.38	5653	10	
	11	5653	6882.99	1480.34	21.51	24.56	1712.38	6972.7	5653	11	
	12	1770	2562.01	691.43	26.99	20.85	1427.19	6844	5653	12	
	13	5653	7574.06	1803.12	23.81	24.64	1667.2	6767.01	5653	13	
	14	5653	7428.1	1876.23	25.26	25.32	1676.82	6622.27	5653	14	
	15	4346	5508.79	1175.33	21.34	18.67	1446.43	7745.41	5653	15	
	16	1928	1627.1	259.79	15.97	0	0	0	0	16	
	17	0	0	0	0	17.12	450.42	2631.02	2867	17	
	18	3077	2838.08	366.22	12.9	31.6	483.32	1529.55	1478	18	
	19	1754	1767.16	502.31	28.42	17.63	285.11	1617.43	1635	19	
	20	1927	1747.44	461.01	26.38	0	0	0	0	20	
	21	1325	1668.23	350.91	21.03	0	0	0	0	21	
	22	3902	4726.28	1212.44	25.65	0	0	0	0	22	
		3861.2	4584.105	933.347273	19.590455	17.264091	965.29227	4513.451	3857.8		
			WON	LOST	WON	LOST	WON	LOST			

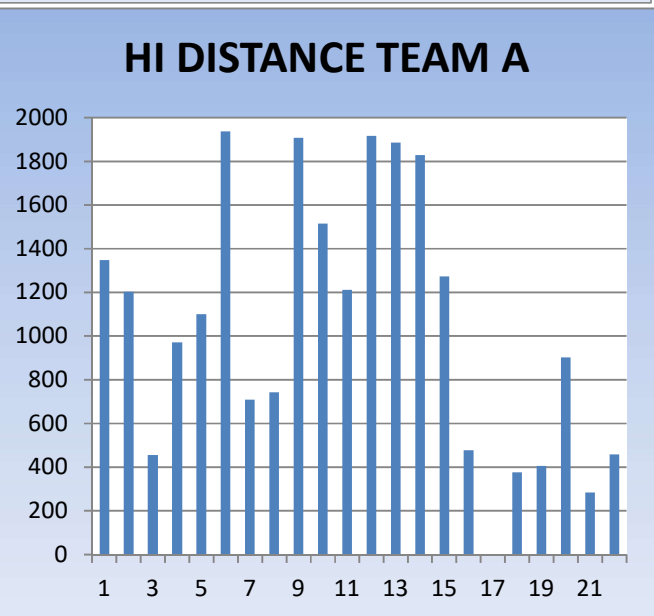
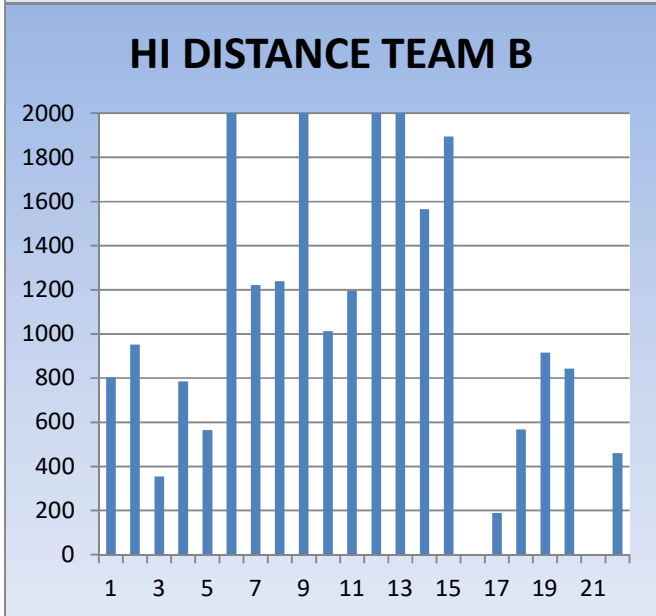
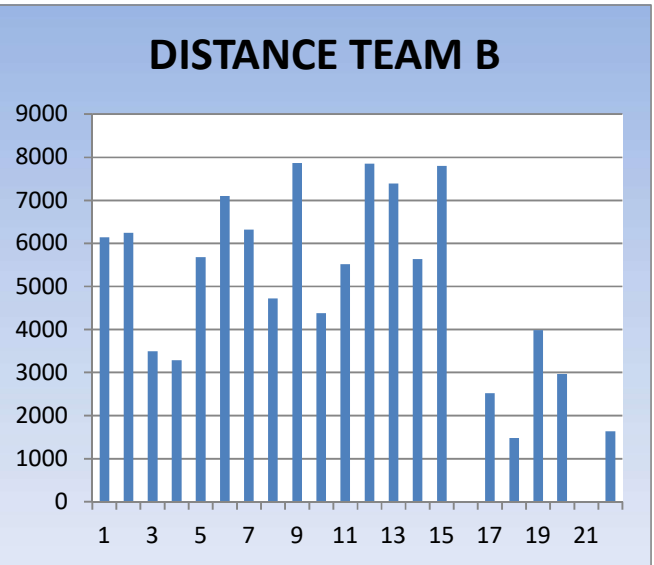
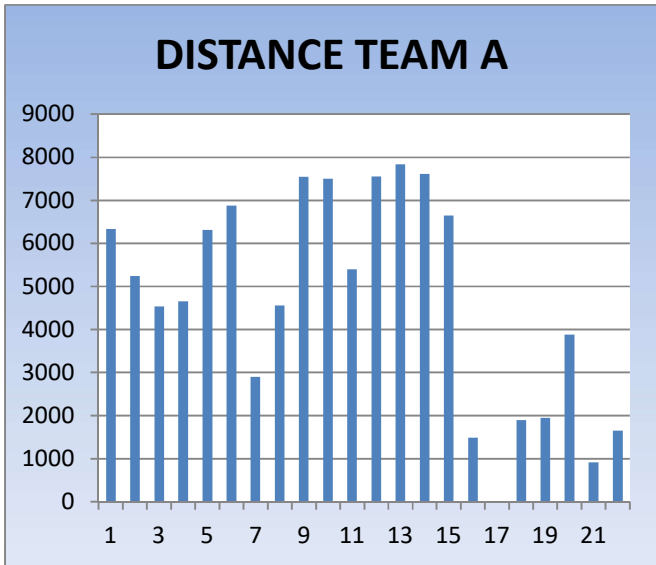


MATCH 16

		Winning Team				Losing Team				
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No
Props	1	4671	5580.83	1314.57	23.56	13.9	878.58	6322.28	5653	1
	3	5653	5638.61	536.96	9.52	10.35	354.52	3425.02	2801	3
		5162	5609.72	925.765	16.54	12.125	616.55	4873.65	4227	
Locks	4	2576	3175.22	512.3	16.13	18.75	1183.61	6312.17	5653	4
	5	5653	6056.33	776.27	12.82	23.13	1184.37	5120.57	4047	5
		4114.5	4615.775	644.285	14.475	20.94	1183.99	5716.37	4850	
Loosies	2	4762	5436.42	1137.8	20.93	12.52	702.53	5610.08	5653	2
	6	3934	5200.9	1260.82	24.24	22.92	1411.09	6157.64	5653	6
	7	5653	6532.3	1185.07	18.14	20.53	1281.48	6241.44	5653	7
	8	3751	4646.58	722.26	15.54	21.29	1059.51	4977.31	4207	8
		4525	5454.05	1076.4875	19.7125	21.58	1250.69333	5792.13	5171	
In Backs	9	5653	6996.63	1516.51	21.67	29.87	2135.08	7148.65	5653	9
	10	5653	7256.24	1391.95	19.18	26.16	1896.79	7251.38	5653	10
	12	1770	2562.01	691.43	26.99	20.85	1427.19	6844	5653	12
	13	5653	7574.06	1803.12	23.81	24.64	1667.2	6767.01	5653	13
		4682.3	6097.235	1350.7525	22.9125	25.38	1781.565	7002.76	5653	
Out Backs	11	5653	6882.99	1480.34	21.51	24.56	1712.38	6972.7	5653	11
	14	5653	7428.1	1876.23	25.26	25.32	1676.82	6622.27	5653	14
	15	4346	5508.79	1175.33	21.34	18.67	1446.43	7745.41	5653	15
		5217.3	6606.627	1510.63333	22.7033333	22.85	1611.87667	7113.46	5653	

**MATCH
17**

TEAM A				Score	33	3	Score				TEAM B
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No	
	1	5340	6334.36	1348.53	21.29	13.09	804.83	6146.24	5340	1	
	2	4249	5241.6	1203.67	22.96	15.25	952.15	6244.72	5340	2	
	3	4508	4533.61	456	10.06	10.15	355.07	3497.95	3142	3	
	4	3822	4654.31	970.96	20.86	23.89	785.44	3288.36	2496	4	
	5	5340	6312.99	1099.89	17.42	9.95	565.45	5683.1	4978	5	
	6	5340	6874.45	1938.02	28.19	29.77	2113.57	7100.1	5340	6	
	7	2234	2900.94	710.28	24.48	19.33	1221.59	6320.35	5340	7	
	8	3825	4558.93	742.14	16.28	26.27	1239.45	4718.84	3637	8	
	9	5340	7546.09	1907.87	25.28	38.96	3063.21	7863.23	5340	9	
	10	5340	7505.19	1516.05	20.2	23.12	1011.84	4375.54	3218	10	
	11	4191	5395.99	1211.69	22.46	21.7	1196.13	5511.11	4552	11	
	12	5340	7556.88	1916.72	25.36	27.33	2145.01	7849.93	5340	12	
	13	5340	7839.91	1886.79	24.07	27.12	2003.54	7387.63	5340	13	
	14	5340	7615.56	1828.09	24	27.76	1565.72	5640.7	4430	14	
	15	4730	6650.82	1272.7	19.14	24.28	1894.06	7800.1	5340	15	
	16	1132	1488.28	476.7	32.03	0	0	0	0	16	
	17	0	0	0	0	7.51	188.93	2516.84	2244	17	
	18	1544	1891.75	376.54	19.9	38.38	568.07	1479.96	983	18	
	19	1544	1947.11	406.38	20.87	22.97	916.34	3988.78	3267	19	
	20	3112	3877.71	902.71	23.28	28.44	842.94	2963.84	2155	20	
	21	638	911.98	284.21	31.16	0	0	0	0	21	
	22	1164	1647.81	458.06	27.8	28.13	459.98	1634.91	929	22	
		3609.7	4694.83	1041.54545	21.685909	21.0636364	1086.06	4636.92	3579.6		
			WON	LOST	WON	LOST	WON	LOST			

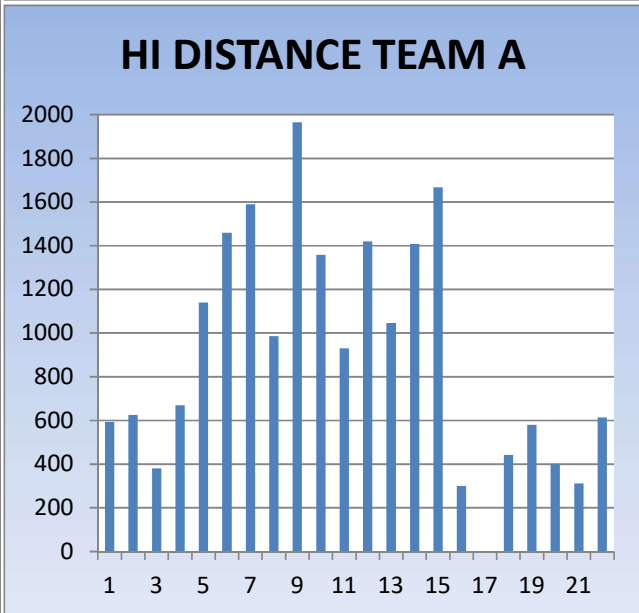
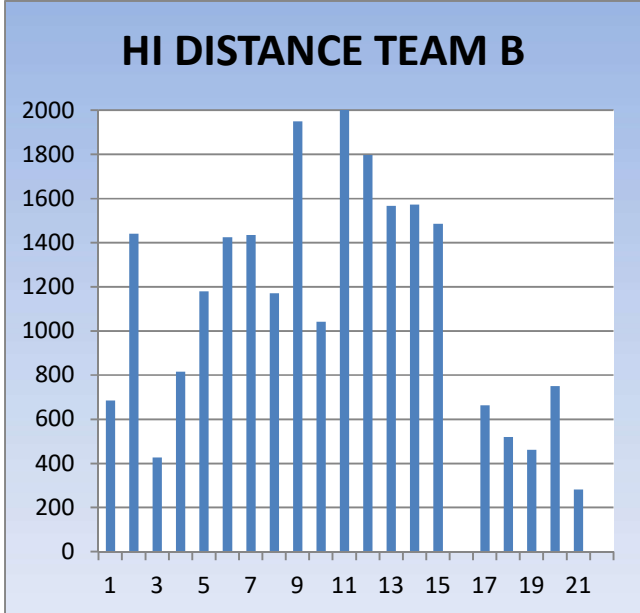
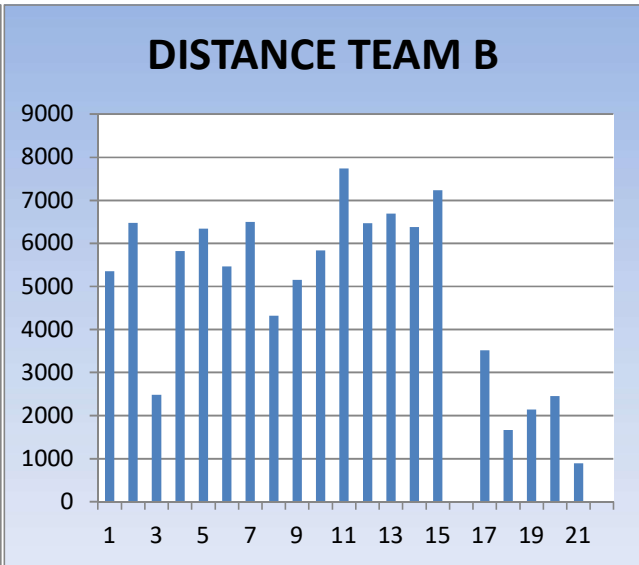
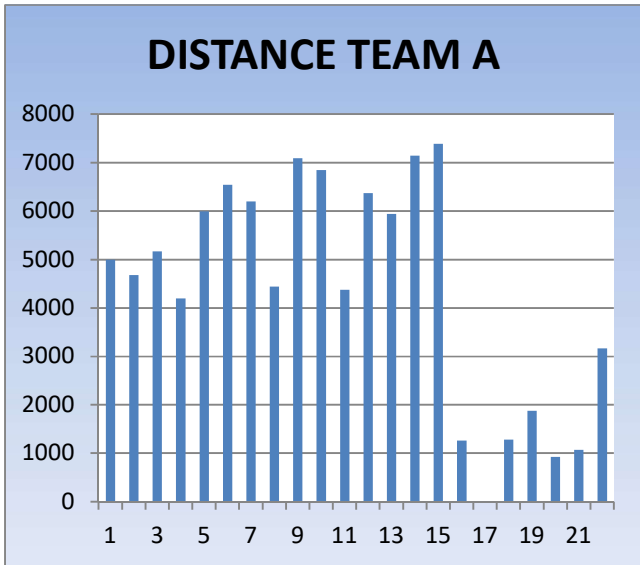


MATCH 17

		Winning Team				Losing Team				
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No
Props	1	5340	6334.36	1348.53	21.29	13.09	804.83	6146.24	5340	1
	3	4508	4533.61	456	10.06	10.15	355.07	3497.95	3142	3
		4924	5433.985	902.265	15.675	11.62	579.95	4822.095	4241	
Locks	4	3822	4654.31	970.96	20.86	23.89	785.44	3288.36	2496	4
	5	5340	6312.99	1099.89	17.42	9.95	565.45	5683.1	4978	5
		4581	5483.65	1035.425	19.14	16.92	675.445	4485.73	3737	
Loosies	2	4249	5241.6	1203.67	22.96	15.25	952.15	6244.72	5340	2
	6	5340	6874.45	1938.02	28.19	29.77	2113.57	7100.1	5340	6
	7	2234	2900.94	710.28	24.48	19.33	1221.59	6320.35	5340	7
	8	3825	4558.93	742.14	16.28	26.27	1239.45	4718.84	3637	8
		3912	4893.98	1148.5275	22.9775	25.123333	1524.87	6046.43	4772.3	
In Backs	9	5340	7546.09	1907.87	25.28	38.96	3063.21	7863.23	5340	9
	10	5340	7505.19	1516.05	20.2	23.12	1011.84	4375.54	3218	10
	12	5340	7556.88	1916.72	25.36	27.33	2145.01	7849.93	5340	12
	13	5340	7839.91	1886.79	24.07	27.12	2003.54	7387.63	5340	13
		5340	7612.018	1806.8575	23.7275	29.1325	2055.9	6869.083	4809.5	
Out Backs	11	4191	5395.99	1211.69	22.46	21.7	1196.13	5511.11	4552	11
	14	5340	7615.56	1828.09	24	27.76	1565.72	5640.7	4430	14
	15	4730	6650.82	1272.7	19.14	24.28	1894.06	7800.1	5340	15
		4753.7	6554.123	1437.49333	21.8666667	24.58	1551.97	6317.303	4774	

MATCH 18

MATCH 18											
TEAM A				Score	30	8	Score				TEAM B
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No	
	1	4793	4997.88	592.98	11.86	12.79	684.52	5351.82	5486	1	
	2	4437	4675.46	625.44	13.38	22.26	1441.37	6474.45	5486	2	
	3	5486	5162.72	380.39	7.37	17.16	426.5	2485.07	2361	3	
	4	4458	4195.15	670.05	15.97	14.03	815.81	5815.4	5486	4	
	5	5486	5993.35	1140.64	19.03	18.62	1179.65	6336.85	5486	5	
	6	5486	6543.46	1459.92	22.31	26.07	1424.72	5464.83	4198	6	
	7	5486	6200	1589.59	25.64	22.08	1434.41	6496.6	5486	7	
	8	4027	4439.85	986.53	22.22	27.11	1170.4	4317.86	3657	8	
	9	4906	7091.5	1965.08	27.71	37.84	1949.18	5151.13	3651	9	
	10	5486	6843.38	1358.41	19.85	17.85	1042.62	5841.17	4829	10	
	11	3284	4375.95	930.25	21.26	28.75	2223.28	7733.45	5486	11	
	12	5486	6367.85	1419.77	22.3	27.78	1796.65	6466.84	5486	12	
	13	4730	5945.02	1046.12	17.6	23.41	1567.14	6695.21	5486	13	
	14	5486	7145.37	1408.89	19.72	24.65	1572.2	6377.87	5486	14	
	15	5486	7391.22	1667.26	22.56	20.51	1484.86	7239.55	5486	15	
	16	1080	1258.12	300.78	23.91	0	0	0	0	16	
	17	0	0	0	0	18.86	663.38	3518.14	3233	17	
	18	1048	1281.51	442.39	34.52	31.16	519.53	1667.04	1306	18	
	19	1537	1877.5	580.15	30.9	21.56	461.43	2140.35	1841	19	
	20	602	925.01	401.06	43.36	30.62	751.39	2453.86	1840	20	
	21	795	1067.65	312.16	29.24	31.63	282.18	892.25	675	21	
	22	2214	3163.23	614.8	19.44	0	0	0	0	22	
		3718.1	4406.417	904.211818	21.3704545	21.579091	1040.51	4496.352	3747.8		
			LOST	LOST	LOST	WON	WON	WON			



MATCH 18

		Winning Team				Losing Team				
	No	Time	Distance	HI Distance	% WR @ HI	% WR @ HI	HI Distance	Distance	Time	No
Props	1	4793	4997.88	592.98	11.86	12.79	684.52	5351.82	5486	1
	3	5486	5162.72	380.39	7.37	17.16	426.5	2485.07	2361	3
		5139.5	5080.3	486.685	9.615	14.975	555.51	3918.445	3923.5	
Locks	4	4458	4195.15	670.05	15.97	14.03	815.81	5815.4	5486	4
	5	5486	5993.35	1140.64	19.03	18.62	1179.65	6336.85	5486	5
		4972	5094.25	905.345	17.5	16.325	997.73	6076.125	5486	
Loosies	2	4437	4675.46	625.44	13.38	22.26	1441.37	6474.45	5486	2
	6	5486	6543.46	1459.92	22.31	26.07	1424.72	5464.83	4198	6
	7	5486	6200	1589.59	25.64	22.08	1434.41	6496.6	5486	7
	8	4027	4439.85	986.53	22.22	27.11	1170.4	4317.86	3657	8
		4859	5464.693	1165.37	20.8875	25.086667	1343.17667	5426.43	4447	
In Backs	9	4906	7091.5	1965.08	27.71	37.84	1949.18	5151.13	3651	9
	10	5486	6843.38	1358.41	19.85	17.85	1042.62	5841.17	4829	10
	12	5486	6367.85	1419.77	22.3	27.78	1796.65	6466.84	5486	12
	13	4730	5945.02	1046.12	17.6	23.41	1567.14	6695.21	5486	13
		5152	6561.938	1447.345	21.865	26.72	1588.8975	6038.588	4863	
Out Backs	11	3284	4375.95	930.25	21.26	28.75	2223.28	7733.45	5486	11
	14	5486	7145.37	1408.89	19.72	24.65	1572.2	6377.87	5486	14
	15	5486	7391.22	1667.26	22.56	20.51	1484.86	7239.55	5486	15
		4752	6304.18	1335.46667	21.18	24.636667	1760.11333	7116.957	5486	

GROUND	Winning Team Front row					GROUND	Losing Team Front row				
	No	Time	Distance	HI Distance	% WR @ HI		No	Time	Distance	HI Distance	% WR @ HI
H	1	3844	4273.02	507.33	11.87	A	1	3135	3229.98	368.38	11.41
H	3	3834	4157.19	488.34	11.75	A	3	5714	5269.6	290.49	5.51
A	1	3512	4322.97	722.9	16.72	H	1	5409	6268.81	1040.31	16.6
A	3	5409	6426.37	1063.22	16.54	H	3	2073	2511.83	279.25	11.12
A	1	3444	3866.91	340.61	8.81	H	1	5525	5436.69	394.46	7.26
A	3	3444	3567.42	203.16	5.69	H	3	2815	2846.96	120.63	4.24
H	1	5552	5204.73	371.39	7.14	A	1	5541	5913.12	698.48	11.81
H	3	3444	3287.34	202.26	6.15	A	3	5217	5188.99	335.7	6.47
A	1	5634	5247.34	285.34	5.44	H	1	5634	5409.3	545.68	10.09
A	3	4973	5213.54	547.63	10.5	H	3	4804	5124.86	688.27	13.43
H	1	4365	4587.02	391	8.52	A	1	3795	4498.23	552.57	12.28
H	3	4709	5127.63	418.51	8.16	A	3	5323	6087.56	783.84	12.88
H	1	3884	3824.99	447.7	11.7	A	1	4272	4213.65	675.19	16.02
H	3	5769	5682.4	651.81	11.47	A	3	5871	5182.19	476.06	9.19
H	1	4020	4308.36	430.95	10.00	A	1	5607	6798.22	1479.52	21.76
H	3	5607	6279.35	487.78	7.77	A	3	3020	3345.99	633.09	18.92
A	1	5354	6265.02	1281.37	20.45	H	1	5354	5720.98	892.85	15.61
A	3	5354	6367.95	1450.71	22.78	H	3	2587	2949.94	546.70	18.53
H	1	4338	4456.35	617.72	13.86	A	1	5462	5879.60	1037.25	17.64
H	3	5462	5355.30	679.84	12.69	A	3	5039	4668.77	413.40	8.85
H	1	4744	5052.29	299.95	5.94	A	1	5652	6062.55	646.13	10.66
H	3	5037	6232.49	705.06	11.31	A	3	5282	6232.35	957.79	15.37
A	1	5433	6155.78	453.91	7.37	H	1	4438	5291.76	826.59	15.62
A	3	5433	6846.33	1228.66	17.95	H	3	4802	5720.86	846.73	14.8
H	1	4664	5337.6	893.22	16.73	A	1	5447	6582.7	1158.12	17.59
H	3	5447	6506.3	857.49	13.18	A	3	5447	6572.42	975.6	14.84
A	1	5439	5824.15	723.7	12.43	H	1	4526	4777.16	498.95	10.44
A	3	4154	4776.5	688.17	14.41	H	3	5439	5987.14	622.85	10.4
H	1	4713	4889.81	433.05	8.86	A	1	3949	4456.04	401.83	9.02
H	3	4819	5417.65	433.02	7.99	A	3	5484	6051.46	1150.67	19.01
H	1	4671	5580.83	1314.57	23.56	A	1	5653	6322.28	878.58	13.9
H	3	5653	5638.61	536.96	9.52	A	3	2801	3425.02	354.52	10.35
H	1	5340	6334.36	1348.53	21.29	A	1	5340	6146.24	804.83	13.09
H	3	4508	4533.61	456	10.06	A	3	3142	3497.95	355.07	10.15
H	1	4793	4997.88	592.98	11.86	A	1	5486	5351.82	684.52	12.79
H	3	5486	5162.72	380.39	7.37	A	3	2361	2485.07	426.5	17.16
		4786	5197.448	637.089722	11.8847355			4651.28	5041.89	662.2611	12.911535

GROUND	Winning Team Locks					GROUND	Losing Team Locks				
	No	Time	Distance	HI Distance	% WR @ HI		No	Time	Distance	HI Distance	% WR @ HI
H	4	5041	5508.23	951.96	17.28	A	4	3129	2980.66	358.93	12.04
H	5	5232	6025.7	1095.27	18.18	A	5	5714	6209.54	919.72	14.81
A	4	4819	6331.32	1221.59	19.29	H	4	5409	6539.55	1111.47	17
A	5	5409	6129.64	1033.72	16.86	H	5	5409	6719.57	1136.28	16.91
A	4	4701	4961.78	487.36	9.82	H	4	4695	5005.09	407.53	8.14
A	5	5525	5937.06	844.12	14.22	H	5	3367	3853.06	346.56	8.99
H	4	4063	4251.23	500.53	11.77	A	4	4647	4799.79	782.45	16.3
H	5	5552	5943.5	837.9	14.1	A	5	3150	3442.09	782.8	22.74
A	4	5634	5865.34	798.08	13.61	H	4	5317	5786.32	798.43	13.8
A	5	3524	4030.67	873.79	21.68	H	5	5634	6423.22	1157.93	18.03
H	4	4152	4652.12	698.73	15.02	A	4	4764	6248.47	1992.59	31.89
H	5	5313	6182.89	1079.93	17.47	A	5	4092	4657.71	816.07	17.52
H	4	4346	4176.41	771.2	18.47	A	4	4131	3718.4	584.13	15.71
H	5	5871	5442.16	577.88	10.62	A	5	5871	5923.32	902.39	15.23
H	4	5607	6800.82	1158.39	17.03	A	4	5607	6594.22	992.13	15.05
H	5	5001	6224.29	1173.72	18.86	A	5	4241	5056.04	626.46	12.39
A	4	4024	4783.24	823.14	17.21	H	4	5354	6289.74	1186.13	18.86
A	5	5354	6293.26	1326.07	21.07	H	5	5354	6101.06	1248.55	20.46
H	4	5462	6098.22	1342.04	22.01	A	4	5462	5302.35	749.65	14.14
H	5	5462	5592.38	817.11	14.61	A	5	5462	6096.96	1118.72	18.35
H	4	4187	4755.31	659.85	13.88	A	4	5652	6035.68	796.14	13.19
H	5	5652	6534.74	1103.89	16.89	A	5	5652	6563.98	1361.77	20.75
A	4	5433	6581.25	1499.94	22.79	H	4	4609	5085.71	777.25	15.28
A	5	3060	3670.38	548.17	14.93	H	5	5433	6549.4	1153.6	17.61
H	4	3307	4025.22	931.61	23.14	A	4	4755	5655.29	777.25	13.74
H	5	5447	6352.44	1189.37	18.72	A	5	5447	6911.66	1398.97	20.24
A	4	4684	5625.14	18.54	18.54	H	4	3379	3884.37	855.84	22.03
A	5	5439	5697.66	13.49	13.49	H	5	3877	4041.8	576.92	14.27
H	4	5484	6080.46	1052.25	17.31	A	4	4542	5279.61	939.45	17.79
H	5	4043	4456.24	538.83	12.09	A	5	5484	6024.38	860.99	14.29
H	4	2576	3175.22	512.3	16.13	A	4	5653	6312.17	1183.61	18.75
H	5	5653	6056.33	776.27	12.82	A	5	4047	5120.57	1184.37	23.13
H	4	3822	4654.31	970.96	20.86	A	4	2496	3288.36	785.44	23.89
H	5	5340	6312.99	1099.89	17.42	A	5	4978	5683.1	565.45	9.95
H	4	4458	4195.15	670.05	15.97	A	4	5486	5815.4	815.81	14.03
H	5	5486	5993.35	1140.64	19.03	A	5	5486	6336.85	1179.65	18.62
		4837.8	5427.679	864.960555	16.7552311			4827.3	5453.763	923.095277	16.8310982

GROUND	Winning Team Loosies					GROUND	Losing Team Loosies				
	No	Time	Distance	HI Distance	% WR @ HI		No	Time	Distance	HI Distance	% WR @ HI
H	2	5714	6516.76	1223.39	18.77	A	2	3839	4241.59	706.39	16.65
H	6	5714	6286.59	1259.51	20.03	A	6	3868	4609.17	828.98	17.99
H	7	4404	5190.8	1119.56	21.57	A	7	5714	6286.63	1564.34	24.88
H	8	5714	7254.99	1509.1	20.8	A	8	5714	6175.16	969.64	15.7
A	2	4790	6008.56	1431.8	23.83	H	2	4146	5468.16	1226.33	22.43
A	6	2728	3029.52	473.66	15.63	H	6	3334	4444.83	1121.23	25.23
A	7	5409	7112.29	1376.59	19.36	H	7	5409	6458.1	1191.94	18.46
A	8	5409	6757.14	1575.44	23.32	H	8	2728	3432	887.06	25.85
A	2	5525	6034.46	1075.35	17.82	H	2	2815	3045.18	388.98	12.77
A	6	4198	4760.87	1038.32	21.81	H	6	2815	3246.27	705.94	21.75
A	7	5471	6044.7	1385.38	22.92	H	7	5525	6021.83	960.03	15.94
A	8	5525	6748.51	1445.1	21.41	H	8	5071	5954.73	1596.39	26.81
H	2	3597	3703.43	512.85	13.85	A	2	5552	5748.33	1014.97	17.66
H	6	5552	6125.51	1395.67	22.78	A	6	5552	6071.57	1264.31	20.82
H	7	5552	6114.95	843.38	13.79	A	7	5552	5972.25	1304.08	21.84
H	8	5552	5989.41	1037.95	17.33	A	8	5552	6258.45	1296.03	20.71
A	2	4068	4342.12	571.68	13.17	H	2	5634	5874.69	702.41	11.96
A	6	5634	5395.64	722.77	13.4	H	6	5624	6797.35	1601.79	23.56
A	7	5624	5925.37	1094.73	18.48	H	7	5634	6351.82	1111.58	17.5
A	8	4739	4971.53	829.55	16.69	H	8	4247	4842.22	782.77	16.17
H	2	4581	5354.15	1042.04	19.46	A	2	4591	5271.73	795.03	15.08
H	6	5323	6373.68	1675.74	26.29	A	6	5323	6681.04	1315.6	19.69
H	7	4617	5569.86	1160.83	20.84	A	7	5323	6656.33	1716.22	25.78
H	8	5323	6588.16	1111.47	16.87	A	8	5323	6645.99	1304.11	19.62
H	2	3695	4082.04	928.63	22.75	A	2	4574	4493.15	685.29	15.25
H	6	3621	3876.12	858.3	22.14	A	6	5871	6031.52	1027.01	17.03
H	7	5871	6156.53	1182.82	19.21	A	7	3399	3800.67	876.02	23.05
H	8	5430	5375.59	926.82	17.24	A	8	5871	5726.01	1130.34	19.74
H	2	5331	5783.24	812.95	14.06	A	2	3020	3349.67	753.56	22.50
H	6	5607	7095.04	1538.25	21.68	A	6	5607	6543.19	1451.07	22.18
H	7	5607	6846.28	1313.30	19.18	A	7	5607	6317.22	1742.98	27.59
H	8	4365	5386.83	1160.11	21.54	A	8	4796	5730.22	1073.19	18.73
A	2	3873	4589.08	878.74	19.15	H	2	5354	6058.98	1073.14	17.71
A	6	5354	6242.48	1270.82	20.36	H	6	5354	6464.81	1723.47	26.66
A	7	911	971.54	161.22	16.59	H	7	5354	6701.07	1630.81	24.34
A	8	3509	4242.73	936.32	22.07	H	8	3870	4768.89	937.69	19.66
H	2	3599	3890.89	659.69	16.95	A	2	3862	4269.95	726.56	17.02
H	6	3601	4166.74	750.75	18.02	A	6	5462	6054.74	1222.63	20.19
H	7	3000	3505.56	761.54	21.72	A	7	3853	4398.50	724.26	16.47
H	8	5462	6088.74	1393.37	22.88	A	8	4680	4752.80	415.76	8.75

H	2	702	807.73	193.54	23.96	A	2	4175	4842.59	654.29	13.51
H	6	5652	6060.06	1424.83	23.51	A	6	3824	4439.39	888.57	20.02
H	7	3589	4410.01	897.77	20.36	A	7	3834	5093.5	1169.77	22.97
H	8	5003	5902.78	988.54	16.75	A	8	5521	6445.15	1710.06	26.53
A	2	3580	4343.01	713.5	16.43	H	2	5433	6723.8	1239.63	18.44
A	6	5433	6383.34	1154.57	18.09	H	6	5433	6261.46	1702.01	27.18
A	7	5433	6993.68	1726.4	24.69	H	7	5433	6589.4	1583.5	24.03
A	8	5433	6288.64	1311.07	20.85	H	8	3713	4639.53	932.74	20.1
H	2	4348	5477.83	1193.16	21.78	A	2	2083	2600.44	594.27	22.85
H	6	4667	5914.78	1821.99	30.8	A	6	5447	6271.11	950.42	15.16
H	7	5447	6447.69	1241.61	19.26	A	7	5447	6786.24	1697.46	25.01
H	8	4354	5148.67	823.43	15.99	A	8	4203	4904.76	966.72	19.71
A	2	4154	4788.93	1063.54	22.21	H	2	3663	4258.53	1020.17	23.96
A	6	3607	3980.4	545.75	13.71	H	6	3020	3647.19	830.52	22.77
A	7	5439	6827.06	1396.99	20.46	H	7	5439	6234.56	922.23	14.79
A	8	5439	6102.28	1120.25	18.36	H	8	5439	6514.55	1655.56	25.41
H	2	4044	4571.7	793.73	17.36	A	2	5484	6402.25	1172.47	18.31
H	6	4393	5229.04	1085.02	20.75	A	6	4260	4933.38	1000.37	20.28
H	7	5484	6217.62	939.66	15.11	A	7	3951	4654.59	1062.65	22.83
H	8	4678	5116.19	605.02	11.83	A	8	5484	6129.98	1039.56	16.96
H	2	4762	5436.42	1137.8	20.93	A	2	5653	5610.08	702.53	12.52
H	6	3934	5200.9	1260.82	24.24	A	6	5653	6157.64	1411.09	22.92
H	7	5653	6532.3	1185.07	18.14	A	7	5653	6241.44	1281.48	20.53
H	8	3751	4646.58	722.26	15.54	A	8	4207	4977.31	1059.51	21.29
H	2	4249	5241.6	1203.67	22.96	A	2	5340	6244.72	952.15	15.25
H	6	5340	6874.45	1938.02	28.19	A	6	5340	7100.1	2113.57	29.77
H	7	2234	2900.94	710.28	24.48	A	7	5340	6320.35	1221.59	19.33
H	8	3825	4558.93	742.14	16.28	A	8	3637	4718.84	1239.45	26.27
H	2	4437	4675.46	625.44	13.38	A	2	5486	6474.45	1441.37	22.26
H	6	5486	6543.46	1459.92	22.31	A	6	4198	5464.83	1424.72	26.07
H	7	5486	6200	1589.59	25.64	A	7	5486	6496.6	1434.41	22.08
H	8	4027	4439.85	986.53	22.22	A	8	3657	4317.86	1170.4	27.11
		4634.1	5371.677	1070.102778	19.7547189			4754.9	5507.131	1136.044028	20.52683849

GROUND	Winning Team Inside Backs					GROUND	Losing Team Inside Backs				
	No	Time	Distance	HI Distance	% WR @ HI		No	Time	Distance	HI Distance	% WR @ HI
H	9	5178	6653.44	1218.74	18.32	A	9	4169	5391.27	1478.91	27.43
H	10	4777	6375.5	1395.47	21.89	A	10	4825	5499.69	1142.3	20.77
H	12	5666	7264.39	1926.94	26.53	A	12	5714	6162.25	1189.96	19.31
H	13	5714	6942	1346.31	19.39	A	13	5714	7413.63	1830.47	24.69
A	9	4288	6236.88	1897.81	30.43	H	9	3621	4801.51	1179.76	24.57
A	10	5409	7146.89	1667.38	23.33	H	10	5409	6562.55	1360.56	20.73
A	12	5409	6784.47	1414.07	20.84	H	12	5409	6641.48	1610.02	24.24
A	13	5409	7212.01	1579.28	21.9	H	13	4298	6278.35	1567.27	24.96
A	9	5016	6077.08	1235.37	20.33	H	9	4265	5190.9	1261.76	24.31
A	10	4838	6278.55	1591.34	25.35	H	10	5525	6211.66	1097.83	17.67
A	12	5525	6391.58	1284.25	20.09	H	12	4708	6092.52	1589.31	26.09
A	13	5525	6134.04	1205.63	19.65	H	13	5525	6552.84	1571	23.97
H	9	4210	5725.98	1864.15	32.56	A	9	5216	6484	1766.2	27.24
H	10	5552	6745.05	1700.79	25.22	A	10	5552	6771.53	1585.71	23.42
H	12	5552	7069.82	1772.96	25.08	A	12	5552	5924.33	1182	19.95
H	13	5552	7609.84	2271.08	29.84	A	13	5552	6688.92	1350.61	20.19
A	9	4079	5462.78	1230.87	22.53	H	9	3912	4878	1310.82	26.87
A	10	3507	4307.27	783.71	18.2	H	10	5634	7405.68	1996.59	26.96
A	12	5634	7455.79	1728.98	23.19	H	12	5634	6192.38	1551.96	25.06
A	13	5634	6938.54	1450.45	20.9	H	13	4905	6553.32	1554.68	23.72
H	9	4586	6193.61	1461.1	23.59	A	9	3585	5546.25	1505.21	27.14
H	10	5323	6827.84	1182.79	17.32	A	10	5323	7764.35	2224.19	28.65
H	12	5323	6346.55	1290.86	20.34	A	12	5323	7570.92	1594.48	21.06
H	13	5323	6734.01	1622.24	24.09	A	13	5323	7953.7	1795.62	22.58
H	9	3089	3778.89	1035.6	27.4	A	9	3964	4630.17	1237.09	26.72
H	10	5871	7501.09	1950.31	26	A	10	5871	6485.72	1209.2	18.64
H	12	4147	4608.05	857.35	18.61	A	12	4402	4547.32	936.09	20.59
H	13	5871	7851.62	1864.63	23.75	A	13	5871	6661.2	1606.37	24.12
H	9	4368	6054.16	1440.57	23.79	A	9	5070	6822.59	1214.19	17.80
H	10	5607	8813.97	2195.01	24.90	A	10	4546	6734.51	1571.82	23.34
H	12	3923	5006.37	1106.60	22.10	A	12	5607	7928.73	1983.32	25.01
H	13	5607	7840.98	1877.21	23.94	A	13	5607	7974.51	1920.44	24.08
A	9	5354	7109.00	1355.11	19.06	H	9	4006	5657.54	1185.73	20.96
A	10	5027	6167.20	903.61	14.65	H	10	5354	8151.52	2011.80	24.68
A	12	5354	7842.72	2182.07	27.82	H	12	5354	6897.09	1938.18	28.10
A	13	5354	7082.78	1846.21	26.07	H	13	5354	7636.11	2091.07	27.38
H	9	3266	4550.66	1244.74	27.35	A	9	5145	6301.09	1321.58	20.97
H	10	5470	7263.99	1471.63	20.26	A	10	3284	3944.20	399.64	10.13
H	12	5462	6676.40	1237.00	18.53	A	12	5064	6101.42	1418.09	23.24
H	13	5462	6969.70	1890.34	27.12	A	13	5462	6303.41	1117.80	17.73

H	9	5652	7724.95	1998.25	25.87	A	9	5652	7365.53	1958.51	26.59
H	10	5652	7031.74	1191.01	16.94	A	10	5652	6719.76	1224.8	18.23
H	12	5652	6967.96	1529.89	21.96	A	12	5634	7597.39	1623.96	21.38
H	13	5652	7584.75	1995.26	26.31	A	13	5571	7528.4	1560.61	20.73
A	9	4798	6521.18	1514.71	23.23	H	9	5433	7882.68	2221.23	28.18
A	10	5423	7286.69	1321.88	18.14	H	10	3736	5154.72	950.36	18.44
A	12	4758	6263.13	1424.25	22.74	H	12	5423	7150.07	1490.06	20.84
A	13	5433	7546.7	1657.92	21.97	H	13	5433	7651.94	2064.29	26.98
H	9	5447	7301.87	1894.16	25.94	A	9	4934	7089.26	2076.78	29.29
H	10	5447	7128.51	1232.1	17.28	A	10	5447	7005.8	1600.08	22.84
H	12	5447	7906.13	2027.38	25.64	A	12	3673	4928.52	1296	26.3
H	13	5447	8003.59	2025.33	25.31	A	13	5447	6751.35	1299.26	19.24
A	9	5299	7047.11	1889.22	26.81	H	9	4765	6362.58	1667.59	26.21
A	10	5439	6943.76	1204.32	17.34	H	10	5439	6756.69	1184.24	17.53
A	12	5439	7404.06	1532.78	20.7	H	12	1294	1687.82	448.47	26.57
A	13	5286	7332.5	1771.17	24.16	H	13	5439	7227.73	1580.23	21.86
H	9	5297	7210.06	1541.17	21.38	A	9	5484	6929.15	1595.47	23.03
H	10	4337	5639.77	1101.85	19.54	A	10	5484	7499.84	1536.69	20.49
H	12	4828	6539.4	1721.19	26.32	A	12	5484	6875.97	1585.48	23.06
H	13	5474	7599.03	1714.44	22.56	A	13	5484	6666.18	1365.83	20.49
H	9	5653	6996.63	1516.51	21.67	A	9	5653	7148.65	2135.08	29.87
H	10	5653	7256.24	1391.95	19.18	A	10	5653	7251.38	1896.79	26.16
H	12	1770	2562.01	691.43	26.99	A	12	5653	6844	1427.19	20.85
H	13	5653	7574.06	1803.12	23.81	A	13	5653	6767.01	1667.2	24.64
H	9	5340	7546.09	1907.87	25.28	A	9	5340	7863.23	3063.21	38.96
H	10	5340	7505.19	1516.05	20.2	A	10	3218	4375.54	1011.84	23.12
H	12	5340	7556.88	1916.72	25.36	A	12	5340	7849.93	2145.01	27.33
H	13	5340	7839.91	1886.79	24.07	A	13	5340	7387.63	2003.54	27.12
H	9	4906	7091.5	1965.08	27.71	A	9	3651	5151.13	1949.18	37.84
H	10	5486	6843.38	1358.41	19.85	A	10	4829	5841.17	1042.62	17.85
H	12	5486	6367.85	1419.77	22.3	A	12	5486	6466.84	1796.65	27.78
H	13	4730	5945.02	1046.12	17.6	A	13	5486	6695.21	1567.14	23.41
		5127.	6751.376	1545.675833	22.8670170			5039.7	6496.975	1548.541944	23.7263229

GROUND	Winning Team Outside Backs					GROUND	Losing Team Outside Backs				
	No	Time	Distance	HI Distance	% WR @ HI		No	Time	Distance	HI Distance	% WR @ HI
H	11	5503	6835.46	1330.81	19.47	A	11	1555	2212.78	447.48	20.22
H	14	4772	6482	1561.2	24.09	A	14	5714	5899.18	765.28	12.97
H	15	5714	7785.72	1563.65	20.08	A	15	5714	6462.3	1505.36	23.29
A	11	5020	6479.59	1215.17	18.75	H	11	5409	7203.5	1674.98	23.25
A	14	1535	1765.65	266.01	15.07	H	14	5409	7055.81	1745.42	24.74
A	15	5409	8290.3	2009.04	24.23	H	15	5409	7518.81	1757.96	23.38
A	11	4171	4481	751.75	16.78	H	11	5525	7443.21	1991.78	26.76
A	14	5525	6784.19	1770.04	26.09	H	14	5525	5942.82	1282.42	21.58
A	15	5525	7345.03	1230.35	16.75	H	15	4840	6292.47	1360.79	21.63
H	11	5552	7174.24	1888.5	26.32	A	11	5552	6442.28	1413.86	21.95
H	14	2708	3517.36	786.56	22.36	A	14	5552	6243.15	1164.56	18.65
H	15	4253	4934.89	1059.45	21.47	A	15	5552	7813.78	1430.46	18.31
A	11	5634	6453.39	1283.5	19.89	H	11	5634	7480.23	1741.01	23.27
A	14	5634	6786.96	1321.76	19.47	H	14	5634	6041.81	1316.53	21.79
A	15	4432	6204.48	1501.91	24.21	H	15	4972	6183.25	1495.98	24.19
H	11	4548	5699.11	1034.73	18.16	A	11	5323	7238.69	1763.05	24.36
H	14	3406	4314.19	900.78	20.88	A	14	5323	6168.31	1108.26	17.97
H	15	4605	6457.28	1418.91	21.97	A	15	4086	6000.24	1347.81	22.46
H	11	5871	6834.49	1285.75	18.81	A	11	5871	5814.87	1003.46	17.26
H	14	2760	3629.29	574.24	15.82	A	14	5021	5180.12	1163.49	22.46
H	15	5871	7812.19	1995.79	25.55	A	15	5871	6624.54	1435.57	21.67
H	11	5607	7293.25	1466.04	20.10	A	11	2962	3374.38	720.00	21.34
H	14	4481	6236.17	1235.45	19.81	A	14	5607	8081.32	2257.65	27.94
H	15	5607	7697.54	1823.80	23.69	A	15	5607	8006.89	1630.43	20.36
A	11	5354	6784.40	1502.22	22.14	H	11	2883	2971.50	558.07	18.78
A	14	5354	7353.38	2112.05	28.72	H	14	4818	6903.77	2073.51	30.03
A	15	5354	7458.89	1410.89	18.92	H	15	5354	6946.16	1344.44	19.36
H	11	4552	5285.19	1120.77	21.21	A	11	5462	7083.56	1174.63	16.58
H	14	5462	6125.08	950.29	15.51	A	14	5462	7050.97	1626.53	23.07
H	15	5469	6937.81	1301.68	18.76	A	15	5462	6543.10	1171.80	17.91
H	11	5652	7053.01	1295.21	18.36	A	11	5652	6017.28	1233.51	20.5
H	14	4042	5472.87	1261.62	23.05	A	14	5652	6915.2	1623.99	23.48
H	15	5652	7456.93	1470.8	19.72	A	15	5652	7756.02	1810.27	23.34
A	11	5433	6311.07	1183.38	18.75	H	11	5433	7590.23	1566.54	20.64
A	14	5433	7211.47	1684.42	23.36	H	14	4621	6675.51	1671.59	25.04
A	15	4757	7221.5	1586.81	21.97	H	15	5433	7632.73	1689.18	22.13
H	11	3702	4570.69	1127.15	24.66	A	11	5031	7437.82	1750.19	23.53
H	14	5447	7117.13	1411.81	19.84	A	14	5447	7920.4	2196.77	27.74
H	15	5447	7622.89	1710.24	22.44	A	15	5447	6565.45	1037.12	15.8
A	11	5323	7115.69	1473.41	20.71	H	11	5439	6642.93	1322.75	19.91

A	14	5439	6585.89	1328.3	20.17	H	14	5439	6873.35	1782.85	25.94
A	15	5439	6976.91	1545.33	22.15	H	15	5439	7338.47	1478.63	20.15
H	11	5484	8089.62	1953.42	24.15	A	11	5454	5330.93	750	14.07
H	14	5484	6764.31	1255.03	18.55	A	14	5484	7082.19	1888.54	26.67
H	15	5474	7353.04	1485.12	20.2	A	15	5484	7660.95	1682.42	21.96
H	11	5653	6882.99	1480.34	21.51	A	11	5653	6972.7	1712.38	24.56
H	14	5653	7428.1	1876.23	25.26	A	14	5653	6622.27	1676.82	25.32
H	15	4346	5508.79	1175.33	21.34	A	15	5653	7745.41	1446.43	18.67
H	11	4191	5395.99	1211.69	22.46	A	11	4552	5511.11	1196.13	21.7
H	14	5340	7615.56	1828.09	24	A	14	4430	5640.7	1565.72	27.76
H	15	4730	6650.82	1272.7	19.14	A	15	5340	7800.1	1894.06	24.28
H	11	3284	4375.95	930.25	21.26	A	11	5486	7733.45	2223.28	28.75
H	14	5486	7145.37	1408.89	19.72	A	14	5486	6377.87	1572.2	24.65
H	15	5486	7391.22	1667.26	22.56	A	15	5486	7239.55	1484.86	20.51
		4964.1	6454.746	1375.85037	21.1187536			5221.3	6616.785	1476.459259	22.1227770

Time motion analysis of international rugby

Department of Exercise and Sport Sciences, Faculty of Humanities, University of the Free State, Bloemfontein

Abstract

This study examined the relationship between the *Distance covered*, *High Intensity Distance covered*, and the *Percentage Work Rate at High Intensity* and how it correlates to the score and result of each match. This paper attempted to address deficiencies in the game of rugby and provide a meaningful body of data to determine winning and losing components that jeopardize matches at senior international level. Eighteen matches (Test and Super 14) were used to gather data through the Pro zone time motion analysis program. Calculating the frequency, mean duration and total time spent in activities is fundamental in time motion analysis (McLean, 1992:285-96). The extent of these changes has, however, never been quantified. What is even more important is that their impact on playing the game has not been evaluated. Teams losing the away games, even though they won all components, can be due to home team support, playing conditions, the magnitude of the game, law variations, competition structure and the team structure played. Time motion analysis is an effective method of quantifying the demands of rugby and provides a conceptual framework for the specific physical preparation of players. The results of this study showed no significant difference ($p < 0.05$) between the variables (distance covered, high intensity distance covered and percentage work rate at high intensity) in the winning and losing team. The correlation between all the variables (distance covered, $r = 0.67$, high intensity distance covered, $r = 0.62$ and percentage work rate at high intensity, $r = 0.54$) and winning have practical implications. The information obtained from these analyses allows coaches to structure training programmes specific to the requirements of the game, and facilitates more effective training and improved performance.

Keywords: *Rugby, Time motion analysis, Distance covered, High Intensity distance covered, Percentage Work Rate at High Intensity, Work-to-rest ratios.*

Tydsbewegingsanalise van international rugby

Departement van Oefen en Sportwetenskappe, Fakulteit Geesteswetenskappe, Universiteit van die Vrystaat, Bloemfontein

Abstrak

Hierdie studie het die verhouding tussen die *afstand afgelê*, *hoë intensiteit distansie afgelê* en die *persentasie werk teen hoë intensiteit* bestudeer en hoe dit korreleer met die telling van elke wedstryd gespeel. Hierdie verhandeling probeer die tekortkominge in die spel van rugby aan te spreek deur 'n betekenisvolle hoeveelheid data te lewer om vas te stel watter komponente by die wen of verloor van wedstryde die grootste invloed mag hê en 'n beduidende effek sal uitoefen op senior international vlak van rugby. Agtien wedstryde (Toets en Super 14) was gebruik om data in te samel deur gebruik te maak van die Pro zone tydsbewegingsanalise program. Die berekening van frekwensie, totale tydsduur en die totale tyd wat in aktiwiteite gespandeer word is fundamenteel in tydsbewegingsanalise (McLean, 1992:285-96). Die invloed van hierdie veranderlikes was nog nooit gekwantifiseer nie. Wat selfs belangriker is, is die feit dat die impak van elk van hierdie veranderlikes op die spel nog nie geëvalueer is nie. Verloor spanne wat weg wedstryde speel kan al die veranderlikes wen, maar nie die wedstryd nie. Moontlike redes hiervoor kan ondersteuning, wedstryd kondisies, die belang van die wedstryd, reël veranderinge, kompetisie struktuur en span struktuur wat gespeel word, wees. Tydsbewegingsanalise is 'n effektiewe metode om die vereistes van rugby te kwantifiseer en verskaf 'n konseptuele raamwerk vir die spesifieke, fisiese voorbereiding van spelers. Resultate van hierdie studie wys op geen betekenisvolle verskille ($p < 0.05$) tussen die veranderlikes (distansie afgelê, hoë intensiteit distansie afgelê en die persentasie werk teen hoë intensiteit) en die wen en verloor spanne nie. Die korrelasie tussen al die veranderlikes (distansie afgelê, $r = 0.67$, hoë intensiteit distansie afgelê, $r = 0.62$ en persentasie werk teen hoë intensiteit, $r = 0.54$) en die wen van 'n wedstryd het wel praktiese implikasies. Die inligting wat verkry is vanaf hierdie analises stel afrigters in staat om hul oefen programme te struktureer volgens die vereistes van die spel, en fasiliteer meer effektiewe oefensessies en uiteindelik, verbeterde prestasie.

Sleutelwoorde: *Rugby, Tydsbewegingsanalise, Distansie afgelê, Hoë intensiteit distansie afgelê, Persentasie werk teen hoë intensiteit, Werk-tot-rus verhoudings.*