

# Surf Training Habits and Related Knowledge and Attitudes of Surfers

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## Abstract

Surfing is an activity which has historically been considered a 'lifestyle' or leisure activity. However, over the last fifty years, surfing has increased in popularity, and this has resulted in greater professionalisation. Consequently, surfing research has increased to improve understanding and knowledge of the physiological demands of surfing. While research has shown land-based training should be utilised to meet these demands, there is little evidence of whether surfers are applying this information to their training habits, or indeed, what their training habits are like. Additionally, there is no current understanding of surfers' knowledge and attitudes towards training therefore, the purpose of this study was to investigate surfers' current training habits and their knowledge and attitudes towards training for surfing. Four hundred and thirteen surfers (270 male, 143 female) participated in this mixed-methods, cross-sectional study by completing an online questionnaire focused on surfers' knowledge and attitudes to training and their training habits. The questionnaire had a combination of closed and open-ended questions to provide quantitative and qualitative insight. The qualitative data identified three dominant themes, including: 'attitudes – to train or not to train', 'knowledge of the demands of surfing' and 'training habits for surfing'. Almost 90% of participants believed training for surfing to be important. There was no significant difference between gender and the perceived importance of training but there was a significant difference between the proportion of males (87%) and females (76%) who believed being in the water and surfing was the best way to train for surfing. Additionally, significantly more advanced surfers (90%) believed being in the water is best in comparison to novice (75%) and intermediate (79%) surfers. The main motivators for training were to improve their performance, to ensure they had longevity in the sport and to improve their comfort/confidence. Those who were not motivated to train for surfing either train for general health and wellbeing or surf as a hobby and do not need to. Surfers' knowledge of the demands of surfing was moderate, with 44% of the participants correctly answering at least four of the seven knowledge-based questions however most surfers lacked knowledge about specific aspects of surfing. Results also showed 70% of surfers perform surf training with no significant difference in the length or frequency of training sessions between genders. However, advanced female surfers had significantly more training sessions than novice female surfers, but this was not the case for male surfers. Two trains of thought were found regarding surfers' training habits. Either they felt that 'surfing is the best way to train' or otherwise, 'great surfing requires out-of-water training'. These findings provide a foundation of knowledge regarding surfers' training habits and how they may be influenced by their knowledge of and attitudes towards training. They also suggest as many surfers are inclined to train, more surf

specific resources are required to ensure surfers are training appropriately for surfing. Additionally, surfers may benefit from a surf-specific warm-up to enhance performance and reduce injury risk.

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### **Attestation of Authorship**

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

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It is with great pride and relief to say that I have completed my master's studies! These past two years have been some of the most demanding and trying times of my life and have forced me to develop significantly as a person. For that reason, it has also been extremely rewarding and eye opening to the endless possibilities and opportunities available in the sporting industry and in the world! I am especially grateful to have been able to combine my passion for surfing and research together, as I never would have thought research about surfing was a possibility for a master's dissertation.

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## **Ethics Approval**

Ethical approval for this research was granted by the Auckland University of Technology Ethics Committee (AUTEC) on the 8<sup>th</sup> of December, 2021 for a period of three years:

21/419 - Surf-Related Training Habits and Related Knowledge and Attitudes in Adult Recreational Surfers.

## Chapter 1 Introduction and Rationale

### 1.1 Background

#### 1.1.1 The History of Surfing

Surfboard riding (or 'surfing') is a lifestyle activity and sport that has been practiced for thousands of years. Originating from Polynesia, the Polynesian language referred to surfing as *he'e nalu* (*he'e*: to ride; *nalu*: the surf), and the sport grew and persisted in Hawaii as it became part of Hawaiian culture (Nendel, 2009). Later called the 'sport of kings', it was a sport enjoyed by all ages and genders. However, hierarchy was present as specific boards called 'olo' boards were reserved only for chiefs. Olo surfboards were very long and narrow boards, between 14½ and 18 feet long and had previously been reserved for the ancient Hawaiian royal class (Booth, 1999; Mendez-Villanueva & Bishop, 2005). Commoners or 'ordinary Hawaiians' were also permitted to surf; however, they rode 'alaia' surfboards which were much shorter, broader, and thinner (Booth, 1999).

Since its introduction, surfing has held cultural, spiritual and religious significance in Hawaii. It offers a connection to the ocean and waves therefore, surfboards became a physical representation of Hawaiian history (Nendel, 2009; Taylor, 2007). The main purpose of surfing during this time was to ride the wave as far as possible, as turning could only be achieved by dragging a hand or foot in the water to change direction (Booth, 1999; Nendel, 2009). Many ceremonies were involved in the process of creating a surfboard, from selecting and cutting down the tree, to shaping and launching the finished surfboard and Hawaii was the centre of surfboard technology (Booth, 1999; Nendel, 2009).

Early European explorers, including Captain James Cook, were astounded by the surfers ability to ride waves. However, the arrival of American missionaries in the 19<sup>th</sup> century, who considered surfing sinful, resulted in the decline of surfing, as the Hawaiian people and their culture was decimated by Western encroachment (Booth, 2001). The sport was not revived until the 20<sup>th</sup> century and the rebirth of surfing is largely attributed to Duke Kahanamoku, 'the father of modern surfing'. Kahanamoku was a proud Hawaiian surfer and Olympic gold medal swimmer who promoted surfing around the world (Nendel, 2009; Taylor, 2007). After competing at the 1912 Olympic Games, 'the Duke' was asked to give surfing demonstrations on the coasts of Australia, New Zealand and the United States which sparked interest in surfing all over the world (Booth, 1999; Taylor, 2007).

### 1.1.2 Surfing in the 20<sup>th</sup> century

Although surfing managed to survive the 19<sup>th</sup> century, the annexation of Hawaii to the United States of America and subsequent appropriation of surfing from Hawaiian values and traditions resulted in a change in the culture of the sport (Nendel, 2009). Surfing, which had once been a sport with significant spiritual and cultural meaning was appropriated to resemble the commercial and competitive values seen in other mainstream American sports such as baseball and basketball (Nendel, 2009). This coincided with the development of surfing technologies (such as surfboards and wetsuits) in the 20<sup>th</sup> century which also influenced the change in surf culture and riding style and contributed to the continued popularisation of surfing. The late 1930s was a period of innovation, as surfboard shapers began experimenting with new materials to design boards that were lighter, faster, and more manoeuvrable (Booth, 1999). Tom Blake was an American surfer and surfboard shaper, known as one of the most influential surfers of this period. He was one of the first to experiment with board shapes and revolutionised surfing by creating a lighter, hollow surfboard which could paddle faster and was easier to ride (Taylor, 2007). His designs were used as templates and allowed surfboards to be mass produced and transform the surfing industry. He also proposed the idea of adding a fin to the bottom of the board to improve the ability to turn and perform manoeuvres, thus making surfing easier and as a result, more popular (Nendel, 2009).

The developments in surfboard technology led to the invention of wetsuits in the 1950s, allowing surfers to stay in the water for longer and even surf in the winter. In addition, an increase in specialised surf magazines, 'Tracks' being one of the most acclaimed, and surf films such as 'Gidget' and 'Endless Summer' amplified the change in surf culture and increased participation of recreational surfers (Booth, 2004). Surfing was viewed as "an ecstatic and mystical experience" and surfers spent every waking moment in the pursuit of the 'perfect' wave in paradisaical and uncrowded surf breaks (Taylor, 2007). This brought about the term "soul surfing", which joined surfing and the counterculture mode of surfing known as 'country soul' to create a generation of soul surfers who rejected materialism, capitalism, who scorned at competition and surfed purely for their soul and the feeling of "stoke" (Booth, 1999, 2001; Henderson, 2001). The 'country soul' was an ideology that encouraged surfers to live an alternative lifestyle by living in the country and living to surf rather than supporting the capitalistic, 'competitive' lifestyle lived by those who live in the city (Henderson, 2001). This period of counterculture and anti-competition attitude of soul surfers is suggested to have delayed the rise of professional surfing for a decade (Booth, 1999). However, as the counterculture waned in the early 1970s, professional surfing developed and in 1976 the men's professional surfing world tour was launched.

### 1.1.3 Rise of professional surfing

The introduction of professional surfing, along with developments in surf technology led to the evolution of modern surfing, altering what had previously been a lifestyle activity to a competitive sport. The purpose of surfing changed. From Hawaiians who surfed 'with' the wave to surfers from Australia and America who looked to 'attack' and dominate the wave through sheer aggression (Booth, 1999). This also led to a more aggressive attitude among surfers and phrases such as "killing" or "slashing" a wave became more common among surfers (Waitt, 2008). As the popularity of surfing has continued to grow, so has the level of professionalism within the sport. Over the last fifty years, surfing has progressed into a professional sport with an established world tour for both men and women – the World Surf League (WSL) Championship Tour (CT). The WSL CT is the major international surfing league and is one of the first major sporting leagues to offer equal prize money to female and male surfers (World Surf League, 2018). In addition, surfing was included in the Tokyo 2020 Olympic Games to join the realm of mainstream sports, indicating the growth of the sport (Klingner et al., 2021; Minisian & Hope, 2021; Wheaton & Thorpe, 2018). As a result, academic research has increased to provide greater understanding of the physiological demands of surfing. This is beneficial for professional surfers and coaches, as a greater knowledge of the demands of surfing offers greater understanding of how to better physically prepare for competitions, improve performance and reduce the risk of injury (Barlow et al., 2016; Bernards et al., 2017; Mendez-Villanueva et al., 2005; Tran et al., 2015). Yet, some argue that the increasing professionalism of board sports including surfing and inclusion into the Olympics goes against the fundamental counterculture ideals that set these unorthodox sports apart from other 'mainstream' sports (Harding & James, 2010).

The aggressive and stressful nature of competitive surfing is thought to go against the true meaning of surfing as it does not allow surfers to share an intimate rapport with nature and 'dance' with the 'natural energy form' which is the ocean (Nendel, 2009). One study found that a number of surfers, including professional surfers supported these thoughts (Fuchs & Schomer, 2007). They indicate surfing in contests lacks the fulfilment and meaning of regular recreational surfing and one participant who was a former World Champion suggested competitive surfing removes the enjoyment of surfing as they felt burnt out and began to associate surfing with negative emotions (Fuchs & Schomer, 2007). However, younger surfers have different views, often idolising the idea of professional surfing with the wish to one day become professional surfers (Fuchs & Schomer, 2007). These differing views may result from a lack of experience and/or the marketing of professional surfing which is targeted at younger surfers (Fuchs & Schomer, 2007).

#### 1.1.4 Female surfers and “localism”

While the last ten years have brought about significant changes in equity for women in professional surfing, there remains substantial inequality and sexism within surf culture (Olive, 2019). Women have participated in surfing since the emergence of the sport in Polynesia, however one of the first women known to participate in the sport was Australian surfer Isabel Letham (Fendt & Wilson, 2012; Phillips & Osmond, 2015). Letham was 15 years old when she rode tandem with Kahamamoku during one of his surfing exhibitions in Sydney, where she proclaimed surfing was the most exciting sport (Booth, 2001; Phillips & Osmond, 2015). Letham is widely known as the “mother of Australian surfing” or the pioneer of surfboard riding in Australia and paved the way for surfers. However, this is often overlooked, and female surfers are repeatedly forgotten in the history of surfing and struggle to find a place within surfing society (Henderson, 2001; Olive, 2016; Wheaton & Thorpe, 2018). Representation of women in surfing has often focused more on their appearance instead of their surfing ability and while the rise of professional surfing has provided some improvements in the level of organisation and status of women’s surfing, male surfers are still considered superior in the eyes of surfing culture (Henderson, 2001; Olive, 2016; Wheaton & Thorpe, 2018). This is also reflected in academic literature, with most academic research utilising only male participants (Phillips & Osmond, 2015). Thus, female surfers have been repeatedly excluded from sport science research and current understanding of the physiological demands is based largely on the results of male participants, with the assumption the results would be similar for females.

Most research conducted on female surfers has been in the area of psychology and leisure research. This research highlights that a significant number of women are surfing, although they rarely feel encouraged to participate in the sport, more often feeling patronised and made to feel as though they are not authentic surfers (Fendt & Wilson, 2012; Olive, 2019; Olive et al., 2015). They also continue to be dismissed and objectified in what has remained a male dominant sport (Booth, 2004; Fendt & Wilson, 2012; Usher & Gómez, 2018). Research in women’s surfing has also shown the most dominant sociocultural constraint for female surfers is being a minority as a female surfer and their fear of encountering ‘surf rage’ or “localism” (Fendt & Wilson, 2012). Localism is a behaviour expressed, usually by male surfers, through aggression, territorialism, bullying and overall negative behaviour towards female surfers to assert their dominance in the surf and claim their authority over waves or even certain surf breaks (Olive, 2019). Localism is suggested to stem from a desire to preserve the sport and recapture a sense of order due to the significant rise in popularity of surfing (Olive, 2019). This behaviour also often extends to surfers known as “kooks” (beginners), less skilled surfers and older surfers (Booth, 2004). However, female surfers are forced to endure assumptions rooted in

sexism through a patriarchal society believing women are less capable and do not belong in the surf (Fendt & Wilson, 2012). Despite the efforts of international sporting organisations such as the International Olympic Committee (IOC) and the International Surfing Association (ISA) to support and empower girls and women, it is clear changes in attitudes and behaviours among male surfers and the surfing industry as a whole is needed for greater inclusivity in the surf (Olive, 2019; Wheaton & Thorpe, 2018).

#### 1.1.5 Recreational surfing

Despite the changes in culture and controversial extension of surfing as a professional sport, the ultimate purpose of surfing has remained unchanged. The philosophies created by the first generation of 'soul-surfers' in the 1960s are still revered by many and are the foundation for modern recreational surfing. Surfing is not only a sport or activity but a lifestyle and for many, a way of life (Fuchs & Schomer, 2007). The connection to the ocean it offers and sense of tranquillity is sometimes labelled as an addiction, with surfers often being unable to describe the experience of surfing (Fuchs & Schomer, 2007). There is now an estimated number of 37 million surfers worldwide and close to 315,000 surfers in New Zealand over the age of 15 (McArthur et al., 2020; Remnant et al., 2020). This constant increase in popularity of surfing has resulted in the continual development of wetsuit and surfboard technology and as a result, surfers are able to purchase wetsuits to keep them warmer for longer and surfboards suited to every type of condition (Ekmeçic et al., 2017; McArthur et al., 2020; Minahan et al., 2016). Consequently, surfers can surf for longer periods of time, with some spending over 2 hours in the water each surf session (Mendez-Villanueva & Bishop, 2005).

Due to the recent increases in the popularity of surfing, the inclusion of surfing in the Olympic Games and the increase in professional surfing, there has been increased interest in surfing research. However, there is still a paucity of research in several areas, along with poor female representation in current literature. Further research is needed, especially as there has been growing interest from surfers and strength and conditioning practitioners alike who are interested in understanding the physical demands of surfing and how to train to meet these requirements to enhance performance and reduce injury risk (Barlow et al., 2016; Bernards et al., 2017; Mendez-Villanueva et al., 2005; Tran et al., 2015).

## **1.2 Structure of the Dissertation**

This dissertation is presented in accordance with Auckland University of Technology's Format One structure. This format contains chapters for the introduction and rationale, literature review, methods,

results and discussion/conclusion. Chapter 1 introduces the sport of surfing and examines the history of surfing. Chapter 2 is a review of the current knowledge, attitudes, and training habits of surfers. Training refers to any form of exercise used by surfers to improve their fitness. Chapter 3 explains the methods utilised in this study to investigate surfers' knowledge, attitudes and training habits and Chapter 4 presents the results of the study. Chapter 5 is a discussion of the key findings and includes limitations of the study along with practical applications and recommendations for future research. A reference list has been prepared for the whole dissertation and referencing follows the American Psychological Association 7<sup>th</sup> Edition standards.

### **1.3 Purpose of the Dissertation**

The increase in scientific research focusing on the physical demands of surfing has led to growing understanding that surfing requires significant physical fitness (Farley et al., 2012a; Mendez-Villanueva et al., 2006; Secomb, Farley, et al., 2015). As a result, research has also been conducted to understand the benefits of training and to offer training recommendations for surfers to meet the physical demands of surfing. Research has shown that performing land and water-based training is beneficial for surfers to improve their performance and decrease injury risk (Anthony & Brown, 2016; Coyne et al., 2017; Farley, Secomb, et al., 2016). However, despite the increase in research around surf-specific training and the benefits for surfers, there is a lack of evidence regarding specific training or conditioning surfers perform (Coyne et al., 2017; Mendez-Villanueva et al., 2006; Sheppard, McNamara, et al., 2012). Moreover, studies have noted that surfers see no obvious benefit of training or are unaware of how to train to improve their surfing ability (Farley et al., 2015; Sheppard, McNamara, et al., 2012). The reason for the lack of training is not widely discussed or understood but has been suggested to be a result of a lack of knowledge about training, negative attitude towards training and lack of coaches and formalised training opportunities (Coyne et al., 2017; Dean & Bundon, 2020). Thus, further research is needed to gain a greater understanding of surfers' current training habits and their knowledge of, and attitudes towards training.

Therefore, the two research questions of this dissertation are:

1. What knowledge and attitudes do surfers have towards surf training?
2. What are the current training habits of surfers?



## Chapter 2 Review of Literature

### 2.1 Introduction

The purpose of this chapter is to review and critique the current evidence regarding surfers' training habits and associated knowledge and attitudes. This review is divided into two sections. Section 1 reviews literature that has investigated the action of surfing and the physical demands of surfing. Section 2 reviews literature on training for surfers. The benefits of training for surfers are discussed along with current understanding of surfers' training habits. The knowledge and attitudes of surfers towards training are also discussed as potential factors affecting surfers' participation in training.

### 2.2 The Demands of Surfing

#### 2.2.1 The practice of surfing

Current literature suggests that surfing is a highly complex, intermittent, multiplane activity and sport, varying in duration and intensity (Barlow et al., 2016; Eurich et al., 2010; Farley et al., 2012a; Mendez-Villanueva & Bishop, 2005). It is a unique activity because it requires significant cognitive activity to assess conditions, dynamic balance, whole-body fine motor skills as well as significant muscular and cardiorespiratory endurance, strength, and anaerobic power (Klingner et al., 2021; Mendez-Villanueva & Bishop, 2005).

The action of surfing requires an individual to paddle on their surfboard, duck-diving while holding their breath under any breaking waves, to get beyond the breaking waves to the take-off zone or area more commonly known as 'out the back' (Barlow et al., 2016; Eurich et al., 2010; Farley et al., 2012a). Surfers then need to position themselves in the take-off zone and wait for a suitable wave. As waves approach, they must produce short burst of powerful paddling to gain momentum and catch the wave before they 'pop' up onto their surfboard (Farley, Abbiss, et al., 2016). The pop-up is a quick transition from lying prone to standing on the surfboard, requiring significant upper body strength (Eurich et al., 2010; Fernandez-Gamboa et al., 2020). A powerful and efficient pop-up allows a surfer to get onto the wave faster, allowing for better positioning on the wave and offering a longer ride along the wave (Eurich et al., 2010; Fernandez-Gamboa et al., 2020). Once on their feet, the surfer rides along the unbroken section of the wave where they may perform manoeuvres (e.g., turns or aerials) depending on their ability and the quality of the wave, before repeating the process to catch another wave (Klingner et al., 2021).

Studies using time-motion analysis have provided useful information about the physical demands of surfing. These studies suggest surfing is made up of four capabilities: paddling, being stationary, wave riding and other (e.g., duck diving, recovering from a fall) (Barlow et al., 2014; Meir & Davie, 1991; Mendez-Villanueva et al., 2006). Paddling has been shown to make up the largest proportion of time for both recreational and competitive surfers, accounting for between 44–47% and 42–58% of a surf session respectively. Being stationary to wait for waves accounts for between 35–42% of a surf session for recreational and 28–53% for competitive surfers. While wave riding time is only 5–8% of a session for recreational and 3–8% for competitive surfers. Finally, miscellaneous contributes 3–5% of a session for recreational and 2–5% for competitive surfers (Barlow et al., 2014; Farley et al., 2012b; Meir & Davie, 1991; Mendez-Villanueva et al., 2006; Secomb, Sheppard, et al., 2015). The small differences between recreational and competitive surfers are suggested to be largely due to the specific demands of competitive surfing and tactical decisions made during competition or environmental factors (e.g., currents, swell size, wave size, frequency or length) (Mendez-Villanueva & Bishop, 2005). Nonetheless, surfers, both recreational and competitive spend approximately 45–50% of a surf session paddling, 35–40% stationary, 6% riding and 8% in other activities (Farley et al., 2012b; Mendez-Villanueva & Bishop, 2005). The duration of a surf session can range significantly because competitive surfers are restricted by the duration of a heat, typically between 20–40 minutes, while recreational surfers are able to surf for as long as they choose. Recreational surfers are known to spend between 30 minutes to over 3 hours in the water if the conditions are optimal (Meir et al., 2012; Mendez-Villanueva & Bishop, 2005). This depends on the environmental conditions such as the water/air temperature, wind direction and strength, the size of the waves and type of break (e.g., beach or reef break) and the line-up situation. The line-up refers to the area where surfers sit to wait for waves. If the line-up is crowded or full of aggressive surfers, it can impact how long a surfer chooses to surf for (Fendt & Wilson, 2012; Fuchs & Schomer, 2007; LaLanne et al., 2017). Each of these factors may alter the demands of a surf session and limit a surfer's ability to spend long periods in the water (Coyne et al., 2017; Farley, Abbiss, et al., 2016; Mendez-Villanueva & Bishop, 2005).

The impact of age and gender has been investigated in relation to the competencies required in surfing. Interestingly, one study showed the proportion of time spent in each activity of surfing was not correlated with age between male recreational surfers aged 18 to 75 (LaLanne et al., 2017). Another study suggests female surfers spend less time paddling and more time stationary than male surfers and this was thought to be because female surfers do not imitate the behaviour of actively competing for waves, common for their male counterparts (Barlow et al., 2016). This female surfing practice may be due to the negative behaviour often expressed towards female surfers and the resultant hesitation

expressed by women to compete for waves. Therefore, gender and environmental factors have an impact on the proportion of time a surfer spends in each activity of surfing.

### 2.2.2 The physical demands of surfing

To meet the demands of surfing and contend with the associated environmental conditions, surfers need to have a significant level of physical fitness. An important component of fitness for surfers is upper body strength and power. Surfers may spend between 45–50% of a surf session paddling, with the majority (~60%) of these paddling bouts lasting between 1–20 seconds, highlighting the intermittent, high-intensity nature of surfing which demands upper body muscular strength and power (Farley, Abbiss, et al., 2016; Farley et al., 2012a; Secomb, Sheppard, et al., 2015; Sheppard, McNamara, et al., 2012). Only two studies have assessed upper body strength in surfers, despite the assumed influence it has on paddling power and the pop-up. Both studies found there is a significant correlation between relative upper body pulling strength and sprint paddling performance, confirming the importance of upper body strength (Coyne et al., 2016; Sheppard, McNamara, et al., 2012).

Several studies have investigated sprint paddle power and peak velocity in surfers using a 15m sprint paddling test in a swimming pool or a swim bench/kayak ergometer test (Coyne et al., 2016; Furness et al., 2016; Minahan et al., 2016; Sheppard et al., 2013; Sheppard, Osborne, et al., 2012; Tran et al., 2015). Findings from these studies were able to differentiate power and velocity between senior and junior competitive surfers, selected and non-selected junior surfers, elite surfers and non-elite surfers and competitive and recreational surfers. The superior surfers produced faster paddle times and greater peak paddling velocities. In addition, a number of studies also found surfers with a higher relative upper body peak power output were more likely to be ranked higher in competitive surfing or have greater competitive ability, highlighting the importance of upper body power for surfers (Cámara et al., 2014; Farley et al., 2012a; Furness et al., 2016; Mendez-Villanueva et al., 2005). Another reason why upper body strength and power is so important for surfers is because once a surfer has caught a wave, they are required to perform a 'pop-up' to stand up onto the board. This requires considerable upper body strength and power along with lower body flexibility, core strength and balance to move ~75% of their bodyweight in less than a second (Eurich et al., 2010; Fernandez-Gamboa et al., 2020; Parsonage et al., 2020). Although limited, a small number of studies have explored upper body strength and power in relation to the pop-up and found surfers who have a greater rate of force development, greater upper body muscle mass and maximal strength are able to pop-up faster (Eurich et al., 2010; Fernandez-Gamboa et al., 2020; Parsonage et al., 2020).

Another component of physical fitness that is important to meet this intermittent, high-intensity nature of surfing is paddling endurance. A surfer may spend up to ten minutes paddling back out to the line-up. These prolonged periods of submaximal exercise require substantial upper body muscular and aerobic endurance (Farley et al., 2012a; Parsonage et al., 2017). Studies have used a 400m paddle assessment in a swimming pool and aerobic  $\text{VO}_2$  peak uptake assessments to measure paddle endurance and endurance paddling velocity (Coyne et al., 2016; Furness et al., 2016; Sheppard et al., 2013; Tran et al., 2015). Similar to the 15m sprint paddle test, findings were able to differentiate endurance capabilities between competitive and non-competitive surfers, elite and junior surfers, selected and non-selected junior national team surfers and high- and low-level surfers. The superior surfers produced faster paddle times and greater endurance paddle velocities.

Surfers who have greater upper body endurance, strength and power can meet the aerobic and anaerobic demands of surfing better and fatigue slower than surfers who do not. They can paddle faster and for longer allowing them to have a faster entry into waves and to sit deeper on the peak so they can catch waves from the steepest section (Farley, Abbiss, et al., 2016; Fernandez-Gamboa et al., 2020; Sheppard, Osborne, et al., 2012; Tran et al., 2015). For competitive surfers this is an obvious advantage as a faster entry into waves means they will have greater speed when they first get to their feet, allowing for better acceleration. It also enhances their opportunity to execute a manoeuvre in the first critical section of the wave and offers the opportunity to perform a greater number of manoeuvres as ride time on a wave is suggested to only be between 7-15 seconds (Coyne et al., 2017; Farley, Abbiss, et al., 2016; Sheppard, McNamara, et al., 2012; Sheppard, Osborne, et al., 2012; Tran et al., 2015). They are also more likely to be able to out-paddle their opponent, catch more waves and have the endurance to perform for multiple heats during the day if required, as some competitions have surfers competing in up to four 20-minute heats a day (Farley, Abbiss, et al., 2016). Similarly, for recreational surfers, greater paddling power allows them to spend more time in the water, get into waves earlier than other surfers and maximise their wave count compared to those who are less physically fit. In turn, this provides greater opportunities to practice their surfing ability and performance on the wave (Coyne et al., 2016; Parsonage et al., 2017).

In addition to superior wave riding ability, surfers who have better physical fitness are also thought to be at a lower risk of injury (Forsyth et al., 2019; Furness et al., 2014; Minisian & Hope, 2021). Research regarding surfing injuries is inconsistent and limited, however, studies have found muscle/tendon strains and ligament sprains are some of the most common acute and chronic/gradual-onset injuries in surfing. The main locations of injury are to the shoulders and ankle. The mechanism for these

injuries is commonly paddling and spending long periods lying prone on their surfboards, resulting in overuse injuries (Furness et al., 2015; Furness et al., 2014; Inada et al., 2018; Remnant et al., 2020; Woodacre et al., 2015). Paddling requires extension of the cervical and lumbar spine to lift the nose (front) of the board out of the water. This allows for increased arm clearance when paddling and permits the surfer's head to be above the water and facing in the direction they are paddling (Furness et al., 2014; Mendez-Villanueva & Bishop, 2005; Minisian & Hope, 2021). When surfers lack adequate muscular endurance and strength in their posterior chain (e.g., gluteus maximus and erector spinae muscles), they may put stress on their spinal muscles and as a result, will often extend their neck further rather than extending their back, resulting in excessive strain on the neck (Inada et al., 2018; Mendez-Villanueva & Bishop, 2005). In addition, the repetitive nature of paddling means there is significant strain on muscles around the shoulder and without appropriate strength and conditioning this can lead to shoulder overuse injuries (Furness et al., 2014). One study found recreational surfers experienced more chronic injuries when compared with competitive surfers (Furness et al., 2014), although these results were not consistent among other studies (Meir et al., 2012; Nathanson et al., 2002; Remnant et al., 2020). These results may be inconsistent because while competitive surfers are more likely to perform training outside of surfing to reduce injury risk, they are also more likely to surf larger, more challenging waves and attempt progressive manoeuvres which put them at greater risk for injury (Furness et al., 2014; Meir et al., 2012; Nathanson et al., 2002; Remnant et al., 2020).

After popping-up onto a wave, surfers 'pump' along the face of the wave and perform manoeuvres, while staying balanced on their surfboard, which requires significant isometric and dynamic lower body strength and power as well as adequate balance (Anthony & Brown, 2016; Everline, 2007; Secomb, Farley, et al., 2015). Pumping along the wave is a similar movement to the squat and allows a surfer to create force and momentum to perform manoeuvres (Everline, 2007). To perform a turning manoeuvre such as a cutback, top-turn or bottom turn, surfers need to produce and apply force through their lower body and onto their surfboard to manoeuvre the surfboard and produce 'spray' (Klingner et al., 2021).

Only a small number of studies have investigated lower body strength in surfers. However, one study found elite junior surfers have greater lower body strength than non-elite junior surfers (Sheppard et al., 2013) and greater strength has been shown to enhance performance during turning manoeuvres (Secomb, Farley, et al., 2015). Another study found that surfers who were selected for the national junior team had higher relative isometric strength when compared with those who were not selected (Tran et al., 2015). A few studies have also examined strength by assessing vertical jump ability. Surfers

with better performance during turning manoeuvres had greater peak force production during countermovement and squat jump tests (Secomb, Farley, et al., 2015). It was also found that higher ranked surfers had better vertical jump and maximal lower limb power performance (Fernandez-Gamboa et al., 2017). While the number of studies is limited, it has been suggested surfers with greater lower body strength and power can apply greater force onto their surfboard. Thus, they can perform more powerful manoeuvres by displacing a greater magnitude of water which gives the appearance of a more powerful turn due to the 'spray' produced when performing turning manoeuvres (Secomb, Farley, et al., 2015). It also means they are better able to successfully land and attenuate the forces generated at surfer-board-water contact. This is important when performing more radical manoeuvres such as an aerial (when a surfer uses the wave as a ramp to take off into the air and then land back on the wave) or when attempting to complete a re-entry manoeuvre, often as the wave closes out. (Forsyth et al., 2019; Parsonage et al., 2017). Additionally, aerial manoeuvres and manoeuvres projecting the surfer above the lip of the wave are the most common mechanism for knee injury as studies have found surfers who are able to perform aerials have a higher risk of injury than those who cannot (Furness et al., 2021). To perform aerials surfers are required to project up the face of the wave or launch into the air, rotate or turn the board and then land on the face of the wave or otherwise in the white-water putting high forces on the lower body (Hanchard et al., 2021; Minisian & Hope, 2021; Nathanson et al., 2002). Enhanced lower-body strength and power likely reduces the chance of injury when performing these more progressive, higher force generating manoeuvres (Anthony & Brown, 2016).

The physical demands of surfing are arguably the most researched area within surfing research as it was needed to provide a foundation of understanding around the physiology of surfing and what is required of surfers to be able to surf effectively. Time-motion analysis has been used by numerous studies to determine the energy requirements, distances travelled and heart rates throughout surf sessions. This information is vital as the time spent in each capability (paddling, sitting/waiting, wave-riding and other activities) was previously unknown. With this knowledge, research has progressed to investigate the intensity of each capability, potential injuries that may occur and ways that training can help meet these demands and reduce injury. However, a limitation of the reviewed studies is that of the seven time-motion related studies used in this review, only one study included female participants (Barlow et al., 2016). In fact, of the 27 studies reviewed in this section of the review, only 8 included female participants, the remaining 16 had only male participants, with 3 studies not specifying the gender of participants. This lack of female representation in surfing research is an ongoing issue and while it is slowly improving, it is a clear limitation of the available evidence. As the current understanding of the demands of surfing is largely based on results with male participants,

these results have been generalised for female surfers and therefore may misrepresent the whole surfing population. Similarly, another limitation is the lack of recreational surfers in the reviewed studies. Only nine studies include recreational surfers, the other 17 studies including only competitive surfers and one study not specifying ability. This is also seen with the age of participants in many of the reviewed studies as few include older surfers. As most studies chose to investigate competitive surfers, the age of participants was relatively young for most studies, with nine studies having a mean age of 20 or under. Therefore, current understanding of the demands of surfing may not accurately reflect the surfing population due to the lack of older surfers and recreational surfers. In addition, although most studies include recommendations for training and indicate that training is beneficial for surfers, no studies considered the knowledge and attitudes of surfers towards training. As most studies were conducted on competitive surfers, they may have assumed that competitive surfers are training and therefore took no consideration of whether their recommendations would be utilised. Finally, many of the reviewed studies were conducted in Australia (16) and only a few were conducted in other countries such as the United States (4), Spain (3), UK (2), Japan (1) and only one in New Zealand. As a result, knowledge of the demands of surfing is based predominantly on Australian surfers and this may result in discrepancies between populations (recreational vs. competitive) and between countries.

### 2.2.3 Summary

Research on the physical demands of surfing has shown that surfing is a highly complex sport that requires significant physical fitness to meet these physical demands. As surfers spend large periods of time paddling and lying prone on their surfboard, upper body strength and endurance is essential along with aerobic endurance. Wave riding accounts for only a small portion of a surf session, however, lower body strength and power is also necessary to take advantage of time spent on a wave and to allow surfers to perform powerful manoeuvres. Surfers with greater physical fitness also reduce their risk for injury, most significantly, injuries to the shoulder due to the repetitive motion that occurs when paddling and to the knee when performing and landing manoeuvres. As a result, many studies have suggested that performing training outside of surfing is beneficial for surfers to enhance their fitness, thus reducing injury risk and improving performance.

## **2.3 Training for Surfing**

### 2.3.1 Benefits of training for surfers

The increase in research on the physiological demands of surfing has offered greater understanding regarding the physical requirements and thus the benefits of training for surfing (Bernards et al., 2017).

Although surf sessions can last over several hours, time spent practicing surfing skills on the wave is limited. While it may be difficult to simulate the unique and highly specific nature of wave riding, specific, surf relevant, physical fitness can be enhanced through land-based training (Everline, 2007; Mendez-Villanueva & Bishop, 2005; Mendez-Villanueva et al., 2006). While evidence of surfers participating in training is limited, there is some evidence to show the positive benefits for surfers. Research has suggested surf-specific training is beneficial for surfers for a number of reasons. These include to improve their performance and to maintain or improve their level of physical fitness during periods of injury or poor surf conditions. In addition, training can help decrease any physiological weaknesses or imbalances that may exist due to the repetitive nature of paddling, the surfer's stance (e.g. goofy or natural) or preference of riding a wave on their forehand (i.e. body facing the wave) or backhand (i.e. back facing the wave) and help to decrease risk for injury (Axel et al., 2018; Furness et al., 2014; Meir et al., 2012; Mendez-Villanueva & Bishop, 2005).

Training recommendations for paddling performance are to improve upper body strength through resistance training (Mendez-Villanueva & Bishop, 2005). Upper body pulling and pushing exercises train key muscle groups essential for paddling. These include pull-ups and dips which have been shown to relate directly to paddle power, along with rowing exercises (Anthony & Brown, 2016; Coyne et al., 2017; Everline, 2007). One study reveals surfers with greater relative pull-up and dip strength had superior sprint paddle ability (Coyne et al., 2016). In addition, surfers who performed a 5-week maximal strength training program increased pull-up and dip strength and as a result their paddling performance over 5-, 10- and 15m sprint paddles (Coyne et al., 2017). Performing strength and power training may improve a surfer's ability to produce force and have more explosive paddle strokes and thus, be better able to propel themselves in the water (Farley et al., 2012b; Mendez-Villanueva & Bishop, 2005; Parsonage et al., 2017). Aerobic capacity should also be developed to improve paddle performance through freestyle swimming, prone surfboard paddling, paddling on a modified ergometer and sprint paddle interval training (SIT) or high-intensity interval training (HIIT) (Anthony & Brown, 2016; Farley et al., 2012b; Farley, Secomb, et al., 2016; Mendez-Villanueva & Bishop, 2005). SIT and HIIT training has been shown to improve aerobic and anaerobic capacity in surfers, as one study indicated significant improvements in sprint paddle ability after a 5-week SIT training program and improved sprint paddle ability after a 5-week HIIT training program in adolescent trained surfers (Farley, Abbiss, et al., 2016).

For faster pop-ups, evidence suggests utilising pushing exercises such as push-ups, bench press and overhead lifting movements, including Olympic lifts (i.e., the clean and press) to develop explosive



strength and allow surfers to get into waves faster (Anthony & Brown, 2016; Eurich et al., 2010). One study found male surfers had significantly greater relative force and power in comparison to female surfers due to assumed greater muscle mass along with anatomical differences (Eurich et al., 2010). Similarly, surfers who were stronger in the maximal strength assessments had superior performance in the pop-up assessment (Parsonage et al., 2020).

To train for wave-riding, surfers should utilise relevant dynamic strength along with ballistic and plyometric exercises to develop lower body strength and power (Secomb, Farley, et al., 2015). These include variations of squats and lunges along with plyometric jumps and single leg exercises (Axel et al., 2018). These exercises will enable surfers to have greater strength and control when riding waves and increase their ability to produce force and perform powerful manoeuvres (Anthony & Brown, 2016; Everline, 2007; Secomb, Farley, et al., 2015).

Core, dynamic balance and mobility/flexibility exercises should also be included to improve a surfer's postural control and ability to control their surfboard (Mendez-Villanueva & Bishop, 2005). One study showed surfers who participated in an 8-week core strength training program had improved rotational power and maximal countermovement jump along with greater rotational flexibility and core strength (Axel et al., 2018). This strength in turn leads to increased competitive success and reduced injury risk (Axel et al., 2018).

Although the number of surfing specific studies is limited, there is some evidence to suggest strength and endurance training is beneficial for surfers. Untrained surfers are at a disadvantage as they engage in shorter surf sessions, are unable to compete for waves thus have decreased opportunity to catch waves, reducing their ability to improve their skills and enjoy the sport (Bernards et al., 2017; Farley, Secomb, et al., 2016; Forsyth et al., 2019; Mendez-Villanueva & Bishop, 2005; Parsonage et al., 2017). Additionally, they may be at a greater risk of injury due to weak musculature and the repetitive nature of some demands, especially paddling. Appropriate strength training may provide injury resilience along with improved surfing performance (Mendez-Villanueva & Bishop, 2005).

Strength training has been shown to be particularly important for female surfers. Most research on the benefits of strength training has been conducted with male participants. Therefore, current understanding is largely based on the results of male surfers, and it has been assumed that this will also apply to female surfers despite obvious physiological differences. A limited number of studies have exclusively investigated the impact training can have on female surfers and suggests gender is a

major contributing factor to differences in performance among surfers, both recreational and competitive. It highlights the two main areas of difference are strength and speed as a result of anatomical and physiological differences (Anthony & Brown, 2016; Parsonage et al., 2017). Studies have found female surfers generally have less relative strength and power, especially in the upper body (Eurich et al., 2010; Fernandez-Gamboa et al., 2020; Parsonage et al., 2017). A lack of upper body strength reduces their paddle and pop-up performance, limiting their ability to catch waves and practice wave riding (Eurich et al., 2010; Parsonage et al., 2017). This is especially an issue for female recreational surfers who must compete with all surfers when in the line-up. In addition, competitive female surfers are suggested to be heavier (likely because of increased lean muscle mass) but carrying lower levels of body fat than earlier generations of female competitive surfers. This emphasises the use of resistance training to allow female surfers to exhibit power in the surf and be rewarded in competition (Barlow et al., 2016). By comparison men also tend to have longer limbs than women which is advantageous as it offers the ability for greater torque production, a longer arm stroke and thus greater velocity when paddling (Anthony & Brown, 2016; Eurich et al., 2010). While training cannot change a female surfer's anatomy, it may allow her to compensate for this disadvantage by improving her upper and lower body strength to limit any deficits in performance (Anthony & Brown, 2016; Eurich et al., 2010). Female surfers may also perform resistance training to feel more confident or competent in the surf, especially if faced with localism or an aggressive, male dominant line-up.

Finally, training may improve a surfers' longevity in the sport by reducing injury risk and improving the functionality of surfers. It is becoming more common for surfers to continue participating in surfing over the age of 50 years, especially with the likes of Kelly Slater continuing to compete and win professional events on his fiftieth birthday. One study suggested long-term participation in recreational surfing was beneficial to a group of recreational surfers over the age of 60 when compared to a group of individuals who were similar in age, healthy and active (Frank et al., 2009). Long-term participation in surfing caused specific neuromuscular adaptations that are advantageous for muscle force production and posture, particularly in the knee flexors and ankle plantar flexors resulting in a better ability to control steady muscle contraction (Frank et al., 2009). However, older surfers are also at greater risk of injury as research has shown that age is a significant risk factor for surfing injuries, especially for surfers 40 and over compared to those under 40 (Furness et al., 2014; Nathanson et al., 2002; Remnant et al., 2020). As a result, aging surfers are utilising surfboards with greater buoyancy to evade the age-related deficits in fitness and gain a mechanical advantage when paddling, thus reducing energy expenditure (Ekmeçic et al., 2017; LaLanne et al., 2017). It could

therefore be assumed that land-based training may benefit older surfers as it may reduce the risk of injury and allow older surfers to continue to meet the demands of surfing (Wheaton, 2019).

### 2.3.2 Current understanding of surfers' training habits

Despite the growing evidence of the benefits of training for surfing, limited research has explored whether surfers participate in any form of training aside from surfing itself. In addition, evidence is inconsistent and often based on opinion and to our knowledge only four studies have investigated surfers' training habits and no study to date has examined the knowledge and attitudes of surfers towards training.

Some researchers suggest surfers are participating in training, however, this is often limited to elite or professional surfers due to the increased professionalism of surfing (Cruz et al., 2021; Forsyth et al., 2020; Furness et al., 2014; Furness et al., 2016; Redd & Fukuda, 2016). However, others suggest training is not highly adopted despite growing evidence in support of training for surfers (Coyne et al., 2017; Mendez-Villanueva et al., 2006; Sheppard, McNamara, et al., 2012; Sheppard, Osborne, et al., 2012). Of the four studies touching on surfers' training habits in their investigations, two had participants who were able-bodied surfers (Farley et al., 2015; Loveless & Minahan, 2010), while the other two studies had participants who were adaptive surfers and bodyboarders (Cruz et al., 2021; Silva & Cruz, 2020). Interestingly, only the study by Loveless and Minahan (2010) included recreational surfers, while the other three studies focused on elite or competitive surfers. This is likely due to the increased professionalisation of surfing and resultant focus on competitive preparedness by competitive surfers and their coaches compared to the relaxed nature of recreational surfing. However, the studies recommending training for surfers suggest it is also beneficial for recreational surfers to train for surfing as well as competitive surfers (Coyne et al., 2016; Eurich et al., 2010; Minahan et al., 2016). Overall, a major limitation of these studies is the participant selection was limited to competitive/elite surfers leaving an obvious lack of understanding and knowledge of how recreational surfers are training, if they are at all. Results from these studies are somewhat inconclusive as Cruz et al. (2021) and Silva and Cruz (2020) suggest between 80–90% of their participants participate in some form of dry land training, however, they do not state the frequency, duration, or mode of these trainings. Therefore, it is difficult to grasp what type and how often they are training and thus, whether these surfers were training to benefit their surf performance or if it was purely for their general health. In addition, as these studies were conducted on elite adaptive surfers and bodyboarders competing in the international tournaments for their respective sports, it is possible their training may be taken more seriously to improve performance. In contrast, the studies

by Farley et al. (2015) and Loveless and Minahan (2010) did not include an overall outline of how many participants were performing a form of training but did find the surfers in their studies performed land-based training for an average of four hours and an hour and a half per week, respectively. Farley et al. (2015) found surfers only performed an average of one hour of strength training per week, with an hour and a half dedicated to conditioning and less than one hour dedicated to balance training. In contrast, these surfers surfed an average of almost 19 hours per week, highlighting the significant difference in time spent in the water and time spent performing land-based training. Both Farley et al. (2015) and Loveless and Minahan (2010) suggest this difference was generally due to attitudes expressed by the participants who believed the best form of training is to simply surf and the surfers commonly questioned why they would include training into their weekly surf routine. Loveless and Minahan (2010) did not break down the type of training the surfers performed, therefore, it is difficult to compare the results from these two studies as dry land training could refer to several different modes of training, such as resistance, plyometric or cardiovascular training. They did find there was no difference in time spent dry land training between competitive and recreational surfers. This is interesting because this goes against the ideas proposed in the studies by Cruz et al. (2021) and Silva and Cruz (2020) who suggest training is being utilised more by competitive surfers. The results from these four studies show there is inconsistent evidence regarding surfers' training habits. One thing to note is none of these studies examined the factors impacting surfers' training, nor has any study to date investigated the potential barriers or motivations for surfers to train. Therefore, there is no current understanding around why surfers do or do not participate in any form of training for surfing.

### 2.3.3 Factors affecting surfers' participation in training

While no study has directly examined what factors may contribute to surfers training, several studies have explored the general culture of surfers and surfing as well as the knowledge and attitudes of surfers towards other injury prevention measures. These studies may offer insight into the knowledge and attitudes of surfers towards surf training.

One major factor is thought to be the aesthetics of surfing. Surfing has long been known to be a sport of style and encapsulated by the idea of 'soul-surfing', with surfers believing surfing is central to their life, providing an overall sense of wellbeing along with the adrenalin high, more often known as 'stoke' (Wheaton, 2017, 2019). This has led to certain stereotypes about surfers in terms of what is considered 'cool' and what is not. Surfers want to look cool and stylish rather than looking like a 'kook' (i.e., a beginner or inexperienced surfer), therefore, it is possible training does not fit into this aesthetic. These ideas were discussed in studies examining surfers' perceptions of protective headgear which

has been shown to reduce the risk of concussions when surfing. One of the main reasons behind the reluctance to use headgear was due to a dislike for the look of headgear. Surfers stated using headgear is embarrassing as it looks uncool, implies a level of inexperience, and is therefore only associated with unfashionable surfers such as old men and “grommets” (i.e., young, enthusiastic surfers) (Dean & Bundon, 2021; Taylor et al., 2005). This attitude suggests appearance is something surfers take into consideration, and they do not want to participate in anything detracting from how others may view them and their ability. This may also be the case in the context of surf training because it is possible surfers convey a similar attitude about training, believing it is not authentic to the culture of surfing and is uncool, detracting from their appearance of being an experienced surfer. Therefore, it is possible these attitudes may influence surfers’ willingness to engage in surf training.

Another potential factor is surfing was historically a leisure activity and considered by many as a lifestyle or religion and this belief still resonates with many surfers, especially recreational (Fuchs & Schomer, 2007; Wheaton, 2017, 2019). The belief of surfing being a ‘chill’ leisurely activity rather than a sport may support the notion there is no real need to train for surfing. Additionally, studies have shown many surfers do not consider the health benefits or staying fit as the main reason for participating in surfing, but rather they emphasise the feeling of stoke as the reason why they participate in surfing (Wheaton, 2017, 2019). Therefore, surfers with this attitude may lack the understanding or the motivation to training for surfing because they are partaking purely for “the buzz”. In addition, one study also suggests surfers are individuals who have risk-taking personalities or characteristics, meaning they would prefer to take risks as a way of committing themselves to the sport (Dean & Bundon, 2020).

In addition, many surfers believe surfing is a relatively safe sport, therefore, training and injury prevention is not necessary (Taylor et al., 2005; Wheaton, 2019). The studies on perceptions of the use of protective headgear found only a small proportion of surfers use headgear and many would rather risk an injury than wear a helmet (Dean & Bundon, 2020, 2021; Taylor et al., 2005). This attitude exists despite one study finding almost 75% of participants said they believe using headgear could reduce injury risk (Taylor et al., 2005). Many surfers believed surfing is not inherently risky and therefore headgear is not necessary compared to sports like snowboarding or skateboarding or it is only for beginners or big-wave surfers rather than experienced surfers (Dean & Bundon, 2020). This attitude may be similar for training and suggests surfers may possess knowledge about training and the benefits it can elicit for injury prevention, however, they do not believe it is necessary or is only necessary for less experienced or big-wave surfers.

Age may play a role in the knowledge and attitudes of surfers to training. It may be surfers who are younger participating in more training outside of surfing because they are exposed to more information about the benefits of training. Especially as younger surfers often aspire to become professional surfers and may understand how performing training in addition to surfing may offer a competitive edge (Fuchs & Schomer, 2007). However, it is also possible these younger surfers will have the common risk-taking behaviour seen in surfers and believe they do not need to train, but just need to surf. In contrast it is possible the older surfers may perform training to reduce injury risk, however, it is more common for older surfers to adapt their equipment and ride a longer, floatier board or surf in more manageable conditions to combat the loss of strength and mobility (Wheaton, 2019).

Gender may also be a factor impacting on attitudes to surf training. Cruz et al. (2021) found more male surfers were participating in complementary training than female surfers. However, they also found female surfers were more likely to perform resistance training than cardiovascular training and that all female surfers had a coach while less than 40% of male surfers did. Therefore, it is possible surf training knowledge and resultant attitudes may differ by gender as one study investigating concussions among Canadian surfers suggested that female surfers were more inclined to ask for help, as they were more transparent and open with their injury. On the other hand, male surfers were more likely to push through the pain (Dean & Bundon, 2020). It may be that this is similar for surfers who want help training for surfing. Men may be more likely to continue the way they have and try to keep progressing without asking for help. Whereas women may be more likely to reach out for help to be more prepared for when they go out surfing and to reduce injury.

Limitations of the studies reviewed in this section are similar to those in the previous section especially regarding participant demographic and geographical location of the studies. A significant limitation among these studies was the lack of research investigating the training habits of surfers. While there have been several studies that have examined the benefits of training for surfers, very few studies have explored whether surfers perform any form of training. In addition, no study was found that examined the factors which may influence surfers' training habits, in particular, their knowledge and attitudes towards training. Therefore, although research within the area of surfing is increasing, more research is required to better represent the surfing population and to understand if surfers perform any form of training and factors that may influence their behaviour.

#### 2.3.4 Summary

There is evidence to show that surfers may benefit significantly from performing training alongside surfing. Surfers who train can paddle and pop-up faster, surf for longer, perform more powerful manoeuvres and reduce their risk of injury. Despite this, evidence of the current training habits of surfers is limited and inconsistent. In addition, little is known about surfers' knowledge and attitudes towards training and the influence these factors may have on a surfer's training habits. Therefore, further research is required to understand surfers' training habits and their related knowledge and attitudes towards training. In turn, this research may offer possible directions for future research in this area and allow strength and conditioning practitioners to understand and target the area which is most likely to hinder a surfer's participation in training.

## Chapter 3 Methods

### 3.1 Introduction

The purpose of this chapter is to describe and explain the research methods used to investigate surfers' training habits and associated knowledge and attitudes. A survey was the chosen method to collect data and was distributed online to participants worldwide. The research methodology and researcher position are discussed first before the methods are explained. This includes the survey design, participant recruitment and data collection and analysis.

### 3.2 Research design

#### 3.2.1 Methodology

The research paradigm of this study was the post-positivism paradigm. Similar to the positivist paradigm, post-positivism focuses on gathering data objectively but builds on this idea by acknowledging that subjectivity may occur and can be beneficial for the research. Post-positivism also retains elements of reductionism from the positivist view, as the beliefs and habits of surfers can be summarised into a group of ideas or codes that can be outlined and analysed. However, post-positivism emphasises less on what is the 'truth', instead understanding outcomes may be a result of many factors and therefore knowledge on a subject is based on what has been discovered and understood to this point rather than being the absolute truth (Giddings & Grant, 2006). As a result, mixed method was the methodological approach utilised in this study, as it offered the ability to blend quantitative and qualitative methods of research. By doing so, it provided the opportunity to use numerical measurements and analysis to measure quantities and also capture the feelings or thoughts of participants that are not easily quantifiable (Giddings & Grant, 2006; Jones, 2015). This combination can allow the qualitative data to be used to support and expand on the quantitative data (Jones, 2015).

#### 3.2.2 Researcher position

As a surfer of over ten years, the primary researcher can provide insight into the experiences had by surfers, such as the impact of swell and weather conditions, the physical demands, and the joy of surfing. This perspective means she can make sense of the surfers' responses from the perspective of a surfer. It also means she may bring some bias to the study, especially with her understanding of specialist surfing terms that a non-surfer may not know. Being able to draw on her own personal experiences is a strength, but she is also conscious of making the study clear for readers with no surfing experience.



### 3.3 Methods

#### 3.3.1 Study participants

Four hundred and thirteen surfers (male = 270, female = 143) took part in this study. To participate, the survey participants were required to be over 18 years of age and to have at least 12 months of experience as is common with previous surfing research studies. This ensured surfers had been participating in the sport for a period of time to ensure relevance of responses. Recruitment of participants was planned to occur over a one-month period in order to fit the Master of Sport, Exercise and Health timeframes. The sample size was therefore one of convenience that could be recruited over that time. Research ethics approval was granted by AUT Ethics Committee (21/419).

#### 3.3.2 Survey design

A cross-sectional study design was implemented to understand surfers' knowledge and attitudes towards training and resultant training habits. A survey was used as it was the ideal way to gather data from surfers for several reasons. First, appropriate tools were available for constructing the survey, it could utilise both quantitative and qualitative questions and could be distributed online and in-person which offered the ability to reach a wider sample of surfers from multiple countries. This also allowed greater accessibility for participants as they could fill out the questionnaire when it suited them and from the comfort of their own home. This last point was especially significant as many people were in Covid-19 lockdowns in New Zealand and worldwide at the time of data collection.

A mixed-methods approach was utilised in the survey, with a combination of closed and open-ended questions similar to those of previous studies that investigated athletes' training habits and attitudes towards training (Bøymo-Having et al., 2013; Brooks et al., 2018; García-Pinillos et al., 2021; García-Pinillos et al., 2020; Huebner et al., 2020; Molz, 2021; Saari et al., 2020). Questions regarding the surfers' knowledge of training were adapted from previous studies investigating knowledge of sports injuries or exercise recommendations (Bohne et al., 2015; Hyde et al., 2019; Overton et al., 2016) and modified to apply to surfing as no study was found that investigated athletes' knowledge of training. Answers to the knowledge-based questions were based on current literature of the demands of surfing.

The survey (appendix C) consisted of four sections and a total of 39 questions. Section one contained questions regarding demographic information (age, gender) and surfer information (years surfing, type of surfer, level of surfer, type of surfboard commonly ridden, length of surf sessions). The type of surfer was captured as leisure, amateur competitive or professional competitive. The level of surfer

was categorised into three levels – novice, intermediate and advanced surfer with accompanying criteria to allow participants to select which level applied best to them (appendix C). These criteria were based on information gathered from surf coaches and previous research (Scarfe et al., 2003; Surf Coaching Raglan, n.d.; The Art of Surfing, n.d.). Section two contained questions relating to surfers' training habits, with training defined as any form of exercise performed to improve fitness for surfing. Questions included when surfers' usually train, frequency of training, length of training session, if resistance training is utilised, the form of resistance used and if other forms of training are used. Section three contained questions which aimed to understand surfers' knowledge of the demands of surfing. Questions were based around what aspects make up the largest portion of a surf session, the length of typical paddling bouts, muscles involved in paddling and pumping and common surfing related injuries. Section four aimed to further explore surfers' knowledge and their attitudes towards training. This included the importance of training, the most important fitness aspects of surfing and if being in the water and surfing is the best way to stay surf fit.

After initial development of the survey, it was pilot tested on two surfers who met participation requirements and one expert surf coach. Two researchers with experience in survey design reviewed the survey to ensure face validity and the relevance of questions included. Based on the feedback received minor changes were made to provide clearer descriptions and improve formatting/design.

### 3.3.3 Recruitment and data collection

Initially, both online and in-person distribution was to be used as it was not certain how successful online distribution would be. Online questionnaire distribution occurred through multiple social media platforms (Facebook, Instagram and LinkedIn) to maximise the reach of the survey. Online distribution began through the primary researcher's own social media accounts and then expanded to public surfing pages and advertisements posted to surf specific Facebook groups (appendix D). Posting to surfing Facebook pages was very successful and allowed surfers from overseas to be recruited too. It is possible the success of the online distribution was also due to many people being in Covid-19 lockdown or restrictions worldwide and therefore having more time to spend completing the survey. In-person questionnaire distribution was attempted but yielded only a small number of participants in comparison to online distribution. This was largely due to Covid-19 in the community which meant all contests scheduled over the data collection period were cancelled. Online data was collected using Qualtrics' survey tool (<https://www.qualtrics.com>) using an anonymous link attached to the social media posts. The data collected through Qualtrics was exported to a Microsoft Excel spreadsheet in preparation for analysis.

### 3.3.4 Data analysis

Descriptive statistics and frequencies were used to summarise the responses to the closed-ended questions (quantitative outcomes). Inferential tests were used to investigate differences in these outcomes between genders and the level of surfer. Specifically, independent t-tests were used to determine differences in age and the number of years surfing between genders. A Chi-square test of independence was used to determine differences in the belief surfing is the best way to train for surfing between genders and levels of surfer and to determine differences in knowledge of the demands of surfing between genders. For this later comparison, the seven knowledge-based questions were recoded to either “good knowledge” (4 or more correct) or “poor knowledge” (<4 correct). Finally, a Chi-square test was also used to determine differences in length of training sessions (categorical outcome) between genders and an independent t-test was used to determine differences in the frequency of training sessions between genders. A one-way ANOVA was used to determine differences in training hours between the three different levels of surfer. All statistical analyses were completed using IBM Statistical Package for Social Sciences Statistics (SPSS), version 28.0.1.1 (IBM Inc., Armonk, NY) or MedCalc (MedCalc Software Ltd, 2022) with statistical significance defined as  $p < 0.05$ .

Inductive thematic analysis was utilised to analyse the qualitative data gathered from the open-ended questions (Braun & Clarke, 2013, 2022). Inductive thematic analysis is a data driven form of thematic analysis whereby coding and the development of themes are driven by the content of the data (Braun & Clarke, 2013, 2022). To explore the data, a Microsoft Excel spreadsheet containing the raw qualitative data was created. Codes were formed by the researchers that reflected the responses to the open-ended questions and captured important ideas relevant to the research questions. The codes were examined to develop broader patterns of meaning (potential themes) and then revised to develop themes further by discarding, combining, or splitting themes until researchers agreed the themes accurately represented the data (appendix E).

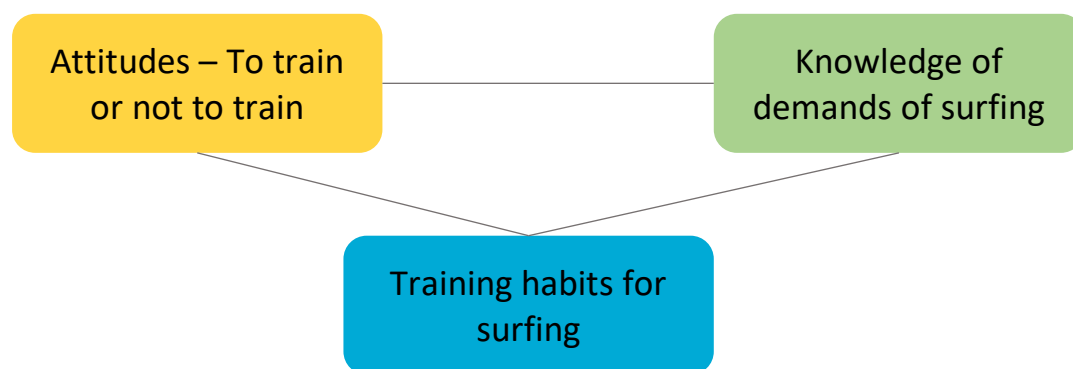
## Chapter 4 Results

### 4.1 Introduction

This chapter initially presents the participant characteristics and then reports findings based on the key qualitative themes. When surfers reflected on the idea of training for surfing and their own training habits, three dominant themes became obvious. Figure 2 presents these dominant themes which were: 1) attitudes – to train or not to train, 2) knowledge of the demands of surfing and 3) training habits of surfers. Each theme is illustrated below by verbatim responses from the survey and is also supported with quantitative results where appropriate.

**Figure 1.**

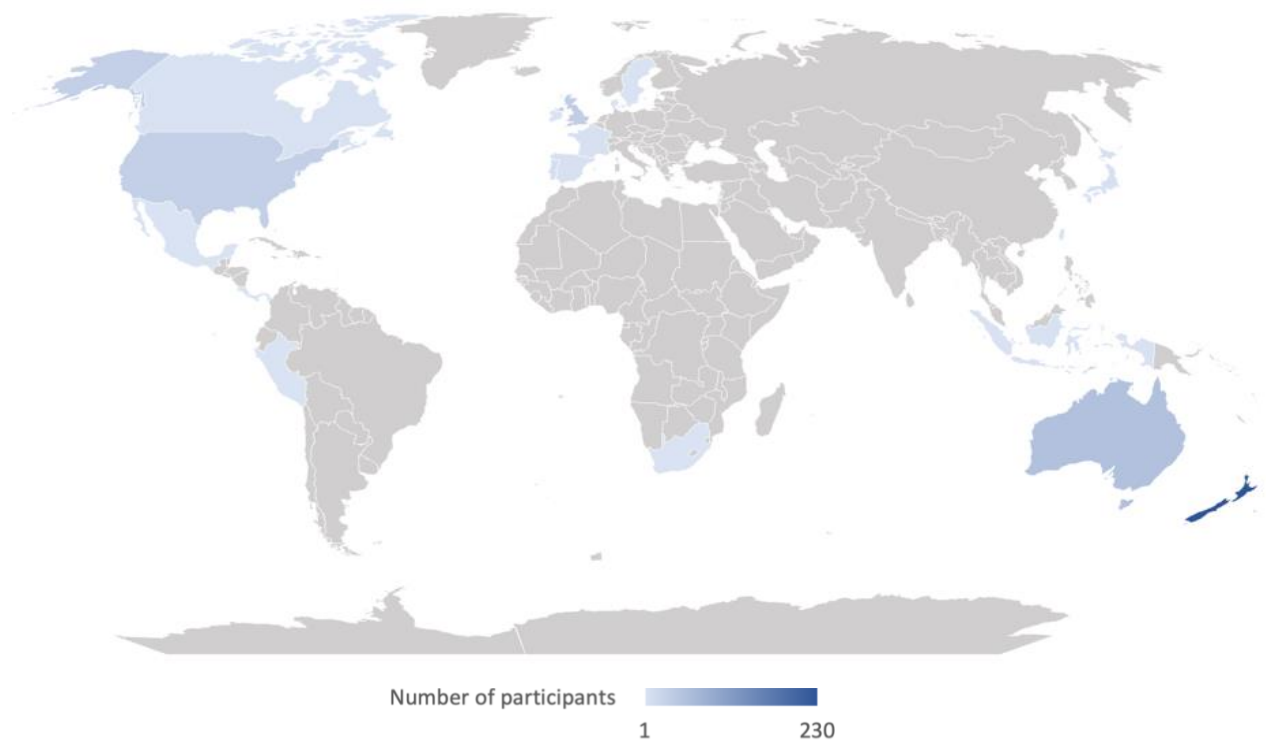
*The Three Dominant Themes.*



### 4.2 Participant characteristics

A total of 413 participants (65% male (n=270), 90% leisure surfers (n=143)) were included in the data analysis of this study. Survey data was collected from participants worldwide with New Zealand (n=230), Australia (n=55), UK (n=35) and USA (n=32) being the most common. The global distribution of participants is shown graphically in Figure 2.

The mean age of participants was 36 years (SD = 11, range 18–70) and males (mean = 38 yrs) were significantly older than females (mean = 33 yrs) ( $p < 0.001$ ). The mean number of years surfing was 14 years (SD = 13, range 1–53) and males (mean = 18 yrs) had significantly more experience than females (8 yrs) ( $p < 0.001$ ). Seventy one percent of participants (n=291) stated that surfing was their primary sport. Additional surfer demographics are summarised in Table 1.

**Figure 2.***Global Representation of Participants.***Table 1***Type of Surfer, Level of Surfer and Type of Surfboard Ridden.*

	Total (%)	Male (%)	Female (%)
<i>Type of surfer</i>			
Leisure	373 (90.3)	236 (87.4)	137 (95.8) *
Amateur competitive	38 (9.2)	33 (12.2)	5 (3.5) *
Professional competitive	2 (0.5)	1 (0.4)	1 (0.7)
<i>Level of surfer</i>			
Novice	60 (14.5)	14 (5.2)	46 (32.2) *
Intermediate	167 (40.4)	93 (34.4)	74 (51.7) *
Advanced	186 (45)	163 (60.4)	23 (16.1) *
<i>Type of surfboard</i>			
Shortboard	275 (66.6)	209 (77.4)	66 (46.2) *
Longboard	138 (33.4)	61 (22.6)	77 (53.8) *

\* Significant difference to males ( $p < 0.05$ )

The mean frequency of surf sessions was 3 per week (SD = 2, range 0–10), with most participants spending either more than 1 hour (21%), more than 1.5 hours (37%) or more than 2 hours (39%) in the water per surf. Only 27% of participants stated they always perform a warm-up prior to a surf session and 33% stated they sometimes do. Only 5% stated they always perform a cool-down, with 11% stating they sometimes do.

Seventy five percent of participants had sustained one injury from surfing and 48% of participants had sustained two or more injuries from surfing. An injury was defined as anything that resulted in the participant seeking medical attention or that kept them from surfing for more than one day. The most common injury locations were to the shoulder, head, leg and knee (see Table 2). Skin injuries (32%), muscular injuries (18%) and joint injuries (17%) were the most common type of injuries among participants. Other injuries included bone (7%), concussion (6%), ear (2%), eye (1%), nerve (1%) and other (17%).

**Table 2**

*Injury Locations.*

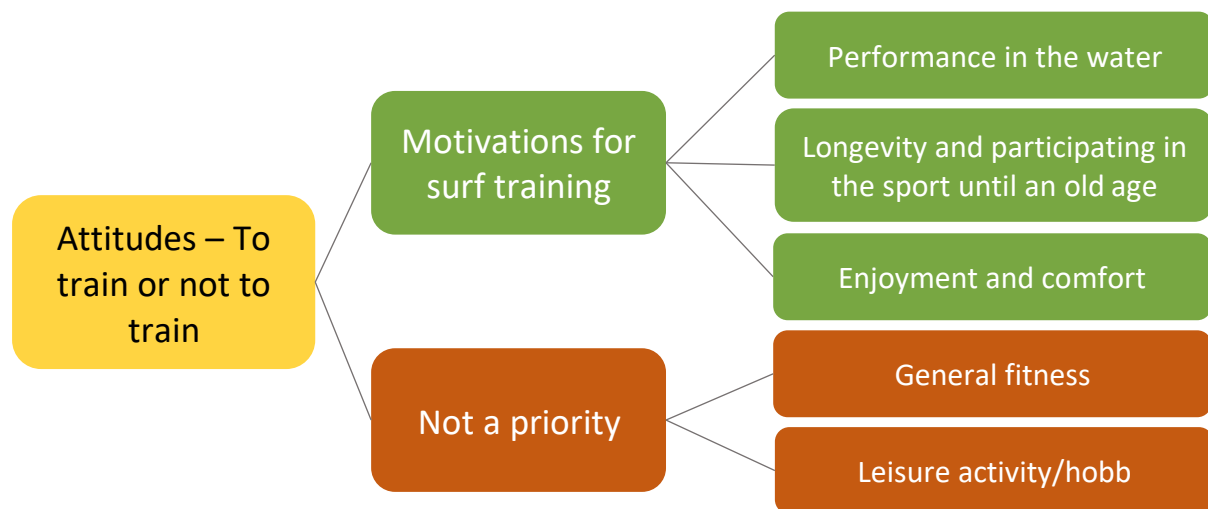
<b>Injury location</b>	<b>Total number</b>	<b>Percentage (%)</b>
Shoulder	86	18
Head	78	16
Knee	53	11
Thoracic region	51	11
Face	35	7
Neck	37	8
Foot	37	8
Ankle	28	6
Lower back	19	4
Hip	21	4
Leg	25	5
Hand	11	2
Elbow	3	1

### 4.3 Attitudes – To train or not to train

The first dominant theme 'Attitudes - To train or not to train' centres around surfers' motivations to train and the main purpose or reason behind their training or lack thereof. Within this theme two sub-themes and associated categories were identified (Figure 3) which are described below.

**Figure 3.**

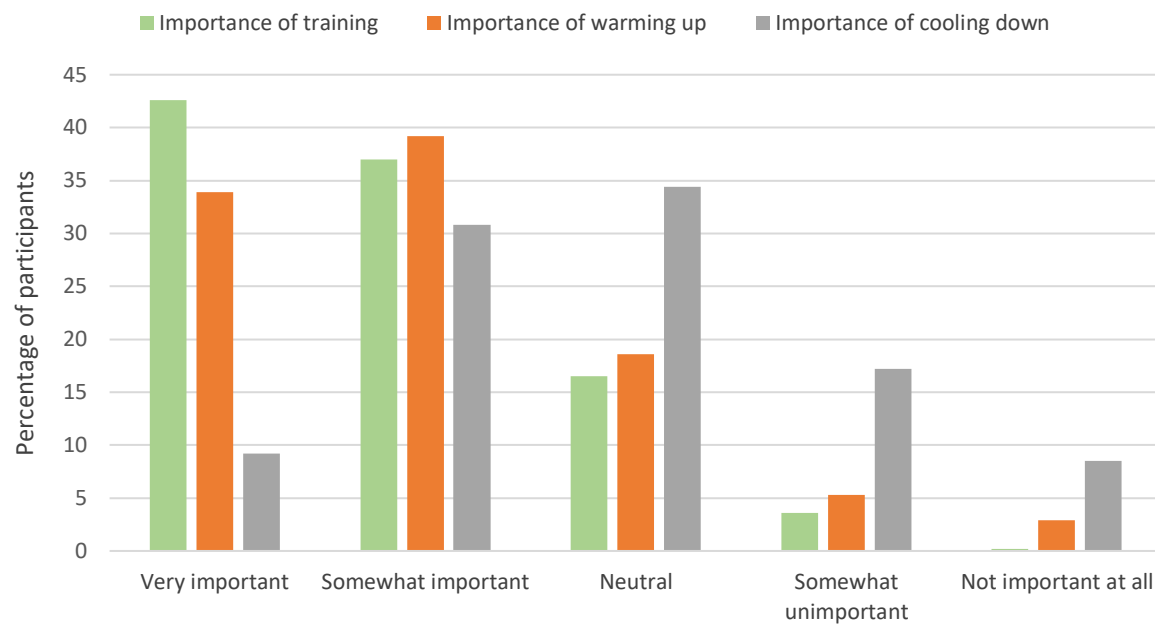
*Attitudes – To Train or Not to Train Theme and Associated Sub-Themes.*



For 83% of participants, being in the water and surfing is the best way to train for surfing however, there was a significant difference between the proportion of males (87%) and females (76%) who believed being in the water and surfing was the best way to train for surfing (mean difference = 11.9%, 95% CI = 4–20,  $p = 0.003$ ). Additionally, significantly more advanced surfers (90%) believed being in the water is best in comparison to novice (75%) and intermediate (79%) surfers ( $\chi^2 = 10.8$ ,  $p = 0.005$ ). However, 89% also stated they believe additional training to be important for surfing. This is supported by the finding that most participants stated training for surfing and warming up prior to surfing is very important or somewhat important for surfers (Figure 4), but this was not the case for cooling down. There was no significant difference between gender and the perceived importance of training for surfing ( $p = 0.4$ ) or the perceived importance of warming up ( $p = 1.0$ ) or cooling down prior to surfing ( $p = 0.2$ ).

**Figure 4.**

*The Importance of Training for Surfing, Warming Up and Cooling Down Before a Surf Session.*



#### 4.3.1 Motivations for training

A surfer's motivation for training appears to be a complex idea. There are several factors which may influence their incentive to train as shown, but not limited to the key ideas that came through from the questionnaire. This group of surfers felt the following things were important factors they considered when deciding to train; performance in the water, longevity in the sport and enjoyment/comfort.

##### *Performance in the water*

The desire to be a better surfer was a clear motivation for many surfers to perform surf training. Surfing is such a physically demanding sport, therefore, some surfers felt if they train out of the water, they can progressively overload fitness capabilities such as strength and cardiovascular endurance. In turn, tasks such as paddling and catching waves will be easier thus, more time and energy can be spent riding the wave and performing manoeuvres to become a better surfer. As one surfer stated, "Additional training will help overcome plateaus in performance by increasing strength/ fitness/ power above the levels attained by surfing alone" (P81)

Similarly, another significant motivator for surfers to train was to improve their wave riding skills faster by practicing specific skills on land. Wave riding requires significant skill as a surfer needs to



understand how to pump along the wave to create speed and how to use speed and weight distribution to perform manoeuvres. To improve these skills, many surfers mentioned the use of surf skateboards which aim to replicate the movement of riding a surfboard while on land. By utilising a surf skate, surfers can practice specific manoeuvres repeatedly which they are often not able to do due to limited wave time. Likewise, practicing other skills such as paddling technique or improving fitness capabilities also contribute to improved performance as they can paddle and pop-up faster and produce powerful manoeuvres. This is explained by the following quotes

In order to practice and learn new manoeuvres the best way to do this is to learn on dry land - for example on the surf skate - learning weight distribution, upper body positioning, when to compress to propel energy etc. (P45)

I think surfing is such a challenging sport that in order to improve, you have to do the land-based skills. You're asking too much of yourself to simply turn up and hope to be physically ready. (P224)

The ability to catch more waves is another important motivator for training. The goal of surfing is to be able to catch as many waves as possible as it is most enjoyable but also to be able to have more time to practice wave-riding skills and to improve performance. As a result, several surfers felt that training on land is beneficial as increased fitness allows surfers to be able to surf and paddle for longer and thus catch more waves. This is demonstrated by one surfer who stated, "being more fit will help the surfer catch more waves and improve more as they will be able to successfully paddle for more waves" (P301).

One limitation to improving performance seemed to be the inconsistent nature of surfing. This was due to the numerous environmental factors that impact surfing conditions such as tide, swell size, and wind. These factors can influence wave quality and therefore the opportunity to perform manoeuvres and improve performance. In addition, the distance required to travel to surf was another constraint for surfers. Therefore, many surfers felt that being able to train out of the water is useful as they can train if the conditions are not optimal, as explained by the following

"Surfing can be a sporadic sport as it is weather dependent, and beaches are often quite a large commute from the city centre. Therefore, ensuring fitness through other activities for surfing can prepare you for when the time to surf actually comes." (P28)

"I need to be fit for when the conditions are good. The North Sea is inconsistent. It's also extremely cold, which can have a big impact if you're not really fit." (P389)

Surfers also felt surfing alone was not enough to contribute to improved performance for a number of reasons. First, as mentioned previously, surfing conditions often vary, making it difficult to catch waves if the surfer cannot meet the demands of those conditions. Large crowds can make these

situations even more difficult as the surfer must compete with other surfers for waves along with paddling and the actual surfing itself. Therefore, some surfers felt training can prepare fitness capabilities required for surfing that surfing on its own cannot always do, as explained in the following quotes

"If you live somewhere where the conditions are always small for example, your surf fitness would be limited in development for that beach only. There would be no progressive overload so to speak. If you then went and surfed another beach, where there was a longer paddle out or bigger waves for example, the surfers body would not be able to meet the demand." (P264)

"Actual surfing in the ocean only allows for brief bouts of exercise that can be varied on any given day due to conditions and crowds. Training out of the ocean allows for targeting of specific muscles to maintain proper form and function of the joints and movements needed for surfing." (P293)

Surfers also stated training out of the water allows them to be prepared for surfing and ready to perform. Being prepared for surfing means surfers can utilise their time in the water more effectively and catch as many waves as possible. If a surfer is not prepared, they may spend more time in the whitewash being pummelled and tossed around or otherwise paddling for long periods rather than catching waves. One surfer explained that "it's important to train outside surfing so the body is ready to perform in the water" (P117). Another surfer who held this view said "Because limitations in time and good conditions prevent most people from surfing as much as they like. Extra training will improve the experience when you are able to surf." (P92)

#### *Longevity in the sport*

Several surfers also expressed interest in utilising training to be able to keep surfing and thus, increase their longevity in surfing. For many, surfing is a lifestyle as well as a sport and one surfer stated, "[I want] to maintain my surfing fitness so I can surf into my eighties" (P316). Therefore, the motivation to train stems from a desire to continue surfing until an old age.

The reduction of injury risk was another motivator for surfers to train. Many surfers were aware of the risk of injury when participating in surfing, as 65% of participants correctly identified the most common type of injury (muscle/tendon strain) in surfing. Therefore, they want to prevent any injuries from occurring, as it hinders their surfing ability and may reduce their ability to surf at all. As one surfer stated, "surfing needs to be complemented by training to prevent injuries and to enhance performance (P148)". By training on land, it allows surfers to strengthen weaknesses or imbalances that may be present in the body and acts as "pre-habilitation. [By] strengthening areas that are known common points of injury" (P219). Thus, reducing the chance of injury and ensuring limitations do not hinder their ability to continue surfing into the future.

### *Enjoyment/ comfort*

Surfing is typically considered to be a fun and enjoyable solo activity. "Only a surfer knows the feeling" is a common catchphrase among surfers as the feeling of riding a wave is often felt to be too magical to describe. However, when difficult conditions and a lack of fitness prevents a surfer from catching many waves or makes it difficult to even get out the back of the waves it can be frustrating. Therefore, many surfers felt training on land and increasing their fitness will increase the probability of catching waves. Thus, it "makes it more enjoyable if you are fit" (P155). Similarly, another surfer stated, "the harder I train on land the more fun I have in the water" (P282), indicating that training for surfing can increase the enjoyment of surfing when out on the water.

By training out of the water utilising drills and scenarios that put them under physical and mental stress, some surfers felt they can improve their comfort in stressful situations such as being held underwater when pummelled or after falling off a wave. This in turn "helps improve confidence in new manoeuvres" (P137) or "to feel more confident in heavier surf" (P177).

### 4.3.2 Not a priority

On the other hand, some surfers are not motivated to train for surfing as it is not a priority. For this group of surfers, key ideas showed that sometimes surfing itself is not a priority, especially if they participate in other sports as well. Otherwise, the desire to just surf as much as possible may be more of a priority than training for surfing, especially for those who feel that they only surf for fun. These surfers stated the following ideas contributed to their lack of surf training and will be discussed below; general fitness and leisure activity/hobby.

### *General fitness*

Some surfers stated they do not perform surf specific training as they instead do general fitness training for personal health and wellbeing. For 30% of participants, surfing is not their primary sport, therefore these surfers may not be interested in training specifically for surfing. Indeed, several surfers stated while they do train, the training they perform is not specifically for surfing, with one surfer stating, "I train for other reasons and because of that I don't specifically train for surfing" (P31).

For other surfers, they "don't specifically train for surfing because I have sports every day anyway" (P23). For many people who participate in several sports, it may not be feasible to train for each specific sport individually, therefore they rely on fitness capabilities from different sports to cross over

to surfing. One surfer explained "I do other sports such as swimming and hiking which already help my fitness levels and breath hold so I don't really feel the need to" (P280).

#### *Leisure activity/ hobby*

Another reason for surf specific training to not be a priority was the belief surfing is a leisure activity or a hobby, therefore training is not necessary. Several surfers felt training is only for surfers who are professional surfers as expressed by one surfer who stated, "unless become professional/competition there isn't really any need for me to train to get better as I surf to have fun" (P29). This indicates that for some surfers, training is associated with the professionalisation of surfing and only those who compete and surf as a sport should train. This suggests these surfers feel that as they are not at an elevated level of the sport, they did not see the need to train. This is further explained by another surfer who said "it depends what kind of surfing you want to. For competitive surfing I believe any extra would be beneficial but if you get out several times a week and enjoy a leisure surf than that is all you need" (P8).

Similarly, the statement "I don't feel the need" (P120) was expressed by a few surfers and as one surfer explained, "for me I am happy with my level of surfing and for this reason see no reason to train" (P247). This reflects their purpose for surfing, as they are not looking to improve their surfing performance but those who are, should train. The following quote expands on this idea further

"For me personally because I don't take my surfing particularly seriously. It's fun and I can do it reasonably well, but I don't feel the need to do land-based training to enjoy and do it well." (P296)

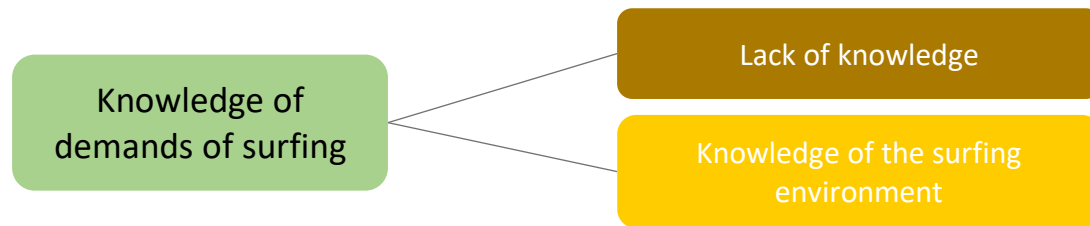
Equally, a number of these surfers stated they "only surf for fun" (P218) and participate in surfing "as a hobby more than something I have to perfect and train for" (P365). Therefore, these surfers seem to feel training for surfing would not make surfing itself any more enjoyable. They would rather spend as much time as possible out in the water and catching waves and as highlighted by one surfer they believe "the best surfer out there is the one enjoying themselves the most, not the most athletic in my opinion" (P223).

#### **4.4 Knowledge of the demands of surfing**

The second dominant theme 'knowledge of the demands of surfing' centres around surfers' understanding of the sport of surfing and its associated physical demands. The sub-themes indicate how a surfers' knowledge of surfing may influence their decision to perform surf-specific training (Figure 5).

**Figure 5.**

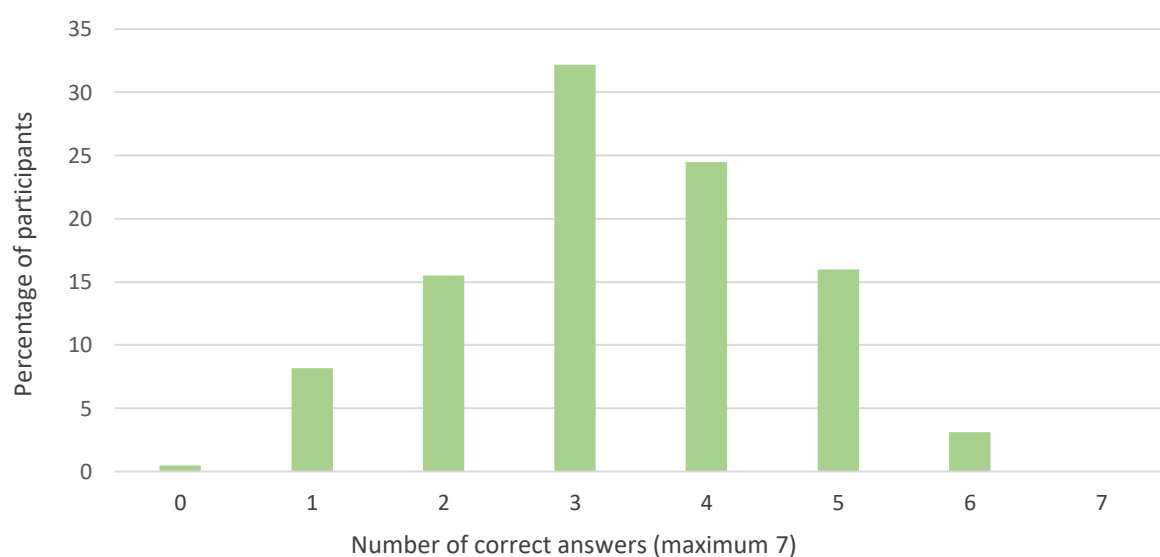
*Knowledge of the Demands of Surfing Theme and Associated Sub-Themes.*



Many participants (56%) answered at least 3 knowledge questions correctly (Figure 6). There was no significant difference between the proportion of males (42%) compared to females (47%) with good knowledge of the demands of surfing (mean difference = 5%, 95% CI = -5–15,  $p = 0.38$ ). The questions answered with greatest success were “what makes up the largest portion of a surf session?” (67%) and “what is the most common injury in surfing?” (79%). On the other hand, only 14% of participants correctly identified the average duration of a paddling bout and only 10% knew the most common lower body injury for surfers.

**Figure 6.**

*Surfers’ Knowledge of the Demands of Surfing.*



#### 4.4.1 Lack of knowledge

For several surfers, their lack of knowledge of the demands of surfing impacted their knowledge of how or why to implement surf training. Only 44% of participants got four or more of the knowledge-based questions correct and no participant answered all the questions correctly (Figure 6). Therefore, it is not unexpected that several surfers stated they had a "lack of knowledge of effective training" (P81) or "no knowledge about surf training" (P234), which hindered their utilisation of surf training rather than a lack of interest.

#### 4.4.2 Knowledge of the surfing environment

For many, a surfer's knowledge of the demands of surfing also extends to their understanding of the surfing environment. Understanding not only the physical demand the sport puts on a surfer through paddling, duck-diving, and riding waves but also the uncontrollable elements of surfing which are the result of being in the ocean. This includes the differences the surf break (beach vs reef), how the tide influences a surf break and other elements such as currents and rips. Two key ideas arose from the questionnaire in relation to these ideas and they were knowledge of the environment and safety.

Surfing is a unique sport, as a surfer not only requires physical skill and fitness, but they also need to have sufficient knowledge of the ocean. A surfer's knowledge of how to read waves and understanding where the best position is to take off on a wave can have significant influence on their ability to catch waves and thus surf. Therefore, several surfers felt this knowledge of the ocean environment is the most important for a surfer and thus felt that spending time in the water and learning how to read waves is the best way to train for surfing, as explained by the following quotes

"Surfing is more than just standing on a wave, you need to read the water - rips, currents. You need to read the wave - breaking point, left or right turn, reef or sand break. Feeling the elements - sun burn, wind, temperature. It's a sport where you can prepare for what's to come but you can't plan every moment. The best practice is to be in the water. The more hours the better." (P27)

"The conditions on land and water are entirely different, so by spending time in the water you're used to the various factors such as wave conditions, crowds which is taxing on your mental capacity. On land, you are in a safe space, which doesn't apply well in real conditions." (P213)

In contrast, for some surfers', their knowledge of the sport and ocean environment led them to be more inclined to perform training out of the water. During a surf, there is the possibility of getting caught on the inside, also known as the 'impact zone'. This is the area just inside of where waves break during a set and if caught in this area, it can be difficult to get out with waves continuing to break. It can be very fatiguing as a surfer needs to keep paddling and duck-diving to get out of this area. Surfers may also get held down in this area after falling off a wave which poses a risk as they are required to

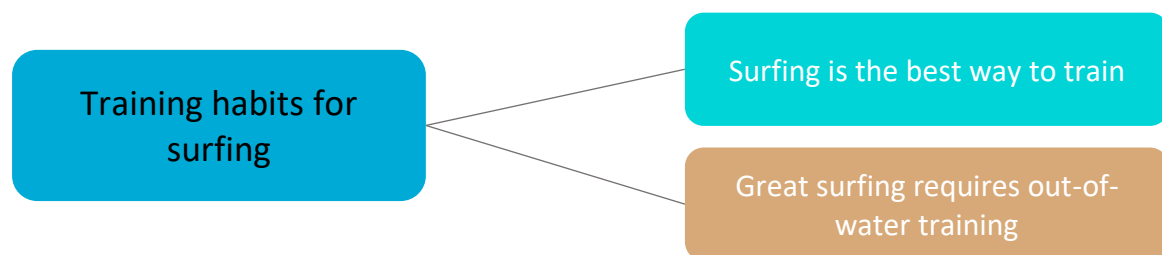
hold their breath, sometimes for long periods of time. Therefore, this knowledge and understanding of the potentially dangerous nature of surfing was the reason some surfers felt that training can help them “be strong against the ocean” (P225) and as one surfer stated, “to be able to get myself out of dangerous situations” (P51). Additionally, “safety in the water” and “to not drown” were statements also mentioned by a few surfers.

#### 4.5 Training habits for surfing

The third dominant theme was ‘training habits for surfing’ and centres around surfers current training habits. The sub-themes propose the two trains of thought among surfers regarding training habits. These were ‘surfing is the best way to train’ and ‘great surfing requires out-of-water training’ (Figure 7).

**Figure 7.**

*Training Habits for Surfing Theme and Associated Sub-Themes.*



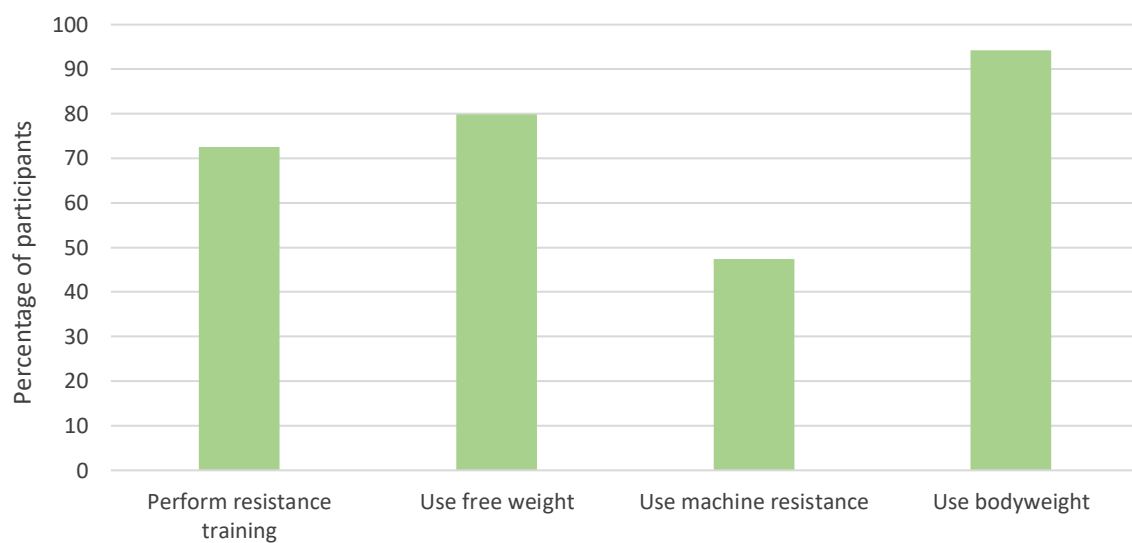
Seventy percent of participants stated they train for surfing other than surfing itself, with 81% training all year round. Participants most frequently train in the afternoon/evening (33%), while 32% of participants stated they only train when there is no surf. On average, participants train 3 times per week (SD = 2, range 0.5–9) and trained most frequently for more than 30 minutes (56%) or more than one hour (24%). There was no significant difference in the proportion of males and females who trained for less than 30 minutes (males = 18%; females = 12%), more than 30 minutes (males = 53%; females = 63%), more than 1 hour (males = 24%; females = 25%), more than 1.5 hours (males = 3%; females = 1%) or more than 2 hours (males = 2%; females = 0%), ( $p = 0.3$ ). There was also no significant difference in the number of training sessions per week between males and females (mean difference = 0.3, 95% CI = -0.1–0.7,  $p = 0.2$ ). A one-way ANOVA showed there was a significant difference in the number of training sessions per week depending on the level of surfer ( $F = 3.6$ ;  $p = 0.3$ ), however there was a significant interaction effect by gender ( $p = 0.02$ ). Advanced female surfers had significantly

more training sessions than novice female surfers (mean difference = 1.5; 95% CI = 0.24–2.7;  $p = 0.02$ ), but this was not the case for male surfers (mean difference = 0.36 to 0.84;  $p = 0.13$ ).

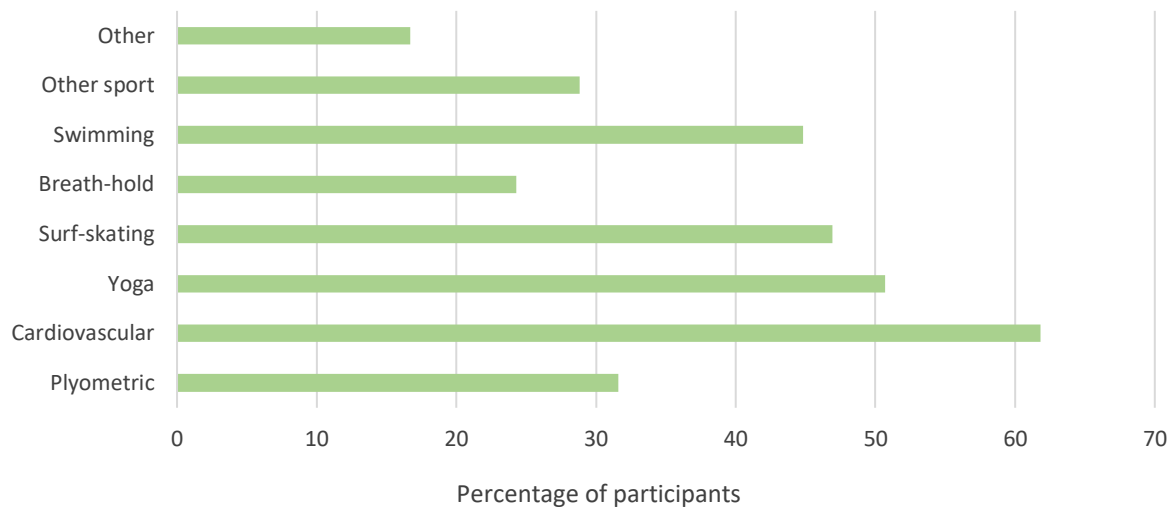
Seventy three percent of participants stated they perform resistance training, with additional information on the forms of resistance used presented below in Figure 8. The most frequent repetition range for participants who utilise resistance training was between 6–12 repetitions (58%) and only 28% of participants stated they utilise a training program when training. The most common additional forms of training were cardiovascular endurance (62%), yoga (51%) and surf skating (47%) as shown in Figure 9. No significant differences in resistance training habits were found between males and females.

**Figure 8.**

*Participants Use of Resistance Training.*





**Figure 9.***Additional Forms of Training Utilised by Participants.*

#### 4.5.1 Surfing is the best way to train

The first train of thought around training habits for surfing was that surfing is the best way to train. This was present in surfers who were considered “die hard surfers” or purists. They often view surfing as a way of life, and they dedicate a lot of their time to surfing and surfing alone. This mindset leads these surfers to often believe training outside of the water is pointless as surfing provides all the training a surfer really needs. This was supported by the quantitative data where access to a surf coach (46%) or a wave pool (24%) was a priority. This indicates these surfers want services directly related to their surfing ability rather than something that can be used to complement their surfing.

Indeed, several surfers expressed this mindset by suggesting nothing is the same as surfing. Many surfers stated it is difficult or even impossible to replicate all the elements of surfing on land through statements such as “nothing simulates surfing more so than surfing itself” (P215) and “land-based training cannot truly duplicate the surfing experience” (P124).

Similarly, other surfers stated as time in the water is the most valuable experience for surfers, there is nothing more important than spending as much time as possible surfing and in the ocean. This is shown by one surfer who stated, “the more you in the water the more knowledge and experience you get to become a better surfer” (P378).

“Surfing is my training for surfing” was a statement echoed by several surfers as they believed surfing is the best way to train. This is further explained in the following quote

“No other way to train for surfing but to surf. Why? Because no one wave is the same you have to be able to absorb vast information and study while you are physically training. Every mistake is a chance to learn. And this can only happen from actually surfing. To learn another language you need to practice speaking it to be fluent same with surfing. It's not just a physical sport so you cannot just define it as a physical sport it is an all-in-one package” (P210)

One surfer said, “practice makes perfect” (P1), thus showing they believe practicing on waves and in the water is the best way to train. As surfing requires significant skill to perform manoeuvres, these surfers feel training by surfing is the best way to improve these skills, as suggested by a surfer who stated, “when I surf more I surf better and have tangible evidence of improvement” (P11).

Finally, some surfers felt they “surf often enough” and therefore “do not need to” perform additional training. This is supported by the quantitative data showing around a third of participants train only when there is no surf. Therefore, many surfers may support the notion that by surfing often enough, they remove the need to train.

#### 4.5.2 Great surfing requires out-of-water training

The second train of thought around training habits for surfing is for surfers to be great at surfing, they need to train. They believe there are aspects of surfing that are trainable out of the water and by training these aspects out of the water, they are maximising their potential when they are in the water. This was supported by the quantitative data as participants stated training equipment (23%) or some form of strength and conditioning (23%) was what they desired most to improve their surfing.

When participants were asked what the most important aspects for surfing were, cardiovascular endurance was considered one of the most important by 69% of participants. Most surfers would have experienced the cardiovascular demand of surfing. Therefore, it is unsurprising fitness and stamina were aspects many surfers thought could be trained out of the water. This is shown by one surfer who said “there are definitely other means to optimise fitness levels other than surfing alone. Similar with playing rugby, game time isn't enough to optimise fitness levels.” (P5)

Another example was flexibility, as flexibility was considered by 40% to be one of the most important aspects of surfing. Many surfers indicated a lack of flexibility can seriously impact their ability to perform crucial parts of surfing such as a pop-up or even paddling. Therefore, flexibility was also

mentioned as an aspect of fitness that is trainable out of the water. The following quotes support this notion

“Because I started surfing late (late twenties), there are some strength and mobilities I need to improve outside of water so I can surf better when I am in the water. For example, my hip joint is stiff which affects my pop up. And I don't think keep surfing in water will improve my hip mobility better than exercises I do outside of water” (P129)

“Recovery is also very important. If we'd surf as much as possible the body wouldn't have time for that. Also, flexibility and certain movements can be trained better outside the water than while surfing (yoga, surf skate)” (P290)

Strength was also important to 34% of participants as one surfer stated they “need extra muscle strength to support surfing” (P67). Developing strength out of the water allows surfers to challenge their body more than they may be able to in the water as explained by one surfer who said, “in terms of physical development, increasing capacity by developing bigger, more efficient muscles/body is not as easy and sometimes not achievable in the water.” (P264)

Paddling strength/power was also an important aspect for some surfers and one surfer expressed it is useful “so I can last longer and paddle faster than everyone else” (P314). Although only the most important aspect of surfing for 14% of participants, paddling strength/power is essential to get a surfer into waves and to paddle through difficult conditions.

Balance is another essential aspect of surfing, specifically for wave-riding and was one of the most important for 31% of participants. Good balance enables a surfer to stand on their board and pump along the wave and training offers the ability to “to focus or work on different aspects such as balance” (P46) and was therefore mentioned by several surfers as an element they trained for out of the water.

Several surfers also stated muscle memory was an aspect trainable out of the water. Muscle memory refers mostly to wave-riding and performing manoeuvres which are highly technical and by training this out of the water, it reduces the amount of wasted opportunity on waves as explained by the following quote

“I believe that a lot of work can be done on land. By training this way, you develop the muscle memory necessary for the moves and manoeuvres. Just going into the ocean isn't enough and the nature of the medium means that it's constantly changing and therefore, you should be in the right physical condition to be able to adapt to whatever is. Being out there is the time to practice new skills and have fun.” (P224)

Similarly, technique/skill can be trained on land and by doing so, some surfers felt they are able to ensure they are constantly progressing their ability as they have more time to practice new skills. One

surfer stated, “with surf skating you can get more manoeuvres in a session than you would in water” (P179), suggesting surf skating is a useful way to improve a surfer’s technique/skill. Another surfer indicated, “assessing your strengths and weaknesses for surfing and then training on land it gives the surfer the ability to practice skill acquisition repetitively with less fatigue e.g., catching a wave versus using a skate ramp for top turn practice” (P264).

## Chapter 5 Discussion and Conclusions

### 5.1 Introduction

This chapter interprets and expands on the results of the questionnaire. The three dominant themes presented in the results are the main discussion points that will be explored. These three points are the focus for this dissertation and relate closely to the research questions of this study. How they relate to existing research, along with the implications of the results are also discussed. Finally, the limitations of the research and recommendations for future research will be discussed as well as the practical applications of the research.

### 5.2 Discussion

The increase in popularity and consequent professionalisation of surfing has led to an increase in research to better understand the demands of surfing and the benefits of performing surf specific training. Despite numerous studies indicating the benefit of utilising surf training to improve surfing performance and reduce injuries, there is limited research to show what surfers' training habits are and if they are using the recommendations set out by current literature. In addition, there has been no study to date to provide insight into the knowledge and attitudes of surfers towards surf training. Therefore, the purpose of this study was to investigate surfers' current training habits and their knowledge and attitudes towards training for surfing.

#### 5.2.1 Surfers' attitudes towards surf training

No previous study has investigated surfers' attitudes towards training however, many have implied surfers have little interest or experience in surf training (Axel et al., 2018; Mendez-Villanueva et al., 2006; Secomb, Sheppard, et al., 2015). Contrary to this, the results of the current study revealed a far more positive attitude towards surf training. Although 83% of participants did state they believe surfing is the best way to train for surfing, 89% of participants felt performing surf specific training could be beneficial. This contradicts previous assumptions and suggests surfers are more open minded toward training than many have believed. Additionally, most research although limited, has indicated very few competitive surfers train for surfing and it is even more uncommon for recreational surfers to train (Coyne et al., 2017; Furness et al., 2016; Mendez-Villanueva et al., 2006; Redd & Fukuda, 2016). This difference in attitudes to training was not the case in the current study as most participants were recreational surfers and did have an interest in training for surfing. It is therefore possible training for surfing is becoming more of a common practice among surfers, even recreational surfers. This was reinforced by the qualitative findings of this study. Surfers who had a positive attitude towards training

held clear motivations for why they believed training would benefit their surfing. These motivations were grouped into three clear categories: *Performance in the water, longevity and participating in the sport until an old age and enjoyment and comfort.*

One dominant motivation for many surfers to train was to improve their surfing ability and be a better surfer. As surfing occurs in the ocean, there are many environmental factors which may influence the surfing conditions. Due to this inconsistent nature of surfing and the fact that time surfing on a wave is often very limited, many surfers felt that training would offer the opportunity to improve faster, be better prepared when they did go surfing and allow them to catch more waves. Several previous studies support this idea, as they have found training out of the water can produce favourable physical changes that in turn improve performance (Axel et al., 2018; Coyne et al., 2017; Parsonage et al., 2017; Secomb, Sheppard, et al., 2015). This has been shown to be especially important for female surfers as they are at a physical disadvantage when compared to male surfers who possess superior anthropometric and sprint paddle qualities along with greater relative strength and power (Anthony & Brown, 2016; Eurich et al., 2010; Parsonage et al., 2017). As a result, female surfers are not able to paddle as fast or for as long, often pop up slower and may perform less radical or powerful manoeuvres (Eurich et al., 2010; Fernandez-Gamboa et al., 2020; Parsonage et al., 2018; Parsonage et al., 2017). Therefore, it is extremely beneficial for female surfers to train out of the water, and this was in fact reflected in the results of the current study, as significantly fewer female participants believed surfing is the best way to train for surfing in comparison to males. Thus, it is possible many female surfers understood they have physical disadvantage and know the potential advantage training can offer them and their performance.

Aside from improving performance, a key motivator for surfers to train was to improve their longevity in the sport. Surfing is considered by most surfers to be a 'lifestyle' rather than just a sport (Fuchs & Schomer, 2007; Henderson, 2001). The idea of 'living to surf' is a common notion among many surfers and indicates their dedication to surfing. The pure joy or 'stoke' surfers experience when riding a wave is undeniably why they wish to keep surfing for a long time (Bush, 2016; Fendt & Wilson, 2012; Fuchs & Schomer, 2007). Spirituality has long been intertwined with surfing and dates to surfing in ancient Hawaii. It is another element which adds to the allure of surfing and may contribute to surfers wanting to be able to surf far into the future (Amrhein et al., 2016; Fuchs & Schomer, 2007; Moreton et al., 2022). Often surfers will enter a 'flow' state whereby they are so engrossed in the action of riding a wave they lose a sense of self and time. This state of flow has been linked to improved mood and higher self-esteem, showing a clear link between surfing and positive psychological wellbeing and

another key factor to the ‘addictive’ nature of surfing (Fuchs & Schomer, 2007; Moreton et al., 2022; Partington et al., 2009).

Being able to connect to nature and being in a “blue space” is another key element of why surfers enjoy surfing and want to continue surfing (Levin & Taylor, 2011; Olive & Wheaton, 2021; Wheaton, 2017). A “blue space” is a term used to describe waterscapes such as the ocean and their surroundings and surfing offers the opportunity to immerse into these blue spaces and as a result has been shown to lead to reduced stress, blood pressure and cortisol levels (Moreton et al., 2022; Olive & Wheaton, 2021). Studies have also found that depression and anxiety is lower in people who surf than those who do not and have suggested there is a therapeutic effect associated with surfing (Amrhein et al., 2016; Levin & Taylor, 2011; Moreton et al., 2022). In addition, studies have shown surfing can lead to a reduction in anxiety and depression and has also been shown to decrease symptoms of post-traumatic stress disorder (PTSD) and major depressive disorder (MDD) in combat veterans after following surf therapy sessions (Caddick et al., 2015; Glassman et al., 2021; Walter et al., 2019). It is unsurprising therefore, that surfers would want to continue surfing for as long as possible, as there are clear psychological benefits that surfers experience in addition to the pure enjoyment of surfing. Along with the mental benefits, the physical benefits of surfing are also a significant reason for surfers to want to continue surfing. As a form of exercise, there are many associated physical and cognitive benefits. For example, one study by Simas et al. (2019) suggested surfing was an effective way to reduce age-related bone deterioration, while another study of surfers over 60 by Frank et al. (2009) showed long-term participation in surfing created specific neuromuscular adaptations which were advantageous for muscle force production and posture. Therefore, there are numerous benefits to continued participation in surfing and surfers in the current study felt by performing land-based training, they would be able to continue surfing far into the future. However, literature has also shown that age is a major barrier for many surfers continued participation in surfing, due to reduced physical capabilities along with the increased risk of injury (Wheaton, 2017). Age is a major risk factor for most soft tissue injuries in surfing, often as a result of the cumulative time spent in the water, therefore, training has been recommended to improve strength and reduce injury risk (Nathanson et al., 2002; Remnant et al., 2020). Results from the current study show a large portion of the participants were aware of the most common injuries in surfing and held a positive attitude towards training to reduce the risk of injury, particularly muscular and joint injuries. Therefore, it is possible the surfers in this study were aware of how age can impact their ability to surf and believe training is a useful way to reduce injury to increase their longevity in the sport.

Finally, enjoyment and comfort in the water was an important motivator to perform surf training for many surfers. For some, being fitter was associated with having more fun in the water and this has also been shown in previous surfing research. Surfers who possess greater upper body strength and power can paddle and pop-up faster, therefore getting onto the wave earlier and maximising their time riding the wave. Additionally, greater cardiovascular endurance allows surfers to paddle for longer, thus they can surf for longer durations and catch more waves. This in turn also means they can paddle for extended periods to get out to the take-off zone and are therefore less likely to get caught on the inside getting pummelled by the wave. This is significant as the main goal of surfing is to catch the longest waves and to catch as many waves as possible as it is the most enjoyable part. Additionally, some surfers felt training would improve their overall comfort in the water. The main reason for this was training would improve their fitness capabilities and in turn, they felt more confident to surf in larger waves or attempt more difficult manoeuvres because they had prepared on land beforehand. A key reason for this attitude may be the greater risk associated with surfing bigger waves or attempting more difficult manoeuvres. When surfing big waves, there is the chance of getting 'held down' after falling off/finishing a wave. This may also occur if a surfer attempts but does not successfully complete a difficult manoeuvre. In this situation, surfers are pushed underwater by the breaking wave and need to hold their breath until the wave(s) have cleared (Greever et al., 2019). In addition, when paddling back to the 'line-up' surfers are often required to duck-dive which also requires breath-holding. By training, surfers may reduce the stress they experience in the water as both breath-hold and aerobic exercise training have been shown to increase breath-hold capacity by reducing oxidative stress and metabolic acidosis (Greever et al., 2019; Joulia et al., 2003). Therefore, it is possible surfers in the current study felt by training, they would increase their aerobic capacity and their ability to paddle out the back faster to avoid getting caught inside or improve their breath-hold capacity to feel more comfortable when being held underwater.

While the results show a more positive mindset towards surf training than previously believed, there was still overwhelming support for the notion surfing is the best way to train for surfing. Interestingly, results showed significantly more advanced surfers hold this view when compared to novice and intermediate surfers. This was surprising as one may have assumed advanced surfers would be more aware of the benefits of training for improving performance and reducing injury risk. However, this was clearly not the case and suggests advanced surfers are less likely to engage in surf training than novice or intermediate surfers. One potential reason for this difference in engagement is possibly where a surfer's ability level increases there is a decrease in the relative exercise intensity as shown in a study by Barlow et al. (2014). Therefore, advanced surfers may feel training is not important



because the physical demand they experience when surfing is less than surfers with a lower ability. Another possibility is because most advanced surfers were male participants, it can be suggested male surfers are more likely to hold this view than female surfers and this attitude against training for surfing may reflect the traditional masculine surfing culture mindset. This mindset reflects the 'soul-surfing' philosophy that lay the foundation for modern surfing culture, and it may be surf training is not authentic to the culture of surfing. A similar attitude has been seen in studies investigating attitudes of surfers towards protective headgear. Despite headgear being a clear tool to reduce the risk of head injury, many surfers felt it was uncool and signified a level of inexperience, therefore, they did not want to detract from their image of an experienced surfer by wearing a helmet. It is possible, similar to the attitudes displayed towards protective headgear, surf training implies a lack of experience and inauthenticity within surf culture (Dean & Bundon, 2021). Conversely, it is also possible novice and intermediate surfers are more inclined to train to improve their confidence and comfort in the water as previously mentioned. Previous research has shown novice surfers can feel criticised because their surfing ability is inferior to more advanced surfers and have fears around looking or feeling incompetent (Wheaton, 2017). Therefore, by training, they can reduce these feelings and feel more confident in their physical abilities when they are out on the water.

Surfers who stated they were not motivated to train for surfing acknowledged it was not a priority for main two reasons: *General fitness* and *Leisure activity/hobby*. For several surfers, surf training was not important because surfing was not a priority. Thirty percent of participants stated surfing is not their primary sport and their training focused more on general health and wellbeing or involved participating in several sports rather than training one specific sport. On the other hand, some surfers felt training was not a priority because they surf for fun and therefore do not feel the need to train. Many surfers indicated they believe training is only for professional or competitive surfers as they are at a level that requires training, however, for recreational surfers, training is not necessary. This attitude has been echoed in literature as numerous studies state only competitive surfers have been shown to perform surf training and it is not commonly seen among recreational surfers (Coyne et al., 2017; Furness et al., 2016; Mendez-Villanueva et al., 2006; Redd & Fukuda, 2016). This suggests the surfers in this study viewed training as a resource only 'serious' surfers should utilise but for those who partake as a hobby, it is unnecessary. Additionally, several surfers stated they did not believe surf training was necessary because they were at a level they were happy with and enjoy surfing enough already without feeling the need to train. This attitude suggests these surfers feel performing surf training will detract from the enjoyment of surfing rather than enhance it. As many surfers emphasise the feeling of "stoke" as the reason they participate in surfing, rather than staying fit, surfers with this

attitude may lack the understanding or the motivation towards training for surfing because they are partaking purely for "the buzz" (Wheaton, 2017).

### 5.2.2 Surfers' knowledge of the demands of surfing

Results from the current study shows most surfers had a moderate understanding of the physical demands of surfing, with 44% of participants answering at least four of the seven knowledge-based questions correctly. Overall, most surfers possessed understanding of the general nature of surfing, such as paddling being the largest portion of a surf session and the most common types of surfing injury. However, more specific knowledge such as the average duration of a paddling bout or the most common locations of injury in the upper and lower body was limited, implying most surfers have sufficient knowledge of the general demands and characteristics of surfing but are missing more in depth understanding. Consequently, this suggests many surfers may lack adequate understanding of how to appropriately train for surfing as they have insufficient knowledge of what physical capabilities need to be trained and to what extent. This is reflected in the qualitative results as '*Lack of knowledge*,' a key sub-theme regarding surfers' knowledge of the demands of surfing. It was clear many surfers felt they did not understand how to train for surfing, as a result of the lack of understanding around the demands of surfing. This is significant because while results of the current study indicated the most surfers are performing some form of training for surfing, it may be the training implemented lacks surf specificity. Especially as results also showed only 28% of participants utilise a training program which indicates there is a clear need for more surf specific training resources.

For some surfers however, the demands of surfing were not just the physical demands such as paddling, duck-diving and wave riding but also extended to the demand of being in the ocean and the second sub-theme of '*Knowledge of the surfing environment*'. Being in the ocean is a fundamental part of surfing, however, it does add an element of unpredictability as there are many factors that cannot be controlled such as wave size and quality, along with current and rips at different surf breaks (Barlow et al., 2014). Therefore, for a few surfers it was important to acknowledge having knowledge of the demands of surfing also meant having knowledge of the ocean and surfing environment. As a result, they felt spending time in the water and developing their knowledge of the surfing environment was more important than training. This attitude was largely because they felt the conditions of surfing could not be replicated on land and knowing where to sit in the line-up, which wave to paddle for and where on the wave to take-off from were skills that could only be developed in the water. This has been seen in one study by Furley and Dörr (2016) which suggested surfers' 'wave knowledge', or their ability to make decisions around wave choice is something best developed by spending more time in

the water. Furley and Dörr (2016) provided evidence to suggest experienced surfers have a greater cognitive advantage and can distinguish between surfable and non-surfable waves when compared with less experienced surfers. They proposed this was because experienced surfers have gained knowledge and expertise through significant practice. This in turn leads to memory adaptations to enable them to pick up early cues such as waves on the horizon or recognise specific patterns of information (e.g., ocean surface conditions or speed of swell movement). These cues inform them as to what situation is likely to occur (e.g., a left-hand wave breaking wide of the surf break) so they can anticipate and decide on their action faster. Therefore, knowledge of the environment is obviously vital for surfers and for many, it was more important to develop this knowledge than develop their physical capabilities.

On the other hand, some surfers felt more inclined to train due to their knowledge of the ocean and the potential dangers they may face when surfing as a result of being in the ocean. For most surfers, dangerous situations related to being forced underwater for long periods of time and the possibility of drowning. When surfing, a surfer is often required to hold their breath, sometimes for extended periods of time if they have fallen off a wave and are being 'held down' under the water, or continually when duck-diving as they paddle back out to the line-up (Farley et al., 2012a; Greever et al., 2019). In addition, they also need to paddle, either to avoid being pummelled or to paddle out to the line-up (Farley et al., 2012b). These situations can cause significant stress for a surfer because as one study found, the increase in exercise intensity from paddling results in a reduced breath-hold capacity due to increased carbon dioxide production which stimulates the urge to breathe (Greever et al., 2019). Indeed, they also found a 30-second bout of paddling can reduce a surfer's breath-hold capacity by 79%, thus significantly reducing a surfer's ability to hold their breath. This can lead to potentially dangerous situations, even drowning, which were concerns of participants in the current study. This is likely why participants felt training would be advantageous at mitigating these risks, especially as previous studies indicated breath-hold training and aerobic exercise training can increase breath-hold capacity in non-surfers (Fernandez et al., 2019; Joulia et al., 2003) and surfers (Greever et al., 2019).

### 5.2.3 The current training habits of surfers

Current research in the area of surfing has shown clear evidence to suggest training is beneficial for surfers, as it can help improve performance and reduce the risk of injury (Axel et al., 2018; Coyne et al., 2017; Everline, 2007; Forsyth et al., 2019). However, research to this point has also suggested not many surfers train for surfing and for those who do, it has been inconclusive regarding whether they train for surfing or for general health. Therefore, the results from the current study provide novel

findings in this area of surfer's training habits. Results show 70% of participants perform training specifically for surfing, with most participants indicating they believe training to be important for surfers. As no study has reported how many surfers perform surf specific training, the results cannot be compared however, they do imply surfers have a more positive attitude towards training than previously believed. Indeed, two previous studies found surfers surfed far more than they trained (Farley et al., 2015; Loveless & Minahan, 2010) but in the current study, the average hours spent surfing and training were very similar. This is potentially because the age of participants in the studies by Farley et al. (2015) and Loveless and Minahan (2010) were between 13 to 18 years of age, compared to the present study which was between 18 to 70. Therefore, it is possible youth surfers have more time available to spend in the water compared to adults. As a result, adults or surfers who do not have access to surf as often as they would like may have utilised land-based training to make up for their lack of time in the water. Indeed 32% of participants stated they only train when there is no surf, highlighting for some training is complementary but if they can surf, they will. This attitude to training was also seen in a study by Everline (2007) who found a common idea among surfers who train was "when the surf is good: Surf. When the surf is poor: Train."

Participants trained on average three times per week which is higher than results from the only previous study investigating surfers' training frequency, which found surfers only trained once per week (Loveless & Minahan, 2010). This is potentially because the study by Loveless and Minahan (2010) investigated junior male surfers between the ages of 16 to 20 while the current study only included surfers over the age of 18. Therefore, it is possible there are differences in knowledge, attitudes, and resultant training habits of surfers under 20 and those over 20 and this is an area for future research. Interestingly, there was a significant difference in the number of training sessions depending on the level of surfer. However, this was only found in female surfers, as results showed advanced female surfers trained more frequently than novice or intermediate, but this was not the case for male surfers. This supports the ideas discussed previously regarding how the traditional mindset of male surfers may influence a disregard for training, as it may not be seen as authentic to surfing culture. Additionally, it is also possible advanced female surfers are aware of the physical disadvantage they possess along with the significant benefits surf training can offer and are therefore more inclined to perform land-based training to improve their performance or to be able to compete with male surfers in the line-up. Overall, the results from this study give a general indication of surfers' current training habits and despite surfing historically being a 'chill' leisure activity, results have shown many surfers do train. This finding suggests the attitude among surfers may be changing to be more open-minded towards surf training. This change in attitude was seen in the qualitative results as there

were clearly two trains of thought regarding training for surfing – the more traditional mindset ‘*Surfing is the best way to train for surfing*’ and a more progressive mindset ‘*Great surfing requires out-of-water training*’. For those who felt surfing is the best way to train for surfing, it was clear surfing is their training, and they believe there is nothing that can simulate surfing other than surfing itself. This attitude was also seen in two of the previous studies regarding surfers’ training habits (Farley et al., 2015; Loveless & Minahan, 2010). The extent of knowledge of the ocean required by surfers is another element which they felt could not be learnt on land and is something that can only be learnt through experience. Indeed, previous studies have suggested that it is difficult, potentially impossible, to simulate surfing on land (Mendez-Villanueva & Bishop, 2005; Mendez-Villanueva et al., 2006). Additionally, by spending as much time as possible surfing, the participants in the present study felt they removed the need to train because they can practice over and over to master their skills. This was important for some surfers because as seen in previous studies, a surfer’s skill level is very important as it is linked not just to their own enjoyment, but also to their image as a surfer (Sanz-Marcos, 2021; Usher & Gómez, 2018; Wheaton, 2017). A surfer’s image has been shown to have a significant impact on whether they are considered a ‘real surfer’, especially among male surfers. One study found skill level was indicative of whether you could even claim to be a surfer for male surfers, whereas for female surfers, they focused more on a surfer’s purpose in the water and if you are having fun, then you are a surfer (Bush, 2016). This insight indicated that for some surfers, especially male surfers, possessing advanced surfing ability is very important. Therefore, these surfers may have felt purely surfing as training for surfing was the best way to improve their surfing ability.

On the other hand, the more progressive mindset seen in many participants suggests being a good surfer means you need to perform additional training out of the water. These surfers felt it is difficult to truly replicate surfing out of the water, however there are many aspects of surfing that are trainable on land. While surfing is obviously the preferred method of training, if they were to train outside of the water, participants felt they would be far more physically capable of meeting the demands of surfing and still have enough strength to pop-up after paddling for extended periods of time. This capacity would in turn ensure they maximised their potential when on the water because they would be able to paddle into waves and pop-up at speed. These beliefs reflect the findings of numerous studies which have found training can be an advantage for surfers to improve performance and reduce injury risk (Mendez-Villanueva et al., 2006; Parsonage et al., 2017; Sheppard, McNamara, et al., 2012). One of the main aspects surfers’ felt was trainable out of the water was cardiovascular endurance as they believed it would ensure they could meet the significant paddling demands required when surfing. This belief was seen in the training habits of the participants in the current study, as 62% of

participants stated they perform cardiovascular training for surfing. Previous studies support this as they have shown by possessing greater aerobic/cardiovascular endurance, surfers can extend the amount of time and the quality of the time spent on the water by delaying the onset of fatigue, thus allowing surfers to spend more time wave riding (Parsonage et al., 2017; Tran et al., 2015).

Flexibility was also expressed as being important for surfers and therefore especially useful to train on land. Over 50% of participants stated they perform yoga as training for surfing and flexibility was highlighted as being crucial for movements in surfing. These movements include the pop-up because the surfer needs to be able to get their feet up under their chest in one fluid movement or when riding a wave, as a surfer will need to compress down into a crouch position to produce speed. Many surfers felt flexibility is difficult to improve unless approached through land-based training and believed by improving their flexibility out of the water, their movements would be more fluid when on the water. The limited research available on flexibility for surfing seems to suggest flexibility may improve performance and reduce injury risk (Bruton et al., 2017; Bruton et al., 2013; Furness et al., 2015; Minisian & Hope, 2021). In particular, two studies found advanced/competitive surfers travel through a greater range of motion in their lower body and as a result can produce more dynamic movements than less advanced surfers (Bruton et al., 2017; Bruton et al., 2013). This was suggested to be due to them possessing more surfing experience, therefore it may be possible for less advanced surfers to utilise land-based training to replicate these movements on land and accelerate their progress. However, further research is required to understand the benefits of flexibility training for surfers.

Developing strength was also important to some surfers who felt that increasing strength can improve their fitness capacity and ability to paddle and surf better. Indeed, this has been seen in many previous studies investigating the impact of strength training on surfers' fitness. Strength training has been shown to improve surfers' sprint and paddling performance, produce a faster pop-up and allow a surfer to produce more powerful manoeuvres (Axel et al., 2018; Coyne et al., 2016, 2017; Fernandez-Gamboa et al., 2020; Secomb, Farley, et al., 2015). This allows surfers to paddle faster and for longer, get into waves faster and perform more radical manoeuvres. Therefore, it was interesting that strength was considered the most important aspect of surfing by only 34%, despite resistance training being highly adopted by participants in the current study. It is possible surfers do not fully understand how beneficial strength training is or there may still be the misconception that by performing strength training, they will gain extreme muscle mass and lose other important aspects of fitness such as flexibility (Sheppard, Osborne, et al., 2012). In addition, very few participants stated they have a training program which does call into question the surf specificity of the training these surfers are

performing. Therefore, future research is required to understand surfers' use of resistance training in greater detail.

Surfers' habits prior to a surf session were also investigated. Results showed only 27% of participants always perform a warm-up before a surf session and only 5% always perform a cool-down after a surf session, despite spending on average over one hour in the water per surf session. Only one previous study has investigated warm-up and cool-down habits of surfers prior to surfing with similar results, as 21% of surfers always warmed up and only 2% cooled down post surf (Meir et al., 2012). While the study by (Meir et al., 2012) found no association between warming up and reduced injury risk, current literature suggests warming up prior to exercise/sport can reduce injury risk and maximise performance (Jeffreys, 2019; Woods et al., 2007). Therefore, it is worth noting few surfers perform a warm-up, despite spending large amounts of time in the water, especially as over 80% of participants in the current study did believe warming up before surfing is important. This is interesting because it suggests surfers may have a positive attitude towards warming up prior to surfing but this attitude is not reflected in their habits. It is possible this behaviour relates back to their image and aesthetics of surfing as they may feel it is uncool or unauthentic to warm-up. Otherwise, surfers may not know what to do as a warm-up or feel they do not need to. Indeed, one study suggested the paddle out to the surf break may be a sufficient warm-up prior to surfing, therefore surfers may feel they do not require additional warming up (Meir et al., 2012). As only one study was found recommending warming up prior to surfing (Minisian & Hope, 2021), it would be useful to investigate the benefits of warming-up specifically for surfers. Especially as it is frequently recommended to reduce injury and improve performance for exercise/sports. Additionally, it would be useful in future to examine the attitudes and potential barriers surfers may have which prevent them from performing a warm-up.

#### 5.2.4 Surfing injuries

There are many factors causing injuries to surfers, such as situations while paddling, wave riding or even when getting pummelled by the surf. In 2021, the Accident Compensation Corporation (ACC), a government organisation providing no-fault insurance in New Zealand, received almost six thousand new claims relating to surfing injury, resulting in a cost of over \$10 million NZD (ACC, 2022). This was reflected in results from the present study, as 75% of participants stated they have sustained at least one injury from surfing. Injuries to the shoulder were most common among upper body injuries which is consistent with previous research and ACC data who found the shoulder to be a common risk area among surfers (ACC, 2022; Furness et al., 2015; Furness et al., 2014; Inada et al., 2018; Remnant et al., 2020). The repetitive nature of paddling is suggested to be the main mechanism of injury to the

shoulder in surfing, as surfers can spend over 50% of a surf session paddling, thus putting significant stress on their shoulders (Hanchard et al., 2021; Inada et al., 2018; Meir et al., 2012). In addition, age has been found to have a considerable influence on injuries to the shoulder for surfers. Furness et al. (2014) found surfers who were over 39 years of age were at a higher risk of developing gradual-onset injuries and this is suggested to be because older surfers have spent more time in the water and have a greater cumulative exposure (Remnant et al., 2020). As the mean age of the current study was 36 years old with an average of 14 years surfing experience, it can be assumed extended periods of time surfing have contributed to the high number of injuries, especially shoulder injuries in this study.

The knee was the most common lower body injury location and is reflected in ACC data (ACC, 2022) but differs from previous research which found the ankle or lower back to be more common among surfers (Furness et al., 2015; Furness et al., 2014; Inada et al., 2018; Woodacre et al., 2015). It has been suggested the change in surfing style, with more emphasis on powerful manoeuvres, in addition to more surfers attempting aerials is a potential contributor to an increase in knee injuries among surfers (Furness et al., 2014; Meir et al., 2012). Studies have also found surfers who can perform aerial manoeuvres have a higher relative risk for injury compared to those who could not (Furness et al., 2015; Furness et al., 2021). This was attributed to the stress placed on the lower body when landing an aerial manoeuvre as a surfer may produce vertical force of up to six times their body weight which needs to be absorbed through the lower body on landing. Turning manoeuvres are also associated with knee injuries as these manoeuvres require the feet to stay fixed to the board while the rest of the body turns and rotates thus, putting significant stress on the knee (Furness et al., 2014). As almost half of the participants in the current study were advanced surfers, it is likely the high number of injuries to the knee reflects their surfing level.

Skin injuries were the most prominent type of injury found in this study and this aligns with most previous surfing injury studies (Hay et al., 2009; Moran & Webber, 2013; Nathanson et al., 2002; Taylor et al., 2004; Woodacre et al., 2015). This finding suggests an impact with the ocean floor, a surfboard (either their own or another surfer's) are the leading cause of skin injuries. However, it is interesting to note over a third of injuries in the current study were muscular and joint injuries. This is consistent with several recent studies suggesting the rising number of muscular and joint injuries reflects the changing surf style and increased utilisation of shorter and lighter surfboards (Furness et al., 2015; McArthur et al., 2020; Nathanson et al., 2007). These types of surfboards offer greater manoeuvrability and allow a surfer to perform more radical manoeuvres such as aerials as described previously. As a result, this may create more stress on ligaments and contractile tissues and it is



possible this is the reason for the number of muscular and joint injuries in this study (Furness et al., 2015).

#### 5.2.5 Differences between male and female surfers

Although not a specific aim of this study, the findings reveal important differences between male and female surfers. The mean age of participants in this study was higher than those seen in previous surfing studies and this difference seemed to apply more to the male participants of this study as the mean age of male participants was significantly higher than female participants. In addition, surfing experience was also significantly higher in male surfers than female surfers. This is consistent with current literature and suggests male surfers are introduced to surfing at an earlier age and are more likely to continue surfing past middle-age while female surfers seem to participate in surfing mostly during early adulthood. There are many factors which may contribute to women having less experience and not surfing into later life such as societal norms, familial obligations, or concerns around safety (Bush, 2016; Usher & Gómez, 2018). Indeed, one study found female surfers often began surfing at a young age but stopped for over twenty years, only returning when struggling with issues from adulthood (Bush, 2016). Physical ability may also be a contributing factor as numerous studies have shown female surfers possess inferior strength and power compared to male surfers which impacts their paddling velocity and endurance along with speed when popping up onto the surfboard (Anthony & Brown, 2016; Eurich et al., 2010; Parsonage et al., 2017). This may cause significant challenges for female surfers as they age and limit their ability to catch waves or make it to the take-off point, which takes away from the enjoyment of surfing. These physical deficits combined with the decline of physical capacity due to age has been shown to be a major barrier for surfers when considering if they should keep surfing and may therefore deter female surfers from continuing to surf into later life (Wheaton, 2017).

This study also had a substantial number of female participants compared to previous surfing research. Interestingly, the results (Table 1) show within the female cohort, there were significantly fewer self-described 'advanced' surfers in comparison to males. There were also very few female amateur competitive surfers, with most being leisure surfers. One possible reason for this is the male participants being significantly older and more experienced, thus more likely to be at an advanced level. However, it is likely there are other factors contributing to these results, with the most prominent being the culture of surfing. Surfing is known to be a male dominated sport and it is only in the last decade that women's professional surfing has become more legitimate (Fendt & Wilson, 2012). While there have been improvements in pay equity at the highest level of professional surfing

between men and women, this positive attitude towards women's surfing is not commonly seen at the recreational and amateur level of surfing. Many female surfers are still dismissed and the belief they are inferior continues to be perpetuated by the surfing industry and culture (Olive, 2019; Sanz-Marcos, 2021; Wheaton & Thorpe, 2018). This impacts female surfers as the domination of male surfers in the line-up and gender hierarchy makes it difficult for them to catch a wave without experiencing scrutiny (Bush, 2016; Comley, 2016). Some even feel uncomfortable just sitting in the line-up and are therefore forced to sit further on the 'inside' of the break to catch smaller or inferior waves (Wheaton & Thorpe, 2018). It is common for female surfers to feel as though they must 'prove' themselves when first entering a line-up for other surfers to take them seriously and allow them to catch waves without being hassled (Bush, 2016; Comley, 2016; Olive, 2019; Sanz-Marcos, 2021). Therefore, it is possible the culture of surfing and consequent behaviour of (male) surfers may have a serious impact on female surfers' capacity to progress their surfing ability, thus making it more difficult to reach the level of an 'advanced' surfer. This may be the reason for fewer female amateur competitive surfers, as female competitive surfers receive less support, sponsorships and opportunities than those offered to their male counterparts (Fendt & Wilson, 2012; Parsonage et al., 2017; Schmitt & Bohuon, 2021; Usher & Gómez, 2018). Similarly, over half of the female participants in the present study stated they ride longboards rather than shortboards which is significantly more than the male surfers. It is possible this is purely because the female surfers preferred longboarding over shortboarding, however, it is also possible this reflects the impacts of surfing culture on female surfers. It may be easier/more enjoyable to surf on a longboard as they are able to ride the smaller inside waves rather than having to compete with other (male) surfers for bigger set waves (Comley, 2016). One study found some women experience anxiety when considering riding a shortboard because it is linked to more 'authentic' surfing which is reserved just for men (Sanz-Marcos, 2021). While many women do ride shortboards, studies have shown they frequently feel frustrated when doing so as they are made to feel as though they are not authentic surfers and often receive unwanted attention and advice from male surfers (Comley, 2016; Olive et al., 2015; Schmitt & Bohuon, 2021; Waitt, 2008). This reflects the attitude that women's surfing is inferior to men's surfing because men are more powerful and aggressive while women are supposedly more relaxed and stylish due to their inferior physical ability (Comley, 2016; Olive et al., 2015; Sanz-Marcos, 2021). Furthermore, numerous studies have found female surfers are frequently told to "surf like a man" to be accepted by male surfers and be considered a real surfer because the feminine way of surfing is not as impressive or seen as soft (Bush, 2016; Olive et al., 2015; Usher & Gómez, 2018; Waitt, 2008). This is also seen among female professional surfers with one example being seven-time world champion Stephanie Gilmore who is often referred to as the most stylish surfer stating in a recent docuseries "I'm actually kind of

annoyed. They need to be banned from saying the word 'style'. It's almost like that's all I've got" (WSL, 2022). This highlights her frustration at not being considered anything other than stylish, despite being arguable one of the most successful surfers on the WSL CT. It also shows how women are constantly compared to men regarding their ability and may be why some female surfers opt to ride longboards to avoid being compared and scrutinised.

### **5.3 Limitations**

There were several limitations to the present study. First, the retrospective nature of this study was a limitation as it relies on participants' memory and their ability to recall information about their training habits and previous injuries. Prospective data methods may have provided more accurate data as participants would record their weekly training habits and injuries as they happen. However, self-reported data was used as it allowed a general understanding of surfer's training habits, which is currently largely unknown and could be done while in lockdown due to Covid-19. Future research could look to utilise prospective data methods to investigate surfers' training habits in greater detail and accuracy by having participants use a training diary to collect more precise data.

Second, surfers who perform surf training or are interested in surf training are more likely to complete the questionnaire due to interest in the topic. To limit bias toward surfers who train, the questionnaire advertisement specified that any surfer could participate. It should also be noted that as participant recruitment was completed through social media platforms, it limited participants to those who have access to the internet and are on the specific social media platforms used for questionnaire distribution. While this is a limitation, by utilising an online data collection method, it offered the opportunity for participants internationally to participate.

Third, participants under the age of 18 were not included in the study. While the sample size was reasonable, it may be useful in future to investigate the knowledge, attitudes, and training habits of youth surfers. Their interpretation of surfing as a sport may be different from older surfers as they have been exposed to the opportunities of professional surfing more than those of previous generations. Also, the sample had very few amateur and professional competitive surfers. Only 10% of participants were amateur competitive surfers and 0.5% were professional competitive surfers. Therefore, no comparisons could be made between the level of surfer and their knowledge, attitudes, or training habits. It may be useful in future to investigate the differences in knowledge, attitudes, and training habits between competitive and recreational surfers to see if these factors are different among those who compete in surfing compared to those who do not.

## 5.4 Practical applications

This study provides novel research in the area of surfers' knowledge and attitudes towards training and surfers' training habits for surfing. In this study, it was established that more surfers perform training for surfing than previously believed, with clear motivations of why they train. Understanding the motivations of surfers who surf provides insight into why surfers train and resources and facilities can be aimed to focus on these areas (e.g., performance, longevity). In addition, more resources (e.g., training program, strength, and conditioning coaches) are required to provide surf specific training and ensure surfers are maximising their time training to achieve their goal for surfing. In addition, strategies should also be implemented to educate surfers around the specific demands of surfing and how training should be specific to these demands.

As the most common injuries among participants in the present study were muscular and joint injuries, training should aim to focus on areas of weakness, especially in the joints and common areas of injury such as the shoulders to decrease injury risk. Additionally, a surf specific warm-up may be beneficial for surfers to reduce injury and improve performance. As current literature suggests warming up prior to exercise is beneficial for performance and reducing injury risk, it could be beneficial to promote warming up to surfers. Therefore, there is need for a surf specific warm-up to be created so surfers have a better idea of what to do as a warm-up prior to surfing.

## 5.5 Recommendations for future research

The growth of surfing, both professionally and in popularity has led to an increase in research regarding the physical demands of surfing and benefits of training for surfers. However, more research is needed around the knowledge, attitudes, and training habits of surfers. This study provides a foundation for future research to build on to better understand what surfers know and their beliefs about training for surfing as well as their current training habits. Therefore, recommendations for future research include:

- Longitudinal studies to investigate surfers' training habits in greater detail. Utilising methods such as a training diary or app to record surfers' day-to-day training could offer further insight into the type, frequency, intensity, and duration of surfers' training.
- Further research investigating surfers' knowledge and attitudes towards training and their current training habits. Qualitative research methods such as interviews could be used to expand on surfers' knowledge and attitudes and provide further understanding of why surfers possess these views. Also, further investigation of differences in knowledge, attitudes, and

training habits between different groups of surfers. Exploring if there are differences between ages (younger and older surfers) and type of surfer (competitive and recreational surfers).

- Exploration of barriers preventing surfers from surfing and if these barriers can be mitigated by training.
- Exploration of the impact of media on surfers' attitudes and perspectives towards surf training. As surfing culture continues to develop and change, it is possible surfers' beliefs around surf training is influenced by surfing media.
- Further research into injuries among surfers, especially recreational surfers. Also, if there are differences in injury type and frequency depending on age and gender.
- Further research into the impact of flexibility on surfers and potential benefits performing flexibility training may elicit for surfers' performance and injury reduction.

## 5.6 Conclusions

Currently, there is a paucity of research regarding surfers' knowledge of training, their attitudes towards training along with their current training habits for surfing. As this is an area with little research, the intent of this study was to investigate these areas to provide greater insight into surfers' knowledge and perceptions of surf training and the potential impact this may have on their training habits. This research contradicted previous assumptions of surfers' attitudes towards surf training and found most surfers had significant interest in training for surfing. Motivations for training were to improve their performance, ensure their longevity in the sport or to increase their enjoyment when in the water. Training for surfing was not a priority for only a small number of participants who trained for general health and wellbeing or who only participated in surfing as a hobby. Surfers' knowledge of surfing and the surfing environment seemingly impacted their training habits with some surfers feeling time in the water is most important for surfers while others believed training is important to prevent dangerous situations from occurring. Finally, a significant number of surfers performed surf training, with the belief great surfing requires additional training. Cardiovascular endurance, flexibility and strength were most important and most trained by surfers and suggest most surfers understand the general demands of surfing. However, further research is required to investigate surfers' training habits in greater detail to provide greater insight and aid future development of training protocols better suited to surfers.

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# Appendices

## Appendix A: Ethical approval



### Auckland University of Technology Ethics Committee (AUTEC)

Auckland University of Technology  
D-88, Private Bag 92006, Auckland 1142, NZ  
T: +64 9 921 9999 ext. 8316  
E: [ethics@aut.ac.nz](mailto:ethics@aut.ac.nz)  
[www.aut.ac.nz/researchethics](http://www.aut.ac.nz/researchethics)

8 December 2021

Chris Whatman  
Faculty of Health and Environmental Sciences

Dear Chris

Re Ethics Application: **21/419 Surf-Related Training Habits and Related Knowledge and Attitudes in Adult Recreational Surfers**

Thank you for providing evidence as requested, which satisfies the points raised by the Auckland University of Technology Ethics Committee (AUTEC).

Your ethics application has been approved for three years until 8 December 2024.

#### Non-Standard Conditions of Approval

1. On the Information Sheet remove this part of the sentence from the 2nd paragraph: 'and you may withdraw at any time'.

Non-standard conditions must be completed before commencing your study. Non-standard conditions do not need to be submitted to or reviewed by AUTEC before commencing your study.

#### Standard Conditions of Approval

1. The research is to be undertaken in accordance with the [Auckland University of Technology Code of Conduct for Research](#) and as approved by AUTEC in this application.
2. A progress report is due annually on the anniversary of the approval date, using the EA2 form.
3. A final report is due at the expiration of the approval period, or, upon completion of project, using the EA3 form.
4. Any amendments to the project must be approved by AUTEC prior to being implemented. Amendments can be requested using the EA2 form.
5. Any serious or unexpected adverse events must be reported to AUTEC Secretariat as a matter of priority.
6. Any unforeseen events that might affect continued ethical acceptability of the project should also be reported to the AUTEC Secretariat as a matter of priority.
7. It is your responsibility to ensure that the spelling and grammar of documents being provided to participants or external organisations is of a high standard and that all the dates on the documents are updated.
8. AUTEC grants ethical approval only. You are responsible for obtaining management approval for access for your research from any institution or organisation at which your research is being conducted and you need to meet all ethical, legal, public health, and locality obligations or requirements for the jurisdictions in which the research is being undertaken.

Please quote the application number and title on all future correspondence related to this project.

For any enquiries please contact [ethics@aut.ac.nz](mailto:ethics@aut.ac.nz). The forms mentioned above are available online through <http://www.aut.ac.nz/research/researchethics>

(This is a computer-generated letter for which no signature is required)

The AUTEC Secretariat  
Auckland University of Technology Ethics Committee

Cc: [bqf2081@autuni.ac.nz](mailto:bqf2081@autuni.ac.nz); Patricia Lucas

## Appendix B: Participant Information Sheet



### Participant Information Sheet

#### Project Title

Surf Training Habits and Related Knowledge and Attitudes in Surfers.

#### An Invitation

My name is Nyena Kawai and I am a postgraduate student studying a Master of Sport, Exercise and Health at AUT in Auckland. I am conducting research on surfers and would like to invite you to take part in my study.

Participation is completely voluntary so you do not need to participate if you do not wish to. You are able to withdraw from the study at any time before your responses are submitted. However, as this survey is anonymous, your data cannot be withdrawn once the survey has been submitted.

If you agree to participate in this study, by completing the survey, you are consenting to participate.

#### What is the purpose of this research?

Surfing is starting to increase in popularity and professionalism and as a result, research about surfing is also increasing. However, current research focuses heavily on the demands of surfing and how to train to meet these demands. Little research has been conducted to show if surfers are utilising this information to improve performance and reduce injury. A better understanding of how surfers are training and their related knowledge and attitudes will assist with future development of training related resources and their implementation with surfers.

This study is being conducted as part of my master's degree qualification. The findings of this research may be used for academic publications and presentations.

#### How was I identified and why am I being invited to participate in this research?

You were identified as a potential participant because you are a surfer over the age of 18.

#### How do I agree to participate in this research?

If you agree to participate in this study, please complete the survey that is attached. By completing the survey, you are giving your consent to participate as there is no official consent form.

Your participation in this research is voluntary (it is your choice) and whether or not you choose to participate will neither advantage nor disadvantage you. You are able to withdraw from the study at any time before your responses are submitted and the findings have been produced. However, please be aware this survey is anonymous, therefore, your data cannot be withdrawn once the survey has been submitted.

#### What will happen in this research?

In this study, you will be asked to complete a survey that has been designed to better understand the knowledge, attitudes and training habits of surfers.

Your responses to the survey questions will be analysed to determine key themes. Once completed, all the information that is collated and analysed will form the basis of reports, papers and presentations.

#### What are the discomforts and risks?

You are not expected to experience any discomfort or embarrassment while participating in this study. If you feel uncomfortable answering any questions, please remember your participation is voluntary and you do not have to answer should you not wish to.

## Appendix C: Surfers Survey



### Surf Training Habits and Related Knowledge and Attitudes in Surfers.

Thank you for agreeing to participate in this research study. Surfing is starting to increase in popularity and professionalism and as a result, research about surfing is also increasing. However, current research focuses heavily on the demands of surfing and how to train to meet these demands. Little research has been conducted to show if surfers are utilising this information to improve performance and reduce injury. A better understanding of how surfers are training and their related knowledge and attitudes will assist with future development of training related resources and their implementation with surfers.

By completing the survey, you are giving your consent to be a participant as there is no official consent form. Your participation in this research is voluntary (it is your choice) and whether or not you choose to participate will neither advantage nor disadvantage you. You are able to withdraw from the study at any time before your responses are submitted. However, please be aware this survey is anonymous, therefore, your data cannot be withdrawn once the survey has been submitted.

Please note, to take part in this study you must be **18 years or older**, have been surfing for **more than one year** at the time of completing the survey and are **confidently** able to surf along a wave. This survey will take **10 – 15 minutes** to complete.

To complete the survey, please tick the appropriate box of your selected answer or write your answer in the space provided.

#### Section 1: This section asks you some general information about yourself and your surfing.

1. What is your age (years)?

2. What gender do you identify as?

☐ Male ☐ Female ☐ Other

3. How many years have you been surfing?

4. Where do you commonly surf?



5. What type of surfer are you?

- ☐ Leisure surfer   ☐ Amateur competitive surfer   ☐ Professional competitive surfer

6. What level surfer are you?

- ☐ Novice (can catch unbroken waves unassisted, has difficulty identifying ideal take-off position, pop-up is inconsistent)  
☐ Intermediate (comfortable in 3-4ft surf, can duck-dive, attempts basic manoeuvres)  
☐ Advanced (comfortable in 4ft+ surf, can generate speed, perform standard manoeuvres most of the time and is attempting more progressive manoeuvres)

7. What type of surfboard do you ride?

- ☐ Shortboard (7'0 or under)   ☐ Longboard (over 7'0)

8. Are you a member of a surf club affiliated with Surfing NZ?

- ☐ Yes   ☐ No

9. On average in summer, how often do you surf in a week?

10. How long are your "typical" surf sessions in summer?

- ☐ Less than 30 minutes   ☐ More than 30 minutes   ☐ More than 1 hour   ☐ More than 1.5 hours  
☐ More than 2 hours

11. Do you perform a warm-up on the beach prior to a surf session?

*A warm-up is any exercise that helps prepare you for surfing*

- ☐ Yes   ☐ No   ☐ Sometimes   ☐ I don't know

12. Do you perform a cool down on the beach after a surf session?

*A cool-down is any exercise performed after surfing for recovery*

- ☐ Yes   ☐ No   ☐ Sometimes   ☐ I don't know

13. Is surfing your primary sport?

- ☐ Yes   ☐ No

## Section 2: This section asks about your training habits

Note: In this survey, training refers to any form of exercise that you do to improve your fitness for surfing.

1. Do you do any training for surfing other than surfing itself?

- ☐ Yes   ☐ No

2. If you train for surfing, why? If you don't, why not?

*If you answered "no", please go to Section 3.*





3. Do you train for surfing all year round?

☐ Yes ☐ No

4. When do you usually train for surfing?

Please only select one:

☐ Before or after a surf session ☐ Only when there is no surf ☐ In the morning  
☐ In the afternoon/ evening ☐ Other (please specify) \_\_\_\_\_

5. On average, how often do you train for surfing in a week?

6. How long would a “typical” training session be?

☐ Less than 30 minutes ☐ More than 30 minutes ☐ More than 1 hour ☐ More than 1.5 hours  
☐ More than 2 hours

7. In your training sessions do you perform resistance training?

Resistance training refers to any exercise where external weight is used (e.g. free weights, machine resistance or body weight)

☐ Yes ☐ No

If you answered no, please go to Question 10.

8. What forms of resistance do you use when resistance training?

Please select all that apply:

☐ Free weights (e.g. barbell, dumbbells) ☐ Machine resistance (e.g. cable machine, leg press)  
☐ Bodyweight (e.g. a push up)

9. In your resistance training, what range of repetitions do you usually use?

☐ 1 to 5 ☐ 6 to 12 ☐ 13 to 20 ☐ More than 20

10. What other forms of training do you perform?

☐ Plyometric (e.g. jumping) ☐ Cardiovascular (e.g. running) ☐ Yoga ☐ Surf-skating ☐ Breath-hold  
☐ Swimming (ocean or pool) ☐ Other sports (e.g. rugby, netball) ☐ Other (please specify) \_\_\_\_\_

11. Do you follow a prescribed training program when training?

☐ Yes ☐ No

### Section 3: This section asks about your knowledge of the demands of surfing and appropriate surf training

1. What do you think makes up the largest portion of a typical surf session?

☐ Paddling ☐ Riding waves ☐ Duck-diving ☐ Sitting/ waiting for waves ☐ I don't know



2. What do you think is the average duration of each paddling bout?

*A bout refers to an interval/period of time*

- ☐ 10 to 20 seconds   ☐ 30 seconds to 1 minute   ☐ More than 1 minute   ☐ More than 2 minutes  
☐ I don't know

3. Name two major muscles/ muscle groups used for paddling.

1.  
2.

4. Name two major muscles/muscle groups used for pumping along a wave.

1.  
2.

5. Which part of the upper body do you think is most commonly injured in surfing?

- ☐ Head/face   ☐ Neck   ☐ Shoulder/ arm   ☐ Elbow   ☐ I don't know

6. Which part of the lower body do you think is most commonly injured in surfing?

- ☐ Lower back   ☐ Hip/groin   ☐ Knee   ☐ Ankle   ☐ I don't know

7. What do you think is the most common type of injury in surfing?

- ☐ Ligament sprain   ☐ Muscle/ tendon strain   ☐ Bone fracture   ☐ Dislocated joint   ☐ Concussion  
☐ I don't know

8. What injuries (if any) have you sustained from surfing?

*Injury is defined as anything resulting from surfing that has resulted in you seeking medical attention or resulted in you having to stop surfing for one or more days*

## Section 4: This section asks about your attitudes towards surf training

1. How important do you think training is for surfers?

- ☐ 5 – Very important   ☐ 4 – Somewhat important   ☐ 3 – Neutral   ☐ 2 – Somewhat unimportant  
☐ 1 – Not important at all

2. What do you think are the two most important fitness aspects for surfing (e.g. strength, power, cardiovascular endurance, balance, flexibility) and why?



3. Do you believe being in the water and surfing as much as possible is the best way to stay surf fit?

☐ Yes ☐ No

*Please explain why you think this*

4. Do you think additional training aside from surfing is important to improving as a surfer?

☐ Yes ☐ No

*Please explain why you think this.*

5. If you could access anything (equipment, facilities, coaches etc.) to improve your surfing, what would it be and why?

6. How important do you think warming up prior to surfing is?

☐ 5 – Very important   ☐ 4 – Somewhat important   ☐ 3 – Neutral   ☐ 2 – Somewhat unimportant  
☐ 1 – Not important at all

7. How important do you think cooling down after surfing is?

☐ 5 – Very important   ☐ 4 – Somewhat important   ☐ 3 – Neutral   ☐ 2 – Somewhat unimportant  
☐ 1 – Not important at all

### THANK YOU FOR COMPLETING THIS SURVEY!

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, Dr Chris Whatman, [chris.whatman@aut.ac.nz](mailto:chris.whatman@aut.ac.nz), +64 9 921 9999 ext. 7037.

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTECH, [ethics@aut.ac.nz](mailto:ethics@aut.ac.nz), (+649) 921 9999 ext 6038.

## Appendix D: Social Media Advertisement



Hi all,

My name is Nyena (said like Nina) and I'm currently completing my Masters in Sport and Exercise science and my dissertation is looking at the knowledge, attitudes and training habits of surfers.

If you surf and have 10 minutes in your day to complete my survey I would really appreciate it! The survey is open internationally.

The link to the survey is below with some more info if you need. If you have any questions let me know.

Thanks very much! 😊

[https://aut.au1.qualtrics.com/jfe/form/SV\\_dnXUWwXyqGkpMaO](https://aut.au1.qualtrics.com/jfe/form/SV_dnXUWwXyqGkpMaO)



## Appendix E: Initial Qualitative Data Coding to Themes

### Theme 1: Attitudes - To train or not to train (Motivations - why are people training/ not training)

Interest in surf specific training (Surf specific training - Yes)			Uninterested in surf specific training (Surf specific training - No)		
Longevity and participating in the sport until an old age	Performance in water (Talk about first)	Enjoyment and comfort	General fitness	Leisure activity/ hobby	Importance
Code 18: Can keep surfing/ age	Code 1: Be better at surfing	Code 5: Enjoyment	Code 23: Not training specifically for surfing	Code 24: Not that good	Code 27: Not a priority
Code 10: Injury prevention	Code 15: Improve (faster)/ progress	Code 13: Confidence/ comfort	Code 34: I do other sports	Code 25: Don't feel the need	Code 28: Don't have time
	Code 19: To catch more waves			Code 26: Surf for fun	Code 30: Not motivated/ lazy
	Code 7: Being prepared for surfing				
	Code 38: Just surfing is not enough				
	Code 39: Surf is inconsistent				

### Theme 2: Knowledge of the demands of surfing (Understanding of the demands of surfing)

Lack of knowledge	Knowledge of the surfing environment
Code 31: Lack of knowledge	Code 16: Safety
	Code 35: Learning about the environment

### Theme 3: Training habits for surfing (Two trains of thought)

Surfing is the best way to train (In-water training - Pureists)	Great surfing requires out-of-water training (Aspects of fitness that are trainable out of the water)
Code 37: Nothing is the same as surfing	Code 3: To get stronger/ improve strength
Code 36: Time in the water	Code 4: To surf longer
Code 32: Surfing is training	Code 6: Fitness/ stamina
Code 33: Practice makes perfect	Code 8: Paddle power/ fitness
Code 29: Surf often enough	Code 9: Flexibility/ mobility
	Code 11: Muscle memory
	Code 12: Technique/ skill