Institution: University of Chichester

Unit of Assessment: Sport and Exercise Sciences, Leisure and Tourism

Title of case study: Evidenced based practice to optimise the development and performance of world class and Olympic sailors.

1. Summary of the impact

A 20 year collaborative programme of research and physiological monitoring between the Royal Yachting Association (RYA) and the University of Chichester (UC) has significantly impacted upon training and competitive strategies adopted by the RYA to maintain world class sailing performance within the REF period. Research conducted in the period 1993-2004 provided the first empirical evidence base to underpin training for dingy and boardsailing. This provided the foundation to develop training guidelines for youth and elite sailors, contributing to successful sailing performances in the past five Olympic games. The guidelines are now freely accessible online for recreational sailors.

2. Underpinning research

The collaborative research programme between the RYA and UC was initiated by Prof Tudor Hale in the early 1990's and driven forward by Dr Pete Cunningham, initially in his role as an academic member of staff at UC (1993-1998) and then as Head Physiologist at the RYA (although still employed through the University 1998-2011). Before 1994 there was very limited physiological data documenting the physical demands of competitive dingy and boardsailing and as such training was not underpinned by an empirical evidence base. Cunningham and Hale's early research addressed this shortfall and documented the physical demands placed upon elite athletes during competitive sailing, culminating in the development of novel laboratory simulations where the cardiorespiratory and neuromuscular responses could be studied (Buchanan *et al.* 1996, Cunningham *et al.* 1995, 1998, Cunningham & Hale 2007). Much of the research undertaken in the earlier part of this period formed Dr Cunningham's PhD (undertaken part-time as a staff candidate) entitled '*The physiological demands of elite single-handed dinghy sailing*' (awarded in 2004). Due to the sensitive nature of the research, in terms of competitive advantage for the British Sailing Team, a five-year publication embargo was imposed.

These studies and the baseline data became a foundation for the continuing development of evidenced based training and a sports science support programme for Youth, Podium Potential and Podium squads.

Between 2005 and 2011 Adrian Campbell (UC Research Associate) and Paul Mullan (English Institute of Sport (EIS) Physiologist) worked at UC under Cunningham's supervision expanding the RYA's research and support programme. Although Prof Hale retired in 2004 he continued to contribute to the programme as Emeritus Professor of UC. Dr Rosemary Dyson another member of the UC academic staff also undertook research in to the physical demands of boardsailing. During this period, alongside the monitoring and evaluation that had now become a routine part RYA training and preparation for competition, Cunningham, Campbell, Mullan and UC researchers conducted research projects to investigate novel strategies to enhance performance. Published studies include the investigation into the incidence of injuries in elite and recreational windsurfers (Dyson *et al.* 2006); and the development of haematological tests to monitor risks of overtraining and illness (Lewis *et al.* 2009). Unpublished research included an evaluation of the impact of cool vests on physical performance in hot and humid environments which influenced competitive strategies prior to the 2008 Beijing Olympics.

In 2011 Cunningham left his post with the RYA (and left employment of the University) to take up a full time position as Head of Sport Science and Medicine for the Artemis America's Cup Team and Campbell moved to take up the role of Performance Scientist at the Scottish Institute of Sport. Mullan was then appointed as Head of Sports Science and Medicine at the RYA. Two new research associates (Dr David Macutkiewicz & Tim Jones) were employed by UC in 2011 to work alongside Mullan and they now play an integral part in developing and implementing the RYA's research and evidenced based support programme.

3. References to the research

Buchanan, M., **Cunningham, P., Dyson, R. J.**, & Hurrion, P. D. (1996). Electromyographic activity of beating and reaching during simulated boardsailing. Journal of Sports Sciences, 14(2), 131-137.
Cunningham, P. (1995). The physiological demands of elite dinghy sailing in varying wind conditions. Journal of Sports Sciences, 14, 73.
Cunningham, P., Hale, T., & Miles, H. (1998). Physiological responses to 30 minutes of static simulated dinghy sailing. Journal of Sports Sciences, 16, 43 – 44.
Cunningham, P., & Hale, T. (2007). Physiological responses of elite Laser sailors to 30 minutes of simulated upwind sailing. Journal of Sports Sciences, 25(10), 1109-1116.
Dyson, R., Buchanan, M., & **Hale, T.** (2006). Incidence of sports injuries in elite competitive and recreational windsurfers. British Journal of Sports Medicine, 40(4), 346-350.
Lewis, N. A., Moore, B., **Cunningham, P.**, Castell, L., & Knight, J. (2009). Plasma Antioxidant Capacity Of Olympic Sailors Prior To The Olympic Games. Medicine and Science in Sports and Exercise, 41.

4. Details of the impact

The RYA and UC collaborative research programme has resulted in impact in four broad and interrelated areas in the period 1/1/2008 to 31/7/2013 materially linked to the programme of research described in section 2.

i. Changes to practices of the RYA relating to training and support of Youth, Podium Potential and Podium squad athletes;

The research described in section 2 provided the foundation for developing the first evidenced based guidelines to underpin physical training for elite sailors, which were later distributed to the wider sailing community. Cunningham and Hale's early work generated the first data quantifying the physical demands placed upon elite sailors during training and simulated competition, from which a novel sailing ergometer was developed, which has been used in later sailing research and support work.

To support the introduction and development of the evidenced based training practices; regular physiological monitoring of ~50-100 Youth, Podium Potential and Podium squad sailors per year was conducted annually in the UC laboratories (1995-2010) (~150-300 in the REF period). In 2011 the RYA began to undertake this testing at their headquarters in Portland; portable replicas of the laboratory equipment were developed at UC and are still serviced by university staff. In this (at least) bi-annual testing; cardiorespiratory fitness and muscular strength and endurance are measured and training heart rates are analysed. These data are used to evaluate the impact of interventions (e.g. boat design), training regimes and competition and feedback for future developments.

ii. Publication and dissemination of the Concept2 Indoor Rowing Sailing Guide by Fletcher Sport Science and Concept2 a leading manufacturer and retailer of rowing machines

Cunningham collaborated with Eddie Fletcher, a commercial sports science consultant, to develop and publish the Indoor Rowing Sailing Guide for use with the Concept2 indoor rowing ergometers, which is now also freely available as a download from Fletcher's and Concept2's commercial websites (first published 2007 and downloaded an estimated 7,000 times since), it was also translated into Italian and promoted by various other unrelated sailing and fitness organisations across the globe. Cunningham's contribution to this guide was a key factor in Concept2, one of the world's leading rowing machine manufacturer and retailers, becoming the RYA's preferred supplier of rowing ergometers at no cost to the RYA (up to 20 units in any year).

This guidance is underpinned by Cunningham's research and is the first evidenced based training guidelines using rowing ergometers to simulate the cardiorespiratory and neuromuscular demands of sailing. The guide has been written for elite and recreational sailors, including those in younger and older age categories. Individual heart rate zones are used to prescribe training intensity. Specific training programmes were devised for all of the Olympic sailing classes (i.e. different dinghys and sailboards), with five incremental levels of application, ensuring the training could be used by athletes in the Youth, Podium Potential and Podium squads.

iii. Performance gains for individuals and teams at the elite and recreational level.

The development of the collaborative RYA and UC research and applied sports science support

programmes over the past three decades have paralleled the increase in funding for both elite sailors and their support teams (including sports science and medicine). It is therefore difficult to quantify the exact impact that the aforementioned research and support programmes have had on athletes' success. However, it is notable that Team GB's sailors were at the top of the medal tables at the 2000, 2004 and 2008 Olympic Games and 3rd in 2012; of particular note were the 3 gold medals in 2008 achieved for single-handed sailing, the focus of Cunningham's research work. Iain Percy (Double Olympic champion) provides testament to the significant contribution of Cunningham's sports science support work in helping the team to win medals (see section 5, source 8).

In the 12 months building up to 2008 Olympic Games (opened 8/8/2008) and during the competition period (i.e. after 1/1/2008 and within the REF period), new haematological and biochemical analysis techniques were developed (see Lewis *et al.* 2009 in section 3) and used with all 18 of the British Sailing Team to rapidly identify markers of increased illness risk. This enabled training and nutritional interventions to be targeted to reduce illness, improve training progression and safely and effectively lose weight (see section 5, source 8). The wider impact of the development of these techniques has not been documented but there are clear applications to the wider sporting community.

iv. The transfer of skills and knowledge to other elite sport organisations and teams

The early work of Cunningham and Hale set the foundation on which a more established sports science and medicine team has now developed, they are able to draw on novel research and support techniques developed in other disciplines to inform their own best practice. In turn the RYA and UC are using this knowledge to continue to drive and refine their own research and support programme including an on-going PhD research programme and the continuing monitoring and support to maintain the British Sailing Team's world class performance. The progression of Cunningham to the role of as Head of Sport Science and Medicine in Team Artemis (America's Cup Team)[4], Campbell and Mullan to more senior roles has led to wider dissemination and impact of the knowledge and skills form their roles in the RYA and UC.

5. Sources to corroborate the impact

1. The development and un-restricted availability of the **Indoor Rowing Sailing Guide** – developed for the RYA by Eddie Fletcher and Pete Cunningham – publically available from http://www.concept2.com.au/training/trainingguides/sail.aspx and http://www.rya.org.uk/SiteCollectionDocuments/Racing/Web%20Documents/Concept2_sailing_guide.pdf (retrieved 10 October 2013) and in Italian http://www.concept2.it/download/guida_vela.pdf (retrieved 14 November 2013).

   Also, available from Eddie Fletcher's own site, in an email sent Nov 2013 Fletcher describes it as '*its one of the most loaded guides from my website*'.

   Evidence of the guide being promoted by other organisations: http://www.yumpu.com/en/document/view/3809470/concept2-sailing-rowing-guideindd-fletcher-sport-science (The guide has 1322 views (Nov 2013))

   http://www.ontariosailing.ca/Racing/Ontario_Sailing_Team/Your_Virtual_Coach.php
2. EIS press release relating to impact of haematological screening for illness http://www.eis2win.co.uk/Pages/news_scienceofsailing.aspx
3. Records of Olympic medal winners in dinghy and board sailing: Team GB's sailors have topped the **medal table** at the 2000, 2004, 2008 Olympic Games and were placed 3rd in 2012. http://www.sailing.org/olympics/london2012/about/history/index.php
4. American Cup Uncovered Clips: http://www.youtube.com/watch?v=qW-HFOXOEVI&list=PLC5584E1EA0141700&index=6 (In this video clip Dr Pete Cunningham describes physiological support to the Artemis Racing America's Cup Team (2011 series) which has a clear and distinct link to Dr Cunningham's early work at UC with RYA (for example heart rate monitoring) (818 views)
5. A history of Pete Cunningham's career in sports science support for the RYA, including interviews with Pete and testimonials from athletes and coaches, is documented in Kyndt, T., & Rowell, S. (2013). Achieving Excellence in High Performance Sport: Experiences and Skills Behind the Medals (1st Edition ed.). London: Bloomsbury Sport.