Development of Knowledge and Reported Use of Sport Science by Elite New Zealand Olympic Class Sailors

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Abstract. The objective of this study was to determine the change in elite dinghy sailor’s knowledge and use of sport science, three years after the adoption of a sport science support (SSS) programme by Yachting New Zealand for its elite dinghy sailors. A questionnaire was administered to 28 (22 male, six female) elite sailors in April 1994 and to 33 (24 male and nine female) in March 1997 during a training camp for elite sailors. 15 of the sailors participated in 1994 and 1997. The questionnaire asked whether or not the sailors used a training race diary and inquired about their knowledge and use of sport science in the areas of nutrition, psychology and physical conditioning. In 1997, additional questions enquired about sailor’s perception of sport science and its affect on their racing performance. Between April 1994 and March 1997, sailors received sport science support in nutrition, psychology and physical conditioning. Sailors reported a greater amount of fluid drunk on a four-hour sail in 1997 than in 1994 and a greater proportion of sailors ate a high carbohydrate meal after a race in 1997 than in 1994. In 1997, sailors reported feeling less anxiety before a race, and the sailors common to 1994 and 1997 reported feeling less sick before a race in 1997 than in 1994. Increases were observed in volume and intensity of physical training, and improvements were noticed in the chosen type of aerobic training in 1997. Most sailors believed that their knowledge and use of sport science has increased and that their increased use of sport science has led to improvements in racing performance. The results suggest that elite New Zealand sailors’ use of sport science improved in the areas of nutrition, sports psychology and physical conditioning between 1994 and 1997. However, when the results were compared with those of Legg and Mackie (1999), it was evident that greater physical conditioning improvements had occurred between 1994 and 1995 than had been sustained since, while the majority of sailor’s sport psychology improvements occurred between 1995 and 1997. Sailors reported fluid intake between 1994 and 1997 had steadily improved. The reason for sailor’s change in emphasis on different areas of sport science over time may be a result of their adopting ideas with which they were most familiar (physical conditioning and nutrition) first, and then adopting the less widely understood discipline of sport psychology once they felt that they had mastered their use of physical conditioning and nutrition. This study indicates that sailors are beginning to understand the importance of personal preparation using sport science principles.

Keywords: nutrition, psychology, physical conditioning, sport science, sailing, questionnaires

Introduction

Sport science in competitive dinghy racing is a relatively new field. This is partly because physical conditioning, sports psychology and sport nutrition have not traditionally been a high priority for many competitive sailors. However, recently, competitive dinghy sailors have become more committed and professional in their sport as a result of increasing competition and greater rewards. Greater scientific interest in competitive dinghy racing has resulted from sailors and sailing administrative bodies increasingly seeking advice from sport scientists in order to obtain a competitive advantage. Most studies related to dinghy racing have concentrated on the physiological demands of sailing (Bachemont et al., 1984; Blackburn, 1994; De Vito et al., 1996; De Vito et al., 1997; Gallozzi et al., 1993; Harrison et al., 1988; Pudenz et al., 1981; Vogiatzis et al., 1993; Vogiatzis et al., 1994), the biomechanics of dinghy racing (Beillot et al., 1979; Beillot et al., 1981; Mackie and Legg, 1999; Mackie et al., 1999; Marchetti et al., 1980; Putnam, 1979), the physical profile of sailors (Legg et al., 1997; Niinimaa et al., 1977; Pleyl et al., 1985; Shephard, 1990) and sailor’s responses to physical training programmes (Spurway and Burns, 1993; Wright et al., 1976). However, less is known of sailors knowledge of sport science and the application of sport
Methods

In 1994, Legg et al. (1997) administered a questionnaire to 28 elite New Zealand Olympic class dinghy sailors inquiring about their knowledge and use of sport science. The extent of sailor's sport science knowledge in areas of nutrition, sport psychology and physical training generally appeared to be modest to good, but was poor for a small number of sailors and in some specific areas. As a result of this study New Zealand Yachting (the administrative body for yachting in New Zealand) adopted a sport science support (SSS) programme for elite dinghy sailors, utilizing the expertise of specialists in nutrition, sports psychology and physical conditioning. Legg and Mackie (1999) administered the same questionnaire one year later to 28 elite New Zealand Olympic Class dinghy sailors (10 of which were in the original 1994 group), with the addition of questions enquiring of sailors knowledge and use of sport science. Legg and Mackie found that sailor’s use of sport science improved in the areas of physical conditioning and nutrition between 1994 and 1995, but only a little in sports psychology.

The objective of the present study was to examine the development in knowledge and use of sport science in elite New Zealand Olympic class dinghy sailors three years after the initial gathering of similar information in 1994.

Methods

In April 1994, twentyeight (22 male, 6 female) elite New Zealand Olympic Class sailors completed a short questionnaire which enquired about their knowledge and use of sport science in the areas of nutrition, sport psychology and physical training. The group consisted of eight (five male, three female) Mistral, two (male) Finn, one (male) Tornado, five (male) Laser, one (female) Europe and ten (six helmsmen (five male, one female) and four (male) crew) 470 sailors. The questionnaire was administered to all of the sailors at the same time as part of an introductory seminar on sport science support. It took approximately five minutes to complete.

The nutrition questions enquired whether or not the sailors had experienced dehydration during racing, requested a subjective quantification of how much fluid they took on the boat for a four hour sail and how much they actually drank, and asked what they ate immediately after a long hard race.

The psychology questions required the sailors to select a response by ticking one of five boxes labelled "Never, Sometimes, Often, Very often and All of the time" to the following questions: 1. Before racing, do you get a) anxious? b) sweaty palms? c) a sick feeling in your stomach? 2. During a race do you a) get frustrated when you make mistakes? b) get angry at other sailors? c) have negative thoughts? d) lose concentration near the end of the race? The sailors were also asked whether or not they practised relaxation, visualisation, progressive muscular relaxation, meditation or yoga.

The physical training questions enquired about their use of a training/race diary and their type of training/conditioning (strength/circuit, flexibility, aerobic (off water and on water), and the number of sessions, their intensity (low, moderate or high) and total hours per week devoted to each type of training.

During the following three years sailors received sport science support from specialists in nutrition, psychology and physical conditioning. The extent to which sailors used the sport science expertise available to them was dictated by each sailor’s personal requirements.

In April 1997, at an Olympic training camp, the same questionnaire was administered to 33 sailors, comprising 15 of the 1994 group and 18 newcomers (24 males, nine females, mean age 25.9 (S.D. 6.8), height 176.0 (S.D. 9.0) and weight 72.1 (S.D. 10.0)). The 1997 group consisted of 5 Europe (female), 5 Laser (male), 2 Finn (male), 4 470 (helm (2 female, 2 male)), 2 470 (crew (male)), 3 Tornado (helm (male)), 2 Tornado (crew (male)), 6 Mistral (4 male, 2 female), 1 star (male) and 1 49er (helm (male)) and 2 49er (crew (male)) sailors. Additional questions were included asking sailors if their overall knowledge and use of sport science had increased, and whether they thought sport science had helped to improve their overall racing performance. Sailors were also asked to exemplify their answers.

Analyses of the responses focused on two different areas. Firstly, all of the 1994 data were compared with the 1997 results. Secondly, the results for the 15 subjects common to 1994 and 1997 were compared so that a longitudinal comparison could be made.

t-tests were used to compare the differences in continuous numerical answers. For the comparison of all 1994 subjects with all 1997 unpaired t-tests were used. Paired t-tests were used for the longitudinal comparisons of those subjects common to the 1994 and the 1997 group. Meddis’s rank scores test was used to compare discrete answers such as those using a 1-5 scale or “yes/no” type answer.

Results

Nutrition

Comparison between 1994 and 1997 data (All subjects):

The mean reported amount of water taken on a four hour sail increased from 0.9 (S.D. 0.6) litres (l) in 1994 to 1.6 (S.D. 0.8) l in 1997 (P < 0.001) (Table 1). Of this, the amount actually drunk increased from 0.9 (S.D. 0.5) l in 1994 to 1.5 (S.D. 0.8) l in 1997 (P < 0.01). The proportion
of subjects that reported experiencing dehydration increased from 68% in 1994 to 88% in 1997, and the proportion of sailors that reported eating high carbohydrate food after a race increased from 54% in 1994 to 67% in 1997. However, neither of these findings were statistically significant.

Comparison between results from subjects common to 1994 and 1997:

There was an increase in mean reported amounts of fluid taken and drunk on a four hour sail of 0.9 (S.D. 0.7) l in 1994 to 1.6 (S.D. 0.8)*** l in 1997 (p<0.001) and 1.0 (S.D. 0.6) l in 1994 to 1.5 (S.D. 0.8)** l in 1997 (p<0.05) respectively. There was also an increase in the proportion of sailors reporting eating high carbohydrate food after a race from 40% in 1994 to 80% in 1997 (p<0.05). The proportion of people that had experienced dehydration increased from 67% in 1994 to 87% in 1997, although this was not statistically significant.

Psychology

Comparison between 1994 and 1997 data (All subjects):

A greater proportion of sailors reported feeling less anxious before a race in 1997 (12% feeling ‘not at all anxious’, and only 6% feeling ‘very anxious’) than in 1994 (none feeling ‘not at all anxious’ and 25% feeling ‘very anxious’) (p<0.05) (Fig. 1). Although the differences were not statistically significant, 45% of sailors in 1997 reported never getting a sick feeling in their stomach before racing compared with 25% in 1994, only 52% of sailors in 1997 reported sometimes having negative thoughts during a race compared to 75% in 1994, but 30% of sailors in 1997 reported often having negative thoughts compared with only 14% in 1994, and between 12-13% more sailors in 1997 reported using progressive muscular relaxation, meditation and yoga than in 1994. There were no clear differences in the proportions of sailors who reported having sweaty palms before racing, getting frustrated when they made mistakes, getting angry at other sailors, having negative thoughts or losing concentration near the end of a race.

Comparison between results from subjects common to 1994 and 1997:

More sailors reported feeling less anxious in 1997 (13% feeling ‘not at all anxious’ and none feeling ‘very anxious’) than did those in 1994 (none feeling ‘not at all anxious’ and 27% feeling ‘very anxious’) (p<0.05) (Fig. 2). A greater proportion of sailors in 1997 (53%) reported never getting a sick feeling in their stomach before racing than did those in 1994 (27%) (p<0.05). More sailors reported practicing meditation in 1997 (27%) than in 1994 (none) (p<0.05). 87% of sailors reported never getting sweaty palms in 1997 (73% in 1994). Although not statistically significant, no sailors in 1997 or 1994 reported never getting frustrated when they made mistakes, 13% of sailors reported never having negative thoughts during a race (none in 1994) and 27% of sailors in 1997 reported losing concentration near the end of a race (7% in 1994) while 87% of sailors reported sometimes losing concentration near the end of a race (60% in 1994). More sailors in 1997 reported practicing relaxation, visualisation, progressive muscular relaxation and yoga than in 1994. These differences were not statistically significant, but that for practicing meditation was (p<0.05).

Physical conditioning

Comparison between 1994 and 1997 data (All subjects):

Training and race diary

In 1997, 42% of sailors reported using a training and race diary compared with 39% of sailors in 1994. The difference was non-significant.

Strength/circuit training

A greater mean number of strength/circuit training sessions per week were reported in 1997 (2.2 (S.D. 1.7) compared with 1.3 (S.D. 1.5) in 1994 (p<0.05)) (Table 2).
Fig. 1 Comparison of sailors’ use of psychology in 1994 and 1997. p<0.05 represents a statistically significant difference at the 5% level of probability.
**Fig. 2** Comparison of use of psychology for sailors common to 1994 and 1997. *p*<0.05 represents a statistically significant difference at the 5% level of probability.
More subjects reported participating in strength training in 1997 (73%) compared with 1994 (54%) and a greater mean total hours per week participating in strength/circuit training was reported (3.1 (S.D. 2.8) hours) compared with 1.9 (S.D. 2.4) hours in 1994, but the differences were not statistically significant. There was no change in reported mean training intensity in 1997 compared with 1994.

Flexibility training

In 1997, more subjects reported participating in flexibility training (70% compared with 39% in 1994 (p<0.01)). There were also increases in the mean number of sessions per week (2.7 (S.D. 2.1) compared with 1.4 (S.D. 2.5) in 1994 (p<0.05)) and the mean total number of hours per week (1.4 (S.D. 1.5) compared with 0.4 (S.D. 0.7) in 1994 (p<0.01)) spent participating in flexibility training.

Aerobic off-water conditioning

There was an increase in sailor’s reported sessions per week (2.7 (S.D. 1.8) in 1997 compared with 1.9 (S.D. 1.9) in 1994) (p<0.05), and a greater mean exercise intensity was reported in 1997 (1.8 (S.D. 0.5) on a scale of 1-3) than was reported in 1994 (1.7 (S.D. 0.6) (p<0.01)). Non-significant increases in reported participation (82% of subjects in 1997 compared with 64% in 1994), and mean total hours per week (2.8 (S.D. 2.5) hours in 1997 compared with 1.9 (S.D. 1.9) hours in 1994) were also observed. A greater proportion of sailors participated in cycling (42%) (p<0.01) and rowing (45%) (p<0.001) in 1997 than in 1994 (cycling, 14% and rowing 7%) (p<0.01).

On-water conditioning

There were non-significant decreases in reported participation in on-water conditioning in 1997 (73% compared with 86% in 1994), the mean reported number of sessions per week (2.3 (S.D. 1.7) in 1997 compared with 2.7 (S.D. 1.8) in 1994), and the mean reported total number of hours spent participating in on-water conditioning (7.5 (S.D. 7.3) in 1997 compared with 8.5 (S.D. 6.2) in 1994). There was no change in mean reported intensity in 1997 compared with 1994.

Comparison of results between subjects common to 1994 and 1995:

Training/race diary

The proportion of sailors that reported the use of a detailed training and race diary decreased from 33% in 1994 to 27% in 1997. However, the difference was not statistically significant.

Strength/circuit training

In 1997, 80% participation in strength/circuit training was reported compared with 53% participation in 1994, a greater number of strength/circuit training sessions per week was reported in 1997 (2.0 (S.D. 1.4) compared with 1.0 (S.D. 1.5) in 1994) and the mean reported total hours per week participating in strength/circuit training was 3.5 (S.D. 2.4) in 1997 compared with 1.8 (S.D. 2.5) in 1994. However, none of these changes were statistically

### Table 2

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<tbody>
<tr>
<td>Percentage of sailors keeping a detailed training and race diary</td>
<td>39</td>
<td>42</td>
<td>33</td>
<td>27</td>
</tr>
<tr>
<td>Strength/Circuit training (% participation)</td>
<td>54</td>
<td>73</td>
<td>53</td>
<td>80</td>
</tr>
<tr>
<td>Sessions per week</td>
<td>1.3 (1.5)</td>
<td>2.2 (1.7)*</td>
<td>1.0 (1.5)</td>
<td>2.0 (1.4)</td>
</tr>
<tr>
<td>Intensity (1=low, 3=high)</td>
<td>1.7 (0.5)</td>
<td>1.7 (0.6)</td>
<td>1.7 (0.5)</td>
<td>1.7 (0.7)</td>
</tr>
<tr>
<td>Total hours per week</td>
<td>1.9 (2.4)</td>
<td>3.1 (2.8)</td>
<td>1.8 (2.5)</td>
<td>3.5 (2.4)</td>
</tr>
<tr>
<td>Flexibility (% participation)</td>
<td>39</td>
<td>70**</td>
<td>33</td>
<td>73*</td>
</tr>
<tr>
<td>Sessions per week</td>
<td>1.4 (2.5)</td>
<td>2.7 (2.1)*</td>
<td>1.4 (2.8)</td>
<td>2.8 (2.3)</td>
</tr>
<tr>
<td>Intensity (1=low, 3=high)</td>
<td>2.0 (1.1)</td>
<td>2.0 (0.7)</td>
<td>2.7 (0.6)</td>
<td>1.8 (0.6)*</td>
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<tr>
<td>Total hours per week</td>
<td>0.4 (0.7)</td>
<td>1.4 (1.5)**</td>
<td>0.3 (0.6)</td>
<td>1.3 (1.3)**</td>
</tr>
<tr>
<td>Aerobic off water conditioning (% participation)</td>
<td>64</td>
<td>82</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Sessions per week</td>
<td>1.9 (1.9)</td>
<td>2.7 (1.8)*</td>
<td>2.2 (1.6)</td>
<td>2.4 (1.9)</td>
</tr>
<tr>
<td>Intensity (1=low, 3=high)</td>
<td>1.7 (0.6)</td>
<td>1.8 (0.5)**</td>
<td>1.5 (0.5)</td>
<td>1.9 (0.3)*</td>
</tr>
<tr>
<td>Total hours per week</td>
<td>1.9 (1.9)</td>
<td>2.8 (2.5)</td>
<td>2.3 (1.7)</td>
<td>2.2 (1.8)</td>
</tr>
<tr>
<td>On water conditioning (% participation)</td>
<td>86</td>
<td>73</td>
<td>87</td>
<td>73</td>
</tr>
<tr>
<td>Sessions per week</td>
<td>2.7 (1.8)</td>
<td>2.3 (1.7)</td>
<td>3.2 (2.0)</td>
<td>2.5 (1.8)</td>
</tr>
<tr>
<td>Intensity (1=low, 3=high)</td>
<td>1.8 (0.5)</td>
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<td>1.8 (0.4)</td>
<td>1.9 (0.6)</td>
</tr>
<tr>
<td>Total hours per week</td>
<td>8.5 (6.2)</td>
<td>7.5 (7.3)</td>
<td>9.8 (6.9)</td>
<td>6.4 (5.2)</td>
</tr>
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Numbers are reported as the mean and (standard deviation). *=statistically significant (p<0.05). **=statistically significant (p<0.01).
significant. There was no change in mean reported intensity of training.

**Flexibility training**

The proportion of sailors that reported participating in flexibility exercises increased from 33% in 1994 to 73% in 1997 (p<0.05). Likewise the mean reported total hours per week spent on flexibility training increased from 0.3 (S.D. 0.6) hours in 1994 to 1.3 (S.D. 1.3) hours in 1997 (p<0.01). The mean reported intensity decreased from 2.7 (S.D. 0.6) on a scale of 1-3 in 1994 to 1.8 (S.D. 0.6) in 1997 (p<0.05). The mean number of reported flexibility sessions per week increased from 1.4 (S.D. 2.8) in 1994 to 2.8 (S.D. 2.3) in 1997, however, the difference was not statistically significant.

**Aerobic off-water conditioning**

Sailor's mean reported intensity of aerobic off-water conditioning sessions increased from 1.5 (S.D. 0.5) on a scale of 1-3 to 1.9 (S.D. 0.3) (p<0.05). The reported mean number of sessions per week participating in off-water conditioning also increased (from 2.2 (S.D. 1.6) in 1994 to 2.4 (S.D. 1.9) in 1997, although the difference was not statistically significant. There was a non statistically significant decrease in the mean reported total hours per week spent on off-water conditioning from 2.3 (S.D. 1.7) hours in 1994 to 2.2 (S.D. 1.8) hours in 1997, and there was no change in the proportion of sailors participating in off-water conditioning. More sailors reported participating in rowing in 1997 (67%) compared with 1994 (7%) (p<0.001) and less sailors reported participating in aerobics in 1997 (none) compared with 1994 (33%) (p<0.01).

**On-water conditioning**

The proportion of sailors that reported participating in on-water conditioning decreased from 87% in 1994 to 73% in 1997, the mean reported sessions per week increased from 3.2 (S.D. 2.0) in 1994 to 2.5 (S.D. 1.8) in 1997 and mean reported total hours per week decreased from 9.8 (S.D. 6.9) in 1994 to 6.4 (S.D. 5.2) in 1997. However, these differences were not statistically significant. Mean reported intensity of on-water conditioning increased from 1.8 (S.D. 0.4) in 1994 to 6.4 (S.D. 5.2) in 1997 but this was also not statistically significant.

Sailor’s perception of sport science (all sailors in 1997)

In 1997, 93% of sailors reported that they felt that their knowledge of sport science had increased. 80% reported that their use of sport science had increased (27% in psychology, 33% in nutrition and 33% in physical conditioning) and 73% of sailors reported that they believed their increased use of sport science had led to improvements in their racing performance. Examples include increased physical fitness giving sailors more endurance, improved nutrition giving sailors more energy to sail competitively and enabling sailors to avoid dehydration, and greater use of sport sport psychology giving better preparing for regattas.

**Discussion**

The findings of the present study supplement those reported by Legg et al. (1997) and by Legg and Mackie (1999). Together the three accounts provide a description of sailors knowledge and use of sports science between 1994 and 1997.

**Nutrition**

The increases in sailors’ reported volume of fluid carried and consumed on a four hour sail between 1994 and 1997 indicate that there has been an improvement in their nutritional habits over this time. This is reinforced by the fact that the subjects common to 1994 and 1995 also showed statistically significant increases. Legg and Mackie (1999) reported sailors’ mean volume of fluid carried on a four hour sail in 1995 as being 1.6 l which is the same as that reported in 1997 (the present study). This means that sailors have improved the amount of fluid taken on a sail between 1994 and 1995, and made no further improvements between 1995 and 1997. However, the amount of fluid actually drunk has steadily improved from 1994 to 1995 and from 1995 to 1997. The amount of fluid taken on a sail is probably limited largely by the size of the container usually used to hold the fluid. The sailor is probably also conscious of the extra weight of greater amounts of fluid, hence the plateau effect observed between 1995-1997. Increased awareness of dehydration and the importance of fluid intake is probably the reason for the steady increase of the amount of fluid drunk when sailing between 1994 and 1995 and between 1995 and 1997. In fact, in 1997 it was observed that sailors reported drinking on average 1.5 l from 1.6 l taken sailing indicating that they now appear to drink almost all the water that they carry.

Sailors’ increased fluid intake seems consistent with 88% reporting having experienced dehydration in 1997. Suffering the effects of dehydration would be a good reason to increase the amount of fluid drunk in the future. The increase in mean reported fluid intake between 1994 and 1997 is pleasing as it suggests that sailors are becoming more aware of the harmful effects of dehydration that can easily develop during sailing due to exposure to sun and wind, and the layers of clothing usually worn, especially in hot climates.

**Psychology**

Although sailors reported feeling less anxious before a race in 1997 than they did in 1994, there was no improvement in their anxiety between 1995 (Legg and Mackie, 1999) and 1997. The lack of improvement in reported anxiety between 1994 and 1997 should be of some
concern to the sailing sport psychologist. Because dinghy racing is a very tactically and strategically orientated sport, being in the optimal mental state through use of psychological techniques should be a high priority for sailors. Increased use of sport psychology in a form that is useful to the sailor would help dinghy sailors to have less negative thoughts, get less angry at other sailors, improve concentration at the end of a race and get less frustrated when they make mistakes. More positively, the decrease in the amount sailors reported feeling sick before a race from between 1994 and 1997 is pleasing as it suggests that they are becoming more confident and relaxed before racing. The increase in the proportion of sailors in 1997 reporting using progressive muscular relaxation, visualisation, meditation and yoga is positive and complements the existing high proportion of sailors using relaxation and visualisation. However, greater improvements in sailors’ reported use of psychology would have been expected as a result. Perhaps sailors need to improve the application of psychological skills to a racing situation.

Physical conditioning

Increases in volume, intensity and participation in strength, flexibility and off-water aerobic conditioning by all subjects in 1997 and those subjects common to 1994 and 1997 clearly indicates that there were improvements in the physical conditioning habits of the sailors. However, when 1997 physical conditioning results are compared with 1995, it becomes clear that most areas of physical conditioning have not increased or even reduced. It would seem that the increases in sailors’ volume and intensity of physical conditioning and sailor participation seen between 1994 and 1995 have not continued into 1997. Perhaps sailors improved their physical training habits to a point (1995) where they felt further increases in volume and intensity of physical conditioning would not reap further benefits in terms of sailing performance. The initial improvements from 1994 to 1995 were encouraging, as they showed that sailors were acknowledging that physical fitness is just as an important component to race preparation as is boat tuning, knowledge of the sailing rules, or the development of a race strategy. The trend of more sailors participating in more sport specific off-water aerobic activities such as rowing has become greater since 1995. Perhaps further improvements to sailors’ physical conditioning practices are therefore to be seen in sailors participating in more sailing specific exercises as part of their off-water conditioning programme.

Sailors’ knowledge and use of sport science

Similar proportions of sailors in 1997 reported that their knowledge and use of sport science has improved since 1994 as did those in 1995 (Legg and Mackie, 1999). However, in 1997 27% of sailors reported that their use of sport science had increased in the area of sport psychology compared with 24% in 1995. On the other hand in 1997 only 33% of sailors reported improvements in the areas of nutrition and physical conditioning compared with 57% in nutrition and 71% in physical conditioning in 1995. This reflects the trends shown in sailor use of sport psychology and physical conditioning from 1994 to 1995 (Legg and Mackie, 1999) and from 1995 to 1997. Between 1994 and 1995 significant improvements were observed in sailors physical conditioning and nutrition habits while little improvements in sailors’ use of sport psychology were noted. Between 1995 and 1997 there was little increase and often a decrease in volume, intensity and sailor’s participation in physical conditioning, mixed improvements in nutrition, but greater improvements in use of sports psychology. Physical conditioning and nutrition would probably be the most obvious areas of sport science and least difficult to improve while sport psychology is probably a less obvious way to improve one’s sailing performance and may even be seen with scepticism by some sailors. As a result of this, sailors may have been quick to improve their physical conditioning and nutrition habits when sport science was introduced to sailing in 1994 and then, once they felt they could improve, turned to other areas, such as sport psychology, to gain a competitive advantage.

In this study, two types of comparisons have been made: firstly a cross-sectional comparison between sailors studied in 1994 (28 in total) and those studied in 1997 (33 in total), and secondly a longitudinal study of sailors from the 1994 group that were also studied in 1997 (15 in total). The present study has therefore examined changes in sailors’ knowledge and use of sport science from both a cross sectional and a longitudinal perspective. Comparative analysis between the 13 sailors (28-15) from the 1994 group but who were not re-examined in 1997 and the 18 sailors (33-15) from the 1997 group but who were not examined in 1994 would help to further clarify the effectiveness of the sport science support provided over the three year period of the study.

Conclusions

In conclusion, between 1994 and 1997 elite New Zealand dinghy sailors have improved their use of sport psychology, nutrition and physical training. However, sailors’ improvements in different areas of sport science have been fragmented. The greatest improvements in sport psychology have been made between 1995 and 1997 while the greatest gains in physical conditioning were made between 1994 and 1995. In nutrition, fluid intake while sailing has increased steadily between 1994 and 1997. Most of the sailors believed that their knowledge and use of sport science had increased and this had led to improvements in their racing performance. Overall, elite New Zealand Olympic class sailors are clearly becoming more aware of
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