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Training Profiles of Collegiate Swimmers: A Survey of NCAA Division I, II, and III Coaches About Their Male Freestyle Swimmers During the 1993-94 Swimming Season

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TRAINING PROFILES OF COLLEGIATE SWIMMERS

(TITLE)

BY

SEAN M. CABBAGE

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

MASTER OF SCIENCE IN PHYSICAL EDUCATION

IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY
CHARLESTON, ILLINOIS

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YEAR

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TRAINING PROFILES OF COLLEGIATE SWIMMERS:

A Survey of NCAA Division I, II, and III Coaches About Their Male Freestyle Swimmers During the 1993-94 Swimming Season

SUBMITTED AS PARTIAL FULFILLMENT
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EASTERN ILLINOIS UNIVERSITY

SEAN M. CABBAGE

AUGUST 8, 1994

ABSTRACT

The lack of information about how the majority of college swimming teams train encouraged the author to conduct the following study.

A cover letter and questionnaire, regarding training methods, were sent to all 377 NCAA men's swimming coaches (Division I, II, and III) in the United States, as listed in the 1993-94 NCAA Directory. Approximately 50 percent of all surveys were returned with an equal response rate from each of the respective divisions.

Questions regarded team division and size, the coaches experience level and recent training changes, months of peak training during the 1993-94 collegiate season, peak training volume and frequency, time spent building an endurance base, percentages of times spent at three intensity levels (aerobic, anaerobic threshold, and anaerobic), and finally number of team members who accomplishing specific time standards based on NCAA National Championship time standards for the 50, 200, and 1650 freestyle events.

Upon examination of the results, the author concludes that a significant proportion of NCAA Division I teams do not have financial scholarships. During the peak training months of the 1993-94 collegiate season, the majority of institutions surveyed responded that they perform approximately 6,000 to 10,000 yards per day. Although distance swimmers at all divisions and some sprint swimmers

at Division I reported to train further compared to the other groups, only Division I distance swimmers commonly reported to train more than 10,000 yards per day.

Distance swimmers in each division spent more time swimming aerobically and at the anaerobic threshold than did sprinters. Also, Division I sprinters spent more time at the aerobic level than sprinters in the other two divisions. Most distance groups only performed approximately 15 percent of their training time at the anaerobic level, while many sprint groups spent between 15 to 40 percent of their time at this intensity.

Twice as many swimmers within this population obtained national time standards at the 50 yard freestyle compared to the 1650 yard freestyle, which may have been the result of the moderate swimming volume levels observed in this population.

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The swimming coaches who contributed to this study, as either survey respondents or as consultants about survey content development, were a vital part of this project.

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CHAPTER I

INTRODUCTION

Background

With an increasing amount of available information concerning factors which affect athletic performance, the job of choosing training theories and practices often becomes more complex. The sport of swimming, as other sports, has looked to science for answers about what changes occur to the human body as a result of different types of training. Sport scientists, such as biomechanists, sport psychologists, and exercise physiologists are studying with athletes more now than ever to answer questions about the athletic potential of human beings. However, the body is extremely complex and science is not with out its flaws.

Researchers have great difficulty identifying and controlling all possible variables affecting an athletic performance. Problems still arise when testing for variables which we do know exist. Potentially valuable investigations are often plagued with problems of design, inadequate technology, small numbers of subjects, and inappropriate statistical analysis.

Despite these hinderences, the knowledge surrounding the "science" of swimming is improving greatly, and should continue to do so with the increasing expertise of

researchers and new technology.

In the sport and science of swimming, as in any other discipline, converting theory into fact or common knowledge, is often a lengthy and tedious process. This is especially true when one considers the previously mentioned difficulties in researching human performance. Here lies the dilemma of determining optimal training parameters (such as duration, intensity, frequency, and mode) in competitive swimming. How far and at what specific intensities do swimmers need to swim to prepare for an event? How does one know what type of training will or will not work?

Many coaches rely on their own tried and true methods, developed through years of trial and error. However there seems to be a large number of coaches who are listening more to what researchers are saying in the area of training.

The current practice of many highly successful swimmers has been to train at much lower intensity and distances far greater than those experienced during competition. Recent research has questioned, usually based on the principle of specificity, whether this type training is optimal for helping a swimmer reach his or her full potential in races which are swum at extremely high intensity and usually lasting less than two minutes in duration.

Purpose of the Study

A survey of NCAA Division I, II, and III swimming coaches was performed in order to identify some training characteristics (e.g. peak swimming yardage per day, number of practice sessions per week, weeks spent building an endurance base....) of NCAA male sprint and distance freestyle swimmers during the 1993-94 collegiate season.

Limitations of the study

As with any survey, unanswered questions or invalid responses could result in a misinterpretation of the data. The use of an extensive pilot study might have aided in better detection of questionnaire flaws.

In an attempt to encourage a high rate of return, the survey was designed in such a way that the data obtained from most of the questions was categorical or frequency type data. This approach limits the ability to utilize certain statistical methods in order to identify significant differences or correlations between the training parameters under examination.

Definitions of Terms

The terminology used in the sport of swimming is occasionally used in differing contexts. For the sake of clarity the following definitions are given to some exercise training and swimming terminology.

Aerobic Training - swimming performed at an intensity below the anaerobic threshold, during which the main source of fuel is metabolized via oxidative phosphorylation

Anaerobic Training - swimming performed above the anaerobic threshold, during which the main source of fuel is metabolized without sufficient oxygen

Anaerobic Threshold (AT) the point at which the metabolic demands of exercise cannot be met totally by available aerobic sources, and at which an increase in anaerobic metabolism occurs, as reflected by an increase in blood lactate

Detraining - the process by which a swimmer ceases to train at previous volumes and intensities, usually associated with decline of the physiological gains obtained from training

Endurance Base - believed to be a residual conditioning effect as a result of high swimming volumes at fairly low intensities; most often established during the first part of a swimming season or cycle. Note: There may not be total agreement as to the existence of this concept in the swimming community.

Individual Differences Principle - factors which may vary for each individual athlete include; the level of fitness prior to the beginning of training, the genetic predisposition of an individual to perform a certain activity with ease

Interval Training - repeated bouts of swimming performed at a pre-determined intensity, duration, and distances

Lactic Acid - a by-product of the anaerobic metabolism of glycogen, and specifically the reduction of NADH to NAD^{+}

Overload Principle - maintains that physiological adaptations occur as a result of increased loads during training which subsequently increase the efficiency(eg. biomechanical, physiological, etc.) of the specific system during the performance of the specific activity, the "load" parameter could be frequency, intensity, and/or duration

Reversibility Principle - physiological effects of training can be reversed by detraining

Set - refers to a group of specified distances which are either swum, kicked, or pulled at a pre-determined intensity

Specificity Principle - adaptations(eg. physiological) which occur depend on the specific type of training which is performed, specific exercise elicits specific adaptations creating specific training effects

Training Cycle - various intensities and durations of training sessions are cycled, so as to promote rest and adaptation as well as to avoid fatigue or staleness

Training Intensity - refers to the speed of swimming and the effort needed to propel the body through the water; relative to the skill and conditioning level of each individual athlete and is often best expressed as the heart rate response to exercise

Training volume - the total distance swum, sometimes referred to as yardage swum during training, usually expressed by either per session, per day, per week, etc.

CHAPTER II

REVIEW OF RELATED LITERATURE

The references cited in this paper have been divided into three sections; physiological studies, psychological studies, and coaching philosophy. When drawing conclusions about what may be the best way to train swimmers one must look at both the science of exercise, as well as the experience of coaches.

Physiological Studies

The studies discussed below have examined acute or chronic physiological responses to specific types of swimming training. The idea that more training is better, is becoming increasingly dubious. The reasons why some researchers and coaches question the benefits of high training distances are illuded to in the following studies.

Costill et al. (1988) studied 12 male swimmers immediately after the completion of their competitive season. For two weeks subjects trained at approximately 4 kilometers per week, which was equivalent to training levels 8 weeks prior to the final meet. At week three the men doubled their training from approximately 4 kilometers per day to 8 kilometers per day for 10 days.

Performance levels based on swimming power, sprinting speed, and aerobic conditioning were measured during the first, middle, and last days of increased training with no statistically significant changes during this period. Four of the subjects were unable to maintain the increase in training intensities because of fatigue. Upon examination of muscle biopsies, it was concluded that this fatigue was the result of low glycogen stores. The authors stated that failure to meet the increase in glycogen metabolism through diet probably resulted in fatigue. Subjects who increased their caloric intake to meet their expenditures during this heavy training period were capable of tolerating the increase in load.

The authors noted all subjects performed similarly during the performance tests. The ability of the fatigued swimmers to perform well on these tests, even though they could not maintain the higher training intensity, was due to the relatively small energy requirements of the performance tests compared to the energy requirements of intense training for extended durations.

The glycogen depleting effects of high training loads was not shown in the above study to have a statistically significant impact on performance times. However, other physiological responses to high levels of training have been the focus of other researchers.

Kirwan et al. (1988) monitored the same subjects as

Costill et al. (1988), but focused on certain physiological indices of "staleness" during successive days of intense training, other than muscle glycogen levels. The researchers measured all subjects for blood levels of cortisol, catecholamines, creatine kinase, glucose, lactate, as well as plasma volume, and resting heart rate and blood pressures.

As stated in the corresponding paper (Costill et al. 1988) the swimming performances of these subjects were not affected by the increase in training. However, cortisol and creatine kinase levels in the blood increased in all subjects during the added training loads. Catecholamine levels and resting heart rates were not significantly different, although an increase in diastolic blood pressure was recorded during the increase in training volumes. Because the above physiological changes were evident in all swimmers, but only four were incapable of tolerating the increased training load, it was concluded that these physiological changes observed during the increased training period are limited indicators of a swimmers inability to tolerate sudden increases in training volume (Kirwan 1988).

A study led by some of the same scientists examined a similar group of swimmers during a slightly longer period. Also, a control group was used in hopes of comparing similar swimming groups who performed two different training regimens.

Costill et al. (1991) used college age competitive swimmers, during a 24 week training period, which were divided into two groups following the first four weeks of training. During the next six weeks one group swam more than 10 kilometers per day while the other group remained at the previous training amount of 5 kilometers per day. During the final 14 weeks both groups trained together at 5 kilometers per day.

Subjects sprinting ability based on a timed 22.9 meter swim, blood lactate levels, and performance times resulting from a 365.8 meter swim, were established at various intervals through out the study to compare possible changes in the groups. Also blood creatine kinase, testosterone, cortisol, muscle fiber composition, phosphofructokinase, phosphorylase, and citrate synthase were measured at various times during the study. Other training parameters were measured, however those noted above were the major focus of the authors.

Researchers concluded that the group swimming longer distances showed some loss in sprinting ability during the period of increased training volume, but at the end of the season both groups improved performances to approximately the same degree. It was concluded that this specific group of swimmers showed no significant improvement as a result of the increased training volumes. The authors also noted that current knowledge about specificity in training may tell us

that adaptations resulting from training performed at greater distances and lower intensities may not be conducive to optimal swimming performances, which for the most part are performed for short distances at high intensities. However, the authors commented that this study may not apply to swimmers of different skill or age levels. They suggested that an alteration of the subject composition, as well as the length of this study might produce varying results.

The ability to identify specific mechanical changes, and adaptations of muscle fibers resulting from intense training changes also provides information to coaches and swimmers about training at a high swimming volume.

Fitts, Costill, and Gardetto (1989) performed a study of the effects of increased swim training on single muscle fiber tension and contraction velocity, as well as calcium concentrations and permeabilities. Twelve male college swimmers underwent 10 weeks of training 1.5 hours per day, 5 days per week, and approximately 4.2 kilometers per day. The group then began training twice a day for 1.5 hours per session for the next 10 days. The daily swimming volume averaged 9 kilometers. The percent effort was held constant at 94% of the swimmers' maximal 0_2 uptake.

Muscle fiber samples of both the test group and four control subjects were taken from the posterior deltoid by use of a biopsy, immediately before the increase in

training, on the last day of increased training, and one day following the training period. Increased training levels significantly increased the contraction velocity of slow twitch fibers, while decreasing the velocity of the fast fiber type. The authors concluded that these changes were probably the result of an exercise-induced expression of fast myosin in slow fibers and slow myosin in fast fibers (Fitts et al. 1989)

The results from the study by Fitts et al. 1989 support the idea that training at high distances or high swimming volume could physiologically decrease the athletes performance in races which require great sprinting ability. The fact that subjects, from the study by Costill et al. 1991, lost some sprinting ability during levels of increased training also shows a negative affect of increased training levels.

The practical application of the research above came to life in an experimental examination of one college team's training changes.

Kame, Pendergest, and Termin (1990) studied changes in maximal and submaximal oxygen consumption, and assessment of stroke frequency versus velocity in 17 male collegiate swimmers during a season long, high intensity training program. These swimmers were tested pre-season, mid-season, and post-season while performing the front crawl during a tethered swim to exhaustion (for VO_2 max.) and a 22 meter

time trial (max velocity and stroke frequency).

During this season the training focus was on swimming at or near maximum speeds, with accompanying maximum stroke frequencies. This program consisted of one session per day for approximately one hour. Most of the swimming consisted of interval training shorter than the actual racing distance, in order to allow for high intensity to be maintained. Two consecutive days of high intensity work preceded two consecutive days of lighter work to allow for recovery. The goal was to swim as fast as possible for two days, then recuperate for two days, and start over.

There was a statistically significant increase in maximum VO_2, maximum stroke frequency, and maximum velocity following this experimental competitive season. However, correlations between stroke frequency versus swimming velocity did not show statistical significance at the .05 level. The authors stated that training at high intensities for relatively short distances significantly improved some of the physiological factors affecting the swimmers ability to race at a higher intensity, thus performance improved. However, pre and post test stroke efficiency, which was equated with skill levels, stayed relatively the same. The authors concluded that this data suggests high intensity training brings about some optimal physiologic changes for swimming, but factors affecting skill were not significantly enhanced during this type of training. In order to

facilitate maximal swimming performance all training parameters should be addressed (Kame et al. 1990).

The studies mentioned above have all utilized male competitive college swimmers in hopes of finding evidence about what changes, negative or positive, could come from excessive training levels. From evaluation of the available research it appears that periods of increased training have some negative impact on a swimmers sprinting ability during the period of increased training. Is the adoption of programs which utilize lower training distances and higher intensities warranted by the available research? This is the question coaches and swimmers are left to answer.

Psychological Studies

The psychological profile of a competitive swimmer could play an important role in that individuals ability to compete or even train. Research in this area has focused on the psychological impact increased training loads can have on competitive swimmers.

Morgan, Costill, Flynn, Raglin, and O'Connor. (1988) studied mood states and various psychological parameters in 12 collegiate male swimmers during a 10 day period of increased training volume. This was a co-study of Costill et al (1988), which examined the performance and physiological parameters of these subjects. The purpose of

this study was to determine if a state of "staleness" resulted from an increase in training volume.

Researchers utilized questionnaires to analyze psychological states of the subjects during each day of the study. Profile of mood states(tension, depression, anger, vigor, fatigue, and confusion), muscle soreness, general state of well being, exercise intensity ratings, sleep patterns, and health status were the primary focuses of the study. The physiological measures of these athletes reported by Costill et al.(1988) and Kirwan et al. (1988) showed significant correlation with many of the psychological parameters of the subjects. The authors acknowledged that this study was of fairly short duration. These subjects were also tested following a competitive swimming season, thus this may be different from an actual in-season training scenario. Further, it is difficult to apply what was observed in these athletes to more elite, or less talented swimmers.

Many of the same researchers from the previously mentioned study later examined both male and female swimmers in a similar study. O'Connor, Morgan, and Raglin (1991) studied the psychobiologic effects from three days of increased swim training on 18 females and 22 males from the University of Wisconsin-Madison intercollegiate swimming teams. This study was performed in the middle of the swimmers competitive swimming season during the fall-spring

semester break. The subjects had completed three months of their respective seasons prior to the study. The training levels increased from the usual average daily loads of 6,800 and 8,800 meters to 11,200 and 12,950 meters for the women and men respectively, while relative intensities for the total distances remained the same.

The subjects performed a 182.0 meter swim test on day one and day 4 of the study. Pacing lights on the bottom of the pool were used to insure the swim test was performed at equal to or greater than 90% of each subjects best performance time at the distance of 182 meters. Stroke frequency, stroke length, exercise heart rate, and rate of perceived exertion were all monitored during the test swim. Saliva was obtained 15 minutes and one hour following the swim test, and was analyzed for cortisol levels.

Muscle soreness and mood states were measured daily at 1500 hours, prior to afternoon workouts. The ratings of muscle soreness were made for upper body (fore arms, upper arms, and shoulders) and lower body (quadriceps, hamstrings, and shins), as well as for ratings of overall muscle soreness. The profile of mood states questionnaire assessed tension, depression, anger, vigor, fatigue, and confusion. A measure of overall mood state was also performed.

The authors found that both male and female swimmers responded similarly to the increase in training volume. The 72 hours of increased training was associated with negative

changes in mood, perception, and stroke mechanics. Heart rate and cortisol levels were not significantly changed by the increase in training. The authors concluded that the best strategy for monitoring signs of overtraining will incorporate both biological and psychological variables of fatigue.

These psychological studies have investigated the training phenomenon known as "overtraining" which is at the heart of all research on this topic. There is concern that some swimmers are training at high levels in hopes of increasing performance, but could instead possibly become vulnerable to the negative psychological and physiological effects. Also, as shown from the physiological studies, the physiological gains from high training are still questionable. The psychological factors which affect swimming performance, and how they may be altered during training is an area which warrants an increase in research.

Coaching Philosophy

Scientific research has recently been asked to document how swimmers are physiologically and psychologically altered as a result of their training. However, as discussed in the references below, swimming coaches actually determine how a swimmer will train based on the available evidence.

Councilman (1991 and 1988) refutes the low yardage/high intensity theories on two points; the first being that elite swimmers and coaches have learned through years of trial and error that what works is a high volume training regimen. Secondly, that the widely accepted principles of training(specificity, overload, and reversibility) support increased volume for swimming. Councilman believes that those following low yardage/high intensity programs have done so as a result of misinterpretations of the same training principles which are used to support the other side of the training spectrum. Councilman is highly respected in the swimming community as a successful coach and sports scientist, his arguments are supported by the current training practices of many of the worlds greatest swimmers. In a personal interview during the national U.S. Swimming Championships Councilman asked many top U.S. swimmers how they train, the following are some of their responses; Matt Biondi, the world record holder in the 50 and 100 meter freestyle at the time, swims between 12,000 to 15,000 meters per day, in 11 workouts per week. Dan Jorgensen, winner of the 1500 meter free at the U.S. Championships, averages 15,000 meters per day. Dave Wharton, the American record holder in the 200 and 400 meter individual medley races, swims between 16,000 and 20,000 meters per day. Sean Killion, winner of the 800 meter freestyle in American record time, trains about 12,000 to 13,000 meters per day in

11 workouts a week. Janet Evans, world record holder in the 800 and 1500 meter freestyles, swims 13,000 meters per day in 11 workouts per week. She averages 75,000 meters per week.

Thornton's (1987), arguments support the theory of increased training volume in competitive swimming. As coach to Matt Biondi, one of the worlds premier sprinters prior to the 1988 Olympics and many other highly successful athletes, Thornton bases his practices of high swimming volumes on years of trial and error experience with various training methods. He states that the organization of United States championship events occurring three times in one year does not allow the athlete adequate time for preparation of world class performances in comparison to other countries were championship events are held less often. He believes that since other countries train longer at high volumes before competition, they will surpass the U.S. as the leader in competitive swimming.

More recently Touretski (1994), published the training practices of Alexandre Popov, 1992 Olympic gold medalist in the 50 and 100 meter freestyle, and current world record holder in the 100 meter freestyle. Popov's training under coach Touretski has sparked much interest from other coaches because of Popov's rise from a relatively unknown national swimmer to his current status in just two years. The philosophy of this program maintains that swimming is an

aerobic sport and requires well developed aerobic capacity. The key to this program is the development of speed at each intensity level; low to moderate intensity or aerobic, anaerobic threshold, and at maximum O_2 consumption. Technical precision is strictly pursued at all three phases of training. A three week cycle representative of the overall training period was analyzed. Blood lactic acid levels and heart rate were monitored at the different phases within this micro cycle in order to note specific adaptations and training responses. It was noted by the author that only by developing all energy systems at different intensities can the greatest performances result.

In contrast to the above philosophy, Salo (1988), based his criticism of high volume training habits on the research which had been produced at that time concerning adaptations occurring as a result of the specificity of the exercise being performed. In short, he proposes the adaptation of the athlete to high distance training at low intensities is not beneficial for races of short duration and high intensities. Salo refers to research which has tested some of the physiological parameters of swimming, stating that the body of evidence supporting this idea of specificity of training intensity and duration supports his view.

Summary

Because of the limited number of studies found, and the lack of total agreement concerning the physiological and psychological components of ideal swim training program, as well as differing coaching philosophies, it seemed appropriate to survey a large number of swim coaches concerning their current training practices.

CHAPTER III

METHODOLOGY

Population

This investigation focused on NCAA male intercollegiate freestyle swimmers. All swimming coaches throughout the United States at NCAA Division I, II, and III institutions listed in the 1993-94 NCAA Directory were sent a questionnaire (Appendix A). A total of 377 questionnaires were mailed; 165 to Division I, 45 to Division II, and 167 to Division III schools. This bulk mailing was performed on April 11, 1994.

Questionnaire

After several months of talking with swimming coaches and sports professionals familiar with the survey process, the questions evolved and the final product emerged. To encourage a high rate of returns, it was decided that the survey should be relatively short in length and require a minimum effort on the part of the respondent. On brightly colored yellow paper, a two-sided, one page questionnaire was developed (Appendix A). In most instances, coaches needed only to circle their responses (e.g. yards of

swimming per day 4000 or less, 4001-6000, 6001-10000), though some items required them to write a number on a blank line. The total of 12 questions, some having more than one part, were arranged from least to most complex. This was done in hopes of allowing coaches to feel more comfortable in starting to answer the questions. To encourage honest responses, the respondents were not required to identify themselves.

A brief cover letter (Appendix B) encouraged coaches to complete the questionnaire and return it immediately. To further increase the likelihood of return; envelopes were hand addressed to the individual coaches, EIU letter head was used for the cover letter, and a self addressed stamped envelope was enclosed in the mailing. The Director of Eastern's Human Performance Lab (Dr. Thomas Woodall), and Eastern's Head Swimming Coach (Mr. Ray Podavan) signed the cover letter, and commented on the importance of this study with a brief statement at the bottom of this letter. This was done in hopes of giving more credibility to the project.

Descriptors: Teams and Coaches

Questions were constructed to identify the NCAA affiliation (Division I, II, or III), the number of male swimmers on the team, and how many full tuition equivalent scholarships were offered at each institution. Three other questions dealt with the coaches (respondents) themselves.

It seemed appropriate to find out how long they had been coaching, if they had changed their training philosophy within the last two years, and if so, for what reason it was modified.

Training Parameters

Once the demographic type information was addressed, questions about the general training practices in regards to male sprint and distance freestyle swimmers were asked. There were two sets of identical answers for these questions, labeled as either "sprint" or "distance". Peak training months, weekly swimming yardage during these months, frequency of training sessions during these months, and weeks spent building an "aerobic base" during the 1993-94 season were covered on the first page. To complete the analysis of training profiles, questions dealing with the percentages of training time spent in aerobic work, at the anaerobic threshold, and in anaerobic effort were included. Upon completion of this section by the respondent, information concerning the training duration, frequency, and intensity for each of the respondents was obtained.

Time Standards

The final section of the survey was constructed with the goal of identifying the population based on their ability to achieve established time standards, for the 1993-

94 NCAA Championship swimming meets for Divisions I and III, in the 50, 200, and 1650 yard freestyle events during the 1993-94 collegiate season. The methods used in choosing time standards for various events are similar within each respective division. Time standards for Division II were only slightly more stringent than those of Division III, therefore the slower Division III times were utilized.

The respondent wrote the number of individuals who achieved a particular time standard for each of the three events. Directions stated that a swimmer could be used in all three events, but each swimmer should only be placed in the time slot which corresponds with his fastest time during the 1993-94 season.

Analysis of the Data

On June 15, 1994, approximately two months following the mailing of the survey, an analysis of the data began. The data were entered into a Word Perfect 5.1 word processing file for statistical analysis with SPSS statistical package. A Pearson Chi-Square analysis, was performed on the data in a frequency distribution format and *t* tests were calculated on selected paired samples. Though several statistically significant values were found, they could not really identify exactly which sub groups differed from one another. Therefore, it was decided that it would

be most meaningful to express the results in raw score totals and percentages. No attempt was made to include any statistical analysis in this paper.

CHAPTER IV

RESULTS AND DISCUSSION

Results

The results of this study are presented in nine sections. They are: Team Descriptors, Coach Descriptors, Swimming Volume, Training Frequency, Endurance Base Duration, Percent of Swimming at an Aerobic Level, Percent of Swimming at an Anaerobic Threshold, Percent of Swimming at an Anaerobic Level, and Time Standards.

Each of the coaches who responded to this survey represent a specific institution. The respondents were separated into their respective NCAA divisions. Data were also combined whenever possible.

Throughout the chapter the data are presented as raw score totals; the number of coaches making the same response to an item, and as a percentage shown in parenthesis.

Some coaches who returned questionnaires may have failed to respond to certain questions. Therefore not all column or row totals may equal 100 percent of the total responses.

Team Descriptors

Table 1 provides information about the mailings/returns of the questionnaire, the size of the team (number of members), and the scholarship status of the teams.

Table 1

Team Descriptors

Mailings, team size, and scholarship status

	Respondents per Division Coaches(% within division)			
	Div. I	Div. II	Div. III	Row Total
MAILINGS	No.(%)	No.(%)	No.(%)	No.(%)
mailed	165	45	167	377
returned	77	24	85	189
% return	46.7	53.0	50.9	50.1
TEAM SIZE	No.(%)	No.(%)	No.(%)	No.(%)
≤ 9	6(8.5)	3(13.0)	17(21.3)	26(13.8)
10 - 19	28(39.5)	14(60.9)	41(51.3)	86(45.5)
20 - 29	37(52.1)	6(26.0)	22(27.5)	65(34.4)
≥ 29	N/A	N/A	N/A	10(5.0)
SCHOLARSHIP STATUS equivalent full	No.(%)	No.(%)	No.(%)	No.(%)
none	14(18.7)	6(26.1)	85(100)	105(55.0)
0.3 - 5.0	29(38.7)	12(52.2)	0	41(21.7)
5.0 - 9.9	32(42.7)	5(21.7)	0	37(19.6)

N/A = Not Available

One can see that of the 377 questionnaires mailed, a total of 189 (50.1 percent) were returned with a near equal percentage response from each of the NCAA institutions.

Considering team size, when all divisions were combined the largest percent of coaches (45.5 percent) reported having 10 to 19 members on their men's team, while 34.4 percent had teams of 20 to 29 male swimmers, and 13.8 percent of all coaches reported having 9 or less members. When Divisions I, II, and III were inspected separately, it was noted that a majority of Division I teams (52.1 percent) reported being in the 20 to 29 member category. This was double the percentage of Division II and Division III schools who reported teams this large.

The data on the available equivalent full scholarships for each team are reported in Table 1 under "Scholarship Status". Considering all the schools surveyed, 55.5 percent reported themselves as having no scholarships, 21.7 percent listed themselves as having 0.3, the lowest scholarship amount noted, to 5.0 full scholarships, and 19.6 percent of schools noted they had between 5.0 and 9.9 full scholarships, the maximum allowable for Division I. Division II schools are allowed approximately 2 full scholarships less than Division I by NCAA regulations. All NCAA Division III are categorized as non-scholarship by the NCAA. However, it was interesting to note that 18.7 percent and 26.1 percent of Division I and II teams respectively

reported having no scholarships at all.

Coach Descriptors

Table 2 reveals information about the coaches who responded to the questionnaire.

Table 2

Coach Descriptors: Coaching experience, recent changes in training philosophies, and reasons for changing

	Respondents per Division Coaches(% within division)			
	Div. I	Div. II	Div. III	Row Total
COACHING EXPERIENCE years	No.(%)	No.(%)	No.(%)	No.(%)
≤ 10	N/A	N/A	N/A	60(31.9)
11 - 20	N/A	N/A	N/A	86(45.7)
≥ 21	N/A	N/A	N/A	39(22.4)
TRAINING CHANGES	No.(%)	No.(%)	No.(%)	No.(%)
yes	40(51.9)	13(54.2)	44(51.8)	97(52.2)
in process	9(11.7)	4(16.7)	14(16.5)	27(14.5)
no	28(36.4)	7(29.2)	27(31.8)	62(33.3)
REASON FOR CHANGES	No.(%)	No.(%)	No.(%)	No.(%)
readings	24(31.6)	10(41.7)	37(43.5)	81(42.9)
trial & error	27(35.5)	12(50.0)	35(41.2)	84(44.4)
other	21(27.6)	7(29.2)	17(20.0)	45(23.8)

By far the greatest number of coaches (45.7 percent), claimed to have 11 - 20 years of coaching experience. No attempt was made to identify the years of coaching experience as it relates to each of the three divisions.

Coaches in each of the three divisions responded similarly when asked if they had made a change in their training philosophy within the last two years. When all divisions were combined, two thirds of the respondents indicated that they had made a change, or were in the process of changing their training philosophy.

An equal number of coaches indicated they had made a change in their training philosophy, or were in the process of doing so as a result of recently published research, and/or personal trial and error experiences. Many coaches chose both of these reasons for changing, thus the total response percentage does not add up to 100 percent.

Swimming Volume

Table 3 represents the distance per day that sprinters or distance swimmers swam during the peak training months of the 1993-94 collegiate season as reported by coaches in each of the three NCAA divisions.

Only one percent of all coaches reported training their sprint swimmers less than 4000 yards per day during the peak training months, while none of the distance swimmers were reported to train at this volume.

Just under one half of the Division II and III coaches (41.7 and 42.9 percent respectively) reported their sprint swimmers swim between 4,000 and 6,000 yards per day during peak training months, while only about 15 percent of Division I coaches reported that their sprint swimmers swam less than 6000 yards per day. Very few coaches (5 percent) reported their distance swimmers to train at this lower swimming volume.

Table 3

Daily Swimming Volume During Peak Training Months

	Respondents per Division Coaches(% within division)			
	Div. I	Div. II	Div. III	Row Total
SPRINT SWIMMERS yards/day	No.(%)	No.(%)	No.(%)	No.(%)
≤ 4000	1(1.3)	1(4.2)	0	2(1.1)
4001-6000	12(15.6)	10(41.7)	36(42.9)	58(31.4)
6001-10,000	52(67.5)	11(45.8)	45(53.6)	108(58.4)
≥ 10,000	12(15.6)	2(8.3)	3(3.6)	17(9.2)
DISTANCE SWIMMERS yards/day	No.(%)	No.(%)	No.(%)	No.(%)
≤ 4000	0	0	0	0
4001-6000	1(1.3)	3(13.0)	5(6.2)	9(5.0)
6001-10,000	22(28.9)	10(43.5)	50(61.7)	82(45.6)
≥ 10,000	53(69.7)	10(43.5)	26(32.1)	89(49.4)

The majority of coaches, (approximately 90 percent), in all divisions combined said that their sprint swimmers swam less than 10,000 yards per day, as reported by their coaches. Also, most Division III coaches, (approximately 70 percent) reported their distance swimmers also trained in this same volume range during the peak training periods. However, considerably more of the Division I and II coaches reported their distance swimmers to train more than 10,000 yards per day.

Generally Division I coaches reported more often to training both sprint and distance swimmers at higher volumes than the other two divisions. While Division II coaches more frequently reported higher swimming volumes than Division III coaches for both sprint and distance groups.

Training Frequency

Table 4 represents the number of training sessions per week performed by either sprint or distance groups in NCAA Division I, II, and III during the peak training months of the 1993-94 collegiate season.

Over three fourths of coaches in Divisions I and II, reported that both their sprint and distance groups train between 7 to 10 times per week. Nearly 80 percent of Division III coaches reported that their distance swimmers also trained between 7 to 10 times per week. However, almost 50 percent of Division III coaches reported that

their sprint swimmers trained at a lower frequency of 5 to 6 times per week during months of peak training.

Table 4

Training Frequency in Sessions per Week

	Respondents per Division Coaches(% within division)			
	Div. I	Div. II	Div. III	Row Total
SPRINT SWIMMERS sessions/week	No.(%)	No.(%)	No.(%)	No.(%)
≤ 4	2(2.6)	0	0	2(1.1)
5 - 6	10(13.0)	5(20.8)	40(47.1)	55(29.6)
7 - 8	31(40.3)	11(45.8)	26(30.6)	68(36.6)
9 - 10	31(40.3)	7(29.2)	18(21.2)	56(30.1)
≥ 11	3(3.9)	1(4.2)	1(1.2)	5(2.7)
DISTANCE SWIMMERS sessions/week	No.(%)	No.(%)	No.(%)	No.(%)
≤ 4	0	0	0	0
5 - 6	2(2.6)	0	0	2(1.1)
7 - 8	18(24.0)	9(37.5)	19(23.8)	46(25.7)
9 - 10	39(52.0)	11(45.8)	34(42.5)	84(46.9)
≥ 11	14(18.7)	2(8.3)	3(3.8)	19(10.6)

Endurance Base

Table 5 contains information concerning how many weeks NCAA male freestyle swimmers spent, during the 1993-94 collegiate swimming season, building an endurance base, as

reported by coaches from all divisions.

Over one half of all coaches reported that their sprint swimmers spent 5 to 8 weeks on an endurance base, while many coaches, approximately 60 percent, reported their distance swimmers spent over 8 weeks on an endurance base. However, many of the Division III coaches (approximately 50 percent) reported that their distance swimmers spent 5 to 8 weeks developing an endurance base.

Table 5

Number of Weeks Spent Building an Endurance Base

	Respondents per Division Coaches(% within division)			
	Div. I	Div. II	Div. III	Row Total
SPRINT SWIMMERS weeks	No.(%)	No.(%)	No.(%)	No.(%)
≤ 2	1(1.3)	0	1(1.2)	2(1.1)
3 - 4	11(14.5)	6(25.0)	20(23.5)	37(20.0)
5 - 8	43(56.6)	11(45.8)	48(56.5)	102(55.1)
9 - 12	19(25.0)	5(20.8)	13(15.3)	37(20.0)
≥ 13	2(2.6)	2(8.3)	3(3.5)	7(3.8)
DISTANCE SWIMMERS weeks	No.(%)	No.(%)	No.(%)	No.(%)
≤ 2	1(1.4)	0	0	1(0.6)
3 - 4	3(4.1)	3(12.5	4(4.8)	10(5.5)
5 - 8	21(28.4)	5(20.8)	39(47.0)	65(35.9)
9 - 12	30(40.5)	10(41.7)	32(38.6)	72(39.8)
≥ 13	19(25.7)	6(25.0)	8(9.6)	33(18.2)

Aerobic Swimming

Table 6 illustrates the distribution of NCAA Division I, II, and III coaches who noted the approximate percent of training time which was swum at the aerobic level defined by a heart rate of less than 160 beats per minute by both their sprint and distance swimmers.

Table 6

Percent of Swimming Volume in Aerobic Swimming

Aerobic is defined by a heart rate of <160

	Respondents per Division Coaches(% within division)			
	Div. I	Div. II	Div. III	Row Total
SPRINT SWIMMERS percentage	No.(%)	No.(%)	No.(%)	No.(%)
≤ 15	11(14.7)	5(22.7)	10(12.2)	26(14.5)
16 - 40	28(37.3)	8(36.4)	49(54.9)	81(45.3)
41 - 59	21(28.0)	7(31.8)	19(23.2)	47(26.3)
60 - 79	15(20.0)	2(9.1)	9(9.8)	25(14.0)
80 - 100	0	0	0	0
DISTANCE SWIMMERS percentage	No.(%)	No.(%)	No.(%)	No.(%)
≤ 15	7(9.7)	4(18.2)	9(11.5)	20(11.6)
16 - 40	27(37.5)	4(18.2)	32(41.0)	63(36.6)
41 - 59	18(25.0)	6(27.3)	22(28.2)	46(26.7)
60 - 79	18(25.0)	8(36.4)	14(17.9)	40(23.3)
80 - 100	2(2.8)	0	1(1.3)	3(1.7)

Considering coaches from all three divisions combined, approximately half noted that their sprint and distance swimmers spend less than 40 percent of their time in aerobic swimming. While the other half of these coaches indicated that their distance swimmers spend between over 40 percent of their training time at this level.

In general distance swimmers spent more time training at the aerobic level, with the exception of Division III swimmers who spent less time at this level than distance groups from the other two divisions.

Also, division I sprinters were reported to generally spend a higher percent of their time training at an aerobic level.

Anaerobic Threshold Swimming

Table 7 illustrates the distribution of NCAA Division I, II, and III coaches who noted the approximate percent of training which was swum at the anaerobic threshold, as defined by a heart rate of 160 to 180 beats per minute, by both their sprint and distance swimmers.

Most coaches from all divisions, approximately 60 percent, reported that their sprinters spent between 16 to 40 percent of their time swimming at an anaerobic threshold. About 30 percent of these coaches noted their sprinters spent between 40 and 60 percent of their time at the anaerobic threshold.

The coaches from all three divisions combined, said that their distance swimmers spent a slightly greater percent of their time at the anaerobic threshold. The responses of coaches for all three divisions were similar in regards of both sprint and distance swimmers.

Table 7

Percent of Swimming at an Anaerobic Threshold(AT)

AT is defined by a heart rate of 160 - 180 beats per minute

Respondents per Division
Coaches(% within division)

	Div.I	Div.II	Div.III	Row Total
SPRINT SWIMMERS percentage	No.(%)	No.(%)	No.(%)	No.(%)
≤ 15	6(8.0)	2(9.1)	3(3.6)	11(6.1)
16 - 40	43(57.3)	14(59.1)	54(65.1)	110(61.1)
41 - 59	22(29.3)	6(27.3)	20(24.1)	48(26.7)
60 - 79	4(5.3)	1(4.5)	4(4.8)	9(5.0)
80 - 100	0	0	2(2.4)	2(1.1)
DISTANCE SWIMMERS percentage	No.(%)	No.(%)	No.(%)	No.(%)
≤ 15	4(5.6)	1(4.5)	3(3.7)	8(4.5)
16 - 40	24(33.3)	12(54.5)	36(43.9)	72(40.9)
41 - 59	30(41.7)	4(18.2)	29(35.4)	63(35.8)
60 - 79	14(19.4)	5(22.7)	13(15.9)	32(18.2)
80 - 100	0	0	1(1.2)	1(0.6)

Anaerobic Swimming

Table 8 illustrates the distribution of NCAA Division I, II, and III coaches who noted the approximate percent of training which was swum by both their sprint and distance swimmers at the anaerobic level which was defined as a heart rate of greater than 180 beats per minute.

Table 8

Percent of Swimming Volume in Anaerobic Swimming

Anaerobic as defined by a heart rate of >180 beats per minute

	Respondents per Division Coaches(% within division)			
	Div.I	Div.II	Div.III	Row Total
SPRINT SWIMMERS percentage	No.(%)	No.(%)	No.(%)	No.(%)
≤ 15	21(28.0)	6(27.3)	15(18.1)	42(23.3)
16 - 40	38(50.7)	11(50.0)	49(59.0)	98(54.4)
41 - 59	9(12.0)	2(9.1)	11(13.3)	22(12.2)
60 - 79	6(8.0)	3(13.6)	6(7.2)	15(8.3)
80 - 100	1(1.3)	0	2(2.4)	3(1.7)
DISTANCE SWIMMERS percentage	No.(%)	No.(%)	No.(%)	No.(%)
≤ 15	44(60.3)	14(63.6)	47(58.0)	105(59.7)
16 - 40	19(26.0)	7(31.8)	30(37.0)	56(31.8)
41 - 59	10(13.7)	1(4.5)	2(2.5)	13(7.4)
60 - 79	0	0	1(1.2)	1(0.6)
80 - 100	0	0	1(1.2)	1(0.6)

It is not surprising to note that, considering all divisions, sprint swimmers generally spent a greater percent of their time swimming at the anaerobic level compared to distance swimmers. There were about 28 percent of Division I and II coaches reporting that their sprint swimmers spent less than 15 percent of their time performing anaerobic swimming, while about 18 percent of Division III coaches reported the same practices. However, approximately 60 percent of all coaches said that their distance swimmers spent less than or equal to 15 percent of their time at this level. Most coaches (approximately 80 percent), said their sprint swimmers spend less than 40 percent of their training time at this level. While 90 percent of these coaches reported that their distance swimmers spent less than 40 percent of training time in anaerobic swimming.

Time Standards

Information was requested concerning the ability of individual swimmers, within the teams surveyed, to meet the Division I or III, automatic or consideration time standards, for the respective 1993-94 NCAA championship swimming meet. The author wanted to compare the type of training this population of swimmers performs with their current swimming ability based on how many swimmers could achieve selected NCAA time standards for three events during the 1993-94 collegiate season.

Table 9 reveals that of nearly all 3500 to 4000 swimmers who were represented, (189 teams X average team size of approximately 20 swimmers), only 17 performances met the Division I qualifying standard for the three events.

Table 9

Swimmers reported by their coaches as achieving NCAA Division I or III, automatic or consideration time standards for the National Championship swimming meets during the 1993-94 collegiate season

	Swimming Event		
	50 yd. Free	200 yd. Free	1650 yd. Free
TIME STANDARD	(sec.) # Swimmers	(min.:sec.) # Swimmers	(min.:sec.) # Swimmers
Division I Automatic	(:19.97)	(1:36.77)	(15:12.97)
Swimmers Achieving	7	6	4
Division I Consideration	(:20.56)	(1:39.67)	(15:40.35)
Swimmers Achieving	57	63	43
Division III Automatic	(:21.00)	(1:42.00)	(16:10.99)
Swimmers Achieving	139	170	81
Division III Consideration	(:21.50)	(1:43.75)	(16:30.12)
Swimmers Achieving	277	209	92
Total Swimmers	480	448	220

When considering the total number of swimmers that qualified in each event, one can see that more than twice as many swimmers achieved one of the 4 time standards in the 50 yard free, as compared to the number of swimmers obtaining standards at the 1650 yard freestyle.

Discussion

From the information provided in the previously presented tables, much can be noted about how NCAA Division I, II, and III sprint and distance freestylers trained during the 1993-94 collegiate season. Due to the response rates, and the fact that this entire coaching population was included in this survey, it was felt the data obtained were fairly representative of the whole population.

Team Descriptors

It was indicated from the results that Division I teams appeared to have more members than Division II and III teams, which was not surprising. Also, Division II swimming teams seemed to have slightly more members than Division III teams. The larger number of team members could possibly be accounted for by a number of factors, for example, size of the general budget, available scholarship funds, and the capacity of the available facilities.

Information obtained on the available equivalency of

the maximum allowable full scholarships indicated that there is a considerable percentage of Division I and II schools that do not have scholarships. This would leave one to wonder how teams, within a respective division, with such a variety of available "talent attracting" scholarships, could compete with one another on the national level. Perhaps winning a national championship may not be the goal of every NCAA swimming program regardless of the division. The "success" of a collegiate swimming team could be greatly affected by the available scholarship funds.

Coach Descriptors

Approximately half (45.7 percent) of the NCAA coaches surveyed have between 11 to 20 years of experience, and have recently changed or are changing their training philosophies in some fashion. Many of these coaches noted that information obtained from reading, as well as through personal trial and error experience contributed to the changes. Also, some coaches listed other reasons for changing their philosophies, such as talking with and observing other swimming coaches, personal research, and feed back from swimmers themselves.

Swimming Volume

The question, "How far should swimmers train?", has been addressed by many coaches and researchers (Costill

1991, Councilman 1990 and 1988, Salo 1988, Thornton 1987, and Touretski 1994). Also, the training habits of many elite, world class swimmers have been documented (Norton 1987, Councilman 1988, Touretski 1994). But, this small group of highly elite swimmers, which have been the focus of most studies to this point, may not be a true representation of how the whole population of competitive swimmers are actually training. It appears from what has been published on the topic of swimming training, as well as through discussion with coaching professionals, that swimmers who perform between 6000 to 10,000 yards per day could be described as moderate to high training levels. It has also been indicated that training volumes which exceed approximately 10,000 yards per day could definitely be labeled as "high" training levels.

Most coaches regardless of division reported their swimmers to train less than 10,000 yards per day, with distance swimmers training farther than sprinters. However, Division I distance swimmers, as reported by approximately 70 percent of coaches, trained more than 10,000 yards per day.

Training Frequency

As might be expected, the results of this study show that, in general, distance groups train more frequently than sprint groups. This could be the result of the different

training needs for these two groups of swimmers. Distance swimmers compete in events of longer duration requiring much more aerobic endurance. Therefore distance training has traditionally focused on building an aerobic capacity in these athletes, which is more time consuming. Distance swimmers often meet the increased training durations, utilized for by aerobic performances, through an increase in the number of training sessions. Some coaches surveyed even noted that their distance swimmers perform at least 11 practice sessions per week.

Endurance Base

Distance swimmers spend more time building an endurance base than sprinters. This was previously discussed to be expected as a result of the special endurance needs of distance swimmers. In general a large percent (55.1 percent) of sprint groups were reported to spend any where form 5 to 8 weeks on an endurance base. While, many of the coaches (39.8 percent) reported their distance swimmers spending between 9 to 12 weeks building an endurance base.

Aerobic Swimming

Approximately one half of the institutions reported their sprint swimmers to spend about one third or more of their training time during peak training months at the aerobic level. Distance swimmers were noted to spend more

time training at this level. Coaches reported distance swimmers to spend anywhere from 15 to 80 percent of their time during peak training months at this level, although most reported to spend about one half of their training time at this level. Although the above ranges are fairly broad, most swimming coaches are using a considerable amount of endurance training for both sprint and distance swimmers.

Anaerobic Threshold

Over one half (61.1 percent) of the respondents reported that their sprint swimmers spend one third of their training time, during the peak training months, at the anaerobic threshold.

Just under one half (40.9 percent) of the swimming coaches surveyed also revealed that their distance swimmers were spending approximately the same time as the sprint group. However, the other half of these coaches said their swimmers spend at least one half of their time at the anaerobic threshold. Therefore distance swimmers are believed to spend slightly more time at the anaerobic threshold, which is probably the result of the fact that their races are performed at or just below this level.

Anaerobic Swimming

Some researchers and coaches have proposed that the largest percent of training time for competitive swimmers

should be spent at the anaerobic swimming level (Costill 1991, Kame 1990, and Salo 1988). Most swimming competitions last less than two minutes, therefore it would seem that swimming performance in these races would depend on the ability of the athlete to work at a very high intensity for a fairly short period of time, or anaerobically.

The results of this study show that most NCAA swimming coaches reported their male freestyle sprint and distance swimmers to spend between 16 to 40 percent of their total training time during peak training months at this intensity level. However, most distance groups spent 15 percent or less of their time at this level.

Time Standards

Most NCAA swimming teams have indicated that their swimmers train at moderate swimming volumes (6000-10,000 yards per day). Therefore, the fact that twice as many swimmers reported achieving time standards in the 50 yard freestyle as compared to the 1650 yard freestyle may not be due to coincidence. The poor achievement level observed in the longer event could be related to much less attention toward training at higher swimming volumes (more than 10,000 yards per day). It is difficult to place a finger on one particular factor which affects the outcome of a swimming performance. However, the examination of this population of swimmers has revealed that the moderate training levels

reported could be the cause of fewer swimmers achieving time standards in distance events.

CHAPTER V

SUMMARY

A survey of NCAA Division I, II, and III swimming coaches was performed in order to identify some training characteristics (e.g. peak swimming yardage per day, number of practice sessions per week, weeks spent building an endurance base and time spent at various intensities) of NCAA male sprint and distance freestylers during the 1993-94 collegiate season.

A cover letter and questionnaire were sent to all 377 NCAA men's swimming coaches (Division I, II, and III) in the United States, as listed in the 1993-94 NCAA Directory. Questions regarded team division and size, the coaches experience level and recent training changes, months of peak training during the 1993-94 collegiate season, peak training volume and frequency, time spent building an endurance base, percentages of times spent at three intensity levels (aerobic, anaerobic threshold, and anaerobic), and finally number of team members who accomplishing specific time standards based on NCAA National Championship time standards for the 50, 200, and 1650 freestyle events.

Upon examination of the results, the author concludes that a significant proportion of NCAA Division I teams do not have financial scholarships. During the peak training

months of the 1993-94 collegiate season, the majority of institutions surveyed responded that they perform approximately 6,000 to 10,000 yards per day. Although distance swimmers at all divisions and some sprint swimmers at Division I reported to train further compared to the other groups, only Division I distance swimmers commonly reported to train more than 10,000 yards per day.

Distance swimmers in each division spent more time swimming aerobically and at the anaerobic threshold than did sprinters. Also, Division I sprinters spent more time at the aerobic level than sprinters in the other two divisions. Most distance groups only performed approximately 15 percent of their training time at the anaerobic level, while many sprint groups spent between 15 to 40 percent of their time at this intensity.

Twice as many swimmers within this population obtained national time standards at the 50 yard freestyle compared to the 1650 yard freestyle, which may have been the result of the moderate swimming volume levels observed in this population.

Recommendations for Further Study

A study which could identify specific reasons why certain training trends may be present in a population would contribute to the current information on training for

swimmers. Also, the examination of other populations of swimmers (e.g. females, age group swimmers, and swimmers who primarily compete in events other than freestyle) could be compared to the data obtained from this study.

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APPENDIX A: QUESTIONNAIRE

Training Questionnaire

INSTRUCTIONS!!!! Circle the best answer, or fill in the blank for each of the following questions. For purposes of specificity please answer this questionnaire in regard to your MALE FREESTYLERS WHO WERE ELIGIBLE FOR COMPETITION AND HAD CONSISTENT ATTENDANCE, DURING THE 1993-94 SEASON. Please return ASAP. Any questions call me collect (217) 348-5416. Thanks, Sean Cabbage.

1. **Coaching Experience(years):** _____

2. **Division of team:** NCAA Div.I Div.II Div.III

3. **Number of NCAA equivalency scholarships available (MEN'S TEAM):**_____
   (Example: 9.9, the max for Div. I)

4. **How many NCAA eligible male swimmers do you have on you team?**
   9 or less 10-14 15-19 20-24 25-29 30 & up

5. **Have you changed any of your training philosophies in the past two years?** YES IN THE PROCESS NO

6. **If you answered yes, or in the process to question 5, why?**
   Recent Published Research Trial and Error Other_____

7. **What two months during your winter season comprise the highest swimming yardage for sprinters and distance freestylers.**

   Sprinters: October November December January February

   Distance: October November December January February

8. **Regarding question #7, during this peak training period approximately how far do your swimmers train per day.**
   Is this number in Yards or Meters? Y M

   Sprinters: 4000 or less 4001-6000 6001-10,000 10,001 & up

   Distance: 4000 or less 4000-6000 6000-10,000 10,000 & up

9. **Regarding question #7, how many sessions per week do your freestyle sprinters and distance swimmers train during months of max yardage?**

   Sprinters: 4 or less 5-6 7-8 9-10 11 & up

   Distance: 4 or less 5-6 7-8 9-10 11 & up

10. **How many weeks do the following freestylers spend building an endurance base?**

    Sprinters: 2 or less 3-4 5-8 9-12 13 & up

    Distance: 2 or less 3-4 5-8 9-12 13 & up

11. Approximately what percent of your swimming (freestyle only), over the course of a competitive season is performed, or designated for, swimming at each of the following intensities or approximate heart rate (H.R.) zones? We acknowledge that all athletes are unique in regards to heart rate levels during rest and physical activity. The concept of different "intensity zones" used during training is the focus of this section.

Below an anaerobic threshold; Aerobic (H.R. approx. <160)					
Sprinters:	15% or less	16-40%	41-59%	60-79%	80-100%
Distance:	15% or less	16-40%	41-59%	60-79%	80-100%

At an Anaerobic threshold (H.R. approx. 160-180)					
Sprinters:	15% or less	16-40%	41-59%	60-79%	80-100%
Distance:	15% or less	16-40%	41-59%	60-79%	80-100%

Above an anaerobic threshold, or sprinting (H.R. approx.>180)					
Sprinters:	15% or less	16-40%	41-59%	60-79%	80-100%
Distance:	15% or less	16-40%	41-59%	60-79%	80-100%

Please indicate the number of male swimmers on your team who obtained the following time standards. You may count an individual for more than one of the distances, but only count his best time at each distance during the 1993-94 season. **Please indicate times in yards.**

50 Freestyle

≤ 19.96 _____

19.97-20.55 _____

20.56-21.00 _____

21.01-21.50 _____

21.51-22.51 _____

200 Freestyle

≤ 1:36.77 _____

1:36.78-1:39.67 _____

1:39.68- 1:42.00 _____

1:42.01-1:43.75 _____

1:43.76-1:45.76 _____

1650 Freestyle

≤15:12.97 _____

15:12.98-15.40.35 _____

15:40.36-16.10.99 _____

16:10.99-16:30.12 _____

16:30.13-17:00.00 _____

YES, please send the results to me, my address is:_____

APPENDIX B: COVER LETTER

April 4, 1994

Dear Coach,

Here is your chance to kill two birds with one stone. Complete this survey, and you will help me compile data on current training procedures of collegiate teams in the United States. You will also be helping an aspiring young swimming coach with a masters thesis. This questionnaire will help me show what was actually done in regards to training yardage for **COLLEGIATE MALE FREESTYLERS DURING THE 1993-94 SEASON.** To be accurate in our evaluation of training volume we are specifically examining **MALE FREESTYLERS DURING THE 1993-94 SEASON.**

All NCAA Division I, II, and III programs will be sent this questionnaire. Please spend approximately ten minutes to increase our base of knowledge in a truly great sport. **IN NO WAY** will the identity of you or your team be revealed in this study. Confidentiality is of the utmost importance. The data obtained will be statistically examined, and all teams or coaches identities will be secret. We merely want to see how many coaches at different levels are training swimmers similarly or dissimilarly.

Upon request, conclusions of this study can be mailed to you, simply circle the word **YES** at the end of this questionnaire, and give us your mailing address. With your help this study could benefit the swimming community in a positive way, by helping us examine training techniques in this population of swimmers.

Thanks,

Sean Cabbage