CSABA SZANTO

LEVEL 2 AND 3

ICF COACHES EDUCATION PROGRAMME

CANOE SPRINT

COACHING MANUAL

Author:
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References:
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Photographs:
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ANDY TRAIN
World Championships medalis

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REFERENCES OF OTHER EXPERTS

The presented Education Program has been reviewed with regards the content, methodic approach, description and general design. In accordance with above mentioned criteria the program completely corresponds to world wide standard and meet expectations of practice. Several suggestions concerned the illustrations and technical details were transmitted to the author.

CONCLUSION: The reviewed program is recommended for sharing among canoe-kayak coaches of appropriate level of competence and is worthy for approval.

Reviewer:
Prof. Vladimir Issurin, Ph.D.
Wingate Institute for Physical Education and Sport,
Netanya, Israel

Csaba Szanto's work is a great book that discusses every little detail, covering the basic knowledge of kayaking canoeing science. The book provides a wide range of information for understanding, implement and teaching of our sport.

This book is mastery in compliance with national and international level education, a great help for teachers and coaches fill the gap which has long been waiting for.

Zoltan Bako Master Coach,
Canoe-kayak Teacher at ICF Coaching Course Level 3
at the Semmelweis University,
Budapest Hungary

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FOREWORD

Csaba Szanto has obtained unique experience in the field of canoeing. Probably there is no other specialist in the canoe sport, who has served and worked in so many places and so many different functions.

Csaba coached Olympic champions, but he has been successful with beginners as well. He contributed to the development of the canoe sport in many countries throughout the world.

Csaba Szanto wrote this book using the in depth knowledge he has of the sport. He is very much aware what is needed for someone wishing to acquire the basic knowledge of being a good coach.

The book presents a cross-section of canoe sprint for experienced coaches.

I wish every success to the participants at the courses and also to the competitors, who will be prepared and trained by the coaches benefiting from the knowledge in this book.

Budapest, 2014

Vaskuti István
Olympic Champion
ICF 1st Vice President

THE AUTHOR

Csaba Szanto submitted this book in using his 55 years of experience in canoeing and the other existing available materials from other experts and sciences.

References:
Comments by Istvan Vaskuti, Zoltan Bako and Prof. Vladimir Issurin

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Miklos Fisher

Coach's philosophy: Attila Szabo

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C1 200m by Paraja Diaz Neftali

ICF COACH'S EDUCATION LEVEL 2 STRUCTURE

DESCRIPTION		LEVEL 2 NATIONAL, REGIONAL, CONTINENTAL OR INTERNATIONAL COACHING COURSES
Coach label		Advanced Coach
Course name		Canoe-Kayak Sprint Advanced Coaching Course
Course purpose		To provide the candidates with knowledge and teaching skills on a National Level and basic knowledge of all canoeing disciplines.
Main role		Prepare to deliver and review coaching sessions.
Coaching experience		Participant has some experience in coaching canoeing.
Positioning		This coach directs assistant coaches and reports to the expert or master coach.
Responsibility		This coach has considerable responsibility in the coaching process.
Entry requirements	Age	Minimum 18 years old
	Coaching level	Completed Level 1 course or has at least 2 years proven coaching or paddling experience on national level
	Other skill	200 meters swimming ability
	Language	National or main regional language (why? Why not english and national language?) Delete
	Academic level	Secondary school leaving examination (you can't say this csaba) delete
	National federation agreement	The participation must be supported by the applicants national federation delete
	Coaching experience	Relevant (minimum 2 years)
Career prospective		To become a level 3 expert coach not really, could be happy at level 2. Delete as irrelevant
Target audience		Coaches with the recommendation of the national federation. This is very narrow i would imagine the book should serve a wider audience
Suggested duration		8-10 days (60 hours)
Hours	theory	42
	practical	18
Practical apprenticeship		Candidates have the opportunity to learn more then in the Level 1 course and apply their skill and knowledge on Club and National Level
Venue requirements		Requires a suitable place for theory and practical courses, generally the same location
Equipment	for lectures	Class room, white board, Computer, projector, DVD player and note books
	for practical	Stable type of boats with paddles,1.2 m long tube as a paddle shaft, life jackets, coach's power boat. Require some athletes for demonstrations
Examination		All candidates shall complete a written examination, which contains 30 questions, and exam on demonstration and teaching abilities
Records		The ICF keeps the records of the coaches passed the examination: name, date of birth, contact details
Certification		Successful candidates shall receive a „Canoe-Kayak Sprint Coach Level 2" Diploma
Proposed "european qualification framework (eqf)" level		Depending from the system established in the country where the certification is issued. DELETE IRRELEVANT HERE – KEEP TO ICF FOCUS

DESCRIPTION OF THE ICF CANOE SPRINT LEVEL 2 COURSE

The courses can be organised and hosted by any National Federation, Continental Association or the ICF .It is possible to have financial support from the International Olympic Committe through the Olympic Solidarity. (Application to the Olympic Solidarity shall be made via the National Olympic Committees).

The criteria for hosting a course:

- The application for the organisation of a coaches' course shall be made by National Federation to the Continental Association and the ICF
- The coaches participation shall be supported/approved by their National Federation
- The lecturer will be appointed (or approved) by the ICF
- The conductor of the course shall apply the ICF Teaching Materials
- The participants shall pay the required amount for the attendance (if any) and for the ICF Diploma,
- The duration of the course must not be less than 8 (eight) days

The language: selected by the organizer of the course

The content and the teaching materials of the courses will be prepared and provided by the ICF including the form and test of examination.

The participants will undertake a written examination and demonstrate their skills in a practical examination.
The participants who pass the examinations will receive the ICF Certification of the ICF Level 2 Canoe Sprint Coach and will be registered in the ICF coaches' database.

Those coaches whom are motivated and wish to extend their education can participate in the ICF Coaching Course Level 3 programme.

PREFACE

Unfortunately the worldwide successful Canoe Sprint discipline has not many specialised bibliography and teaching materials for coach's education. This addition is a contribution to reduce the lack of technical books for canoeing.

Over many years the International Canoe Federation (ICF) has been extremely active in promoting and organising coaching courses in Canoeing including seminars and symposiums at national and international level.

The aim of the ICF is to develop canoeing worldwide both at recreational and elite levels. The ICF launched a structured Coaches Education Programme in 2011. The principle goal of the programme is to help coaches at different levels to develop their knowledge and expertise in coaching canoeing skills by giving them an opportunity to participate in well defined courses approved and run by the ICF.

The ICF Coaches Education Programme has four levels:

The Level 1 Courses: National Courses can be organised and hosted by any National Federation. Level one courses are designed for the beginner or inexperienced coaches.

The Level 2 Courses: National, Regional and/or International Courses can be organised by any National Federation, Continental Association and/or ICF. These courses are for experienced Canoeing coaches.

The Level 3 and 4 Courses: These courses are for elite Canoeing coaches and are organised by reputable Universities such as the Semmelweis University Faculty of Physical Education and Sport Sciences, Budapest in English with cooperation of the ICF.

Most of the theoretical part of the course is conducted through online education (four months) whilst the mainly practical modules take place in Budapest, Hungary (one month). The programme concentrates on the Canoe Sprint discipline but also provides information that is transferable for progressing athletes' performance in other canoeing disciplines.
All courses have been designed in accordance with international standards for the sport of canoeing including sustainable environmental behaviour.

The participants who pass the examination at any level will receive an official ICF Diploma, which may entitle them to be employed by National Federations as a canoeing coach. The coaches will be registered by the ICF on their International database.

These courses might be financially supported by Olympic Solidarity. Applications for funding can be made via the respective National Olympic Committee.

This manual is intended for the ICF Canoe Sprint Level 2 and to some extent Level 3 Coaching Course for experienced coaches and/or athletes.

Some subjects of this book have already been mentioned in the Level One Manual. However, more detail and complex analysis will be discovered in Level Two.

The key objective of this manual is to provide a common framework for experienced coaches of canoeing. The book aims to describe accepted working methods for coaching and training of athletes and enable the coach to compare their existing knowledge, methods and experience with standards in the sport.

CHAPTER 1
COURSE ADMINISTRATION

1.1 KNOWLEDGE OF THE COURSE

Name of the course:
ICF Level 2 Canoe Sprint Coaching Course

Nominal duration of this course:
8- 10 days, 60 hours

- 40 hours of lectures, (if interpretation is necessary more time maybe required.)
- 14 hours of coaching practice (practical)
- 2 hours of examination
- 4 hours DVD or video on canoeing technique

Practical trainee period (minimum 6 weeks) better to say number of hours because won't be full time.

Target market for the course:
This course designed for canoe – kayak coaches with a few years of coaching experience in canoeing and/or for athletes with several years of practice

The potential target market comprises educated and experienced coaches and/or athletes. The course will provide general knowledge of Canoe Sprint techniques.

Attendance requirements:
Candidates must attend the full course in order to be eligible for sitting the examinations at the end of the course.
The minimum 6 weeks (hours?) practical period should ideally be completed with a higher level coach.

Venue:
The course should be conducted at a venue that has both suitable places for lectures and on water practice sessions. (For the practical sessions local athletes' attendance is highly recommended.)

Required Equipment:
a) For the Lectures
   · White board and markers, computer projector and DVD player/TV,
   · Note books and pencils for the participants.
b) For the Practical sessions
   · Boats: stable type of kayaks such as touring, slalom, wildwater boats, polo or children "mini" kayaks and 2 seaters touring canoe.
   · Paddles: any available kayak or canoe paddle.

   For athlete demonstration of paddling technique they need to use their racing boats. Confusing as you just mention stable boats above and now saying racing boats...Do you mean in demonstrations it is advisable to do with Canoe Sprint racing boats.

   · Paddle shaft: for all the participants which can be a piece of wood, bamboo, plastic tube etc. at length approx: 110 cm for kayaking and 130cm for canoeing
   · Life jackets
   · Rescue boat with engine

1.2 COMPETENCY STATEMENTS

The certified coach of the Level 2 Coaching Course shall be able to:

- compare his athlete's level with the international standard
- construct a yearly training plan and individual session plans for training
- conduct safety and rescue procedures
- demonstrate the technique of kayak and canoe in suitable conditions
- teach the advanced technique for both kayak and canoe
- plan and conduct physical conditioning training
- able to produce training programmes for endurance and speed development
- able to plan and conduct strength development training for maximum force and strength endurance
- prepare athletes for high level competition

1.3 OVERVIEW OF THE LEVEL 2 COACHE'S COURSE

Chapter Name	Unit Content	Delivery strategies	Nominal Duration
Introducing the course	Targets, administration, operation, requirements	Theory	2 Hour
The required abilities in canoeing	• The principal abilities, which determines success • The Characteristics of an elite athletes • Trends of athlete training methods	Theory	2 Hour
Safety and rescue	Equipment, personal safety, injury prevention and treatment and rescue methods	Theory and practice	1 Hour 1 Hour
Introducing technique	• Hydrodynamics • Common points of kayak and canoe technique	Theory	4 Hour
The technique of Kayaking	• Position, balance, strokes • Advanced technique, power circles	Theory and Practice	3 Hour 5 Hour
The technique of canoe and Team Boats	• Position, balance, power-transmission, effects of wind • Specifics of Team Boats	Theory and Practice	3 Hour 5 Hour
Teaching of technique	Teaching skills and communication, coaching tools, methods and teaching beginners	Theory	1 Hour
Physiology	The Circulatory and respiratory system; energy supply and Nutrition	Theory	3 Hour
Physical Conditioning I.	• Endurance • Endurance development	Theory	1 Hours
Physical Conditioning II.	• Strength • Strength development	Theory and Practice	1 Hour 2 Hour
The Speed	Speed, Speed improvement and Pacing	Theory	2 Hour
Training and Training Methods Training intensity	• Why training is necessary, Principle of training, Physiological effects • Over training, Intensity and its measurement	Theory	2 Hour
Training Plan	• Planning programmes • Period training	Theory	2 Hour
200m distance	Specificity of the 200m distance and training requirements	Theory	2 Hour
The role of a Coach	Teaching skills and communication, coaching tools, methods and teaching beginners, tasks and pedagogy	Theory	2 Hour

1.3 OVERVIEW OF THE LEVEL 2 COACHE'S COURSE

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The role of a Coach	Teaching skills and communication, coaching tools, methods and teaching beginners, tasks and pedagogy	Theory	2 Hour
Total 60 Hours: 40 hrs Theory, 14 hrs Practice, 4 hrs DVD, 2 hrs Examinations			

FIG1.3: :LISA CARRINNGTON NZL OLYMPIC CHAMPION

CHAPTER 2
INTRODUCING CANOEING

2.1 THE HISTORY OF CANOEING

Such as every sport the sport of canoeing has its own history origin. The historical development of canoeing and the used type of boats can be separated in three stages considering the purpose and the reason of their use:

- The use of canoe for living and fighting reason from 6000b.c to 18th century
- The use of canoe for transporting and recreational reasons 18th to 19th century
- The use of canoe for sport performance from the 19th century

FIG. 2.1: PRE-HISTORIC ROCK CARVING IN CANADA LAKE SUPERIOR

The oldest proof of, a canoe and paddle was made of silver, more than six thousand years old, in the tomb of a Sumerian King on the banks of the Euphrates River. In those times, it was believed that the monarch would be able to accomplish his last voyage along the river of Beyond. This tale is repeated in many cultures around the world.

Archaeologists have found Egyptian examples of vessels propelled by paddles 3 to 4000 years old.

In the Yucatan peninsula, canoes were depicted on a mural painting dating 1150 years before Christ.

In Guatemala bones were uncovered with engravings of canoes dating 700 years before Christ.

In literature, Christopher Columbus introduced the word "piragua" (Spanish for canoe) in Europe.

Origins of canoes can be found in all continents. In New Zealand there are the Maori War canoes), Asia there are Dragon Boats and other indigenous boats in India and Africa as well.

Internationally, the word "canoeing" is often used as a collective term for both canoeing and kayaking, probably because a number of languages have no word for the kayak.

Campbell Mellis Douglas (CAN) built his first canoe called "Harmony" in 1864. Harmony remained in Lakefield at Northcotte, with the Douglas family until 2010 where it was placed in the care of the Canadian Canoe Museum.

However the first recorded kayak regatta in modern history was organised in England in 1715 the big increase in kayak touring and racing came in the 1890s. A Scot, John McGregor, often regarded as the father of modern kayaking built a wooden kayak (Rob Roy) which was 4 metres long, 75cm wide and weighed 30kg. (It is still in good condition in Eton's Ship Museum) He travelled and introduced his kayak to France, Germany, Sweden and Palestine. After returning he organized the formation of the British Royal Canoe Club.

The first canoe club in the United States was organized under the name New York Canoe Club in 1871. Regarding some surcease the first kayak race in Europe took place in 1862 in Budapest (Hungary) In 1885 the first kayak regatta for women was organised in Russia.

The 1st European Championships was held in Prague in 1933and the 1st World Championships was organised in Waxholm /Sweden in 1938

By the 1890s kayaking and canoeing popularity increased all over Europe.
Parallel to "flatwater" canoeing (recently calls Canoe Sprint) canoe slalom discipline also developed and the 1st Slalom competition was held in 1934.

After the turn of the century the construction and design of kayaks improved dramatically. By 1913, ten different kayak designs were being produced. Kayaking was used for recreational touring and for competitions. Evolution of different disciplines separated from canoe sprint such as slalom, wild-water, marathon, canoe polo, Ocean Racing and Dragon boat disciplines. More and more countries established canoeing Federations and joined the ICF. Also more and more canoe Clubs were established in the various countries. Canoeing went through major technological changes to allow for optimal comfort, speed and performance.

"Since the sport of canoe/kayak was established in the mid 19th century in London, it has gone through major technological changes to allow for optimal comfort, speed and performance. The main factors that affect this performance and hence how fast the canoe / kayak moves include the force and power provided by the paddler, technique and aerobic fitness." (Michael et al., 2008; Aitken anNeal, 1992; Mann and Kearney, 1980).

FIG 2.2: THE ESKIMO BOATS; ANCESTOR OF THE MODERN KAYAK.

FIG 2.3: CANADIAN INUIT KAYAK

2.2 THE ORIGINS OF KAYAKING AND CANOEING

The word kayak (ki ak) means "man-boat" in Eskimo. The kayak originates from Greenland, where the Eskimos have been using it for hunting, fishing and travel for centuries. Kayak historically has been built using animal bones and skins. The paddler is seated, propelling it with a two-blade paddle, and steering the boat by means of a rudder controlled with the feet.

The English explorer Burrough, who travelled among the Siberian Samoyeds, described the kayak in 1556. James Cook, who wrote about the exploration of the Aleutian Islands in the 1790s, also mentioned the kayak as a practical means of travel.

The canoes are open boats built for trading, voyages and warfare, in all sizes and number of paddlers built using a variety of materials. Often used by the indigenous people of North America to cover great distances with their goods or to carry the mail, sometimes taking advantage of the quiet waters and in other occasions, conquering the aggressiveness of rapids and strong currents.

Papyrus reeds were used to construct the boats used by the Egyptians and tree the main material for the Polynen canoes and Indians used deer's skin and birch bark.

A Maori war canoe exhibited in New Zealand is 117 feet long (approx 36 metres) and was manned by 80 paddlers. The paddler propels canoes with a single bladed paddle, and sits or rests over one or the two knees, having to steer the canoe by means of movements of his paddle, since it has no rudder.

FIG 2.4: INDONESIAN STAND UP RACING

FIG 2.5: PERU, LAKE TITICACA

FIG 2.6: RACING IN THE AMAZONAS

FIG 2.7: AMERICAN INDIANS 1847

FIG 2.8 :WEST SIBERIA OB RIVER 1926

FIG 2.9 AFRICAN BOY IN DUGOUT CANOE

FIG 2.10: ABORIGINAL PEOPLE PADDLE IN BARK

FIG 2.11 MEN MADE BOAT IN AFRICA

2.3 THE ICF

The formation of the first international organisation for Canoeing and Kayaking, was inspired by the American W. Van B. Claussen. As a result of his work the International Representative Shaft Des Kanusport or "International Community of Canoeing Representatives" (IRK) was created by Denmark, Germany, Austria and Sweden. This was the origin of the International Canoe Federation. After World War II the IRK was replaced by the International Canoe Federation.

The International Canoe Federation was founded with the cooperation of 19 nations, in Copenhagen, Denmark, January 20, 1924.
Nowadays the International Canoe Federation includes 160 affiliated countries, from five Continents.

The ICF consists of member national federations, Continental Associations from the 5 continents, Committees for each disciplines, Board of Directors included the Executive members. The highest authority of the ICF is the Congress.

The ICF introduced the Canoeing Development Programme in 1988 and the Talent Identification Programme in 2008. In the frame of these programme the ICF support the developing federations by equipment, education and participation in Training Camps and main Events.
In 1924 at the Olympic Games in Paris canoe and kayak were included as demonstration events. At the next Olympics in Berlin, canoeing events became permanent. Since then Olympic Games Canoeing has been ever present in the Olympic programme.

W. P. Stephens wrote the first technical description of canoe, titled: 'Canoe and Boat Building For Amateurs' in the 1880s. He defined the canoe as a "Boat of long and narrow proportions, sharp at both ends and propelled by paddles held in the hand, without a fixed fulcrum, with the crew facing forward".

After the turn of the century the construction and design of kayaks improved dramatically. Alfred Hein Reich built the first "faltboat", the Dolphin, in 1904." Faltboat" describes a type of construction still used for recreational kayaks which consists of a rubberised canvas stretched over a wooden framework, which can be taken apart and reassembled with ease. In 1906, Hans Klepper started the large-scale manufacture of "faltboats" in Germany. The first kayak with a rigid hull and canvas deck, named Rodny was built exclusively for racing in Sweden in 1910. By 1913, ten different kayak designs were described in the first authoritive book on the subject 'the Kenufurer' written by Alfred Korn. Commercially built canoes followed the same design principles: canvas stretched over wooden framework, followed by solid lamination. The introduction of aluminium considerably boosted the durability of lightweight canoes at the end of the First World War. Mr. Gregor Hradetczky (AUT) was the first Olympic Champion in K1 1000m men with a time of 4:22.9 while in C1 Francis Amyot (CAN) in 5:32.

The first European Championships were hold in Prague Czech Republic in 1933.

The 1st World Championships were organized in Waxholm (SWE) where the winners in the single boats were:

- K1 men 1000m Karl Widmark (SWE) 5:03
- C1 men 1000m Otto Neumuller (GER) 6:45
- K1 women 600m Maggie Kalka (FIN) 3:26

The International Canoe Federation oversaw several types of canoe and kayak racing events at the 1948 Olympic Games, in London. Kayak races in post war Olympic Games and World Championships were dominated by Sweden, Denmark, Finland and Czechoslovakia. Since the World Championships in 1954, Russia, Hungary, Rumania, East Germany and Bulgaria become the most successful countries in international competitions.

However Poland, Great Britain, New Zealand, USA, Australia and other countries in the 80-90s have made notable gains such as Norway, Sweden, Spain, France, Portugal, Finland and China.

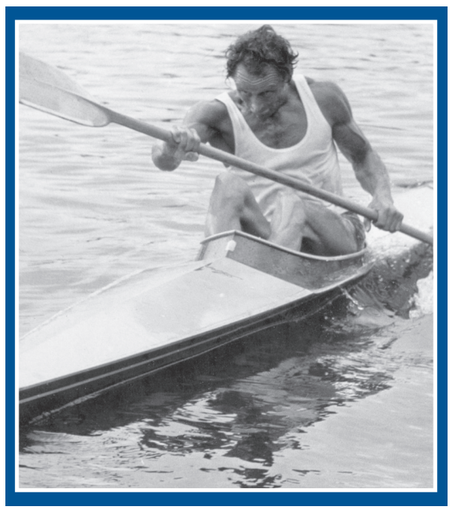


FIG 2.12: GERT FREDERICKSON (SWE)

FIG 2.13: BIRGIT FISHER 8 TIMES OLYMPIC CHAMPION

FIG 2.14: KATALIN KOVACS HUN 3 TIMES OLYMPIC CHAMPION AND 33 TIMES WORLD CHAMPION

Now dominating the sport are talented athletes from many different countries.

The most successful paddlers of the Canoeing history are:

- KAYAK MEN: Gert Frederickson (SWE) (6 Olympic Gold Medal)
- CANOE MEN: Ivan Patzaichin (ROM) (6 Olympic Gold Medal)
- KAYAK WOMEN: Birgit Fischer (GER) (8 Olympic Gold Medal)

Birgit Fischer is the most successful athlete in Canoeing but also among the best athletes in the all sports by winning 8 Olympic Gold and 29 World Championships not mentioning her numerous other silver and bronze medals.

More recently Katalin Kovacs (HUN), has won 3 Olympic Gold Medals and 32 World Championship titles in women's kayaking.

The most important international canoeing competitions are:

- The Olympic Games: 12 Canoe Sprint and 4 Canoe Slalom events on the programme
- The Youth Olympic Games since 2010 with 8 special events
- The World Championships annually except in the Olympic year
- The World Junior Championships every year (15 – 18 Years of age Under 23 World Championships every year since 2012
- Continental & Regional Games and Championships
- World Cups, 3 events per every year
- Paralympics (Paracanoeing events including Paralympics from 2016

2.4 DISCIPLINES OF CANOEING

The highest honour of Canoe Sprint is to win the Olympic Games. Then there are World Championships, World Cups, Continental & Regional Games, and National Championships.

The sport of canoeing consists of different types of boats propelled by single or double bladed paddles with no fulcrum to the boat in a number of disciplines. The paddler(s) are facing toward in the direction of travelling.

FIG 2.15: IVAN PATZAICHIN (ROMANIA)

Canoeing disciplines belonging to the International Canoe Federation (ICF) are:

- Canoe Sprint (included Paracanoeing)
- Canoe Slalom
- Canoe Marathon
- Wildwater Racing
- Canoe Freestyle
- Canoe Polo
- Dragon Boat Racing
- Ocean Racing
- Va'a (outriggger) – associate member
- Wave ski – associate member

BRIEF INTRODUCTION OF THE MAIN CANOEING DISCIPLINES:

Canoe Sprint

In Canoe Sprint events, paddlers race on a straight course in lanes separated by markers over 200m 500m and 1,000 meter distances for both Canoe and Kayak. The aim is to cross the line first by paddling the complete distance at the higher possible speed.

The Youth Olympic Games has a special course and competition format. The description of that can be found in Chapter 27.

Paracanoeing became an official category in canoeing in 2010. Four to eight events will be included in the Paralympics from 2016. Paracanoe gives opportunities for paddlers with physical disabilities to participate and compete at club, national and international levels. Working on the development of the sport for over four years, the ICF has improved and expanded the sport significantly and more and more athletes are competing and enjoying Paracanoe around the world.

Canoe Slalom

Rough waters are the mains feature in Canoe Slalom events. Recently artificial slalom courses exist and the main competition are held on these courses as the conditions are more controlled and predictable.
In Slalom the paddler has to negotiate the rapids as well as the gates that are set up on the course. The course is between 200 and 300m in length. To touch or miss one or more gates incurs a penalty that will be added to the time taken by the competitor to complete the course.

The paddlers start individually at time intervals and must complete the course in the minimum time possible, without penalties. If they touch one or both poles of any gate, a 2 seconds penalty is added. Not passing through a gate or pass

FIG 2.16 CANOE SINGLE /C1

FIG 2.17 KAYAK SINGLE K1

FIG 2.18 KAYAK DOUBLES K2

FIG 2.19 KAYAK FOUR / K4

FIG 2.20 CANOE SINGLE /C1

FIG 2.21 CANOE DOUBLE / C2

FIG 2.22 CANOE FOUR / C 4

FIG 2.23 SLALOM KAYAKER

FIG 2.24 WILDWATER CANOEING

FIG 2.25 MARATHON

FIG 2.26 CANOE POLO

ing it incorrectly receives a penalty of 50 seconds added to that time of the run.
The actual history of Canoe Slalom started in 1932 following the ski slalom in summer times on water. The first Canoe Slalom World Championships were organised in Switzerland in 1949. Slalom Events were held in Olympic Games for the first time in Munich in 1972 then reappeared from the Olympic Games in Barcelona 1992. There are five Canoe Slalom events in Canoe Slalom.

These are K1 – C1 men and women and C2 men events.

Wildwater Canoeing

Descent is yet another way of enjoying the scenic possibilities of canoeing. The courses vary in length and offer an assortment of natural obstacles. In the Wildwater discipline, the only obstacles are those posed by the river. The skill of the competitors is constantly put to the test in these races.K-1 events are held for both women and men, while the C 1 and C 2 events are reserved for men. There are two distances the 3 Classic and the 3 Sprint events.

The distance of the Sprint events are between 400 and 800 meters while Classical course must be approximately 30 minutes in duration.

The starting process in Wildwater is similar to Slalom with individuals starting at intervals.

The first Wildwater World Championships were organised in France in1959.

Canoe Marathon

Canoeing over long distances has been known as long as Canoeing has been a sport. Long distances races were organised in many countries all over the world a long time ago but the first Canoe Marathon World Championships was held in 1988. Since then the discipline has progressed and being practiced around the world on all the continents and in more then 50 countries. The excitement of a marathon race particularly during the portages makes it an important discipline of the ICF and Canoeing World. The distance of the races takes approximately 2.5 to3 hours of paddling for seniors whilst for juniors the races are 1.5 hours long and about 18-22 km. A minimum of two portages where all competitors shall disembark in a defined area carry their boats along the portage and re-embark in a defined area.

The Marathon categories are K 1, K 2, C 1, C 2.

Canoe Polo

Canoe Polo is a spectacular sport in which pits two teams against each other to score with a ball in each other's goal on a marked water pitch. It is a cross between basketball and water polo in boats.

The roots of Canoe Polo can be found in the other disciplines of Canoeing. In the thirties, European countries started sitting in a kayak and throwing a ball to each other. These plays became a spectacular and exciting ball game with

FIG 2.27 FREESTYLE PADDLER IN ACTION

more formal rules applied. A team consists of five players one of them is the goal tender. The Polo kayaks are 3m in length and the front and back of the boats are supplied with protection material so to avoid personal injury and equipment damage.

The ideal playing area has a length of 35 metres and the width of 23 metres. The goals measure 1,5 m X 1m and are suspended at a height of 2 meters measured from the water surface.

Dragon Boat

FIG 2.28 DRAGON BOAT

Ancient China used Dragon Boats for religious purposes since 278BC. Dragons have a symbolic meaning for the Chinese. A classic dragon has the head of an ox, the antler of a deer, the mane of a horse, the body of a python, the claws of a hawk and the fins and tail of a fish. Through his strength and power he can ride on clouds and command both the wind and rain. Dragon Boats are designed to resemble these creatures. The bow is crafted as a dragon head while the stern resembles the tail. The hull is painted with scales and the paddles symbolically represent the claws.

With at least two boats competing against each other over various distances, not only are strength, endurance, courage and skill important, but unity, harmony and team spirit are as well. This all becomes apparent when everybody in the boat paddles to the rhythm of the drum. With its strong visual impact, Dragon Boat is a superb spectator sport.

Dragon Boat a global canoe discipline at competitive, festival and recreational levels. The long boats have 20 paddlers while the shorter modern version is paddled with 10 people. In addition both boats have a drummer and helmsman. The craft is often decorated with a dragon head and tail.

Canoe Freestyle

This white water discipline belongs to the extreme sports category. The discipline involves the athlete leaping into a large wave behind rapids in wild water.. Athletes perform a range of acrobatic tricks and show their skills by manoeuvring the boat in the wave for 45 seconds. The moves are scored by judges. The winner is the one with the most accumulated points. There is a K1, C1, Open C1 class and Squirt Class. . Combined moves add greater scores.

Canoe Ocean Racing

Ocean Racing is the latest discipline to fall under the ICFs mandate. This exhilarating sport encompasses long distance Surfski, Sea Kayak and Sea Touring races and its athletes are among the fittest of the Canoe World, requiring endurance and navigational skills as well as other ocean-going expertise.

A marriage of kayak technique and speed, Ocean Racing is an ideal meeting place for athletes of all Canoe disciplines. Indeed, some of the most successful Ocean paddlers are well-established Canoe Marathon or Canoe Sprint athletes. That's not to say there are no specialized Ocean Racing athletes out there too. An extremely popular sport in warm coastal regions, such as Australia, USA (California and Hawaii), the Mediterranean and South Africa.

2.5 THE DEFINITION OF CANOE SPRINT DISCIPLINE (CSP)

Canoeing is a technical isokinetic, dynamic sport that involves symmetric (kayak) or asymmetric (canoe) rhythmical movements.

Sprint Canoeing is among the endurance type of sports but requires great strength and efficient technique according to the distances paddled. The target of Canoe Sprint Racing is the highest possible seed on the given racing distance. Canoeing is a common name of two types of distinct categories: Kayak and Canoe.

The paddlers are required to place exceptional demands on the muscles of the upper body to move their kayaks as fast as possible along the length of the competing distance. However, the faster your kayak moves, the greater the energy cost of paddling a given distance will be. Peak kayak paddling performance is therefore dependant upon maximal metabolic power (aerobic and anaerobic) complimented with superior paddling technique.

CHAPTER 3
THE DETERMINING ABILITIES IN CANOEING

INTRODUCTION

All sports require certain characteristic abilities from the athletes, which are essential for their success.

Canoe/kayak is a sport that requires coordinated action between the paddler (athlete), the paddle as the propulsion tool, the boat as the vehicle providing buoyancy and the water as the medium of transportation.

Canoeing also requires a well-conditioned body able to operate at a high performance level, both during training and during competitions.

The best canoe/kayak athletes are incredibly fit with a great capacity to deliver oxygen to their muscles and are very strong relative to their body weight. Athletes paddle with efficient technique to maximise boat speed and distance.

Performance is basing on the physical condition of the athlete, his/her technique and mental ability to adapt to the racing conditions.

3.1 DETERMINING ABILITIES IN SPRINT CANOEING

The simple factors which are essential for successful performance in Canoeing are:

- **efficient paddling technique** with adequate stroke rate acceptable for the distance and speed required
- **endurance** (aerobic; anaerobic) note: keep same terminology from first book...
- **muscular strength** (maximum, explosive and endurance)
- **speed** (maximum speed and constant speed endurance)
- **"winner" psychology**

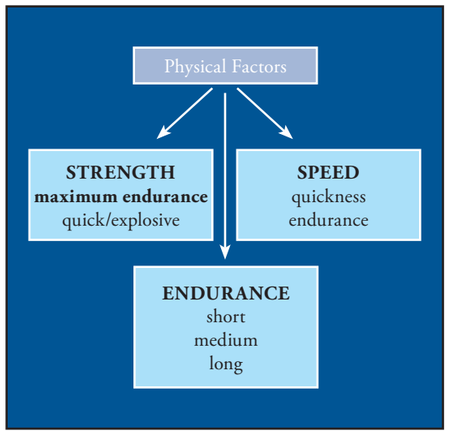
If one of the above listed abilities is poor great success is impossible!
The high level competitive paddler requires a well developed physical condition, excellent technique and robust mental strength. The levels of these determine the athletes' potential performance and results.

The determining factors of athletes abilities in canoeing

Physicality	Physiology	Technique	Mental Power
Endurance	Circulator system	Adequate	Will power
Muscular strength	Energy supply	Efficient	Competitive Toughness
Quickness	Lactate tolerance	Proper stroke rate	Passion to canoeing
Morphology			Ability to learn

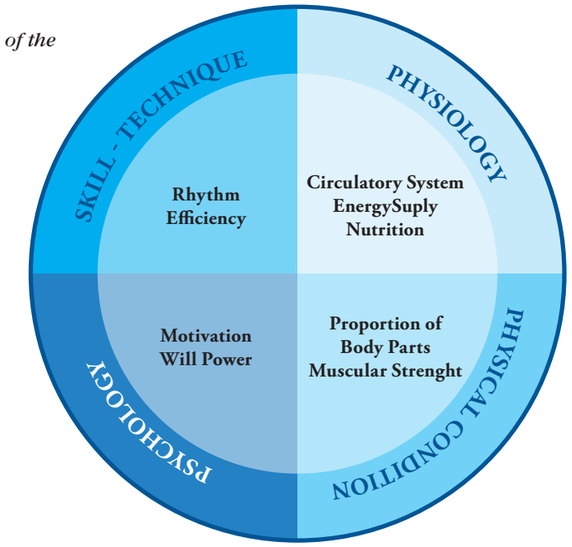
In addition to the athletes individual genetic and trained abilities the equipment (type, size, weights and condition) also influence the speed of the boat and hence the performance.

The physical factors that influence the speed and performance



In order to develop the speed of the boat therefore the performance level of the athlete all the listed abilities should be considered and improved by training!

Fig. 3.1 - Division of the abilities reqired for Canoeing



Factors of sport performance

Circulatory system	V0 capacity, Treshold of LA level
Paramet average	V02: 63, LA max.: 15, HTK: 0,45%, Heart rate: 187/min
Body composition (%)	Muscle: 48,3 Fat: 9 Bone: 17 Residium: 25,7
Blood composition	Volume of hemoglobin
Motoric caracters	Ability of learning and adaptation
Psychology	Will power, Motivation

3.2 THE PERFORMANCE DETERMINED BY SOME ELITE ATHLETES AND COACHES

The advice of Arne Nilsson Denmark Olympic and several times World Champion Canoe Sprint says that the key factors involved in the preparation of the success of competitors in canoeing are:

- Defined and well-structured training systems
  and programmes;
- Controls of training effects; (by testing)

- Measurement of Improvements in training effects
- Technique development/maintenance to obtain the maximum speed;
- Psychological training;

Requirement for successful performance:

- High endurance capacity
- High speed ability
- Ability to explode from the start line
- Maintain high speed (speed endurance)
- Proper pacing due to distance

3.3 THE PHYSICAL CHARACTERISTICS OF ELITE ATHLETES

The physique of world-class kayakers and canoeists varies considerably. There have been world cham-

pions 170 cm (5'7") tall, while some have reached 200cm (6'8")in height. Some World Champions have the capacity to bench press is 160kg whilst others only manage 80kg. Canoeing has World Champions at 19 years old but also at 46.

It is revealing that height or muscular strength is not the dominant factors determining performance. Perhaps the only common feature these paddlers have is the pronounced athletic build: broad shoulders well developed muscles, strong trunk, long arms and relatively slender legs. Thus, we favour athletes with strong upper body, long arms and great fitness. Success is further determined by an efficient technique, strength, endurance and circulatory system, coupled with a positive psychological outlook.

The average statistics of elite Canoeists

Characteristics of elite men athletes (average)	
Height	182-184 cm
Sitting height	96 cm
Torso height	81 cm
Arm span	195-198 cm
Upper arm circumfuse	35 cm
Body weight	82-82 kg
Body fat (men) (women)	9,3% 14-15%

3.3.1 HEIGHT AND BODY FRAME

In general it is an advantage if a paddler is tall but it's only one of the factors of all the necessary abilities for success.
Measurements of the athletes' body size are often completed to determine the "ideal" body frame for paddlers. This data is gathered by coaches and researchers during major world-class races.
Body frame measurements mainly deal with the specific parts of the body associated with canoeing technique and arm relationship..

Fig. 3.2 - The average statistics of elite Canoeists

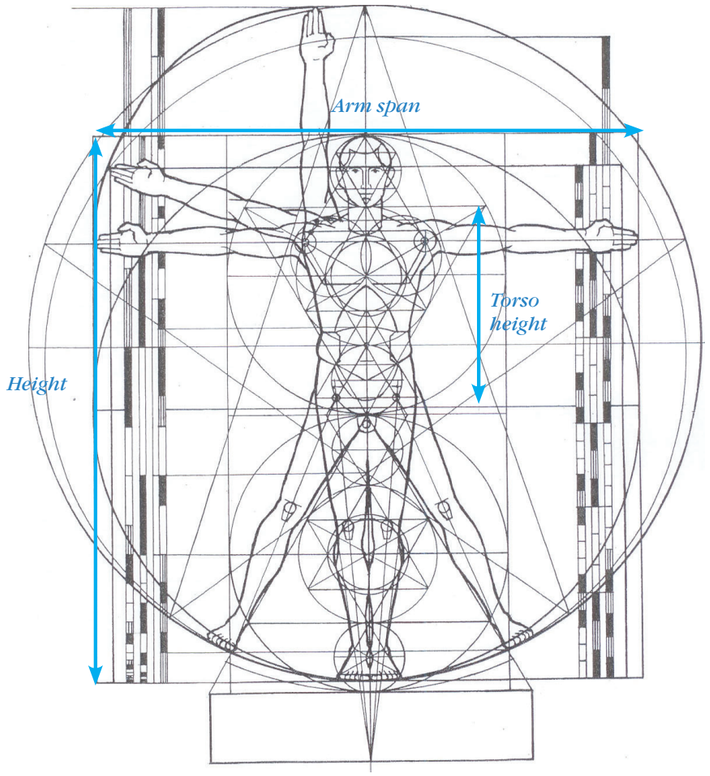


Fig. 3.3.1 - Measure from the base to the middle of the fist

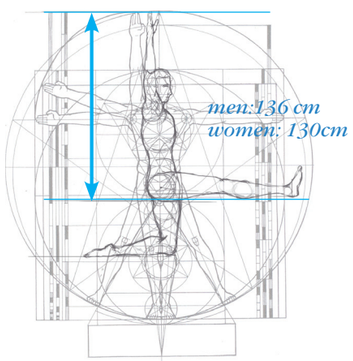
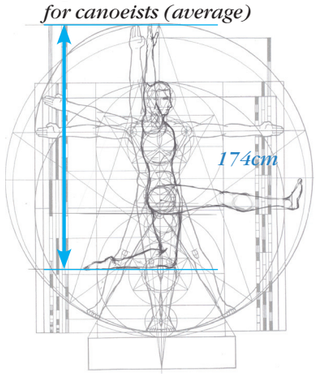


Fig. 3.3.2 - Measurement for canoeists (average)



3.3.2 AGE

Age is an indicator of physical and mental maturity of an individual. Many international sports competitions are classed by age. But the definition of a youth or junior athlete by age is not uniform because of the physical and mental activity which each particular sport is based on. For example, swimmers or artistic gymnasts are generally younger than athletes of other sports while the average age of the bob racers or archery athletes are much older.

Exceptionally, the Swedish paddler, Gert Frederickson, who holds the record of having obtained, six gold medals in Olympic Games, five of them in K-1, between 1948 and 1960, the last when he was 45 years old. The International Olympic Committee awarded him, in 1956, the "Trophy Mohamed Taher", in recognition for his sporting career.

Another outstanding case is Birgit Fisher the most successful paddler ever. She won her 7th Gold medal in Athens at the age of 40. Another Olympic and World Champion Josepha Idem (ITA) won Silver Medal at the Olympic Games Beijing at age 44. Both of them were mothers of two children.

the height - weight and age statistics in Olympiads

	Men kayak			Men canoe			Women kayak		
	age	cm	kg	age	cm	kg	age	cm	kg
2000	25,8	184	81,2	27,2	182,5	81,1	25,8	171	65
2004	25,7	185	84,1	26,5	179,8	80,8	25,7	171,4	67,2
2008	25,9	185,2	86,4	27,5	180,7	81,9	25,9	172,6	66,3

Age, height and weight statistics of the athletes participated for Flatwater Canoeing in the Olympic Games Sidney 2000 and Atlanta 1996.

Age statistics of Olympians

	Event	All athletes		Medalist	
		1996	2000	1996	2000
Men	K1	25,6	25,5	26,5	27
	K2	25,5	25,8	28	25,3
	K4	26,1	26,5	27,7	25,7
	C1	26,6	27,4	26	27,5
	C2	26,3	27,7	26	27,8
Women	K1	25,3	26	30	32,6
	K2	26,7	26,6	32	25,8
	K4	25,12	25,8	28,08	26,5

Height statistics of Olympians

	Event	All athletes		Medalist	
		1996	2000	1996	2000
Men	K1	184,2	184,6	189	190,6
	K2	183,9	184,6	185,4	184,5
	K4	186,8	186,5	190,2	188,25
	C1	180,4	181,5	181,2	181,3
	C2	179,2	179,8	178,2	182,8
Women	K1	171,7	171,9	175	175,3
	K2	171,4	171,6	173	170,2
	K4	171,2	172,2	170,6	174,8

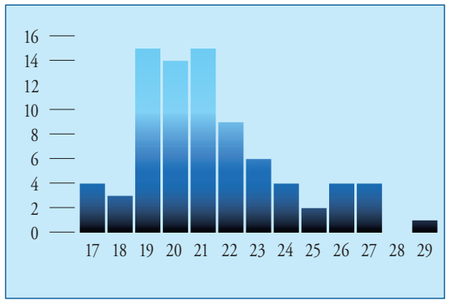
Weight statistics of Olympians

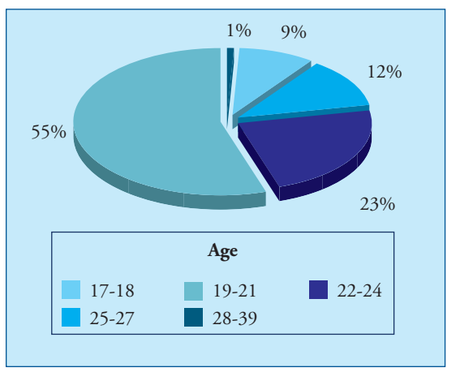
	Event	All athletes		Medalist	
		1996	2000	1996	2000
Men	K1	82,9	83,5	87	89,7
	K2	83,9	84,1	86,5	86,1
	K4	85,5	85,4	87,9	84,2
	C1	81,8	83,2	87,2	82
	C2	79,8	80,6	80,2	82,9
Women	K1	67	65,1	68,3	69
	K2	66,8	65,8	67,2	67,8
	K4	67,7	68,1	68,3	70,4

The dates from two Olympic Games did not show significant differences!

The following table show the results of a study concerning the age of 70 world level athletes. The conclusion showed that the successful paddlers started in canoeing between ages of 12 and 13 and the majority (55 %) of the participants in World Championships are between 19 and21 years of age.

Ages statistics of athletes at World Championships





Information of age of elite athletes

Turning points	Age
First race	12-13
Attend in junior WCh	17-18
Attend in senior WCh	20-21
Medalist in WCh	21-22
World Champion	23-

Consequently the recommended age to start Canoeing is between 10 and 12 years of age but realistically should be before 14 years of age.

However, there are a number of examples of World and Olympic medallists taking to canoeing later in life. Generally these are exceptional athletes with a background in other sport. People such as, Kenny Wallace (AUS) or Ian Fergusson (NZL), 4 times Olympic Gold medallist then his son began kayaking aged 18 who grew up using Ocean Racing, lifesaving, surfing etc. Here we also state that the height, weights or physical characteristics itself does not determine the athlete potential in canoeing.

The psychological characteristics of the athlete strongly affect their performance in competition but also their training.

3.3.3 WEIGHT AND BODY COMPOSITION

Weight is a basic measurement.. However, total body weight is not a true indication of an individual's muscle mass so placing emphasis on this measurement alone should be done sparingly.

Weight is compared to height ratio (Body Mass Index) and composition of the body to determine lean body weight is a good indicator of fitness. Lean body weight is determined by subtracting body fat from total body weight. The measurement is used to determine percentage body fat and calculates the relationship of body fat to total body weight.

The percentage of body fat is often related to a specific sport. For canoeing body fat ratios are approximately 7 % to 10 % for men and 10% to 14% for women. Once an ideal weight is established for an athlete, nutrition and weight control can be used to maintain the correct weight and keep percent body fat at a level conducive for high-level competition. Sudden body weight loss during heavy training usually indicates over training.

Body mass index

BODY MASS INDEX (BMI)

Body weight in kg divided by height in m²

i.e.: weight: 75kg
height: 1,75m = 3,0625
75 : 3,0625 = 24,48

RESULT
20 = underweight
20-25 = healthy
25-30 = overweight
30-40 = obese

3.3.4 PHYSICAL ABILITIES

Characteristics of elite women athletes

Morphological characteristics of Olympic women sprint paddlers	
Data obtained from Auckland et al. (2003) (pp288).	
Age	26,4
Body mass (kg)	67,7
Height (cm)	170
Seated height (cm)	90,4
Sum of skinfolds (mm)	80,0

The next table is based on a survey of high level athletes and shows the main factors for physical performance of elite athletes in canoeing:

Physical test results

PHYSICAL TEST RESULTS OF ELITE ATHLETES							
Test		C1	C1	K1 m	K1 M	K1 w	K1 W
MAXIMUM STRENGTH	Bench press	160 kg	155 kg	135 kg	140 kg	85 kg	85 kg
	Bench row	135 kg	125 kg	135 kg	125 kg	83 kg	85 kg
ENDURANCE	Cooper test	3.750 m	3.300 m	3.300 m	3.200 m	3.000 m	3,050 m
	2.000 m paddling	09:00	08:31	08:10	08:06	08:55	08:48
SPEED	400 m running	58 sec	01:03	01:00	57 sec	01:10	01:08
	100 m crawl	01:05	01:08	01:08	01:00	01:20	01:15
	200 m paddling	40 sec	41 sec	37 sec	37,5 sec	41 sec	42 sec
SPEED ENDURANCE	1.200 m running	03:20	03:50	03:50	04:00	04:20	04:18
	1.000 m paddling	03:58	03:55	03:35	03:33	04:02	04:05

Canoeing requires a large proportion of muscular strength besides endurance and speed.

Some available test examples of elite athletes prove this fact. (Table 10.)

Physical Parameter testing 16 years old athletes in National teams with 4 year experience

Result of junior athletes

Category	Paddling		Bench press max. in kg	Running men 1.500m women 800m
	2.000 m	100 m		
Kayak men	9'00"-10'30"	19"9-23"2	60-100	4'26"-6'08"
Canoeists	9'50"-11'30"	23"8-28"	60-100	4'26"-6'12"
Women	10'00-11'40"	23"5-28"	42-75	2'35"-3'25"

Physical Tests of male athletes at age of 9 to 18 in Hungary

CANOE/ KAYAK BOYS PHYSICAL TEST UNGARY 2004 (377 persons)											
TEST	Rank	AGE									
		9	10	11	12	13	14	15	16	17	18
Pull up's 1 min	1	20	26	25	24	37	35	34	36	42	39
	2	14	25	25	24	31	30	32	36	38	36
	3	8	24	24	23	30	30	32	35	38	35
	4	5	23	24	23	28	29	31	34	37	34
	last	4	2	1	1	2	1	19	17	19	24
Leg up's 1 min	1	57	59	58	55	34	34	34	35	38	40
	2	54	55	57	54	26	34	33	33	37	33
	3	48	53	53	54	26	30	32	32	33	30
	4	42	51	52	51	25	29	31	31	32	27
	last	37	36	31	8	2	1	8	4	4	18
Bench press 40 kg	1	-	-	-	-	-	-	54	71	81	86
	2	-	-	-	-	-	-	41	62	81	79
	3	-	-	-	-	-	-	38	59	78	78
	4	-	-	-	-	-	-	37	59	78	69
	last	-	-	-	-	-	-	12	34	32	55
Cooper test	1	-	-	-	-	-	-	3.338	3.475	3.483	3.485
	last	-	-	-	-	-	-	2.440	2.000	2.720	3.090

Physical Tests of female athletes at age of 9 to 18 in Hungary

CANOE/ KAYAK GIRLS PHYSICAL TEST UNGARY 2004											
TEST	Rank	AGE									
		9	10	11	12	13	14	15	16	17	18
Pull up's 1 min	1	27	23	30	23	31	30	32	30	33	34
	2	12	21	30	23	26	27	30	26	29	32
	3	13	17	29	22	25	25	28	26	27	31
	4	10	8	26	20	24	24	27	24	26	29
	last	-	8	11	-	5	7	2	7	18	13
Leg up's 1 min	1	57	50	61	53	29	28	29	35	36	36
	2	46	49	58	52	26	24	27	32	28	33
	3	38	26	57	50	26	22	27	26	28	31
	4	54	21	54	47	19	21	27	26	23	29
	last	32	21	26	21	1	7	2	7	4	
Bench press 40 kg	1	-	-	-	-	-	-	59	72	74	86
	2	-	-	-	-	-	-	54	62	69	85
	3	-	-	-	-	-	-	43	56	66	79
	4	-	-	-	-	-	-	40	56	65	78
	last	-	-	-	-	-	-	14	17	25	28
Cooper test	1	-	-	-	-	-	2.820	3.005	2.905	3.080	2.995
	2	-	-	-	-	-	2.798	2.949	2.890	3.080	2.930
	3	-	-	-	-	-	2.795	2.840	2.845	2.820	2.920
	last	-	-	-	-	-	2.000	2.070	2.300	2.238	2.340

According to evidence of athlete comparing performance the following table shows the physical level requirements of canoeists at young age.

Requirements of physical performance of boys

Age	Sit up's max (1 min)	Pull up's max (1 min)	Cooper test meters	300m swimming
11	20	3	1.600	8:30
12	25	5	1.950	8:00
13	30	10	2.100	7:30
14	35	15	2.300	7:00
15	38	20	2.550	6:30
16	40	25	2.800	6:00

3.4 THE PSYCHOLOGICAL PROFILE OF ELITE ATHLETES

The psychological characteristics of the athletes are strongly effects their performance in competition but also in training.

The Characteristics of Elite athletes:

- High level of confidence
- Optimism
- Mental toughness
- Highly competitive
- Control anxiety
- Good adaptation abilities for the environment
- Set and achieve real goals

Morphological characteristics of young elite CSP athletes

OBJECTIVES	FEMALE		MALE	
	Age		Age	
	13	14	13	14
Paddling experience (years)	3,2 - 3,9	3,9 - 4,2	3,1 - 4,6	3,9 - 4,9
Weekly training (in hours)	7,2 - 8,8	7,2 - 9,0	7,0 - 8,6	7,4 - 9,0
Average body mass (in kg)	59	60	59	65
Sum 6 skinfold mm (average)	89,7 +- 23	88,2 +- 21	66,2 +- 30	63,4 +- 31
Height (cm)	162	164	163	169
Sitting height (cm)	85 +- 3	87 +- 3	85 +- 4	88 +- 1,5
Arm span (cm)	165 +- 8,5	166 +- 6	167 +- 9,8	174 +- 8,6
Upper arm girth (cm)	25,4 +- 2,2	26,5 +- 2,5	25,2 +- 3	26,5 +- 2,7
Hip girth (cm)	90,7 +- 7	92,3 +- 6	85 +- 7	88 +- 6,6

Results of K1 2000m paddling time trials for Junior women and men kayakers

AGE	CLUB (JWK1)	TIME
17	Honvéd	8:59:00
17	Honvéd	9:24:00
15	KDSE	9:16:00
18	Dunakeszi	9:29:00
17	Dunakeszi	9:29:00
16	KSI SE	9:38:00
16	Honvéd	9:47:00
16	MAFC	9:48:00
16	UTE	9:57:00
16	Szolnoki Sportcenter	9:55:00
16	Esztergomi Hajós E.	9:57:00
16	Szolnoki Sportcenter	9:59:00
15	Atom SE	10:09:00
18	VVSI	10:06:00

AGE	CLUB (JK1M)	TIME
17	KSI SE	8:17:00
16	Diósgyőr	8:18:00
17	Dunafüred	8:30:00
17	Váci Hajó	8:32:00
18	Multi	8:33:00
17	Démász Szeged	8:33:00
16	KSI SE	8:38:00
16	Grabopast Győr	8:40:00
17	Dunafüred	8:33:00
16	Grabopast Győr	8:48:00
16	MAFC	8:54:00
16	KSI SE	8:40:00
17	Építők	8:38:00
17	TVSE	9:06:00

CHAPTER 4
SAFETY AND RESCUE

INTRODUCTION

Water Safety and Rescue was described in the Coaching Manual Level 1 the importance of this subject requires some addition explanation.

Water can pose a potential danger to those who are not sufficiently versed in safe paddling practices and the technique of rescue. Here are some of the important aspects of personal safety.

Since Canoeing is a sport that is performed in an environment that is not controlled and is predominately natural the safety measures must be adhered to at all times to avoid accidents.

The safety philosophy and activation should start from the moment a Canoeing activity is being planned.

Novice paddlers must always go out paddling under the close supervision of a coach or in the company of more experienced paddlers, who can help in case of emergency.

4.1 WATER DIFFICULTIES

Any area if water can be apt for the practice of Canoeing. These range from a covered swimming pool where the basic techniques can be learnt and practised in relative safety to the most turbulent rivers or the ocean.

The following is the international standard table of degrees of difficulties for water difficulties. The definition of difficulties might differ slightly from one National Federation to another. Paddling in Canoe Sprint racing boats is recommended only on Class I water.

Class I. Easy. Calm waters, no difficulty for navigation.

Class II. Minor difficulties, with currents, small weirs and rapids. Not apt for racing boats. Use of helmet and life jacket recommended.

Class III: Difficult navigation. Starting with this class, the use of helmet and life jacket is mandatory. Here are quick currents, strong rapids that require good control of the boat, not suitable for racing boats.

Class IV: Very difficult, but without hazards for trained boaters. Dangerous for racing boats. It is mandatory to use life-jacket and helmet.

Class V: Extremely difficult navigation. White-water. Dangerous. Only suitable for paddlers with extensive experience, trained and fit. Usage of life jacket and helmet are mandatory.

Class VI: Not passable. No possibility of navigation.

4.2 PERSONAL SAFETY

You must be able to swim! You need not be a fast swimmer but a confident one who will not panic in unexpected situations (e.g. Cold water). Your ability to swim can make the difference between a minor mishap or a tragedy.

Using a life jacket or vest while paddling gives more safety and confidence for paddlers!

Other requirements:

- Be familiar with the water
- Make sure you know the approximate depth of the water throughout your course. Shallow spots can damage your boat and paddle, or may cause you to capsize.
- Make sure your course is free of turbulence, eddies, sudden rapids, drops, unforeseen dams, submerged obstacles /rocks, stumps or other debris/ or logjams.
- Be familiar to areas good for landing if you must stop for emergency reasons, especially if you paddle on a long course that takes you far away from your starting point.
- Paddle in daylight only. In the dark you are heading for danger, even on water familiar to you. Floating obstacles and powerboats can cause catastrophe. Reflected or flickering light can play tricks on your sense of balance in the dark making paddling hazardous or impossible.
- Do not train in severe cold, intense heat, thunderstorms or in heavy rain. Heat exhaustion is a more frequent occurrence among paddlers than hypothermia. It is the result of excessive water loss of the body. When the environmental temperature exceeds 29-32°C (83-90°F) water loss occurs mostly through heavy sweating, which the body's protective mechanism to excessive is heating. When sweating dissipates more water than the body can furnish, dehydration, heat stroke, convulsion, and even kidney failure will occur. The use of salt tablets for the effective prevention of dehydration has been repudiated in recent years. Acute and prolonged exposure to the sunlight causes sunburn and sometimes serious damage to blood vessels. Always wear light protective clothing in strong sunlight.

The following table shows the effect of water temperature on the body:

WATER TEMPERATURE:	UNCONSCIOUSNESS OCCURS IN:
0°C (32.0°F)	less than 15 minutes
0-4.4°C (32-40°F)	15-30 minutes
4.4-10°C (40 50°F)	30-60 minutes
10-15.5°C (50-60°F)	1-2 hours

These times are further lessened if you attempt to swim in cold water.

A simple technique can extend your survival time by 35-65% depending on how you are dressed. It consists of curling up in a fatal position and keeping your head and neck above water as much as possible.

Wear sensible clothing when paddling. Dressing right for paddling does not imply an aesthetically appealing attire, although it looks nice, but rather a practical outfit which is right for the season, the time of day, and the duration and intensity of your paddling. The paddlers' clothing serves one main purpose, which is protection from exposure, whether cold or heat.

The outcome of a training session or a marathon can depend on the clothing you wear. This, of course, is especially true in climatic extremes, and in times of changing temperature. As a general rule, always wear clothing, which is soft, comfortable, lightweight, and porous, permitting perspiration without condensation inside. For kayaks spray decks over the cockpit also retains body heat and keeps the cold out.

It is also highly recommended to wear a life vest or jacket for children and beginners.

4.3 RESCUE

As racing boats are very unstable, learning basic balance requires a few weeks/month of practice. During this time, and once in a while thereafter, your athletes will capsize and a rescue will need to be performed. Coaches should teach their beginners that capsizing is a normal part of learning the sport and is not embarrassing. By following instructions and procedures and with proper management, rescues can be conducted safely and without danger or risk to paddlers or equipment.

4.3.1 SELF RESCUE

When paddlers lose their balance and bracing is not effective they fall out of their boat. Canoes generally remain upright while kayaks usually tip

upside down. The first step in any rescue is for the paddler to stay with the boat and make sure it is the right side up. The sooner this is accomplished, the less water will get into the boat.

The standard of any rescue should be that the paddler(s) stays with the boat, holds it so as to keep more water from getting inside, puts the paddle(s) into the boat and remains calm. In case of standard kayak the trapped air keeps most of the water out, usually only a small amount of water enters the boat. However, if a kayak or canoe is constructed where it is entirely open inside when in a capsized position it can fill with water. This makes righting of the boat difficult and the boat will be very heavy. After righting the boat put the paddle in it and holds either the bow or the stern of the boat and swim ashore with powerful leg kicks.

A key to self-rescue is to paddle close to shore in the first place so if the boat does capsize the swimming distance is very short. Very important that you constantly remain with the boat as it is a floating devise especially if you must swim a long distance. The boat will help keep you afloat! The canoe or kayak should be pointed towards the shore, as it is very difficult to push sideways.

When you reach the shallows or the shore (bank) or a pontoon you must keep the boat in the water in the upright position that you are facing with the bow of the boat and follow the procedure for emptying the boat:

Push down the bow until the water collects there. Then you suddenly rise up and twist it over so that the water drains out through the cockpit or goes to the rear. Repeat this until most of the water is bailed out. It is important to remember that a fully or even partially swamped boat should never be lifted out of the water, since it will break under the weight of the trapped water.

Some paddlers with good skill and practice are able to climb back into a capsized racing boat in the water (if its not full of water therefore not semi submerged) but the boat could easily be damaged. This practice is not recommended.

This practice is much easier if there is another boat which can help the troubled paddler to gain support and balance whilst bailing or re-entering the boat.

4.3.2 ASSISTED RESCUE

The easiest and safest way to perform a rescue is from a small motorboat operated by the coach. The coach should approach the paddler in the water slowly and carefully, and come parallel to the capsized boat about a half-meter away. With the engine stopped and the propeller still, have the paddler swim the last half-meter to the motorboat. The paddler in the water is safest if he/she is at an end (bow or stern) of the capsized canoe or kayak. Avoid positioning the paddler between the motorboat and the capsized boat, especially in rough conditions. Also keep the swimmer towards the front of the motorboat and away from the propeller. Once the paddler grabs hold of the motorboat help him get into the motorboat, dump out the water and get him back into the canoe or kayak or drag the boat back to shore by motorboat.

Experienced paddlers in his or her own racing boat can often help a capsized paddler back into their boat. By holding the two boats parallel and bracing across the two boats with a paddle, the experienced paddler can form a raft with enough stability that the capsized boat can be put back on the water and the athlete can re-enter the boat to continue paddling.

Coaches working with children and beginners will be assessed in their safety and rescue skills as part of their training

Coach's duty:

- Regardless of whether is working from the bank or from a boat their attention for the safety is always essential!
- The positioning of the coach during a training is critical for observation and action of rescue
- To ensure that all reasonable steps are taken to ensure safety of any person involved in training activity

CHAPTER 5
BRIEF INFORMATION ON EQUIPMENT

INTRODUCTION

The two essential technical equipment in Canoeing are the boats and the paddles.

The different canoe disciplines require different type of boats (e.g. shape, size, form) to perform efficiently in different water conditions. There are different type of canoes and kayaks for Canoe sprint, Canoe slalom, Canoe freestyle, Ocean racing etc"

Kayak / canoe sprint boats have an extensive history of development. Before the ICF made restrictions on boats in 1948 the boats were all designed differently in terms of, length, beams and weight. To create fairness the ICF instigated a strict limit on kayaks and canoes which could be used officially in its competitions. Those measurements did not give a large possibility for design variance however several types of boats were designed and built within the given standards.

The main reason for new boat design has always been the - to achieve some speed advantage over other boats. Due to this aim boats have become more U then V shaped in terms of their hull. They are lower and narrower taking the widest required point of beam further from the bow of the boat. This also allows flexibility to design suitable boats for each paddler tailored to their weight, height, power, paddling style and balance. Boats are fundamentally designed to the weight of the paddler. Light weight (65-75 kg); heavy weight (75-85kg) and super heavy weight for athletes over 85-90kg.

Most top paddlers have custom made boats. The best producers invest heavily into equipment development using the latest computer technology and testing the new designs with athletes. There are "tailor made" individual designed boats for elite athletes in accordance with their technique, power and body size in consideration with the specialised distance. There are boats for high speed (200m) for medium speed (1000m) and for longer distance like Canoe Marathon racing. There is no minimum weight limitation for marathon racing therefore the producers' makes boats from light materials. For example the weight of a K1 boat is about 8kg.

Equipment development has been driven by the desire for speed!

5.1 SELECTION OF BOATS

There is a huge diversity canoe and kayak models on the market that the selection of the correct boat for performing the desired canoeing activity can be a complex task.

Frequently paddlers need to share the same boat for different activities and /or for the same activities even though it is not the best suited for each of them the boat needs to be adequately adaptable for the group of athletes.

Understanding the basic criteria for selecting equipment will help achieve the selection of the most suitable boat for each discipline.

5.1.1 SELECTION OF BOAT ACCORDING TO ITS MATERIAL

The mechanical properties of boat types are closely related to the materials and construction systems used in their fabrication.

Fibreglass canoes and kayaks are lightweight and rigid; both qualities are desirable for paddlers with a good technical level. These are boats suitable for competition, training, canoeing schools, clubs etc. However, these types of

boats are fragile (low resistance to external impact) and need to be used with care. These boats are among the cheapest in the market they are recommended for novices.

The polyester resin can be damaged by exposure to seawater and excessive sunlight. The good maintenance of these boats contributes to the extension of the life of the boats.

Canoes and kayaks made from Polyethylene are much more elastic and, accordingly, have excellent impact-resistance. They are suited for novice paddlers and for any activity involving frequent impacts against other boats or obstacles. However, they are heavy and are limited to the early learning stages of canoeing technique.

Advanced materials such as Carbon, Kevlar, Aramyde, Haney cam and combinations (sandwich types) with each other and/or with Fibreglass materials prove to be very popular. These boats have strong rigidity and are light weight. They have high resistance for impact and longer lifespan. Due to the materials these boats are more expensive and are generally used for individuals rather than groups.

5.1.2 SELECTION OF A BOAT ACCORDING TO ITS DESIGN

The dynamic characteristics of a boat depend on its design. The following characteristics are essential:

Stability and Speed
Speed and stability of a boat depends on the dimension and shape of the cross section of the boat.

Narrow cross sections cause instability while wide cross-sections provide stability.
Cross-sections of a "V" shape hull result in extremely unstable boats when stationary or at low speeds, while cross-sections of a rounded shape are more stable and rectangular cross-sections are extraordinarily stable. The latest boat designs are less stable than the previous types but these assure higher speed.
Lately, athletes have been selecting boats based on the distance of the athlete's target at elite level of performance. It is considered that different designed boats are suitable for 200m compared to 1000m distance and for Canoe Marathon racing.

5.2 PADDLE

The paddle designs have history of changes. A wide variety of Paddle blade shapes and sizes are available in the market. Race length, physical strength, body maturity, and paddling experience should be considered when choosing a paddle blade. Smaller or junior-sized paddles should be used for younger and less experienced paddlers. For longer races, in excess of ten kilometres, many athletes prefer small blades because it is easier to maintain the aerobic energy output level needed for these events.

The correct shape, length and surface area of the blade is an individual matter, determined by the paddler's height, arm length, strength, style and the distance raced. Important, that athletes use the most optimal paddle in accordance with the previous descriptions.

The selection of proper size of shaft and blade of a paddle is essential. If there is doubt blade size should be smaller than larger and length should be shorter than longer.

5.2.1 KAYAK PADDLE

The shape of the paddle has developed from the ordinary flat shape to the so-called wing or flip paddle. The wing paddle produced since 1987 has revolutionised the kayak strokes and technique! Nowadays all racing paddlers have wing paddles which facilitates a very firm catch without swaying with its wing which is on the upper edge of the blade. This paddle requires a paddling technique, which is characterized by an explosive-dynamic swing stroke with signifi-

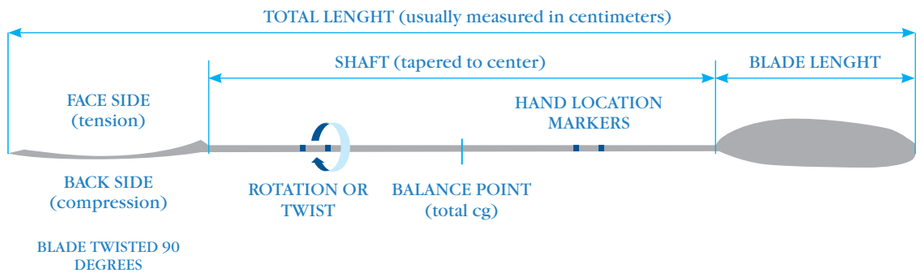
cant body rotation. The wing blade gives a high lift force which is effective for power transmission and the trunk rotation is produced using the large muscle group of back.
There are several types and sizes of wing blades in the market. Athletes or coaches can select the design based on the athlete's physical power, style and personal sensation when using the paddle.

The right length is to stand upright next to the paddle, with an arm reaching up.

The fingertips are able to roll over the top of the paddle.

A basis of grip position is to have upper and lower arm at 90 degrees.
The blades of the racing paddle are twisted from 68° to 78° with respect to each other. This reduces wind resistance on the blade during the recovery or swing part of the stroke and assures a splash free exit of the blade from the water. The blade rotation can be adapted to cater for left and right hand control paddlers.

Fig. 5.1 - Measure from the base to the middle of the fist



Relationship of kayak paddlers height and paddle grip
Measurements taken from 3rd finger of each hand on paddle shaft distance

Paddler height	Grip Width cm	Paddler height	Grip Width cm
156	62,2	176	69.7
158	63.1	178	70.5
160	63.7	180	71.2
162	64,5	182	72.1
164	65.2	184	72.7
168	66.7	186	73.5
170	67.5	188	74.2
172	68.2	190	75.1

5.2.2 CANOE PADDLE

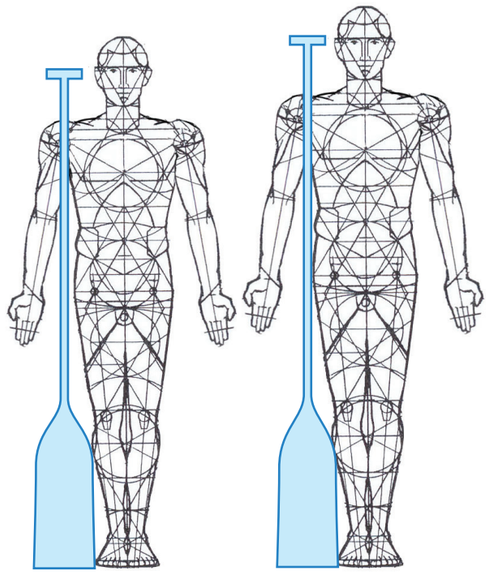
A canoe paddle is a single blade paddle and mainly remained unchanged over the years unlike the kayak paddle.

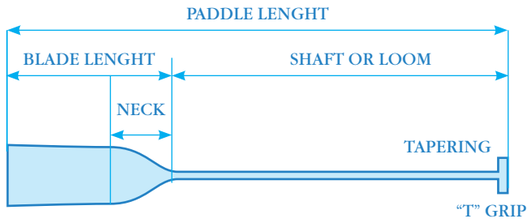
The general size of the blade length is approximately 50 to 55 cm and the blade width is approximately 19 to 24cm.

The blade is offset from the plane of the shaft (called the rake) by a few centimetres which facilitates better water catch with fewer splashes.
There have been various attempts to introduce unsymmetrical blades or with a keel, a bent T bar, wing shaped blades etc. but so far no new design has proven popular with athletes more than the traditional canoe paddle with minor modification of the blade. The length is individual measurement; the standard is with the T-bar at the eyebrow level when the athlete is standing.

The width of grip is like at kayak paddles, 90° angle

Fig. 5.2 - The correct size of the canoe paddle





5.3 REPAIR

Any damage to equipment should be repaired as soon as possible to avoid further damage.
The repair of Fibreglass boats is relatively easy and does not require special tools. Before starting the repair it is essential to dry the boat thoroughly.

- If the repair must be done from the outside of the boat, the gel-coat layer should be eliminated (if the repair is done from the inside of the boat, this step is not necessary).
- Successive layers of fibre are applied, impregnating each of them with polyester resin.
- Once the repair is dry, it must be polished with sandpaper to obtain a smooth finish.

The repair of polyethylene boats is not difficult, but requires special tools:

- The repair requires bonding a piece of polyethylene to the damaged area. This operation requires a heat gun, to apply hot air between the boat's surface and the polyethylene piece, causing the fusion of both surfaces. When the material's temperature returns to normal, both parts are bonded. The repair is finished with a final polishing operation.

CHAPTER 6
THE TECHNIQUE AND HYDRODYNAMICS OF CANOEING

INTRODUCTION OF TECHNIQUE OF CANOEING

The Canoe – Kayak technique is the propulsion of the boat with the objective to achieve the fastest speed of the boat.

Canoe/kayak is categorized as a cyclic endurance sport characterized by repetition of a motor action. The goal is to repeat each stroke over and over again in the same form with efficient technique.

THE DEFINITION OF TECHNIQUE OF CANOEING:
"The ideal cycle of motion that produces maximum boat speed"

THE AIM OF TECHNIQUE:
MOVE THE BOAT FORWARD EFFECTIVELY AND WITH LESS ENERGY AS POSSIBLE IN ACCORDANCE WITH AIMED PACE!

6.1 THE ROLE OF TECHNIQUE IN CANOEING

DETERMINING TECHNIQUE
The paddling technique is a
MECHANISM
for obtaining
SPEED and **EFFENCIENCY**
during paddling.
The development of technique is:
Continuous process from the first day until the end of athlete's carrier!

The Principle aim of Canoeing technique is: to obtains the greatest speed over a given distance with efficient energy usage and high velocity.

The objective is to obtain the maximum speed and maintaining that speed which depends on perfecting the athletes' technique and cyclical stroke movement.

The paddling technique coupled with the paddler's abilities allows him/her to reach maximum efficiency and maintaining maximum speed over a given distance. To understand the canoeing technique better we have to deal with the different elements of the paddling stroke.

The interaction of the components of water, weather, boat, paddle and paddler makes the technique very complex and difficult to repeat perfectly each time. To perform a good technique requires great concentration, years of practice and the development of great endurance and power that is specific to the efficient motion for paddling.

For the competitive paddler the quality and efficiency of the technique is a major objective in training and requires considerable practice to master the technique.

THE ATHLETE' TECHNIQE IS ONE OF THE MAIN DETERMINING FACTORS OF THE SPEED OF THE BOAT!

The components of technique

TECHNIQUE
Consider the interaction of 4 components
ATHLETE
BOAT
PADDLE
WATER

The paddler establishes the structure within this 4 components of macro system

According to the elements associated with paddling technique there is a specific form of power transmission between the "motor" (physical capacities of the paddler) and the "wheels" (the boat) through a paddle.

Canoeing paddling technique results in obtaining the maximum speed over a given distance, through a motor action centred on the ideal movement with the most efficient stroke possible.

6.2 THE BRIEF HISTORY OF TECHNQUE

Canoeing technique has developed over the years. The evolutionary change always involved the simultaneous improvement of technique and boat or paddle design. Any change must produce more speed.

Historically, different countries and elite athletes had different techniques.

The paddling technique of most successful athletes was a model for upcoming athletes and paddlers. However, in most of the cases it is simply a copy of the style of the movement. That is, the visible execution of the stroke but clearly not the resultant power transmission that is required to produce the speed necessary through the magnitude and angle of the blades in the water during the stroke movements.

Recently all the different techniques stem from the same basic principles of MODERN CANOEING TECHNIQUE. This technique is based on the hydrodynamic effects, laws of physics (mechanics and kinetics) and biomechanics.

The technique is a perfect model showing the ideal and most efficient movement that must be repeated by every stroke of the paddler.

6.3 HYDRODYNAMICS OF CANOEING

Introduction
It is useful to analyse the hydrodynamic laws and effects to understand better the techniques of Canoeing.

To fully appreciate the sport of Canoeing one should become familiar with the basic principles, definitions and terminology of hydrodynamics. The hydrodynamics of Canoeing relates to the application of physics to the boat moving through water. As in many other sports, certain parameters affect performance. By understanding these principles and dynamics, paddlers can realistically anticipate speed and be successful through good canoeing technique.

In canoeing, the boat is propelled through the water by paddles, carrying paddlers of different size and weight. Freedom of movement is not restricted, both equipment and paddlers are subject to external and internal forces in a three-dimensional field. Subsequently this freedom of movement affects the resistance, motion, and stability of the boat in the water.

6.3.1 RESISTANCES

Both canoes and kayaks are surface vehicles, semi submerged in water. The movement of the boat in the water is restricted by a force called hydrodynamic resistance or drag. The boat and paddle are predominately above the water where another resistance force called aerodynamic drag is present. Both slow down the boat. The water resistance is about 93% whilst the aero-drag is 7%.

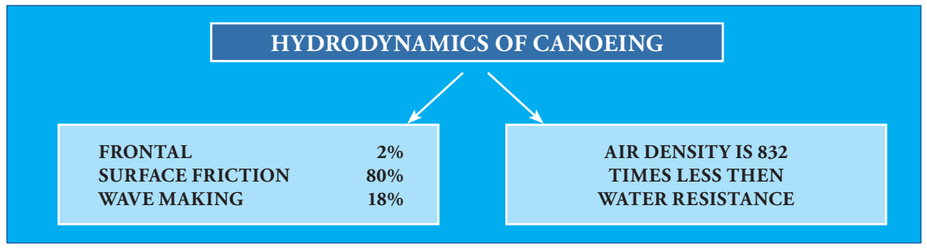
Aerodynamic drag is relatively low under normal conditions, compared with water resistance. Air density is 832 times less than that of water and being so low it is often neglected. But under certain conditions this resistance could become an important factor in canoeing performance. For example, lightweight paddlers in a strong head wind will struggle to achieve high speeds.

Resistance acting upon the hull of the boat can be divided into three components:

WATER RESISTANCES:

Frontal resistance	about 2%
Surface friction	about 80%
Wave making resistance	about 18%

The resistances for boats



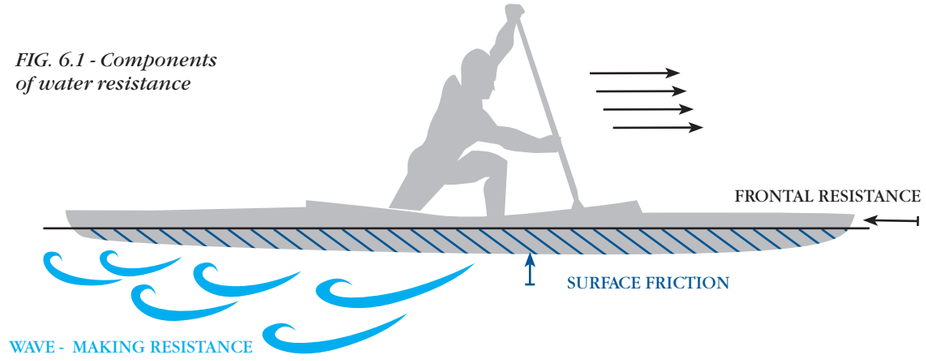


FIG. 6.1 - Components of water resistance

The dominant resistance is surface friction. However, the overall picture is not so simple because of the freedom of movement of the boat and the varying speed of the boat due to paddling technique.

This results in additional resistance, which modify the wave structure and the wake generated by the hull.

6.3.1.1 FRONTAL RESISTANCE

This could be neglected because it is only 2% out of all hydrodynamic resistances concerning the sharp shape of the bows of racing boats.

6.3.1.2 SURFACE FRICTION

The boat moving through the water creates a turbulent wake effect. The water in the wake has momentum imparted to it by the hull. This resistance component is called viscous or frictional resistance.

Frictional resistance largely depends on the quality of the hull surface. By definition, if the boat surface is smooth to touch, it is said to be hydro dynamically smooth, and the surface irregularities are very small.

As the boat moves, the water molecules will come in contact with its surface. These molecules slow down and either become lodged in the small crevices in the surface or bounce off the ridges on the surface into the surrounding layer of water, which slows the boat down even further. This molecular layer of water starts at the bow and gradually increases towards the stern.

The energy lost in the boundary layer is the function of the surface. Surface friction force is directly proportional to the wetted surface area of the boat. Besides the wetted surface, length and the surface roughness the frictional resistance is affected by the viscosity of the water, for example salt or fresh water and the temperature of the water. Warmer water is less viscous than cold.

6.3.1.3 WAVE-MAKING RESISTANCE

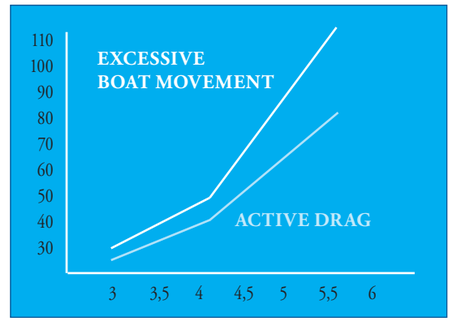
Wave making resistance is the second major component of water resistance in canoeing.

The wave-making resistance and the generated wavelengths are strongly dependent on the shape and speed of the boat and the depth of the water. In shallow or restricted waters the wave pattern is different, which means in this condition the speed of the boat is slower. The resistance is sensitive to the effect of shallow water and the reduction of pressure under the boat and subsequent increased sinking of the boat.

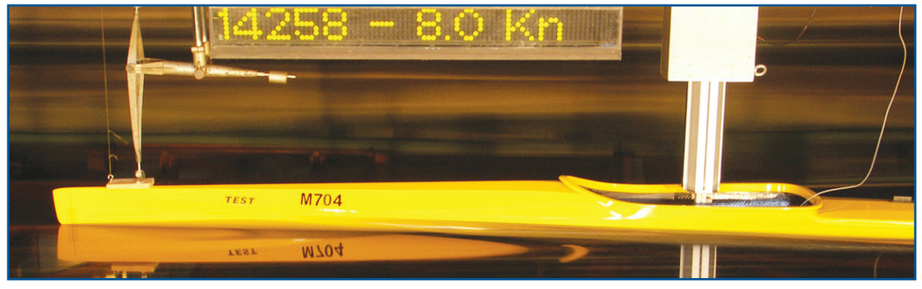
The hull shape will determine the exact position of additional pressure points for a given speed. But any new wave system will lead to move resistance depending on the speed of the boat in relationship to its length. The relationship between wave making resistance and the displacement of the boat is approximately squared for a given length of hull running at a given speed. This relationship can be explained with the following example: 50kg and a 90kg heavy paddlers use the same boat and travel at the same speed. A more heavily loaded boat submerged more deeply into the water takes more power by the paddler to move at the same given speed as the lighter paddler. See the table below.

Frictional resistance can be calculated accurately knowing the wetted surface of the hull under the displacement of the boat. Paddling with inefficient technique such as having a tilted boat can increase the resistance of water on the boat.

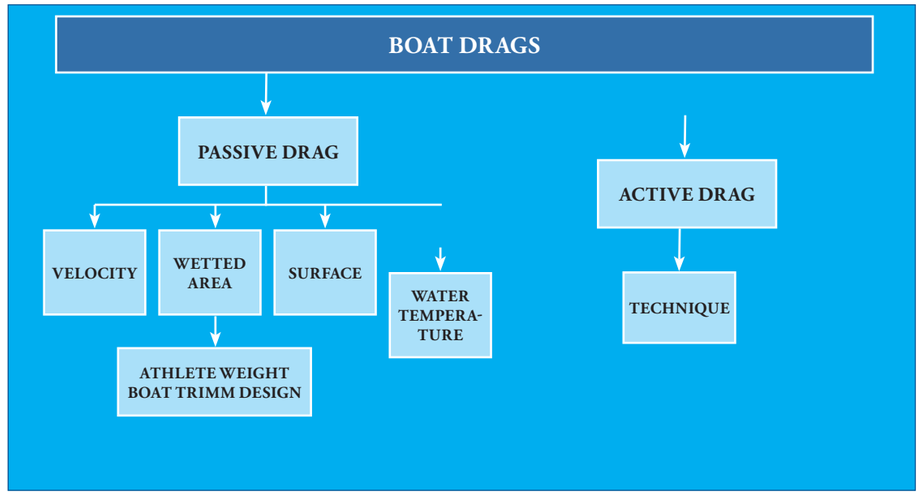
The speed and the drag relation



Testing of water resistances in test canal



Summary table of boat drags



The mass of the kayaker may negatively affect the speed of the boat because the kayak submerges deeper in the water with heavier paddler in. This increasing wetted area of the hull will increase the drag. The boat constructers design boats with the hull design and shape for the different weighted athletes.

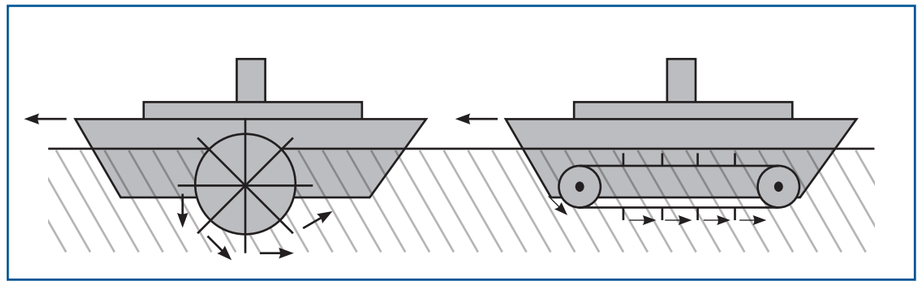
6.3.2 THEORY OF BOAT PROPULSION

From the theory of propeller propulsion it is known that the magnitude of the normal force is closely related to the size and shape of the propelling surface. (Paddle)

The forward movement has to produce more force by a propeller than the water resistance on an object. There is no movement if the proportions of both forces are equal.

An example: (adapted from J. Councilman famous swimming coach) Steam ships are propelled by driving-wheel paddles. In the table below we can see the propelling system of a steam ship. The wheel paddles can meet with the "standing water" to give force to the boat continuously. This propeller theory worked well in practice. A later developed design with another theory wasn't successful in practice because the steam-ship almost couldn't move forward in water. The driving-wheel paddles could not give enough power to the ship from the "moving water" on the given speed of wheel. In canoeing the shape of boat and the direction of the path of the paddles path (especially when using wing blade) almost automatically avoids this problem. In paddling we must take advantage of these principles. That is, the draw is technically perfect if the blade stays fixed in the water at the point of the paddle being fully submerged into the water and the canoe drawn to it. (See diagram ?)

FIG 6.2 - a) Economical propulsion system - b) Uneconomical system (Councilman, 1970)



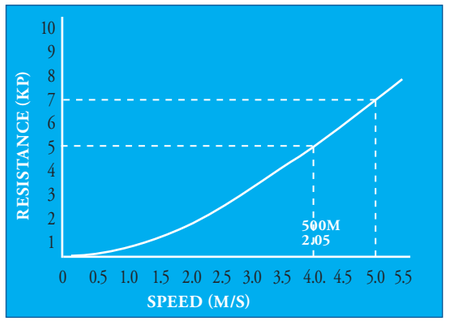
The boat's propulsion 1

The boats propulsion increases proportionally with greater volumes of water the paddle is able to move quickly over the shortest distance.

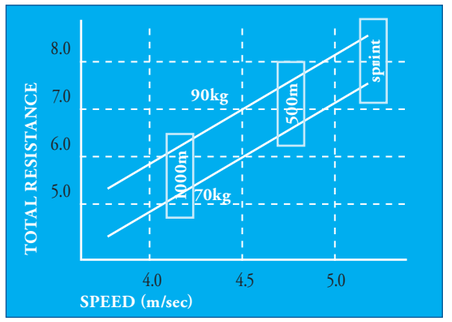
The drag forces act to slow the boat down. Thus in order to achieve the best speed of the boat the drag forces on the boat must be minimized and factors which contribute to improved propulsive forces must be maximized. The aim of canoeing technique is to maintain a constant boat velocity.

The main contributor to the wetted surface area is the total weight of the paddler. Hence, body size significantly influences paddling performance. While a larger individual may potentially have a larger VO2 max, too large a body mass of the paddler may negatively affect buoyancy cause the kayak to sit deeper in the water, which increases the wetted area subsequently increasing the hydrodynamic drag. To overcome higher resistance the athlete needs to be stronger especially his/her power to weight ratio.

Speed relation with resistance



Resistance vs. speed for K1 at two different displacements



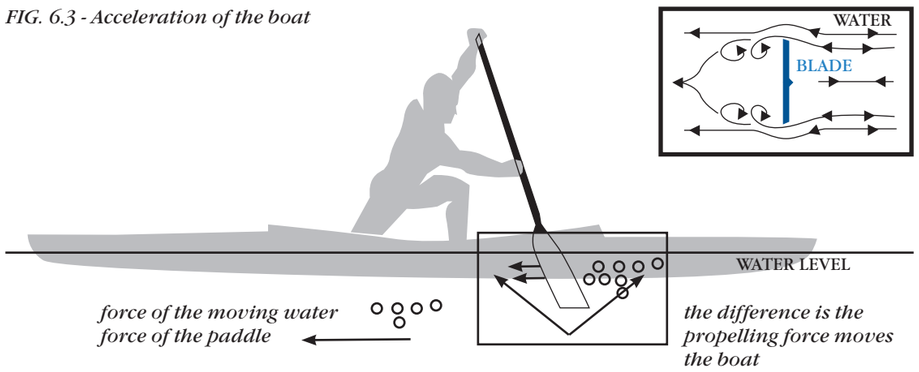
6.3.3 THE HYDRODYNAMICS OF PADDLES

The paddle is used to transmit the power of the athlete to the water. For this the paddle needs to find support in the water – that is, create resistance against the paddle.

The motion of the paddle is unlike any other propulsive device designed to work in water. The paddle has no fixed point of attachment to the boat, only an elastic connection (that is, the paddler's body) through which all forces are transferred to the boat. We know that the forward movement of the boat is based on water resistance or rather on the principle of action and reaction, Newton's Third Law of motion: for every force there is an equal and opposite force or reaction.

The water resistance is proportional to the speed of the boat. At a higher speed the resistance is greater thus the paddle must move with increasing speed through the draw. This is necessary because the blade tends to move slightly backward, pushing some water in the same direction and this moving water provides less resistance if the blade moves at a constant speed. In other words, the boat accelerates only by the difference of velocity between the paddle and the water.

FIG. 6.3 - Acceleration of the boat



CHAPTER 7 - CANOE/ KAYAK TECHNIQUE
THE INTERRELATED PRINCIPLES OF KAYAKING AND CANOEING

INTRODUCTION

THE PRINCIPAL AIM OF THE TECHNIQUE IS:
Obtain the gratest speed over a given distance with less energy and higher velocity.

Although the boat, the paddler's position and his or her movements in the kayak or canoe are different, the principles of both paddling techniques are closely interrelated. Kayaking and canoeing have common technical principles:

The boat and the paddle are "extensions" of the human body. The boat and the paddle are connected to the athlete through a mechanism. This connection can be treated as a human being – vehicle – tool system.

Kayak/canoe technique in the history represented of different countries and/or successful athletes. In these days the technique bases on hydrodynamics effects, the low of physics and biomechanics.

Similarities of kayaking and canoeing technique:
When we examine the technique of paddling as a whole we can recognise similarities between that of the kayak and the canoe. The hand-held paddle (whether single or double bladed) has no fixed point to the boat and has to propel the boat forward at the greatest possible speed. In the kayak, the seating position increases stability and therefore the ability to transmit power but the level and range of power and length of the stroke are smaller than in the canoe. The principal concepts of advanced technique in both craft are the same: using trunk rotation; 'swing'; long stokes; fixed structure of strokes; the angle of the blade at entry; the intention to keep the paddle vertical as long as possible etc.

Put simply, whether kayak or canoe technique:
The speed of the boat and the efficiency of the technique are determined by the stroke (the path, direction and angle of the paddle), the magnitude of power to the paddle, and the transmission of that power to the boat through the frequency of the strokes.

Therefore, paddling technique will be explained in three distinct parts:

a) Common factors (this chapter).
b) Advanced kayak technique (Chapter 8).
c) Advanced canoe technique (Chapter 9).

7.1 COMMON FACTORS

In order to understand and describe technique we need to deal with the main factors, which can be listed as follows:

The paddling technique is a mechanism for obtaining the best speed and efficiency.

FACTORS OF TECHNIQUE
- BALANCE AND STABILITY
- THE STROKES
- POWER TRANSMISSION
- COORDINATION
- RHYTHM
- DINAMICS
- EFFICIENCY
- STYLE

7.2 BALANCE / STABILITY

Stability depends on two main characteristics – (1) the dimension of and (2) the shape of the cross-section of the boat. A narrow cross-section results in instability but greater speed, whilst a wide cross-section provides stability but less speed. Generally, racing boats are designed for maximum speed and thus sacrifice stability, with the trend in recent years towards more narrow boats.

FIG 7.1 BALANCE

All types of racing boat are unstable, so the ability to balance plays an important role in canoeing especially in the learning phase. The first challenge a beginner must face is balance. Once he or she masters it, they will be able to learn the mechanics of the stroke and also learn to deal with, and take advantage of wind, waves and currents. The aim is to transmit, as economically as possible, the maximum force possible through the paddle to the boat to achieve a 'gliding' feeling across the water.

Balance is affected by internal and external conditions.

7.2.1 INTERNAL CONDITIONS
The paddler's position, body weight, height, location of the supporting points and distance of the centre of gravity from the water surface all affect balance. Additionally, body rotation during paddling generates intentional instability (see Chapters 8 and 9) which enables the paddle to fall onto the paddle, taking body weight out of the boat and converting potential energy to kinetic energy. The lack of control in beginners forces them to adopt safer positions, which will not favour good technique.

7.2.2 EXTERNAL CONDITIONS
External conditions such as wind, waves and currents alter the system's stability, to a greater or lesser degree depending upon their direction, strength etc. by causing unwanted movement to the boat or the paddler. In all cases, it is a simple case of hours of training to build up experience to solve these problems.

The stability of the paddler influences the:
- Speed of the boat
- Usable proportion of the athletes' strength
- The proportion of that usable strength that is transmitted into propelling the boat forwards
- Flexibility - relaxation

Using a Swiss Ball for various exercises can improve an athlete's balance. See examples below:

FIG 7.2 EXERCISES WITH SWISS BALL

FIG 7.2 EXERCISES WITH SWISS BALL

FIG 7.2 EXERCISES WITH SWISS BALL

TRAINING OF BALANCE AND TRUNK STABILITY

1. Stand on leg, think all and think of pressing your hip away from the floor to level your hips. Raise both arms straight above you. Staying steady, lower one arm and take it back up. Lower the other arm and take it back up. Take both arms out to the side, turn your body one way and the other. Now move free leg forward, back, out to the side and across your body as far as you can. Repeat 4x each side.

2. Seated on Swiss ball with feet on balance board or wobble cushion.
   Aim: increase trunk stability and righting reactions

7.2.3 SUPPORT STROKE FOR BALANCE

Beginners should learn how to perform a support stroke to prevent them capsizing. It may be used when the boat is stationary as a means of support or may have to be used quickly as a means of keeping the paddler and boat upright when the paddler feels they are falling to one side. In both cases, it is easier to use the back of the blade for support:

The Support Stroke

The back of the blade is placed as flat as possible on the surface of water. The paddler presses down but the blade has to move across the surface in order to remain on the surface supporting the paddle.

Static: When the boat is moving the paddle can be held still in relation to the boat as it will continue to move forwards across the water with the boat. It is important to keep the leading edge of the blade slightly raised by twisting the paddle with the wrist, so that it doesn't slice into the water and pull the paddler in.

Dynamic: When the boat is stationary, the blade needs to move continuously forwards and backwards over the surface. As above, the leading edge of the blade is slightly raised. Because

the blade moves back and forth, the leading edge changes from one side of the blade to the other so the wrist needs to control the angle on the blade through extension and flexion.

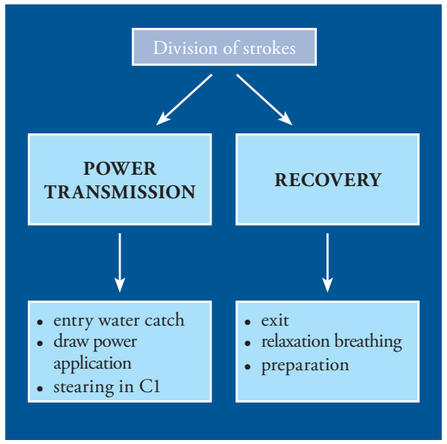
7.3 THE STROKE

The stroke propels the boat and needs to be repeated throughout the distance of paddling. Sprint paddling relies on the quality and quantity of strokes! Each stroke moves the boat forward. However, within each stroke the kayak or canoe speeds up and then slows down due to the dynamic movement of the paddler and the varying magnitude of force applied via the paddle. During the power transition phase of the stroke the velocity of the boat increases, while during the recovery phase the velocity of the boat decreases. The main aim of technique is to minimize the speed differences during and between the phases!

AVERAGE TOTAL NUMBER OF STROKES IN SPRINT PADDLING			
Boat	**200m**	**500m**	**1.000m**
Kayak	70-90	200-250	360-500
Canoe	50-60	120-150	230-270

To understand technique better we have to analyse in detail the common elements of each stroke. Although one stroke is one continuous cycle we can separate it into parts in order to analyse it. We can divide every stroke into two basic parts: the **power transmission phase** (the paddle blade is in the water) and the **recovery phase** (the paddle blade(s) is in the air). Each main phase can be divided into smaller segments as the following table shows.

It is important to recognise that during each stroke the paddler is trying to move the boat as long a distance as possible. The aim is efficiency, i.e. to reach a given distance and speed with the least number of strokes! This can be checked over a given distance by dividing the distance by the total number of strokes. The result shows how far the athlete travels with each stroke in trying to reach the maximum speed. 'Running' the boat does not require as large a force as accelerating from a standing start. The forces applied in the canoe: 25-30 kilopond (kp) or 250-300N moving/50-60 (kp) or 500-600N from standing; and in the kayak about 22-26/40-45.



7.3.1 THE POWER TRANSMISSION PHASE

THE AIM OF ONE STROKE IS:

MAKE THE BOAT TRAVEL AS FAR AS POSSIBLE!

Measurements:
distance (metres)/ number ofstrokes

The transmission of force from the paddle to the boat is performed through the points of contact of the paddler with the boat: the seat and footrest in kayaking and the knee pad and feet on the floor-board/footrest in canoeing.
During a stroke the transmission of power starts at the entry or 'catch', continues through the power application (draw) segment and finishes at the moment of exit. In this period the athlete's power and body weight is transferred down to the blade. The paddle propels the boats. The force from the paddle has to transmit through the body to the boat. Therefore, the body's work is the dominating component of a stroke. The power transmission phase determines speed and efficient technique. Paddlers use whole body movement to transmit power from their body into forward movement of the boat.

During the first part of the power transmission phase (the entry or 'catch'), there is a rapid increase in force until the maximum value is reached at the point where the paddle is nearly perpendicular to the water. The time needed to reach this maximum value is gradually reduced as the efficiency of the paddler improves. A paddler's aim is to maintain a force at or over 70% of his or her maximum force.

The power transmission phase consists of:

- entry (catch)
- power application (draw)
- steering (canoe only)

POWER TRANSMISSION

The power given to the paddle transferred to boat via the athlete's strength, body weight and technical ability!
KEY ISSUE!

7.3.1.1 THE ENTRY ("WATER CATCH")

The catch is generally considered the most important part of the advanced stroke. The catch is the segment of the stroke from the moment of contact of the blade's edge with the water until it is fully submerged. At this stage, the paddler's potential energy is transformed into kinetic energy. This is the moment when the most power can be transmitted from paddle to boat by utilising dynamic swing from the preceding recovery and adding strength and the paddler's body weight. The paddler thrusts the paddle at an acute angle (450 to 550 as seen from the side) into the water close to the boat.
The correct execution is for the paddler to press the blade into the water rapidly, taking the shortest amount of time possible to submerge the blade fully. This period of time is closely related to stroke rate. The highest force usefully applied to the boat is possible only if the blade is totally submerged in the water (and as quickly as possible). Beware of bubbles or splash during the catch. They are signs of insufficient power, slow application of force and/ or incorrect angle of the paddle on entry.

7.3.1.2 THE POWER APPLICATION (DRAW)

The draw follows the catch as a continuous integral part of the stroke. During this period the most important task is to continue to transmit all the power from paddler to paddle to boat. Starting with the catch and throughout the draw the paddler gradually returns to the recovery position whilst pressing his or her weight onto the paddle to keep it in a vertical position for as long as possible. During this movement the paddler needs to keep the entire blade pressed DOWN in the water continuously until the exit.

Although force during the draw comes from two components the paddler's centre of gravity is always moving in order to keep the body weight on the paddle. The first component is the rotational movement of the trunk when the highly extended back muscles return to the basic position. The second component, but not separated from the first, is the pulling/pushing of the arms simultaneously with trunk rotation. With most movements the larger muscle groups lead, followed by the smaller, weaker muscles.

Because unequal forces are applied from side to side in the kayak, or only on one side in the canoe, the boat experiences lateral movement. However, well executed rotational movement will counter-balance these forces, reducing lateral movement and enabling the boat to glide.

A WELL EXECUTED STROKE DURING POWER TRANSMISSION PHASE:

- The athlete "locks the paddle" and fixes the blade in the water from entry till moment of exit
- At the catch, the blade fixes rapidly with minimum 'slip' – achieved through high speed from point of contact with the water surface till fully submerged.
- A combination of downwards force and direction of the athlete's movement keeps the blade vertically as long as possible in the draw segment
- 'Dynamic' execution of the entire stroke

Perhaps the most important point to note is this. The paddle doesn't move alongside the boat (as it seems to) but the **boat is drawn forward to the paddle**. Understanding this concept is fundamental to studying and teaching correct paddling technique!

Paddling efficiency is clearly demonstrated at its best in this series of photographs. The catch is by the buoy and the blade remains there throughout the draw, whilst the boat is drawn forward to the next point of entry. As soon as the blade enters the water, it becomes fixed and 'locked'. The paddler then pulls himself towards the fixed catching point.

The paddler's objective is to find stationary water which provides 'lift' against which the paddle can fix. This is achieved by the correct angle of the paddle at the catch and by the direction of the draw. The paddler's level of performance is determined by his or her strength and endurance, the equipment used but above all by correct technique. However, without a certain level of power, good technique and therefore speed cannot be achieved! In other words the paddler's strength and technique are closely related to each other and to the ultimate speed and acceleration achieved.

BASIC PRINCIPLE:

AT THE MOMENT OF PROPULSION THE STROKE IS TECHNICALLY PERFECT IF THE BLADE STAYS FIXED IN THE WATER. AT THE CATCH, OR MORE EXACTLY AT THE POINT WHERE THE BLADE IS FULLY SUBMERGED,THE BOAT IS DRAWN TO THE PADDLE!

THE BOAT IS MOVED PAST THE BLADE!

7.3.1.3 STEERING MOVEMENT OF THE PADDLE

(Canoe only – see Chapter 9)

7.3.2 THE RECOVERY PHASE

This is the second main part of the stroke. In this phase, the paddle travels out of the water from the exit to the next catch. The paddle is not connected with the water so in this period power transmission is impossible.

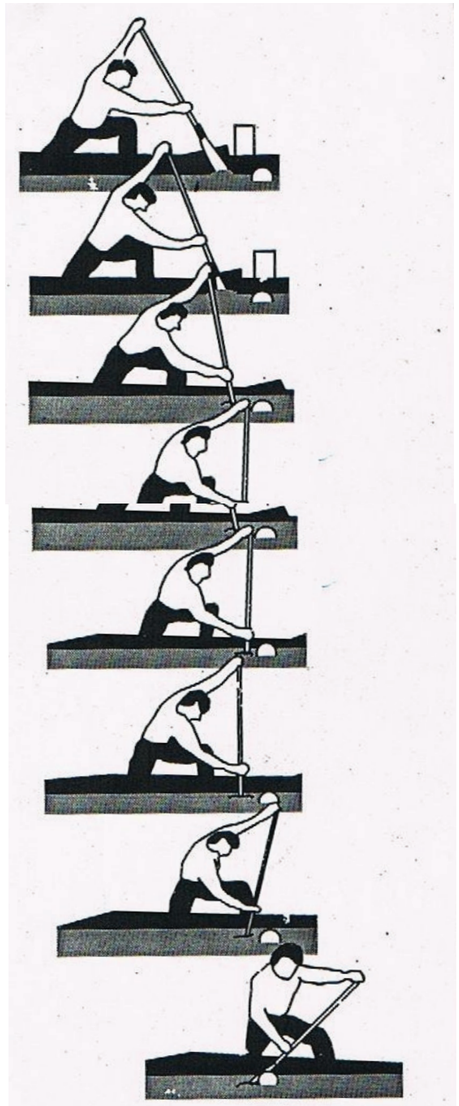


FIG 7.3 STEERING MOVEMENT OF THE PADDLE

THE ELEMENTS OF THE RECOVERY PHASE:

- Exit
- Relaxation and Oxygen Intake
- Firming or set up (preparation for the next stroke)

7.3.2.1 EXIT

Immediately following the draw in kayaking or the steering movement in canoeing, the blade swiftly emerges from the water. We examine this in more detail in chapters 8 and 9. The objective is to take the blade out of the water quickly and without reducing the boat's speed.

7.3.2.2 RELAXATION PHASE

The main emphasis is on muscle relaxation and breathing, in addition to moving the paddle to the next catch position. During recovery, the muscle tone must change from a relaxed to a firm state. This is also a vital part of the overall coordination. The recovery phase can ensure a sustained effective paddling motion without a painfully tense body. During the recovery, oxygen intake is achieved through the correct breathing pattern (see later).

7.3.2.3 FIRMING OR PREPARING FOR THE NEXT STROKE

During this last part of the recovery, the paddler holds the inhaled air giving the whole musculature the firmness necessary for a strong, powerful water catch.

7.4 BREATHING

Breathing frequency is developed individually, depending on the paddler's pulmonary efficiency and ability to utilise oxygen. Humans can utilise only a fixed proportion of oxygen from the inhaled air. Breathing is a function of the stroke rate and physical exertion. When paddling at a comfortable rate one inhales and exhales for every stroke. Inhaling takes place during the recovery before the catch while exhaling occurs during and after the exit. At a higher stroke rate this breathing rhythm is impossible, thus there are two or three strokes for every breath. This imbalance means the paddler must breathe deeper and more efficiently. Forcefully exhaling in order to use the full capacity of the lungs becomes necessary, especially in kayaking where deep breathing is somewhat hindered due to the sitting position. In kayaking, breathing cannot be fully coordinated with each stroke when the rate is high.

Body posture in kayaking is not conducive to easy breathing. Therefore, special attention must be given to deep breathing with an open mouth involving both the stomach and chest. Leaning forward excessively or keeping the knees drawn up high prevents deeper inhalation and should be avoided.

7.5 COORDINATION

All muscles are connected to the nervous system but voluntary muscles (contrast with involuntary muscles such as those in the heart) can be controlled by the individual. This is basically an inborn ability of every individual and determines our level of skill. We know that some people seem to be very skilful at most things or have a specific sense for things, for instance ball sports or martial arts.

However, skills can be improved by exercises. Although the central nervous system gives 'instructions' to the muscle fibres, movement also depends on the joints and on the individual's flexibility. Humans have to learn all movements from walking to dance to sport. Any improvement requires exercises. "Practice makes perfect"!

Firstly, paddlers need to master the basic movements of the stroke to 'teach' the muscles correctly. They have to practice the 'formal model' of technique. Then, over time they will gain a deeper understanding and experience of it. The duration of this period depends heavily upon the individual's skill, or in other words on the neuromuscular control.
In practice, some athletes pick up the basic technique easily, whereas others find it difficult and take a relatively long time to get there. Some paddlers reach the same level but over different periods of time, whilst some never become an exceptionally fast paddler, even with well-developed muscles and hard training, because they are unable to fully coordinate their movements. Ultimately, the athlete achieves good technique when he or she feels the sensation of a 'gliding' boat. This can only result from the rhythmic movement of the whole body!

One of the main tasks for paddlers is to feel, use and change the centre of gravity of their body. In addition, they have to use their muscle groups in the required order from the larger to smaller, having regard to the rhythm of the stroke. A word of warning. If incorrect movements become auto-

matic, any change thereafter is very difficult and often impossible, especially at high intensity.

7.6 RHYTHM

The way in which each and every stroke is executed is also important. In other words, technically well-executed paddling has its own characteristic rhythms. There are two kinds of rhythm. Rhythm between successive strokes and rhythm within one stroke! The former refers to the stroke rate (total strokes per minute) but within each strokes there are varying speeds and this is what we need to concentrate on!

A stroke is defined as the paddling movement of one cycle┬┬┬ -FROM ENTRY TO NEXT ENTRY and not from entry to exit! The rhythm within each stroke means that the integral elements of the stroke occupy varying time periods. Where rhythm is good, at the end of the recovery the paddle (in the air in the preparation position) HESITATES for a fraction of a second just before the blade enters the water.

The duration of a stroke at high frequency is between 0.3 and 0.8 seconds (one cycle). Within the stroke the speed of the paddle movement varies. The greatest power must be applied during the catch when the boat has slowed and the blade meets increased resistance. Through the draw the paddler should always try to accelerate till the end, and never slow down, although the blade should not go beyond the line of the hip. The exit requires the most agility, for the blade must emerge from the water as swiftly as possible otherwise it has a braking effect on the boat. The exit must be followed by an energetic recovery. Paddling rhythm in team boats is critical! Without good rhythm the boat's speed will be decreased.

7.7 DYNAMICS

Any discussion about how the stroke is executed must focus on the dynamics of motion, a vital part of technique. The dynamics of paddling is really about the cyclical way in which the muscles contract and relax. It is important to maintain this chain of muscle coordination in the course of every stroke. For example, the well-executed catch is an energetic and aggressive movement. At this stage the paddler's potential energy is transformed into kinetic energy. Therefore, when repeating a good stroke many times it has to be dynamic in combination with the body's swing, weight and power.

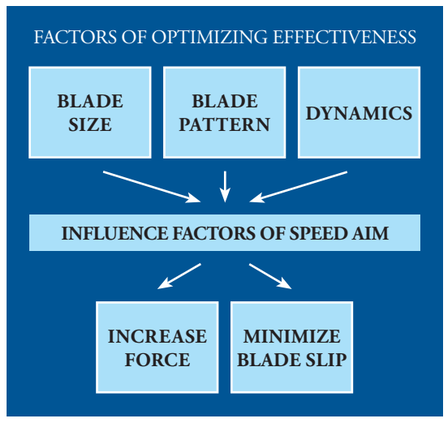
7.8 EFFICIENCY

Work or energy needs to be looked at when talking about the efficiency of the stroke and the speed of the boat. Paddling efficiency may be defined as the relationship between power expended upon the paddle and the speed of the boat. How much power is applied to the paddle in relation to how much is transmitted into the speed of the boat.

$$\text{Mechanical efficiency} = \frac{\text{Speed of the boat}}{\text{Energy used by paddler}}$$

The aim is to increase the speed of the boat in direct proportion to the power exerted upon the paddle. Factors affecting the speed of the boat are:

- the magnitude and direction of power acting upon the paddle and the boat;
- the length of the draw;
- the stroke rate;
- the surface friction and the aerodynamic drag.



Maintaining maximum efficiency should be one of the main technical objectives of the paddler!

7.9 TECHNIQUE AND STYLE

Style is the individualised form of technique. In other words, technique is a model but the way in which it is performed by each paddler is known as style. Beginners have to learn the basic technique of paddling, then each paddler creates his or her own style by combining abilities of skill, muscular strength and balance. Style will also depend on the size and proportions of the body (arm or torso length etc.) and body weight. To the observer, the style of a paddler might appear as an individual technique. However, all individual styles are essentially based on the same technical principles!

Fully understanding an individual's technique visually is difficult because the most important part of a stroke takes place under water and we can't clearly recognise how the transmission of power has been executed by the paddler. For this reason, sometimes we cannot obviously relate the speed of the boat to the paddler's technique. Of course the boat speed is always the most important objective of technique and not the look! In sprint racing we don't need the paddlers with best looking technique but we need the one who is the fastest. To increase the boat's speed is the main objective of technique!

Summary of fundamental technique principles:

- The uniform, correct and consistent movement pattern of the torso in perfect synchronisation with arms and legs, making each stroke completely efficient.
- Every stroke performed dynamically.

It's important to note that the execution of optimal technical depends on several factors and not only the skill of the athlete.

Factors influencing optimal technique

- Paddlers physical fitness
- PWeather and water conditions
- Sport's equipment, Boat and Paddle
- Racing distance
- Training tasks

7.10 BIOMECHANICS

Below is an extract from a lecture, Canoe Sprint Biomechanics: Practical Laboratory and On-the-Water Applications, by Daniel Henderson

"If you have ever thought about paddling technique, thought about how athletes can make the boat go faster through how they move or apply power, you are thinking like a biomechanist. Canoe Sprint is a technically demanding sport. Great advantage can be gained through the development of economy and efficiency to increase boat speed. Biomechanics is a method to further refine our understanding and analysis of paddling technique to enhance athlete performance.

In a search for optimum technique, the balance of bilateral differences and in bringing members of team boats into unified one, joint angles can be measured and compared. In a search for optimum technique, changes in position, velocity and acceleration of paddling motion can be quantified. To improve power, directions of force application can be analysed. Power and power requirements for the entire motion and at each joint, which is useful in developing technique, training regiments and injury rehabilitation, can be determined.

In this presentation, Dan Henderson, canoe sprint coach and biomechanist, will explain roles of biomechanics and describe data gathering tools and methods of analysis, both in the laboratory and on-the-water, and how these can be used to enhance athlete performance."

CHAPTER 8
KAYAK TECHNIQUE

INTRODUCTION

Learning correct and efficient paddling technique is a progressive process and a continuous task from the beginning to the end of an athlete's career. The main factors of kayak technique, described in the previous chapter are balance/stability, the stroke, breathing, coordination, rhythm, dynamics, efficiency and style which take a long time to master. At the highest level the boat will have a feeling of gliding across the water, crucial to achieving the best speed.

8.1 THE PADDLE AND THE GRIP POSITION

Paddle length, blade shape and size and the angle of the blades are individual measurements that depend on the athlete's power, height, race distance, stroke rate and also personal feel. Specialising at a racing distance is a determining factor in the selection of a paddle for an individual. For example, 200m sprinters need a different size of blade (larger) to that of marathon paddlers. In K4 the athletes in the rear two places should use a longer paddle than they would use in a single. In addition, the seating height will influence the paddle length. Athletes in a higher seating position should use a longer paddle.

The length of the paddle is determined by the grip position on the paddle shaft. With the paddle resting on the paddler's head and the paddle held with the elbows at right angles, the distance between the hands is found. The grip should be the minimum of 33% of the paddle length. Examples: grip distance 74cm = paddle length 222cm; or 70cm= 210cm (Barney Wainwright)

8.2 THE POSITION AND POSTURE IN A KAYAK

The paddler must adopt a comfortable seated position. The trunk must be vertical or slightly leant forward, projecting the chest upwards. The head is in vertical position, looking forwards and relaxed. The knees should be slightly bent to allow the alternate pushing of the legs (flexion - extension). The feet should have their heels resting on the bottom of the hull and the balls of the feet in contact with the footrest.

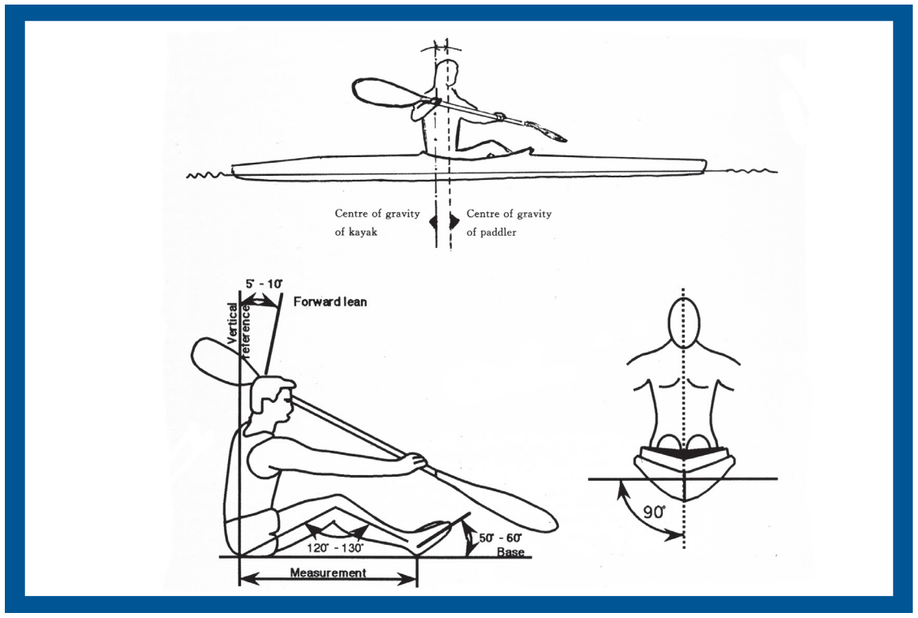


FIG. 8.1

The position in the kayak must be suitable to enable the transmission of force to the boat to generate propulsion. Once seated, the paddler ought to be on the centreline of the boat for perfect balance. Legs should be bent, parallel to each other and feet against the foot-rest with heels resting on the bottom of the boat. The angle at the knees is approximately 120°-130°. The back is straight and the torso is vertical or leaning 5°-15° forward. The centre of gravity of the paddler should be at the centre (from bow to stern) of the kayak or slightly in front. The exact point will depend on the paddler's weight and can be determined by carefully observing the water line on the hull when the athlete is paddling at full speed. The boat should be level so that neither the bow nor stern is high or low.

Kayak paddling possesses a circular, rhythmical pattern of the trunk, hips, shoulders, arms and legs which only comes with many hours and kilometres of paddling and perfect balance.

8.3 BALANCE

The racing kayak is a very unstable boat. To have perfect balance in varying water and wind conditions at maximum speed takes much practice over a long period of time, often years. Balance comes with paddling experience. Paddling many kilometres is the key to improving balance! Lack of balance impedes good technique and the speed of the boat. It is easier to start in a touring kayak or any other type of stable kayak. It is worth the beginner learning how to perform a support stroke (see page 3).

8.4 THE POWER-TRANSMISSION PHASE

From the start it must be pointed out that kayak strokes are executed by rotation from the torso. Put simply, the stroke is not led from pulling the paddle with arms but from the trunk rotating and swinging dynamically. The paddler has three contact points with the kayak: the buttocks on the seat; the heels on the hull; the ball of the feet on the foot-rest. Power is transmitted through these points.

8.4.1 THE CATCH OR ENTRY

The first and extremely important part of the power transmission phase is the catch or entry. It begins when the blade makes contact with the water and it ends when the blade is totally submerged beneath the surface. The force, speed and direction (path and angle) of the paddle at the catch will determine the possible speed of the boat!

FIG. 8.2 WATER CATCH

When the catch begins the athlete's torso is upright or slightly bent forward. The pulling shoulder is lowered, arm stretched forward with trunk rotation near its maximum, toward the pulling side (on-side). The arm on the pulling side is completely extended forward. The arm on the opposite, pushing side(off-side) is flexed at the elbow, with the hand at about temple level and the elbow a little over or at shoulder level, but behind it. The leg on the on-side is flexed and ready to press against the foot-rest. The hips are slightly rotated on the seat toward the on-side. The blade enters the water close to the boat. The muscles are firm as the blade submerges. A good entry is quick and powerful and therefore all the muscles are contracted.

The correct angle of the blade (looking from the side) is approximately 45° degrees. From the front view, the paddle shaft angle is about 60°-70° degrees to the water. This sharp angle eliminates any side to side movement of the kayak.

8.4.2 THE DRAW (POWER APPLICATION)

This is the second part of the power transmission phase. The power transmission phase starts at the catch and finishes at the exit. Between these parts is the draw, which begins when the blade is totally submerged, and ends when the blade exits the water. There is no break between the catch and draw so it is not a separate part of the stroke. During the draw, the paddle should be maintained in a vertical position for as long as possible before the exit.

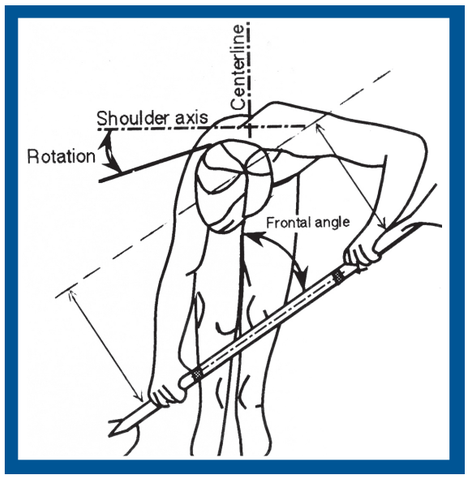


FIG. 8.3

In the draw the torso rotates and the on-side leg puts pressure on the foot rest which becomes a transfer point of forward thrust. Energetic torso rotation continues transmitting power with simultaneous push (off-side) and pull (on-side) of the shoulders and arms on the paddle, pressing it down. The on-side pulling arm, which is extended, performs its action together with the 'unwinding' of the trunk's torsion and the off-side pushing arm. The on-side hand follows a slight downward path and the arm ends in slight flexion. All the muscles maintain the correct depth of the blade, ideally fully submerged.

Throughout the draw, the off-side pushing arm moves to the opposite side, crossing in front of the face. This allows the paddler to keep the paddle in a position close to vertical. It also guarantees that the energy created by torsion in the trunk is efficiently and directly transmitted to the paddle. It is important to state again that non of this is possible without a powerful catch. Without a powerful catch, the draw will be much less effective.

When the paddle is in the vertical position the hand is at its closest to the water. All downward rotational motion of the hand stops and transfers into pulling the hand horizontally, parallel to the water. The pulling hand should never touch the water. Using traditional paddles, the path of the blade runs close to the side of the boat. However, when using wing paddles, at the catch the blade is very close to the boat but moves away from the boat at an approximate 70° angle (when viewed from above). This movement away from the boat occurs naturally, due to the wing shape of the blade, provided all the points above are followed together with correct rotation of the body. In other words, the paddler does not need to make the wing paddle move away from the boat.

The body rolls from side to side in a fluid motion with arms in harmony with the leg drive. The shoulders and trunk to keep the paddler upright and the boat running smoothly.

The arms work together with, and follow, torso rotation in pressing the blade down to the water

When talking about rotation, we need to differentiate between lower and higher components. Lower rotation refers to use of the hips, higher rotation refers to the shoulder motion or 'shoulder swap'. Each component has its own characteristics. Working in harmony with the rotation, the paddler drives with the legs one after the other (almost like 'running in the boat'), which generates additional power to each stroke. Rotation takes advantage of the large, durable back and trunk muscles to preserve energy in the smaller muscles such as the upper arms and forearms.

8.5 THE STROKES IN THE RECOVERY PHASE

8.5.1 THE EXIT PHASE

The exit is a continuous part of the stroke and follows after the power has been applied. The exit phase starts from the point at which the blade begins to be extracted from the water, and finishes when the blade completely leaves the water (about level with the hip when looking from the side) and starts the 'air transfer phase'. By a slight twist of the drawing wrist and led by the lower arm the blade will slip out of the water sideways and upward with the least amount of resistance. The blade quickly leaves the water by 'snapping' the on-side draw wrist upward, followed by the forearm, then elbow, then shoulder lifting. The paddle swings upwards quickly by lifting the exiting hand to forehead level. At the end of the exit the paddles are rotated using the 'controlling' wrist fully to position the blade ready for entry in the water on the other side. The aim at the exit is to avoid any resistance or lifting water. The exit must be smooth, quick and clean.

8.5.2 THE RELAXATION PHASE (AIR WORK)

During the relaxation phase the shoulders are comfortably lowered, most of the muscles are relaxed especially those which are responsible for power transmission. Correct bbreathing takes place through forced exhalation fol-

FIG. 8.4

lowed by 'automatic' inhalation. A quick snap of the wrist swings the paddle upwards, and when the on-side hand moves above the shoulder the hands change roles from on-side hand to off-side hand. During this period the paddler rotates the paddle shaft left or right near the top of the air work to prepare the blade for the next catch. The recovery phase must be fast and smooth enough to minimise deceleration between strokes.

8.5.3FIRMING (PREPARATION FOR THE NEXT STROKE)

At the end of recovery the paddler's whole body needs to be firm, ready for the next catch. This is achieved through forced exhalation followed by automatic inhalation, expanding the chest muscles to give the torso and back muscles firmness again.

8.6 THE LEG WORKS

The legs provide a large amount of propulsion to the stroke. The continuous cycle of leg extension and flexion must be synchronized with the trunk and arm work. At the catch, the on-side knee flattens out at the same rate as the arm pulls. Imre Kemecsey, a well-known expert, believes correct leg-work is essential for good technique:

- edge the boat to lean it onto the on-side (do not allow the kayak to slide);
- the on-side leg stretches out from the footrest vigorously while the heel presses down into the hull;
- the gluteus muscles are contracted on both sides (but less on the off-side) to keep a strong connection between the athlete, seat and boat;
- the off-side hip is rotating forward;
- the off-side foot is pulling and lifting against the footrest strap.

FIG. 8.5

FIG. 8.6

FIG. 8.7

8.7 ADVANCED TECHNIQUE OF KAYAKING

Developing technique is a continuous process as an athlete progresses through the sport. Refinement is needed when the athlete becomes physically stronger, fitter and able to paddle at higher stroke rates. Each of these elements will have an impact on the paddling technique. Some athletes need years of focused practice to understand and execute an advanced technique in order to reach their fastest speed. The strength of back muscles, a swinging and rotating trunk and a fixed blade in the water, pulling the boat passed the paddle all combine to achieve the highest speed. In addition, we need to consider the correct angle of the paddle at various points in the stroke, the smooth and continuous forward motion of the boat, all reliant upon the paddler's body movement and coordination.

When teaching kayak technique the coach should

FIG. 8.8

FIG. 8.9

FIG. 8.10

concentrate on developing an understanding with the athlete of what is trying to be achieved. The overall aim of technique is to achieve the highest speed as economically as possible. Once the paddler can use the least amount of energy to paddle a set distance at a given speed, the 'new' available energy can be used to travel at a higher speed than previously. In order to do this there must be a close link between learning to control and feel individual body parts, muscles and muscle tension and understanding the overall aim. Therefore, to make progression with technique, the coach must make the aim clear to the paddler.

The currently accepted modern, common and uniform technique in kayaking is based on trunk-swinging or rotation. Basically, all high-level athletes have mastered the execution of this technique. Since the wing blade was introduced in 1986, kayaking technique has became quite uniform at high level. The principles of the modern kayak technique are described as follows:

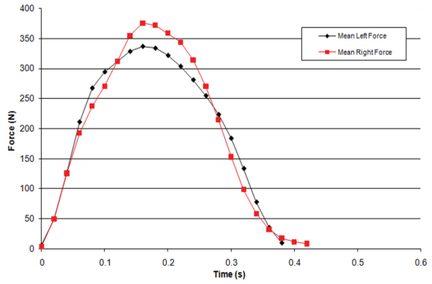
The blade needs to be fixed in the water. The paddler needs to find the water resistance behind the blade. The paddler braces the body on the fixed paddle using strength and 'swings' the body around and beyond the paddle, rotating the shoulder and hip and moving the boat forward to the next supporting point. The boat and paddler move towards the supporting point (the fixed blade) in the water then leave it behind. The force is applied in order: start on the footrest; stretch out the leg; hip; on-side trunk; on-side shoulder; active pushing and passive pulling arm.

The strokes should be performed in a symmetrical motion along the centre-line of the boat. The action of left and right strokes forms the "stroke's cycle". Symmetry between the left and right strokes of the cycle is very important. A totally symmetrical stroke is the ideal, but in practice is non-existent. Paddlers have different levels of power and skill on their left and right sides, but as a rule the closer the two sides are to being symmetrical the faster the boat will go.

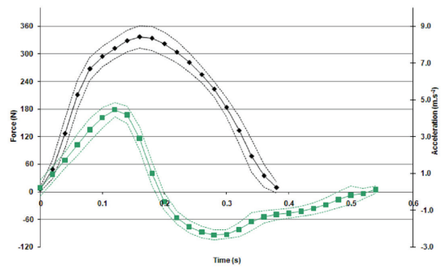
It is essential that this asymmetrical effect is taken into account, not only because of the differing tension on each side and the resulting propulsion forces, but and above all, because it hinders the boat's gliding: *"An unbalance in the forces applied to both sides, causes a reduction in the linear gliding of the boat." (Marek)*

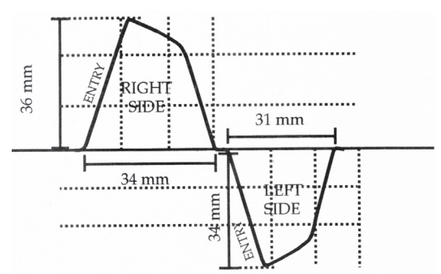
The following diagram shows one left and one right hand stroke. The force on the right side is approximately 50 N stronger than the left! This characteristic is found in most athletes because one side is dominant. Not only that, balance can be better on one side than the other. Focusing on improving (in this case) the left side stroke would increase the speed of the kayak.
The characteristics within each stroke also deter-

Force diagram of the right and left hand stroke



Left stroke force and boat acceleration





mine the acceleration of the boat! We can see in the graph below that the force during the entry phase determines the acceleration of the boat. The greater the force and the quicker the speed at which it is applied (the power), the quicker the acceleration and the higher the speed.

Path of the paddle:
Not forgetting that in reality the boat moves passed the paddle, just for a moment if we take the kayak as a reference point, the paddle appears to move backwards and away from the boat. This 'lateral-back' movement is in fact caused by a turn of the paddle around a point located on the shaft, near the pushing off-side hand.

The on-side pulling arm follows an outward and backward movement away from the boat and the body. This movement is due to an elevation of the arm, bringing the elbow away from the trunk, taking the hand outward and rotating the shoulder. As this happens, the forearm begins to turn, bringing the thumb to the inner side. This helps to release the blade quickly from the water, producing a rapid recovery and the positioning the blade ready for the next catch.

The speed of the blade's lateral movement is mainly due to the action of the on-side pulling arm. The off-side pushing arm is maintained in the same plane, parallel to the water surface. This keeps the blade under the water. The opposing forces on the paddle from the on-side pulling and off-side pushing arm causes the paddle shaft to bend. The paddler should try to bend and 'break' the paddle during the stroke! During the exit and recovery the torsion in the trunk is moving the blade since the on-side arm is fixed relative to the trunk and only elevates the blade. The trunk movement should be dynamically executed. The backward movement of the blade is due to the rotation of the trunk (torsion). The hips begin to turn over the seat to accompany the torsion action.

FIG. 8.11 THE PATH OF KAYAK PADDLE

FIG. 8.12 THE PADDLE HAS VERTICAL POSITION AND THE PULLING-PUSHING FORCE BENDS THE PADDLE SHAFT BETWEEN THE HANDS

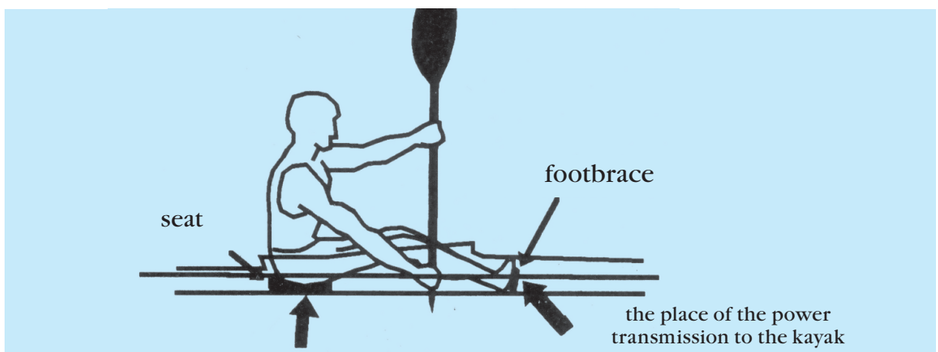


FIG. 8.13 THE PATH OF KAYAK PADDLE

Snaking movements
Each stroke produces torque that pulls the front of the boat from one side to the other. To correct this movement the paddler has to squeeze the boat straight with the body through the hips, compressing the 'water wall' at each side of the boat. The effect of this will be to reduce the amount of 'snaking' movement of the boat.

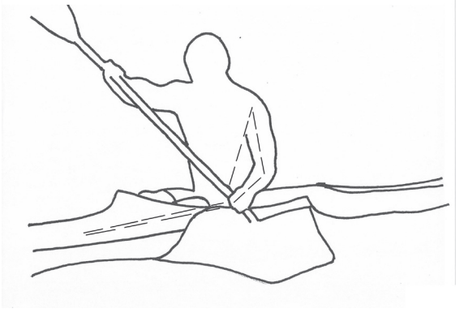
FIG. 8.14 - BENDED BOAT AT FIRMING PHASE

Legs
When the off-side leg is extended the on-side leg begins to flex accompanied by the forward movement of its hip. This movement is dealt with more fully in the advanced kayak technique section below.

8.8 THE FOLLOWING PART IS ADAPTED FROM IMRE KEMECSEY:

"Inner Structure of Kayak Technique"
An extremely useful way to improve and work on the details of technique such as the catch, draw, recovery and air-work is to consider a series of Power Circles within each stroke. In practical terms, the Power Circles and the glide of the boat need to be analysed and improved at the same time. The glide of the boat is crucial and takes priority when improving technique. For example, it will often be the case that although the catch visibly improves, the boat bounces more or slows down a great deal during air work.

FIG. 8.15 -



POWER CIRCLE 1
The Power Circle 1 is "responsible" for good water catch. Lock the blade and glide

Power Circle 1 (PC1) is best observed from a side view. This circle concentrates the paddler upon lines of forces travelling between the on-side hand to the on-side footrest to the on-side hip and back to the on-side hand. This forms a structure which changes shape though the stroke, but the forces within it stay 'connected' throughout the power transmission phase of the stroke

PC1: Begin from the foot-rest on the pulling side ➔ straightening, contracting on-side leg ➔ on-side hip ➔ on-side trunk muscles ➔ on-side pulling arm/hand ➔ and return to the on-side foot.

- Compression: contracting leg ➔ hip ➔ trunk (all on the on-side)
- Tension: on-side pulling arm

POWER CIRCLE 1

- Power from the on-side foot against the foot-rest and the resultant force moves into the on-side hip
- The on-side hip compress against the seat and the resultant force moves up to the on-side shoulder
- The on-side shoulder is „locked" against the paddle
- The on-side hand, counter-balanced by the lower body compression pulls against the fixed paddle to propel the boat forwards
- The circle is completed when the off-side foot starts to press against the foot-rest

POWER CIRCLE 2
Power Circle 2 is "responsible" for the upper body rotation and the arms and shoulders connection with paddle

PC2: The connection between the on-side pulling hand/arm ➔ on-side shoulder ➔ off-side supporting shoulder ➔ off-side supporting arm/hand ➔ through the shaft and returning to the on-side pulling hand. Imagine the kayak stroke with a single bladed paddle as in the canoe! Both arms and trunk work together as one, with the arms transmitting power though the shaft. This PC is based around the chest/shoulders remaining an equal distance from the paddle shaft, and is the main rotational structure. In fact, in this PC the on-side and off-side shoulders and off-side arm remain fixed in relation to each other.

- Compression: on-side shoulder ➔ off-side supporting shoulder ➔ off-side arm
- Tension: on-side pulling arm

It is very important that compression is present in all Power Circles. They all help to increase the tension in the pulling arm. Tension is present only in the pulling arm in PC1 and PC2. The upper arm bends the shaft forward. All the other parts of the body support this work. After practising the Power Circles, all aspects are automatically "put together" to "serve" the pulling arm. It is not about holding the elbow too high or too low or doing poor or too much legwork. Even though the rotation of the trunk differs with each athlete, this, along with the athlete's balance improve significantly.

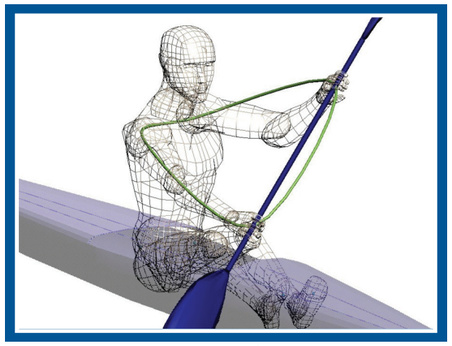


FIG. 8.16 -

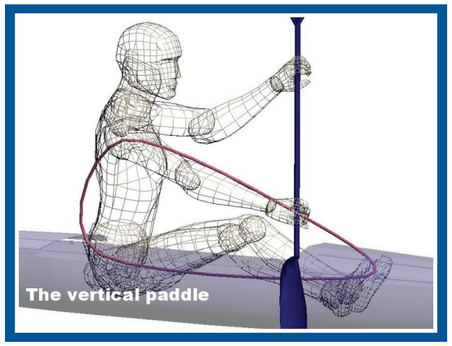


FIG. 8.17 -

POWER CIRCLE 3
Power Circle 3 is "responsible" for leg work

PC3: Legwork. Good legwork is made up of various kinds of movement and movement patterns. This PC focuses on the forces acting through the two legs and hips, connected with the foot-rest and the boat, which together form a solid base for the paddler.

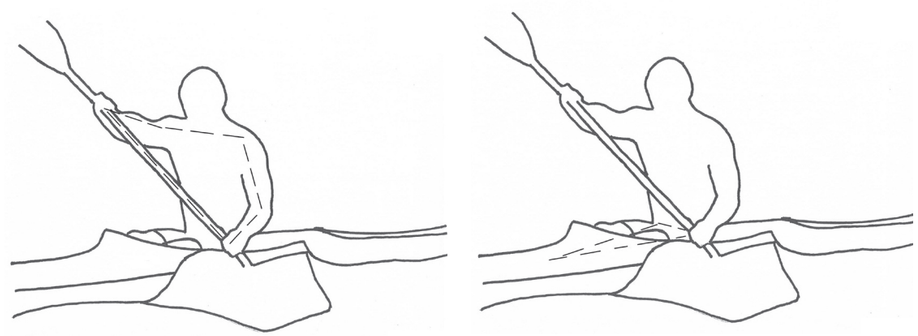


FIG. 8.18 -

A description of this phase by an elite athlete:
"When I was paddling PC3, I pressed my heel down (on the extended leg) and I felt very powerful. I felt I was really getting my full glide. Afterward my heels were sore, from the pushing down on them so hard. It was easier for me to control my boat, but as soon as I let up, or wasn't completely using PC3, everything else fell apart. It's impossible for me to get a powerful "locked" blade for my "swing" from stroke to stroke without a strong base. The PC3 also gave me more balance to be aggressive in my boat, both on the footboard and with my paddle (again 'locking')."

- Compression: straightening and contracting on-side leg ➔ on-side hip ➔ off-side supporting hip ➔ return to the on-side foot against the foot-rest
- Tension: none in this PC

When practising this PC, the paddler should concentrate on the heel pressing down on the on-side and also the 'hip-flick' from side to side.

POWER CIRCLE 4
Power Circle 4 is "responsible" for hip rotation

PC4 can be analysed from front and back views. With the blade locked at the catch the on-side torso muscles transmit force through the body to the off-side hip to move the boat forward and to create more support for the power transmission phase.

➔ blade fixed in the water ➔ on-side pulling shoulder ➔ off-side hip ➔ return to the blade fixed in the water

- Compression: blade in the water ➔ shoulder on the pull side ➔ hip on the support side ➔ "back" to blade in the water
- Tension: none in this PC

When watching the best kayak paddlers one can see that their trunk is flexible but at the same time holds the structure of technique very firmly and transmits the force into the boat. Imagine the lines of force from the paddle to the shoulder and the shoulder to the off-side hip are an inverted "V" of carbon fibre rods. Consequently, the motion is like that of a penguin or someone walking on stilts.

However, the motion of the penguin or walking on stilts are in a way different from kayaking because when paddling it is both stems of the inverted "V" that support each other from the catch and during power phase till exit. Put another way, the blade in the water is pressing the boat against the 'water-wall' or wake (one stem of the inverted "V") and at the same time, the 'water-wall' at the side of the boat presses the water back (the other stem of the inverted "V").

POWER CIRCLE 5
Power Circle 5 is "responsible" for trunk rotation and glide the boat

When athletes were practicing it, it seemed that all parts of the body sooner or later found the most efficient and at the same time most comfortable position, height, ratio and direction of compression and tension. However, it takes month for this to become a reflex. It also takes months of practicing the power circles to get them built into one's technique.

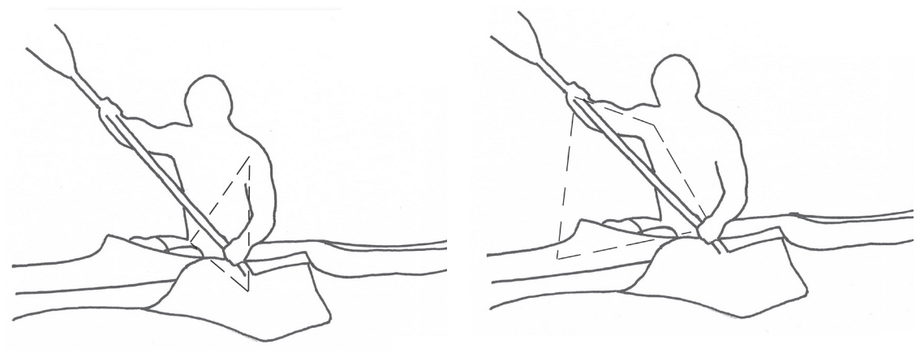


FIG. 8.19 -

Keeping the top arm and shoulder in the correct relationship from one stroke to another and ensuring that the arm is just a part of the rotating trunk structure, linking this to the boat through the stroke side foot.

Compression:
foot board on the pulling side ➔ straightening and contracting leg ➔ hip shoulder on the support side ➔ supporting arm ➔ hand ➔ "back to the foot board on the pulling side

Tension:
none in this power circle

The part of power circle #4 which goes from the shoulder on the pulling side to the hip on the opposite side is like a thin and flexible carbon-fibre rod. Power circle #5 goes from the hip on the pulling side to the shoulder on the support side, crossing the flexible but in one direction very rigid rod of power circle #4.

Practicing:
„synchronizing" the stretching out leg with the support arm

Summary of Forces
- On-side torso rotation forward then
- Off-side torso rotation backward
- On-side arm reaches ahead
- Off-side behind, elbow bent and slightly above shoulder, hand just below top of head
- Extra counter rotation to increase potential energy
- Firm muscles in preparation for catch

Advanced kayak technique has to fulfill the following requirements and/or feelings. These following points are the "First 10 commandments"!

We need to add images and feelings to the "First 10 Commandments". These are the "Second 10 Commandments":

The following summary describes the principles of advanced kayaking technique by explaining how the very best paddlers 'feel' or 'sense' the whole movement.

1ST 10 COMMANDMENT

1. Trunk and hip rotation are the driving forces (pre-tension)
2. Keep the shaft parallel with shoulders
3. Lock the blade at the water catch
4. Put body weight onto the paddle
5. Keep the paddle vertical as much and as long as possible during a stroke
6. Forced legpress
7. Accelerate the speed of the boat through the stroke
8. Power circles
9. Dynamic movements
10. Rotate lower body horizontally

2ND 10 COMMANDMENT

1. Bend the paddle's shaft on each strokes
2. Support the end of the stroke by hip
3. Compress the opposite side of the boat
4. Edge the boat to the pulling side
5. Gliding through the water
6. Rotate your lower body towards the blade
7. Twist stroke side shoulder forward from that support
8. Don't sit down during air-work
9. Boat and body lifted up-feeling
10. "Walk on the surface of the water with

SUMMARY OF ADVANCED KAYAK TECHNIQUE

- Find fixed support in the water
- Hang on the paddle and swing
- Edge the boat at the same time with forced hip rotation into the water-wall
- Forced legwork
- "Lift up" the boat
- Walk on the water - "Do not sit down"
- Be a dolphin!

8.9 COMMON MISTAKES IN KAYAK TECHNIQUE

During the catch:

- Curving the back forward (Dorsal flexion).
- Knees apart, possibly in contact with the cockpit.
- Leaning too far forward or leaning backwards.
- Paddle immersion too slow: a lot of time is wasted in reaching the vertical position with the paddle
- Paddle immersion is weak, soft, gentle: a lot of power is wasted
- Paddle immersion is not deep enough: power potential is wasted (paddler produces splash
- On-side pulling arm is too bent: the stroke will be shorter forcing the off-side hand to rush forward; the arm muscles get tired sooner
- A bent wrist: cause unnecessary strain and reduces power transmission
- The torso is not rotated: means a shorter and weaker entry making it difficult to transmit power well
- Before the blade is fully immersed shoulder and hip rotations start: less force on the paddle, reducing power transmission; too much splash; incorrect paddle angles
- Paddlers transfer centre of gravity from side to side: the boat rolls from side to side producing more surface resistance which slows down the kayak
- The torso doesn't rotate but moves forwards or to the side: results in a rocking motion which slows the boat.

During the draw:

- The angle of the paddle (looking from the front) is too great/small: adversely affects power application and blade orientation, e.g. angle too small means the direction of force of the paddle pushes the boat too far sideways
- Power is not applied to the paddle: less power transmission, slower boat speed
- The off-side supporting arm is ahead of the on-side pulling arm: creates a very inefficient stroke and weak power transmission
- The hip or centre of gravity moves to the off side: the boat will have greater water resistance because it limps along, which results in a larger wetted surface area;
- The relative change between pushing and pulling arms is too fast: weak transmission
- Torso rotation and leg 'pumping' are not synchronized or there is weak leg 'pumping': produces slower boat speed and an unstable boat
- On-side pulling shoulder pulls up and/or on-side arm is too bent: they will soon tire and the muscles will cramp
- Too tight grip on the shaft: results in fatigue
- The paddler does not create maximum torsion in the trunk, and accordingly the biggest and most powerful muscles of the body are not fully used

FIG. 8.20 - BAD SYNCHRONISATION IN K4

- Guiding the off-side hand upwards or downward, above or below the head: a significant reduction in force applied to the paddle
- Pushing with the off-side wrist flexed: excessive tension in the wrist
- Extension of the off-side pushing elbow: causes the paddle to lose the vertical line
- The trunk and arms do not work as a single unit during the draw phase: reduces the force applied to the paddle.

During the exit:

- On-side arm or shoulder continues to move backward too far: the paddle acts as a brake and prevents the gliding motion during the recovery phase
- Boat tips as the paddler loses balance to the off-side: increases surface resistance and slows the speed
- On-side shoulder and elbow start to lift instead of the wrist: the shoulder becomes tight
- The paddle lifts up water: pulls down the stern

During the recovery phase:

- The muscles are not relaxed: leads to fatigue
- The paddle is not rotated enough: produces an inefficient blade angle (in relation to the boat) for the next catch
- No exhaling and/or inhaling in this phase: lack of oxygen and poor rhythm

Firming:

- Muscles are not firm: the catch and draw will lack power
- There is no air held in the lungs: weak contraction (body not firm) and poor oxygen supply
- The torso isn't in the required rotated position: reduces potential for a strong catch

CHAPTER 9
CANOE TECHNIQUE

INTRODUCTION

Kayaking and canoeing have many common technical components. However, two major differences when comparing kayaking and canoeing relate to (1) the balance and (2) the steering. The higher centre of gravity in the canoe means less stability than in the seated kayak and the canoe is steered using the paddle making it more difficult than the kayak (which has a rudder) to keep in a straight line. The first part of this chapter details the correct position in the boat for the paddler and the basic principles of movement throughout the stroke, which form the basis for any advanced technique or style.

9.1. THE KNEELING POSITION IN C1

The first task in canoeing is to ensure the correct kneeling position to provide the optimum stability in the canoe. The knee of the supporting leg is placed in the knee-block, which may be just to one side of the centre-line of the canoe. The centre of support of the knee may be 2 - 3 cm 'off-centre' towards the on-side and just behind the centre point (from bow to stern) of the canoe. This position causes a slight elevation of the stern when the boat is stationary. The feet and the kneeling knee should lie on the vertices of a triangle. This 'narrow and long' triangle forms the base that determines the paddler's balance and stability. Some paddlers use a foot-brace on the rear foot (possibly with a heel strap) with the toes resting on the floor-board in a curled up position, which fixes the foot firmly to the canoe and thus adds to the support. This position make the paddler more "safe" but could have negative effect in the way of remain the bodyweight in the boat and not on the paddle.

FIG. 9.1 - IN MEMORIAL, GYORGY KOLONICS (HUN), C1 AND C2 OLYMPIC CHAMPION AND 15 TIMES WCH

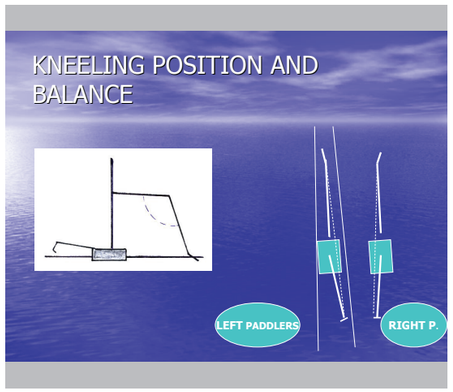


FIG. 9.2 - LEFT AND RIGHT HAND PADDLER POSITION IN CANOE

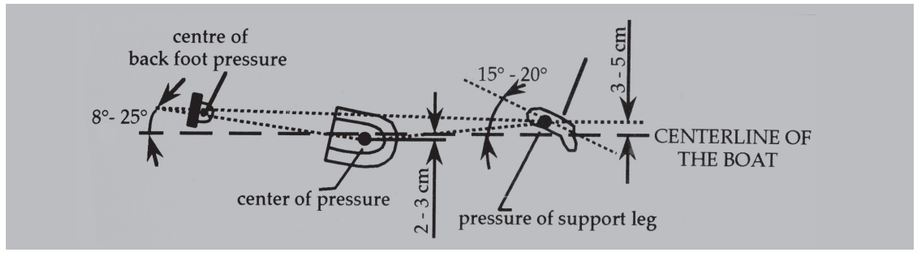


FIG. 9.3 -

The position of the front foot is also important, with toes turned slightly toward the paddling side. This foot can change position from time to time to lean the boat to one side during a turn, when 'wash-hanging', or in a strong side wind etc. Many canoe paddlers place a non-slip surface where the front foot is positioned because the front leg needs to push and it is necessary to prevent forwards sliding of the foot during the stroke.

The position of the off-side front leg can vary from 95°-120° at the knee. A narrower kneeling distance provides less stability, but the paddler is also less likely to push down the bow of the canoe when paddling.

9.2 THE POSITION AND POSTURE IN CANOE

Generally speaking the paddler's centre of gravity should be at the centre (from stern to bow) of the canoe. Slight departures from this rule are sometimes necessary due to body height or weight. Paddlers who are tall or heavy should kneel slightly behind the boat's centre, whilst lighter paddlers should kneel slightly ahead of the centre. The correct kneeling position in a canoe is determined by observing the waterline of the boat or the so-called trim. This must be done during paddling at full speed.

9.3 BALANCE

As already mentioned, one of the major difficulties in learning to paddle a racing canoe is the balance due to the high centre of gravity of the paddler and the small points of support through the knee and feet. Children tend to learn canoeing more quickly because of their smaller size (lower centre of gravity) and their ability to acquire new skills. Good balance simply comes with much practice by completing many kilometres of paddling!

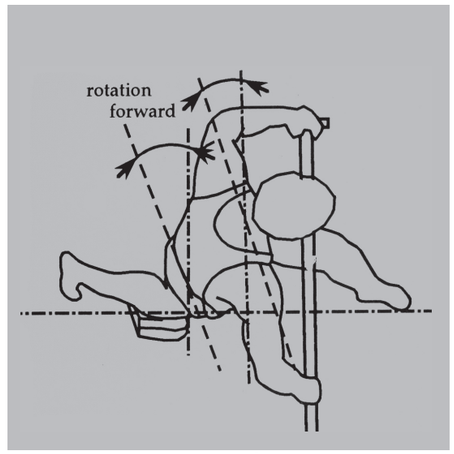


FIG. 9.4 -

FIG. 9.5 - A. DITTMAR RELAXED POSITION

9.4 THE ELEMENTS OF CANOE STROKES IN THE POWER-TRANSMISSION PHASE

9.4.1THE CATCH (ENTRY)

The first movement of the power transmission phase is the catch or entry. Utilising a dynamic swing from the preceding recovery and adding power, the paddler thrusts the paddle at an acute angle (looking from the side) into the water and close to the hull. The catch begins when the paddle is fully extended away from the paddler and the blade's edge comes into contact with the water and it ends when the blade is totally submerged beneath the surface. At the beginning of the catch, the torso is reaching forwards; the whole body is rocked forward on the knee-block. The body's centre of gravity is lowered. The paddler's back and off-side top arm, the paddle and the on-side pulling arm form a capital 'A'.

FIG. 9.6 -

FIG. 9.7 -

FIG. 9.8 -

At the end of the catch, the paddle should be in a vertical position. Once the paddle in this position it should be held there until the steering begins. The force, speed and direction of the paddle at the catch determine the speed of the boat. For the highest speed, it's necessary to reach the vertical, most effective position of the paddle in the shortest possible time. At this point, the torso is leant and rotated forward. The on-side pulling shoulder is lowered, with arm stretched forward and trunk rotation near its maximum (chest turned away from the on-side, back facing the on-side). The blade is next to the boat. The muscles are firm from the moment the paddle reaches the water surface to the point at which it is fully submerged.

The catch is of paramount importance in the stroke as it is the main means of power transmission. At this moment the greatest amount of power can be transmitted into the draw. At the instant prior to contact with the water the trunk rotates energetically, hip pushes ahead, and the upper body leans forward with arms stretched although the off-side supporting arm may have a slight angle at the elbow. The on-side shoulder is forward; the off-side shoulder is up and back above the ear. This position enables the paddler to put his body weight on to the paddle for optimum power transmission. This must be accomplished by using both the arms, pressing the paddle down. Now the powerful pressing down shifts the body weight from the support leg onto the submerging paddle. Consequently, the paddler doesn't push the bow down on every stroke causing "bobbing or rocking". The result is a smooth, uniform and efficient glide through the water.

FIG. 9.9 -

FIG. 9.10 -

FIG. 9.11 -

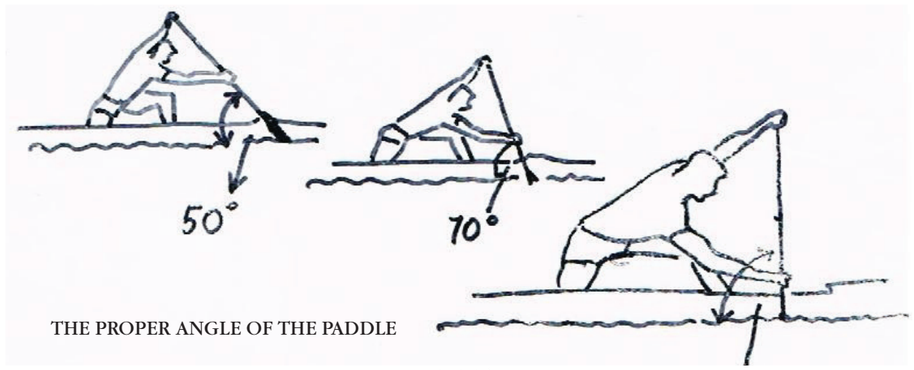
FIG. 9.12 -

9.4.2 THE DRAW (POWER APPLICATION PHASE)

FIG. 9.13 -

The draw follows the catch as a continuous integral part of the stroke once the blade is fully submerged. The on-side shoulder moves backwards (in relation to the boat) with a straight arm. Simultaneously, the rotation of the shoulders begins so at the completion of the draw the off-side shoulder is forward, whilst the on-side shoulder has moved backwards. The paddle is held in a vertical position for as long as possible. The draw provides longest part of the stroke for power transmission. During this sub-phase the arms press down on the paddle while the trunk gradually lifts back up to an upright position in time with the paddle movement.

At the end of this phase the hand of the pulling-side is still in front or with level of the steering knee at normal condition (wind), with the paddle forming an approximate angle of 45°-50°.



THE PROPER ANGLE OF THE PADDLE

FIG. 9.14 -

FIG. 9.15 -

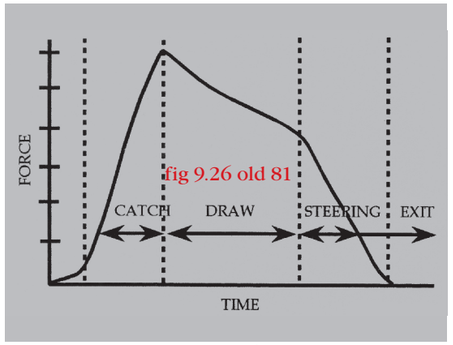


FIG. 9.16 -

9.4.3 STEERING – CONTROL OF CANOES

Every draw in the single canoe finishes with a steering motion. For a beginner this is usually a difficult task, so it must be practiced until it becomes a dynamic and fluid extension of the draw and does not make the stroke 'sluggish'. Paddlers must develop a feel for the correct amount of steering necessary to keep the canoe in a straight line, or to turn it in the desired direction.

Steering is a barely visible movement with advanced canoeists, yet it constitutes a vital subphase of the stroke. It occurs at the end of the draw and without it there would be differing forces acting upon the canoe because it is paddled on one side only. In other words, the canoe would not move in a straight course, but would turn gradually in a large circle!

Steering controls the direction of the boat by a "J" movement (looking from above) with the paddle. Towards the end of draw, the blade moves away from being perpendicular to the hull (looking from above) to and angle of 30º- 40º as the result of a slight twist of the paddle "T" grip. In practice, to the paddler it feels like the water is pushed away from the boat by applying pressure on the face of the blade. In reality, however, the steering action pushes the boat through the water back on to its course, countering the torque that acted upon it during the catch and draw. The steering and exit should occur before or level with the on-side knee. The angle of the twist on the "T" grip varies with the speed and design of the boat, and with water and wind conditions. The blade should remain in the water until the boat's centreline becomes parallel or returns to the direction of movement. With experience, the paddler learns to feel exactly how much pressure to apply on each steering stroke

The point at which the paddler steers the boat will be adjusted depending upon wind direction and speed. The closer the blade is to the boat, the more effect it will have on controlling its direction. The steering motion is always a smooth dynamic and integral part of every draw, yet due to its intricacy it must be taught separately to the beginner.

Although steering always requires extra effort of the paddler, it should be as slight as it can be in order to keep the boat in the required direction. The steering produces a higher or lower loss of speed at the end of the stroke. At one time when canoes were wider, paddlers sometimes used the gunwale as a brace but now, with much narrower boats, the paddle doesn't usually touch the boat

9.5 THE RECOVERY PHASE

9.5.1 THE EXIT

The exit is a dynamic movement with both arms pulling the paddle out vertically and laterally. The exit immediately follows the steering motion. The blade swiftly emerges from water. When the blade is in line with the on-side knee, the off-side arm pulls up the paddle, whilst the on-side arm swings it forward with a 'throwing' motion. Just before the exit, the on-side pulling hand touches or is very close to the hip. Remember, the boat moves to the paddle so in practice the hip moves energetically to the hand helped by the forward torso rotation. If no steering is required (e.g. in a team boat) the paddler should not exit with a "J" stroke, but should continue the stroke in the draw phase until exit. The on-side pulling hand can remain under or over the boat gunwale.

9.5.2 RELAXATION

The paddle travels out of water from the exit to the next catch. The paddle exits as the trunk is up right, which then starts rotating forward simultaneously with the upward movement of the exiting paddle. The main emphasis is on muscle relaxation and breathing in this phase.

9.5.3 FIRMING

During this last part of the recovery, the paddler holds the inhaled air so that the chest is expanded giving the whole musculature the firmness necessary for a strong transmission of power at the catch. Firming is the preparation phase for the catch.

FIG. 9.17 - RELAXATION

FIG. 9.18 - RELAXATION BY V. MENKOV WCH.

FIG. 9.19 -

9.6 THE EFFECT OF CROSS WIND ON THE CANOE

In effect, a cross wind adds to the torque on the canoe requiring the paddler to steer with more or less force. In this situation the paddler can lean the canoe (by shifting the off-side support leg) into or away from the wind depending upon which side it comes from. Tilting the boat increases the wetted surface on one side, and therefore the resistance but this counter-acts the torque from the wind, making it easier to steer the boat.

A right side cross-wind is advantageous the right-sided paddlers and a left side cross-wind helps left-sided paddlers. If the cross-wind is very strong it will be disadvantageous for both sides.

9.7 ADVICE FOR TEACHING CANOE' TECHNIQUE IN TWO PHASES

Phase 1: Beginners
Only concentrate on the basic movements that enable the paddler to balance and control the boat.

Phase 2: Advanced athletes
Emphasise body rotation, leaning and moving the centre of gravity. Keep the body weight on the paddle!

1. Basic Position	2. Raech forward	3. Drive trough	4. Steering
			
USE A VERY LOW KNEE PAD; KEEP THE VERTICAL POSITION; YOU CAN PUT EXTRA WEIGHT IN THE BOAT TO GAIN BETTER BALANCE	BRING YOUR PADDLE FORWARD BY YOUR ARMS ONLY - FIRST NOT FURTHER THAN YOUR FRONT FOOT; KEEP YOUR BODY IN THE BASIC POSITION;	FOCUS ON YOUR BALANCE; MINIMISE POWER PRESSURE ON THE PADDLE; PUSH THE BOAT FORWARD TO THE PADDLE - NOT THE PADDLE MOVES TOWARD TO THE BOAT.	GENTLY CONTACT THE PADDLE WITH THE BOAT RAIL; TURNE THE BLADE AWAY FROM THE BOAT BY BOTH ARMS AS A "J" KEEP THE PADDLE IN THE WATER UNTIL THE BOAT RETURNES STRAIGHT;

5. Rotation	6. Flex forward	7. Knee push & trunk lift	8. Steering
			
EACH STROKE START WITH TRUNK AND HIP ROTATION FORWARD - WHILE YOUR BACK AND LEGS ARE STILL IN STRAIGHT LINE;	FLEX-LEAN-FORWARD WITH ROTATED SHOULDERS FROM YOUR HIP POINT AT THE ENTRY PHASE; PADDLE SHOULD BE VERTICAL;DON'T SUPPORT YOUR BODY WEIGHT WITH YOUR FRONT LEG INSTEAD FALL TOWARD THE WATER. PUT YOUR BODY WEIGHT ONTO THE PADDLE;	PRESS THE PADDLE DOWN IN VERTICAL POSITION WHILE PUSH THE KNEEPAD TOWARD THE PADDLE RE-ROTATE YOUR SHOULDER AND BRING YOUR TORSO INTO UPRIGHT POSITION, START WITH THE LOWER BACK, THEN MIDDLE BACK TO FINISH THE SHOULDERS;	SAME MOVEMENT TO THE P.4 BUT FASTER AND PROPER TO CUT THEN THIS TIME AND AVOID TO SLOW DOWN THE BOAT TOO MUCH; USE THE RAIL AS A FULCRUM POINT;

FIG. 9.21 -

9.8 ADVANCED CANOE TECHNIQUE

Canoeing technique has developed over the years. We know of different descriptions of canoe techniques but on closer examination we see that almost all elite athletes apply the same basic technique principles.

In the last few years, since the minimum width requirement was removed canoe technique has changed significantly because athletes are now using very narrow single and double boats. There appears to be one common technique amongst elite athletes. This latest technique combines different elements from previous techniques together with dynamic execution of strokes.

Canoe technique consists of a series of coordinated movements which cause the boat to move forward at the greatest possible speed.

The ideal technique must be performed with a rhythm that matches the stroke rate, and with body 'swing' and constant changing of the centre of gravity. The fundamental aim of efficient canoeing is to glide the canoe smoothly without or with minimum rocking, snaking or bouncing. When the aim is to reach the paddler's highest speed in a short distance, such as the 200m event, ongoing efficiency and economy of effort are less important. However, whatever the distance, the paddler should always move body weight away from the boat and onto the paddle.

Although there have been different recognisable techniques for canoeing, all share the same principle that a changing centre of gravity is essential and this is no different for what has now become an almost uniform technique amongst today's paddlers. Before we look at this latest technique, it is worth taking a brief look at traditional techniques that were practiced for many years.

MODERN TECHNIQUE:
"Dynamic body movement or swing" technque

TRADITIONAL TECHNIQUES:
"Trunk rotation and lifting" technique
"Fixed hip" technique

9.8.1 TRUNK ROTATION AND LIFTING

Following the exit, and during the recovery phase, the trunk lifts up into a high and rotated position in order to transfer the body's potential energy into kinetic energy. All the body weight falls onto the paddle at the catch. Using this motion, maximum force is exerted on each stroke and the boat moves a long way during each stroke. In fact, this technique has formed the basis of the latest "body swing" technique which is performed more dynamically and has a greater role for the hips and legs.

The strokes are deep and long. Paddlers aim to use the equivalent of 90-95% of the body weight through shifting the centre of gravity. The hip and torso are leant forwards and rotated in the catch position and the paddler's body falls deeply before lifting up gradually during the draw. During the recovery phase, the paddler pauses momentarily in order to 'set-up' the catch. A powerful entry together with a strong draw accelerates the boat very well during the power transmission phase but then decelerates through the recovery phase. Care must be taken to keep the recovery phase time short, but without rushing and upsetting the 'glide' on the boat. This technique has been used by most Hungarian and Canadian paddlers.

Within this trunk rotation and lifting technique we can distinguish further how it is executed by way of hip movement: (1) Forwards and backwards only; (2) swinging over the centreline

THE HIP MOVES FORWARDS AND BACKWARDS

At the catch the hip has fallen a long way forward and moved slightly towards the on-side, thereby greatly increasing the paddler's reach, and in turn the length of the stroke. From this position the paddler drives the canoe towards and beyond the fixed paddle by powerfully pressing with the off-side leg and rapidly returning the hip to its position at the end of the draw. The kneeling thigh is vertical again. After exit the paddle swings forward with the simultaneous energetic trunk and hip rotation and the paddlers is ready for the next catch.

With this technique the hip rotates, moves forwards and backwards with a powerful leg press. Care must be taken to never move the hips further back than the vertical kneeling thigh position. The correct execution of this technique requires the athlete to drop the body weight onto the paddle. During the recovery phase, body weight is transferred from the on-side leg to the off-side supporting leg and then to the paddle. Timing is crucial. Body weight must move onto the paddle before the off-side leg presses down to drive the boat, otherwise the bow of the canoe will move down decreasing the speed of the boat.

THE HIP SWINGING OVER THE CENTRELINE

Here, the use of hip movement is more complex.

The hips, as well as moving forwards, swing in a semi-circular path across the centreline of the canoe. The challenge is to synchronise this hip movement with other parts of the body. Just before the catch, the on-side hip is towards the off-side but then returns in a semi- circular, pressing towards the paddle during the draw, and helping to drive the boat forwards. One advantage of this technique is that the hip is further away from the paddle at the beginning of the draw enabling extra power to be transmitted to the boat though additional transfer of the body's potential energy to kinetic energy. This hip movement is seen in latest technique as well.

VARIATION ON THE TRUNK ROTATION AND LIFTING TECHNIQUE

A slight variation to the trunk rotation and lifting technique is where there is greater rotation but the paddlers has less downwards and upwards movement of the torso. With this technique the centre of gravity of the upper body moves simultaneously with the paddle. Throughout the stroke, the paddler maintains a straight line from the kneeling knee through the thigh and up the spine and rotates around this line. The speed of the paddle and the boat is more constant in one cycle and the paddler minimises deceleration during the recovery phase. This variation in the technique provides a smoother glide to the boat. The stroke rate is higher but the strokes are shorter and the boat travels less distance each stroke. During the recovery phase, the paddle stays close to the water and the legs, hips and upper body all move in one line.

9.8.2 FIXED HIP CANOE TECHNIQUE

With this technique the legs and the hips are in stationary. There is less rotation but the torso moves powerfully downwards and upwards. The kneeling position is very wide. It is a suitable technique for tall and muscular athletes. There are fewer possibilities for error and it is easier to learn and teach. Another form when the paddler has narrow kneeling position up to 90°. This technique prevents the boat up and down movement but the peddlers not use the

FIG. 9.22 - THE VERTICAL PADDLE AT DRAW

benefit of the dynamic hip movement.

9.9 THE DYNAMIC (SWING) TECHNIQUE

In this latest development, the most successful paddlers are using a dynamic body swing together with much hip and leg movement, forwards, backwards and sideways, changing the centre of gravity constantly within each stroke to maximise the power applied to the paddle and transmitted to the boat. Almost the entire body moves and takes part in the stroke. Successful execution of each stroke requires very dynamic and well synchronised movements within the whole body. The athlete uses as much body weight as possible, almost "jumping" from the boat onto the paddle and achieving a very strong power transmission phase.

Some paddlers execute the draw with hand gripping below the level of the gunwale. The "Swing Technique" is what we call the **modern canoe technique**!

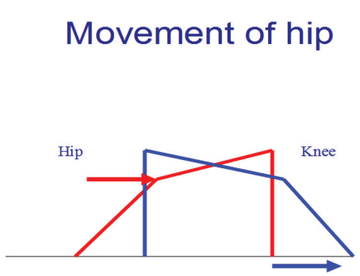
9.9.1 THE CATCH OR ENTRY PHASE

ARMS. The off-side supporting arm is straight and extended vertically over the paddler's head, i.e. the elbow is level with, or just above the top of the head, creating greater torsion in the trunk. The on-side pulling arm is straight and extended close to horizontal. Looking from the front of the boat, the paddle is vertical so the supporting off-side hand is directly above the on-side pulling hand.

TRUNK. The trunk is forwards, low and rotated (with the chest turned towards the off-side). The trunk is close to the thigh of the off-side leg. The on-side shoulder is forward, to achieve a longer reach, whilst the off-side 'top' shoulder twists back at the same time.

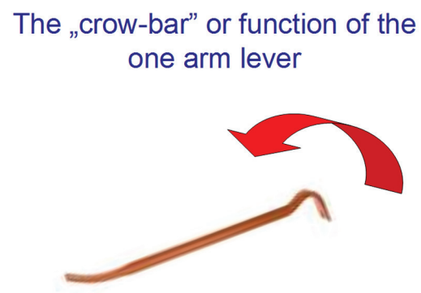
FIG. 9.23 - WATER CATCH BY A, DITTMER OLYMPIC AND WORLD CH.

LEGS. The narrow boats mean the feet and knees are more or less along one line, meaning balance is harder to achieve and makes it more difficult for those trying to learn canoeing. When the paddler is fully extended, the off-side supporting knee is in front of the off-side foot and the thigh is horizontal. The hips are much further forward than the on-side kneeling knee. Most of the body weight has fallen onto the paddle. Even though the off-side knee is well forward of the off-side foot and the on-side thigh is tilted forward as much as 120º, the body weight has been taken off the legs and on to the paddle. This prevents the body weight from pushing the bow downwards.

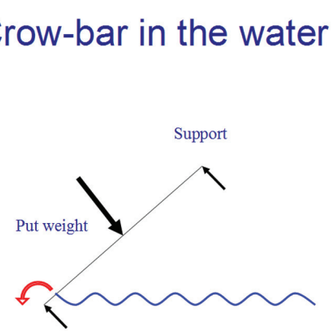


HIP. As an extension of the thigh of the on-side kneeling leg, at the catch the hip is out to the pulling on-side. This hip movement is fundamental to the swing technique. The red line indicates the hip and leg movement at the catch. The blue line shows the angle of the basic hip position in the recovery phase.

The principle of 'fixing the paddle' at the catch (The crow-bar metaphor)
(Adapted from an explanation given by Istvan Vaskuti, Olympic Canoe Champion)



At the catch, the paddler falls or 'jumps' on to the paddle. As the paddle enters the water at an angle, combined with downwards force, an equal and opposite force occurs on the face of the blade, creating 'lift'. The paddle is now fixed and can take on the function of a lever. Imagine the paddler like a pole vaulter, moving upwards and over the paddle taking weight out of the boat, allowing the boat to lift slightly and glide forwards.



VARIOUS STAGES OF AN ADVANCED CANOE TECNHIQUE:

Movement of body parts at the catch:

- Both legs are as far forward as possible
- The on-side hip is extended fully forwards and slightly to the on-side
- On-side hip turned inwards to touches the off-side supporting leg and below the level of the off-side knee
- Trunk is rotated, deep and forwards, with the chest close to the off-side support thigh
- Off-side shoulder draws towards the back of the head whilst the on-side pulling shoulder rises toward chin
- The arms are straight and keep the paddle vertical (from a front view)
- The paddle is at an acute angle to the water (around 500 as viewed from the side)
- Establish the structure created by all the above by locking the blade

FIG. 9.24 - OLYMPIC CHAMPION BRANDEL AT ENTRY POSITION

Execution of the catch – How the paddle acts as a one arm lever:

- The weight and impetus of the upper body,togetherwiththestrengthoftheathlete, 'hit' the water dynamically.
- Body weight moves from the boat onto the paddle.
- The blade enters the water at an acute angle and fixes (locks) and thereby the lever is created.
- Only then will the arms and shoulders press down on the paddle. If the paddle has been fixed correctly, the blade will not move downwards but the paddler will move upwards, giving a lifting force to the boat.
- In proportion to the rising force generated on the paddle the boat is pushed forward and the canoe glides.
- The off-side supporting leg starts to extend and along with the hip drives the boat forward

9.9.2 THE DRAW OR POWER APPLICATION PHASE:

2. POWER APPLICATION (DRAW)

- Keep the blade under the water by pressing it down
- Keep the paddle vertical as far as possible before steering
- Keep the body weight on the paddle
- Bend the shaft of the paddle
- Twist back the hip on the stroke side
- Push the boat forward to the paddle
- Steering

The athlete applies force to the paddle with the on-side pulling arm at the same time as the 'top' off-side arm is pressing down, which locks the blade in position and bends the shaft. Just as in the kayak, the paddler should be told to **try bend and "break" the paddle!**

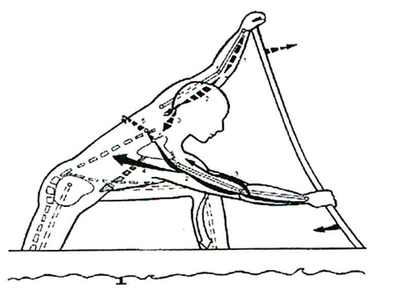
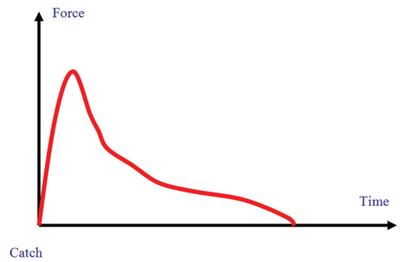


FIG. 9.25 - POWER APPLICATION

FIG. 9.26 - POWER APPLICATION PHASE



AMPLITUDE OF THE ACCELERATION FORCE

9.9.3 THE EXIT

After the draw finishes with the steering movement, the blade leaves the water and there is no force on it any longer.

- The off-side support shoulder starts to lift the support arm, which is nearly straight
- The off-side support hand lifts the paddle from the water
- To take the blade out of the water without braking can only happen if the blade is still moving towards the stern when it exits
- The hip cycle works a little 'in advance' of the upper body so that the hips are already moving forwards when the blade exits the water

9.9.4 THE RECOVERY PHASE

- The air work is led by the hips and legs moving down and forwards, followed by the trunk moving forwards until the point is reached where everything is in position for the catch
- during moving the foot and hip forward the pulling shoulder starts rising the pulling arm, which starts bending at elbow and rises the blade
- as long as the pulling hand will rise forward under the stomach along the side of the boat, the support hand starts out of the boat, so the paddle can easily pass between the paddler's chest and water
- when the paddle passes over the vertical position compared to the boat axe, the support arm will dynamically rise and gets over the water on the pulling side, thus is ready for the next water catch

9.10 SUMMARY OF ADVANCED CANOE TECHNIQUE

3. EXIT AND RECOVERY

- Exit at the hip using both hands
- Clean exit - quick "pops" out
- Relaxation-breathing
- Set up for next entry
- Twist torso and shouders for maximum reach on the paddling side
- Muscles are firm just before next catch

(Adapted from Istvan Vaskuti')

Optimal technique is influenced by:

1. The body type and physical condition of the paddler (size, musculature, strength)
2. The weather and water conditions (wind, waves)
3. The boat and paddle (design, size and form)
4. Racing distance (sprint, middle distance, marathon)

Main Principles of Technique:

1. The blade needs to be fixed (locked) in the water at the entry
2. The body movement of the athlete is in harmony the boat speed, making it glide (imagine pushing a child on a swing - in order to maximise the amplitude of the swing, it is pushed at the top, just as it pauses and begins to travel down again).
3. The air work must be in rhythm with the boat to minimize the deceleration during the recovery phase.
4. The coordination of all these factors

9.10.1 CANOE TECHNIQUE IN DETAILS:

Catch or Entry

1. The lever concept only works if the paddle is fixed at the point of entry.
2. The blade enters vertically (from the front view) next to the boat with a low angle to the water surface (as viewed from the side).
3. The force on the paddle is greatest at the catch.
4. There must be dynamic movement, like a hammer beat!

Body Position at entry

1. Both legs leaning forward fully.
2. The hip on the on-side sinks down under the off-side knee level and moves close to its thigh.
3. The trunk rotates and leans deeply forward, reaching the thigh on the off-side supporting leg.
4. The trunk is fully extend on the on-side but the off-side is shortened.
5. The spine maintains a straight back.
6. The on-side pulling shoulder moves up closer to the chin whilst the offside supporting shoulder moves upwards and behind the line of the back of the head.
7. Both arms are nearly straight
8. The blade is at an acute angle to the water at the catch. Establish the "A" position.

Execution of the catch

- The paddler dynamically 'beats' the blade into the water by using the upper body weight and body-swing.
- As the paddler falls onto the paddle, the shoulders and arms add power to the dynamic body swing motion by pressing down on the paddle. This combination of body momentum and muscular force produces a great impulse with which to glide the boat.
- The power applied to the paddle moves the boat forward in proportion to the amount of power.
- As soon as the catch occurs, the on-side hip moves backwards rapidly together with the off-side supporting leg, which extends. The resultant force drives the boat towards and beyond the fixed paddle.

Power application (draw) phase: 1st part

- Continue the movement/effort begun at entry.
- The athlete presses hard on the paddle.
- The trunk sinks continuously lower.
- The upper-body muscles, including both arms and shoulders keep the blade fully submerged in the water.
- As the boat moves passed the fixed paddle, the on-side pulling shoulder comes level with the line of the kneeling leg thigh.
- Acceleration of the reaches its maximum.
- Having reached maximum power, it then decreases continuously.
- At the end of this 1st part, the paddle is vertical (viewed from all sides)

Power application (draw) phase: 2nd part

- Continue the movement/effort from the 1st part.
- The paddle angle (from the side) moves beyond vertical.
- Leg and hip movement slows down as they gradually return to basic position and lose their ability to push the boat forward.
- The trunk rises dynamically.
- The shoulders still press downwards against the paddle and towards the trunk, maintaining the forward movement of the canoe.
- The 'top' supporting arm moves and presses forward and downward whilst the on-side arm pulls and raises upwards with the trunk.
- As the trunk rises the legs continue to drive the canoe forwards.
- The trunk straightens up (in parallel with the paddle) gradually to vertical or slightly leant forwards.
- The force on the paddle has gradually decreased but the speed of the boat doesn't significantly decrease until the exit.

Exit

- The blade is still entirely submerged at the end of the draw but there is no longer any power applied to it.
- The off-side top shoulder and arm (almost straight) start to lift the paddle out of the water.

- The off-side top arm plays the leading role in the exit with the assistance of the pulling arm, which lifts the paddle up by bending from the elbow.
- The paddle should leave the water without braking the speed of the boat.

Recovery Phase

- The air-work begins with forward movement of the onside hip and off-side supporting leg followed by the trunk rotating and leaning forwards until the blade reaches the entry position.
- The on-side arm moves forward above the gun-whale whilst the 'top' off-side arm moves up and out to the off-side keeping the paddle between the chest and the surface of the water.
- When the paddle reaches the vertical position (as viewed from the side) the off-side top arm lifts dynamically and moves across to establish the vertical position (as seen from the front) of the paddle for the entry.

When thinking of the recovery, imagine the crack of a whip! The whip handle moves up, then is brought down quickly and abruptly stopped, causing the whip to follow and its end to accelerate at great speed and 'crack'. Think of the trunk (with legs and arms) as the handle and the blade as the end of the whip.

9.10.2 SNAKING

FIG. 9.27 - C2 RACE IN LONDON 2012

Each stroke produces torque that pulls the front of the boat from one side to the other. To correct this movement the paddler has to 'squeeze' the boat straight with the body through the hips, compressing the 'water-wall' at each side of the boat. The effect of this will be to reduce the amount of snaking movement by the boat.

9.11 COMMON ERRORS IN CANOE TECHNIQUE

Since the paddle is not fixed at any point to the boat and the paddler has to decide where and how to place the paddle, there is much scope for error. Any errors will inevitably decrease the speed of the boat.

During the Catch:

- The catch is not powerful, firm or quick enough;
- The angle of the blade to the water is too small or too large;
- -The on-side shoulder and/or arm is not stretched forward sufficiently: this causes a short stroke;
- Too much body weight moves onto the off-side support leg, pressing the bow down: causes bobbing which increases the wetted surface area and slows the boat;
- The off-side supporting shoulder is level with or ahead of the draw shoulder: leads to a shorter stroke and the bigger back muscles are not used;
- The off-side supporting arm is too bent and the elbow too low;
- The catch is too far from the hull: leads to an inefficient draw;
- The paddle doesn't enter the water close to vertical (as viewed from the front) because one hand is not directly above the other.

During the Draw:

- Over extension of the supporting shoulder and arm: means the paddle tilts forward beyond vertical (as viewed from the side) too soon within the draw;

- The paddler presses his off-side leg at the wrong time: the bow bounces down and power transmission is not fully used in moving the boat forwards;
- The paddler does not move the hip to the paddle or "sits back ": a very weak draw;
- The back is curved not straight: inefficient power transmission
- Not enough power is applied to the paddle: the whole of the blade does not remain in the water

Steering

- Only one forceful steering action every few strokes which slows the canoe;
- The steering is too far behind the paddler's knee: time is lost;
- The surface of the blade is not fully utilised: steering efficiency is low.

The Exit

- It occurs too late or too far behind the paddler's knee or the blade remains in the water for too long: the 'dragging' blade breaks the gliding of the canoe;
- It occurs too soon (well before the line of the knee): the draw is not fully utilised and the steering is not effective enough at that position
- The torso is not in the upright position: there is no exhalation of air;
- The blade lifts water: push the stern down.

The Recovery Phase

- The paddler lifts the paddle too high: wastes time and slows the stroke rate;
- The paddler does not lift the paddle high enough and the blade catches water;
- The motion is out of rhythm;
- The muscles are unnecessarily tense: no relaxation;
- There is no inhalation;
- The muscles are not 'firm' just before the next entry;
- The hip and trunk do not start to rotate forward ready for the catch position.

CHAPTER 10
TECHNIQUE IN CREW-BOATS

FIG. 10.1 - K4 IN PERFECT HARMONY

INTRODUCTION

Generally, technique in crew-boats (K2; K4; C2; C4) is the same as in the single kayak or canoe. However, as one moves from single to double to four, the challenge is to maintain an efficient stroke. The balance between maximum application of power in the water and maximum relaxation in the air is crucial.

Nevertheless, to create harmony in crew-boats, there are additional factors that we need to take into account such as synchronisation of movement, a higher stroke rate and a different rhythm.

Harmony of two or four paddlers in a boat occurs when each individual's physical, physiological and psychological traits complement those of the other members of the crew. This is achieved by finding the right combination of crewmates. Finding paddlers of similar ability is one of the main principles in establishing a successful crew.

Synchronization demands that every member of the crew is in time from catch to exit without compromising individual style. It other words, each individual's efficiency in the crew-boat should he as good as in the single boat. However, this does require additional skill, because the point of power transmission in the draw phase shifts from paddler to paddler due to faster moving water. This is not as noticeable in doubles but becomes crucial in the K-4 and C-4. The mastery of perfect power transmission in the crew-boats comes only from lengthy and concerted practice. When all phases of the crew's strokes are rhythmical and synchronized, the boat glides smoothly with minimum deceleration between strokes.

FIG. 10.2 - IN PERFECT SYNCHRONY

Physical harmony in a crew-boat is most likely when members of the crew are of similar strength and endurance, and also achieved by trying out different combinations of paddlers and positions in the boat.

Physiological harmony of crew-mates is equally important. Physiological harmony means that members of the crew have similar responses to a given training workload, have similar heart rate levels in relation to the exercise intensity and similar recovery times. If paddlers within a crew are similar to each other physiologically, the training and competitions they take part in together will lead to the best progress possible. However, it is essential when establishing a new crew that members of the crew do not all "hit the wall" at the same time within a race such as 1000m or 500m, causing the boat to slow down

abruptly. Ideally, this "dead point" should occur at different times amongst crew members. They can then "pull each other through" without much apparent change in the boat's speed.

Establishing psychological harmony amongst crew members is probably the most subjective judgement required by a coach and can only be done through getting to know each individual well, and through honest dialogue. It is imperative that crew members trust each other, tolerate each other's idiosyncrasies, and most of all share the same objectives. Only a "one boat, one soul" concerted effort can translate into full physical cooperation and excellence. Even the highest degree of camaraderie will not move a crew-boat fast, but it can certainly assure the best enhance to develop one that will. The common target makes a crew more determinate and motivated. They train and compete for each other.

In establishing a crew, the technical parameters should also be considered. Athletes with similar technique will work together much better, and the shared characteristics of stroke rate and execution of strokes are most important, rather than the style.

FIG. 10.3 - K4 IN PERFECT HARMONY

10.1 TRAINING IN CREW-BOATS

Crew-boat training sessions can be more demanding than in singles. Crew-boat training can be more stressful for paddlers in terms of paying attention to the rhythm, following the stroke and greater physical effort. The success of the session relies upon everyone's condition. Put simply, you may slow down or paddle with less intensity in a single when you feel tired but in a crew-boat session you can't afford to let down the rest of the crew!

The amount of crew-boat training will depend upon paddlers' priorities. If paddlers specialise in K2 or C2, then most of the training should be done in the double boat. The percentage of training in the crew-boat also depends on the time of year. In the basic preparation period athletes should start training in singles and then increase the number of doubles sessions gradually, from 50% to 60% of all sessions to 90% in the racing season. Furthermore, the longer sessions and those of high intensity should be done in doubles, whilst easier sessions should be done in the single. However, the number of crew-boat sessions will also depend upon the history of a pair or four. If the crew have paddled together for a long time they may need less training in the crew-boat and more in singles. Also, exclusively training in crew-boats is usually counterproductive, not only due to physical and mental stress, but because of the negative effect on technique. In the single, the paddler uses more strength in the catch phase, which slightly weakens in the crew-boat due to the higher speed and stroke rate and faster moving water, so with too much training in crew-boats paddling technique will deteriorate. Therefore, after a lot of crew-boat sessions reconditioning in K-1 or C-1 is essential.

The number of training sessions that should be done in K-4 or C4 is complicated by the fact that most crew members also compete in single and/or double. Ideally, a crew-boat consists of paddlers who are only concentrating on that crew so most of their training is together. Generally, to prepare a successful crew, especially a four, may need several years or seasons, although we know of crews that have performed very well after a short time of preparation as they fitted together well.

Although a few paddlers specialise in, and can devote training time to one crew, most athletes as members of clubs or national teams take part in more than one category or distance. However, specialisation is more likely for participation in

the Olympic Games because of the tough qualification process and limited quotas.

Usually coaches "use" the best athletes in more events, i.e. it's common to find the best K1 1000m paddler is also in the K4 1000m crew or K4 members double up in the K2 200m. Often, a K2 crew will take part in more than one distance. Each situation determines the number and type of training sessions in single, double and fours. The programme of races at events also influences the combination of crews. The ideal situation would be to have a different crew for each and every category and distance!

10.2 CREW-BOATS IN KAYAK

FIG. 10.4 -

In the previous paragraphs we discussed criteria for compatibility. Next, we look at technical factors to be considered in selecting crewmates. Importantly, the coach should feel free to experiment with the combinations of crew members and with their positions in the boat without establishing crews on a 'political' basis!

In a well-matched double kayak the front paddler ("stroke") should be the smaller and lighter paddler (if there are major height and weight differences between the two athletes), who has a good sense of rhythm, really understands pacing and tactical aspects of racing and is psychologically strong with a fighting spirit.

The rear paddler should be the heavier, and he or she should have the ability to follow the stroke. If there are two (or more) similar athletes in term of size, power and technique then the 'best' paddler should be the stroke. This is a basic unwritten law in paddle-sport if there are no other factors to consider in selecting the team.

It is important that the two paddlers have identical, or similar styles, and stroke rates. If the paddlers' stroke rates in their singles don't match each other, neither will be able to apply full power. Thus, the combination will not be efficient and successful. It should be noted that sometimes a relatively weak K1 paddler can paddle in a crew-boat successfully if the previously described technical, physiological and psychological conditions are met. More commonly, the two best K1 paddlers will make the best K2 crew as well if the other parameters above also match. If there are limited choice of paddlers the coach can "equalise the stroke rate gap" by giving a larger or longer paddle to the faster paddler.

The front paddler should use the same length paddle as in singles and the paddler at the back should use paddles that are 2cm longer than in K1.
K-4 crew selection has similar considerations. The shortest and lightest athlete is the stroke paddler providing he or she has the qualities described earlier. If there are significant differences between paddlers then as you move from the front to the back of the boat, paddlers will be taller and heavier. But all this is just a starting guide. Experimenting with paddlers in different positions may mean a faster crew. However, the back seat really does call for a tall, strong individual who is efficient with a longer paddle. This is the place where the most strength is needed because the boat speed is more efficiently accelerated close to the stern, which is important at the start, and when increasing pace. One combination that works well is where the first two seats are taken by an existing K2 crew.

The stroke should use the same length paddles as in K1, but due to the faster water flow next to the boat, the 2nd and 3rd seated paddlers should increase paddle length by 2-3cm and the 4th paddler can have a 3-5cm longer paddle.

Every aspect of correct single paddling technique must be strongly emphasized in a crew-boat. In addition to achieving perfect harmony through synchronising movement and having a higher stroke rate, the power transmission phase of the stroke must be as swift as possible to accommodate the fast moving water found behind the stroke. In particular, the catch must be executed even faster and at a more acute angle than in K-1, especially in the 2nd, 3rd and 4th seats, where the paddlers' blade encounters faster moving water. Crew-boat paddlers must be extremely agile and skilful in order to be able to find sufficient resistance in the moving water against which to fix the blade.

The draw also requires extra attention because often, again due to the fast water, the off-side supporting arm tends to move forward prematurely, diminishing the force applied to the blade. The aim is to keep the blade 'locked' throughout the draw.

Similarly, the exit must be faster and earlier than in the K1. This is necessary because of the higher stroke rate and the higher speed of the boat. A dragging paddle will cause considerable braking at high speed.

10.3 CREW-BOATS IN CANOE

FIG. 10.5 - DEEP BODY POSITION AT ENTRY

The main principles of technique apply equally well in crew-boats and in the single so here we focus on the differences between paddling the C-1 and C2:

- The boats are most obviously different in their dimensions (length), although they both follow identical design principles.
- The two paddlers kneel behind one another on the centre line of the canoe. The kneeling knee, feet and legs are more or less along one line, as opposed to the triangular base found in the C-1. The distance between the two paddlers should allow the stern paddler to move freely, without hitting his partner with the paddle. The closer the paddlers can be to each other, the smaller the torque, and therefore the canoe requires less steering to keep it straight.
- Most athletes use the same paddle in C1, C2 or C4. Opinions differ widely on this point. While most canoeists use the same paddle, some prefer a slightly shorter paddle with a larger blade for crew-boats. There has been a trend towards this recently.

FIG. 10.6 - SQUARED BLADED CANOE PADDLE

- Importantly, steering is not needed with every stroke in C2 and C4, but when needed it is done by the stern paddler. In C4 the last two paddlers are responsible for steering the boat. However, in strong cross-winds on rough water or when wash-hanging all the crew will need to assist with steering.
- Since steering is not necessary on every stroke in C2 and C4, the stroke rate is higher than in C1, which means adjustments have to be made to technique. Due to the faster moving canoe, it is more difficult to catch the water at the point of optimum resistance. To facilitate an efficient draw, the catch must be made with a more acute angle than in the C1. It should also be evident that the greater speed in C2 and C4 demands a quicker exit. A force-

ful "striking" catch and accelerated exit characterise paddling style in C2 and C4, and therefore a different rhythm must be closely observed in forming a good crew.

The first question to ask when putting together a C2 crew is who should be the stroke? The stroke should have similar qualities to that of the stroke in a kayak. He or she needs a powerful catch, good rhythm, the ability to exit the water quickly without making "J-stroke", as well as having good balance, experience in pacing and the ability to fight for the lead.

Other factors to consider include which paddler is more able to steer the canoe, which paddler is better at following movements and rhythm, etc. The paddlers' endurance and their point of "hitting the wall" are also important factors in making up a well balanced C2 if there are a number of athletes to choose from. A prudent coach would have a physically stronger and more explosive paddler in the front, and one with more endurance in the back.

The catch must be well synchronized, and the recovery in harmony. Sometimes, the stern paddler has to correct the canoe's direction by steering, thus his or her paddle spends more time in the water. Consequently, he or she has to catch up with the stroke in the recovery phase. If a C2 lacks good synchronization and rhythm it will not run straight and will not have the desired stability. If the stern paddler is late with the catch the stroke" feels as if he or she is "pulling the whole boat alone". Perhaps, synchronization is best achieved when the stern paddler gives an impression of catching the water slightly ahead of the bow paddler.

FIG. 10.7 - DEEP BODY POSITION AT ENTRY

Sometimes even paddlers with different styles can make up a good crew if they complement each other technically and achieve good harmony and rhythm.

Summary of the differences between C1 and C2 paddling technique:

C1	C2
Paddler on either left or right side	Two paddlers on opposite sides
Position of feet and knee forms a long, flat triangle	Position of feet and knee for both paddlers is almost along one line
Steering required at the end of each stroke	Steering only required from time to time for small corrections
Stroke rate lower	Stroke rate higher than C1 by about 10 stroke per minute
A uniform paddling rhythm	Rhythm different due to quicker exit
Optimum speed	10% higher speed
Longer stroke length	Shorter stroke due to earlier exit
Quick catch – blade at acute angle	"Striking" catch – more acute angle
Exit with steering movement	Quicker exit without steering

CHAPTER 11
PROCESS OF SELECTING BEGINNERS AND TEACHING TECHNIQUE

INTRODUCTION

In daily life, we are involved in a continuous learning process, which begins right after our birth. Each day we are conscious of having learnt something else, either through the explanations of some friend, our own experience, the media, our teachers, the club's coach, etc.

As instructors for beginners and, later on, as sporting coaches, we must keep in mind that we will become involved in a combined process of teaching and learning where the aim is to achieve the potential of each individual.

In general terms, we can consider the teaching and learning process as the voluntary transmission of knowledge and experience between two individuals.

This process must not be originated by chance or by subjective decisions or opinions. It must start with the organisation of a group of elements that will define when and how such a process will start and what, how, when and where we are going to teach.

11.1 STAGES OF THE TEACHING & LEARNING PROCESS

The first task is encouraging children to take part in paddling. Recently we can see that interest in participating in sport has been decreasing generally, especially in the well developed countries and in big cities. There are many other popular activities such as TV, video games, internet, listening to music, movies etc. There are some exceptions, mainly traditionally popular and professional sports in particular countries, which can give great financial and/or social status to those who reach a high level. However, it's difficult to find sport-oriented children who like paddling, which is not attractive especially in poorer countries, where daily survival is the main aim.

Paddling is an amateur sport and new or not well known in many countries. National federations, clubs and coaches have difficulties in recruiting youngsters into paddling. Involving girls in paddling seems even more difficult for various reasons, such as cultural, religious or simply because paddling demands a great deal of time must be devoted to training. Its rarely happens that children at early age will choose paddling as a sport. Therefore, we need a system that recruits children into paddling. To be successful we need to find and adapt the best ways of convincing children and parents of the benefits of paddling! Recruitment could be organised via the internet, advertising, connections with schools, personal efforts, introductory events etc. Sometimes, successful participation in Olympics or World Championships draws more attention from the media and TV broadcasting, which increases the interest in a sport. Popularising star athletes can also positively affect youngsters' attitudes towards paddling or other sports.

Possibly, the best way to identify potential in younger paddlers is to select by the so called Talent Identification method. However; because of the difficulties referred to above in attracting children into the sport, we cannot select by only "fishing" in the hoping of catching a big one! Accordingly, upon first meeting children who wish to paddle, it is extremely useful to meet the parents as well. The child's and parents' physical characteristics and attitudes as well as the child's background in sport, will provide great insight into the potential of the child. For example, beginners who have previous experience of swimming training can have an advantage in developing their paddling.

Providing Information to Children and Parents:
It is necessary to inform parents and children of the requirements for taking up paddling, such as the ability to swim, suitable clothing, training times and also number of training sessions per week. It is usual for parents to complete a form declaring any medical issues the child has, the child's swimming ability and the parents' contact details.

The First Training Session
The main aim is to create an atmosphere that is fun to be in. It's worth the coach showing beginners the club facilities such as the boathouse, training venues and equipment. The coach will also want to explain the commitment required and the type of training consisting of paddling, running, swimming, strength development training and games. To be successful, paddling requires endurance, strength and consistent training (a minimum of three 2hour sessions each week to begin with).

An ideal first training session would be some gymnastic type exercises to warm-up, followed by some running and games.

The Second Training Session
It's worth starting with dry land technical exercises with a paddle or a stick. The coach demonstrates the correct way to hold the paddle and the paddling movements. The children can practice the movement standing, and then either sitting or kneeling. The coach will observe and correct the children's movement. It is well worth using this practice as a warm-up for all future training sessions. After the dry land practice the coach will introduce and explain the different types of boats and then play some games.

Further Training Sessions
Ideally, different coaches will coach canoe or kayak or the same coach will train the paddlers in separate. The amount of time spent on dry land work will depend on several factors:

- water conditions (calm, not too deep, not too cold etc.)
- weather conditions (temperature and wind velocity)
- safety aspects, such as water and weather and safety boat availability
- type of boats available (stable or unstable, crew-boats etc)
- the children's levels of skill

First Water Training Session

- teaching the handling of, and carrying the boats to the pontoon
- life jacket usage
- launching the boats
- practice sitting or kneeling in and out the boat at the pontoon
- embarkation - disembarkation

(Its then worth finishing the session with some running and/or games)

FIG. 11.1 - A METHOD FOR LEARNING BALANCE

FIG. 11.2 - SUPPORTED PADDLING

Subsequent Water and Supplemental Training Sessions

- practice simple strokes (in kayak using hands only)
- practice support-strokes and self rescue (demonstration and explanation before the practice)
- paddling (4km to 6km) to improve stability in various water conditions, such as waves
- increasing attention to basic paddling technique

- running (e.g. alternating between 4km and 4 x 4minute intervals each session)
- strength development training with body weight resistance and games

Stages in learning

Early Stages	Progressing Stage	„Automatic" Stage
Beginners 0-12 months	**Advanced 1-4 years**	**Final 4+ years**
concentrate on basics	quality movement	regular observation
limit the number of tasks	frequent practices	pressure of performance
short and frequent practice periods	improving performance	
keep the tasks enjoyable	longer training	
	pressure of speed	

Note that the time taken to reach the 'automatic stage' will be different for each individual.

THE TEACHING PROCESS:
programming – explanation – demonstration – – practice – evaluation

Programming: determining what we will teach and how (methods)
Explanation: verbal explanation of the task
Demonstration: coach performs or models the task
Practice: athletes experience and acquire knowledge of the task
Evaluation: consider whether the planned learning was accomplished (athletes should know how they did the training)
Feedback: direct or indirect feedback from the athletes is essential to repeating the whole cycle

In such a process, the teacher/instructor/coach always plays the leading role.

When running a training session some coaches forget about mental and emotional aspects, which are at least as important as the physical. If the coach is calm, professional and relaxed then athletes will behave in the same way. This style of coaching empowers the athlete. Be positive and realistic and do not give false information. Athletes should be encouraged and talked to individually as well as part of a group.

11.2 STAGES OF TECHNIQUE PROGRESSION

STAGES OF TEACHING OF CANOE/ KAYAK TECHNIQUE:

- Stability
- Technique – basics
- Advanced technique
- Single boat technique
- Team boat coordination
- Stoke rate development
- Final stage of technique

The following is an outline only of the stages of progression in technique. Ideally the process would start when the paddler is at young age and he or she advances through all stages:

BEGINNER STAGE 0-6 months
- stability
- basic technique
- simple mechanics

BEGINNER (STAGE 1) 4-8 months
- boat movement
- stability
- further mechanics

ADVANCED (STAGE 2) 1-3 years
- progress the 10 commandments
- parallel shaft with the shoulders
- longer stroke
- tight power circles (the body to the foot rest and back)
- accelerate the boat speed through the stroke

COMPETITOR (STAGES 3/4) 3 years+
- Athlete understands body, kayak, paddle and water as an overall structure and the movement of forces within the structure. (also see it below)

STAGE 4 – Athletes at a high level with years of competition background

Progression to this stage requires an excellent understanding of the forces and mechanical concepts described in previous chapters. The athlete's inter- relationship and inter-dependency between body parts and muscle groups is greatly improved. The athlete understands the body, kayak, paddle and water as an overall structure and the movement of forces within the structure. The athlete understands the importance of having a strong and solid structure or base upon which the shoulders and therefore paddle must act. These are described in the 1st and 2nd "10 commandments".

How a beginner will learn technique depends on his or her:

- Skill
- Age
- Proprioception and coordination
- Sense of balance and confidence
- Physique, motivation and attitude
- Frequency and duration of training
- Water and weather conditions
- The coach's teaching ability!

The highest levels of technical excellence are achieved when the athlete is paddling "in the zone" with the entire body and paddle working in harmony and the boat gliding smoothly. This harmony can be reproduced for longer periods building up to full race distances, in different conditions, and can be produce 'on demand' in key events. Technique can never been perfect: there will always be parts that can be improved in aiming for higher speed!

11.3 PROCESS OF TEACHING KAYAK TECHNIQUE

The first sessions should be held on dry land rather than in a boat, so that the movement of the strokes can be taught in a stable position. This procedure will provide beginners with more confidence and understanding of the correct technique right from the start.

At first it is best to practice the basic paddling movements standing. The basic movements should be practised with the paddle in the hands. If using a right- hand controlled paddle, the beginner should do a stroke on the left hand side, then the right hand side and then the hand and wrist control movement before the next entry position. The coach can count, "one-two-three", for each cycle and repeat.

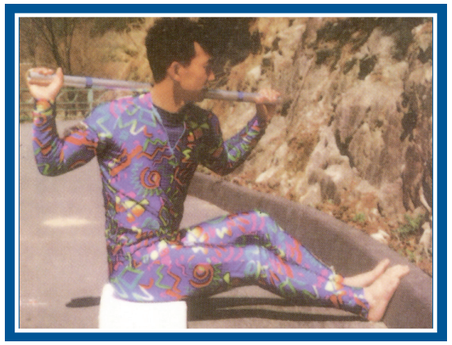
Beginners then move to a sitting position on the ground, bench, paddling tank or machine to practise the correct paddling movements. For this exercise a shaft- like object such as a tube, stick, bamboo etc. (approx. 110cm long) can be used instead of a paddle. You should establish a position where the feet have something to push against fro leg movement.

After several demonstrations, beginners can use the "SZANTO'S Method", a step by step format for teaching technique:

- The beginner sits in a kayak position on the ground (bench or paddling tank) bracing the feet against a stable point, holding a paddle-shaft or stick with elbows at about a 90° angle. The hands simply hold the paddle but don't move it!
- At first, place the shaft behind the head and practice body rotation with the synchronised leg press.
- Second, hold the "paddle" in front at shoulder height and repeat the same body movements (trunk twist with leg press)
- Next, hold the paddle in the entry position and simulate the stroke but only on one side
- After, repeat for the other side
- Then, simulate paddling on both sides

By moving from standing to sitting, the athlete can see and feel how the leg press is synchronised with body rotation.

It's worth noting that this process is useful for more experienced athletes as warming up routines and "reminder" of correct technique. The advantage of this method is that it enables the coach to correct each beginner individually, helping them to repeat the correct movements, physically guiding their body and arms if necessary.



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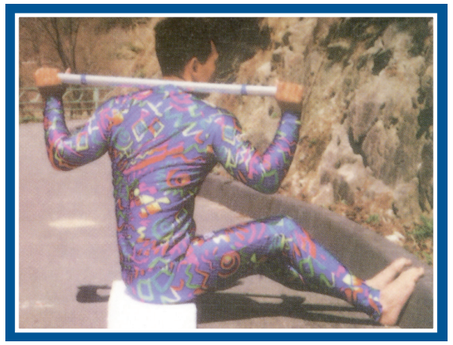

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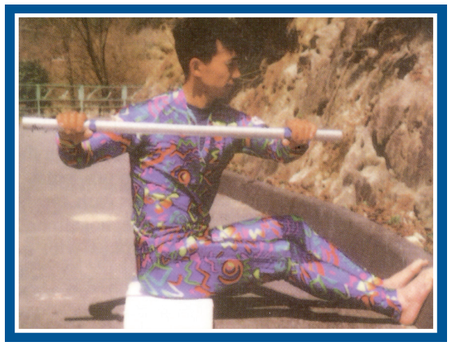

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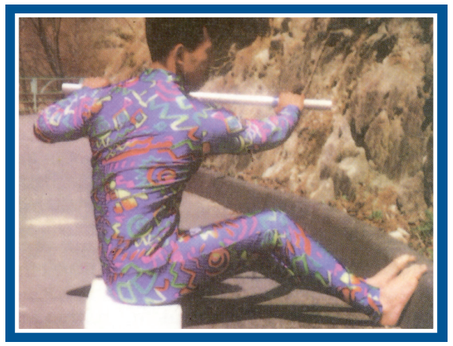

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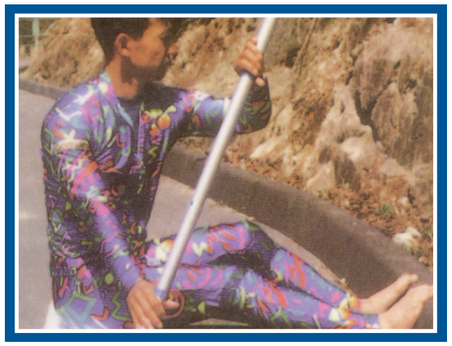

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FIG. 11.3 - SUPPORTED PADDLING

After dry land practices, beginners should paddle in stable kayaks first. If only racing kayaks are available then a balancing structure, such as an out-rigger should be attached to the kayak. Alternatively, the beginner could sit in the back of a racing K2 with an experienced paddler. When the beginner is confident and stable enough to try the racing boat, it's worth taking out the seat from the kayak (if this is allowed by the seating system) to gain greater stability. The beginner should paddle and direct the kayak to start with by only using the hands. This exercise will help to keep the boat more stable. The next task will be to paddle with a kayak paddle without a seat then eventually with a seat. By keeping both feet out of the cockpit and in the water, greater stability will be achieved or the coach or other paddlers can help beginners by holding their boats.

The beginner's actions should be observed carefully and corrected. Good attempts at executing the stroke should be encouraged and practised. Once a beginner is able to stay in and paddle a racing kayak the teaching of paddling technique has two phases:

1ST PHASE

- introduction and explanation of technique
- exercises with basic coordination, balance and correction of mistakes

2ND PHASE

- Further technique development building on balance and experiences
- Progression of fine-coordination (proprioception) on various water surfaces

FIG. 11.4 - PRACTICE ON DRY LAND

FIG. 11.5 - PRACTICE IN WATER

11.4 PROCESS OF TEACHING CANOE TECHNIQUE

To start with, paddlers must decide on which side they want to paddle - on the left or right! If the beginner is not certain the coach will have to decide which side is better suited to the beginner.

Teaching the basics of paddling should first be done on land, or on a special bench, or if facilities are available, in a paddling tank. For teaching canoe technique, basically we should follow the "step by step" SZANTO'S Method" mentioned above. Again, there should be a good demonstration before beginners practice their strokes. During dry land practices the coach can pay attention to and correct each of the beginners individually, guiding their body and arms if necessary.

For teaching on dry-land we need a paddle-shaft or stick (about 120cm in length) and a kneepad. When first taking to the water, a regular-sized canoe paddle could be used but a smaller size blade would be more suitable.

THE PROCEDURE OF TEACHING CANOE TECHNIQUE:

The beginner is helped by the coach into the correct kneeling position. Once the position is established the beginner holds the paddle shaft or stick as if in the catch position.

FIG. 11.6 - DRY LAND PRACTICE OF CANOE TECHNIQUE

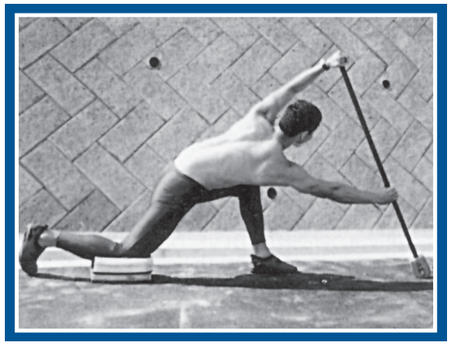


FIG. 11.7 - TECHNIQUE'S PRACTICE ON DRY-LAND

FIG. 11.8 - PADDLING ON A LANDING STAGE

Whilst practising on dry land the coach can count, "one-two-three" to represent the three phases: entry; draw; control ("J" stroke movement) and then the beginner will move to the next entry position and again execute the stroke in 3 parts.

If paddling from a landing stage or in a paddling tank, a narrow bladed paddle (or even upturned paddle) is very useful as a normal sized paddle requires a lot of force to move from a stationary position.

When teaching paddling to young people (under 14 years), it is important to develop both sides to avoid asymmetrical muscular and skeletal development. The crew-boat is an excellent way to paddle on both sides.

FIG. 11.9 - PADDLING ON A LANDING STAGE WITH UP-TURNED PADDLE

FIG. 11.10 - A KIND OF DRY-LAND EXERCISE

The beginner should learn how to control the boat with the "J" stroke at the end of the strokes on dry land first.

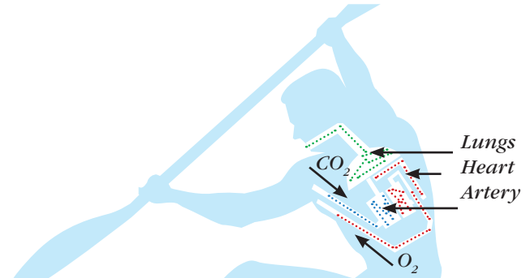
After a few training sessions under close supervision on dry land, the beginner should be ready to go on the water! It is best to start in a stable open touring canoe (or even a touring kayak) or in a crew-boat, rather than an unstable racing C1. As the paddler progresses to a racing C1, at first he or she can try it in a seated position, then move to two knees, to practise balance and steering, and then try on one knee. Once kneeling, a well-fitted knee-block is essential. For beginners a lower kneeling position is better to start with as it's more stable.

Once the paddler is able to paddle in a racing C1, achieving excellent balance and technique will take many months and often years –depending on the number of paddling training and the paddled kms!

CHAPTER 12
PHYSIOLOGY

INTRODUCTION

During training and competition, the human body acts as the engine to move the boat. As an engine, the body requires fuel (oxygen) and energy (food stuffs). In order to improve the efficiency of the human body to utilise the fuels and the energy, many adaptations take place within the body as a result of regular and adequate exercise.



The athlete's physiology is one of the determining elements of success in sport. Therefore, the coach should know how this system is working and the effects within the human body.

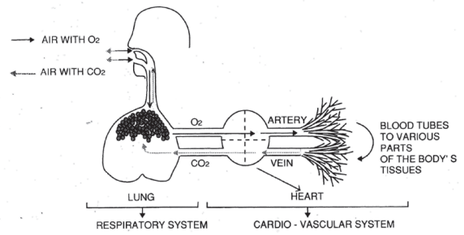
The two main parts of the physiological system are:

- the circulatory system and
- the energy supply

12.1 THE CIRCULATORY SYSTEM (OXYGEN TRANSPORTATION)

The circulatory system consists of the:

- *Respiratory system* responsible for air inhalation, oxygen supply and co2 changes
- *Cardio vascular system* responsible for transporting oxygen in the blood to the muscles and removing waste products such as CO_2.
- *Muscular system* where the density of the capillary system is responsible for oxygen uptake.



THE CIRCULATORY SYSTEM

The circulatory system is responsible for oxygen transportation to the organs and muscles and the removal of CO2. This system plays a vital in determining the level of endurance of each individual. In other words, endurance is the adaptation of the circulatory system to increase and sustain work. By developing the circulatory system you develop endurance because an efficient circulatory system provides a better supply of oxygen and glycogen to the muscles. Also, it decreases the recovery time following exercise.

The components of oxygen transportation are:

LUNGS - BLOOD - HEART - BLOOD VESSELS

The schematic drawing shows in simple terms the mechanism of the circulatory system:

- The inhaled air, rich with oxygen, goes into the lungs
- The oxygen is transported by blood from the lungs to the heart (haemoglobin in the blood is responsible for oxygen up take)
- The heart's mechanism pumps the oxygenated blood via arteries then capillaries into the muscles
- Blood returns from muscle cells carrying carbon dioxide (CO_2) back to the heart via veins
- This deoxygenated blood goes from the heart back to the lungs
- Air in the lungs, rich in CO_2 is exhaled.

12.2 THE RESPIRATORY SYSTEM

The respiratory and circulatory systems work together to supply tissues with oxygen and to expel carbon dioxide from the body.

THE LUNGS

The central part of the respiratory system is the lungs. The lungs don't have their own muscles; expansion and contraction rely on the diaphragm and the inter-costal muscles. The lungs contain million of "balloons" (alveoli) which are immersed in blood. Outside pressure forces air into these "balloons". The capacity of the lungs (the volume of inhaled air in one breath) is the first determining factor of our physical fitness.

The function of the lungs is to exchange gases between the air and the blood. The lungs withdraw oxygen from the inhaled air and pass it into the blood. The haemoglobin in the blood conveys the oxygen to the heart and then to the various tissue and organs in the body.

Air contains 21% oxygen and 79% other gases mainly nitrogen. In other words, the air is a fifth oxygen. The proportion of gases inhaled never changes but the volume does from athlete to athlete. Through regular exercise the lung capacity increases, meaning more air and hence oxygen is inhaled in one breath.

However, during physical activity more oxygen is needed, so a more important measurement is the volume of oxygen **absorbed**, rather than lung capacity. The lungs can take in 120 to 200 litres of air per minute during exercises. This means that up to 42 litres of oxygen per minute can be inhaled in high intensity training or competition.

The respiratory system can develop by training, through general endurance type training or special exercises described in 12.3 below.

An improved respiratory system means:

- Breathing is slower and deeper and more air can enter the lungs in one inhalation
- The volume of the working parts (alveoli) of the lungs is increased hence the volume of oxygen utilised is increased. Untrained people use only 30% of the total lung surface, whilst a well trained athlete will use approximately 70%-75%.
- The lungs work more efficiently, meaning more oxygen can be used for the same volume of air.

12.3 DEVELOPMENT OF OXYGEN UPTAKE BY DEVELOPING THE RESPIRATORY SYSTEM

A well known exercise for developing lung capacity is controlled breathing during aerobic training, such as running, swimming and paddling. The athlete controls the number of breathes in combination with steps or strokes. For example breathing by every third, fourth or fifth strokes in swimming. However, not everybody agrees that lung capacity and oxygen uptake increase significantly by following this training.

Another method could be considered, known as "nose inhalation", which provides extra resistance for breathing and is used commonly by distance runners. The training:

STEP 1: walking with nose inhalation only for 5 -7 steps, where the air is continuously inhaled through the nose, then held before being exhaled quickly
STEP 2: as above but with increased intensity or uphill walking
STEP 3: the same kind of breathing while running, first slowly then faster
STEP 4: running with normal breathing but inhalation is through the nose only.

The results can be significant after 6 weeks.

Voluntarily hyperventilation prior to a sprint race is useful to remove CO_2 from blood in order to be able hold the breath longer at start.

12.4 TEST OF THE RESPIRATORY SYSTEM

a) A **simple practical test** is to see how long you can hold your breath after a deep inhalation. A hold for 50 seconds or longer is considered normal for people with medium

to good fitness levels. One minute without breathing would be a good result. This test could be done under water.

b) The **vital capacity test**. This is a measurement of the volume of the lungs. This measurement depends on the athlete's body size too. Generally, the taller athlete has larger the lungs. Therefore, result of this test is not absolute. The measurement can be in litres or millilitres. The result of this test for men is approximately 5-8l (5000-8000ml) and for women 3-5l (3000-5000ml). Vital capacity is generally about 75% of the complete lungs capacity. The remaining air stays in the lungs.

12.5 CARDIOVASCULAR SYSTEM

The cardiovascular system is responsible for oxygen transportation via blood circulating through the blood vessels (arteries and veins). **The cardiovascular system** can be divided into two major circulatory components: one delivers blood to all tissues of the body before returning it to the heart, the other sends blood to the lungs for oxygenation and removal of carbon dioxide before returning to the heart.

THE HEART is made of special 'smooth' muscle tissue which is responsible for blood circulation. The heart works continuously as a pump, pushing oxygen and nutrients to the body tissues. It is divided into the right and left halves. The right half pumps deoxygenated blood to the lungs and the left half pumps oxygenated blood to the body. At rest, for a trained person the heart beats approximately 42 to 52 beats per minute or even less, while in an untrained person it is about 60 to 72 beats per minute. It means a trained heart beats approximately 30,000 times less a day than an untrained person's heart! The heart rate and pulse rate are the same measurement.

With only about six months of training the heart rate (pulse) can decrease by 8 to 10 beats per minute. A lower heart rate is beneficial as there is a greater range from resting to maximum heart rate, which means a lower heart beat for the same amount of effort. This plays an important role in levels of endurance and lactic acid threshold.

Recovery heart rate refers to how quickly the heart rate returns to its resting value after exercise. An increase in heart rate recovery, or returning to resting heart rate in a shorter period of time, is an adaptation to physical training. The trained heart becomes stronger (thicker heart muscles), larger and more flexible.

One beat can pump a greater volume of blood and can carry away from the muscles more quickly by-products such as lactic acid. Cardiac output varies from 5 litres per minute at rest to 40 litres during vigorous exercise. Blood transports the oxygen. The oxygen capacity not only depends on the volume of blood pumped (which can be increased by regular training) but also the number of the red blood cells, which contain haemoglobin (Hg). Hg carries the oxygen in the blood. Trained athletes have up to 16 % more volume of blood and the higher Hg level can transport more oxygen.

THE BLOOD: At rest, oxygen uptake is around 250-300 ml/kg/min (ml of 02 per kilogram of bodyweight per minute) but during hard exercise it can be up to 8000ml/kg/min. The speed of blood circulation is 20 metres per minute, which can accelerate up to 80m/min during intense training. Another component of oxygen transportation is the flow of blood to the muscles, i.e. greater amounts to the working parts.

Summary of oxygen convey and blood circulation

	In resting phase	At high intensity
Vol. of blood circulation	5 litre/ min.	40 litre/ min.
Vol. of oxygen demands	250 ml	8000 ml
Speed of blood circulation	20m/ min.	80m/ min.

THE HAEMOGLOBIN /HG/: The role of red blood cells, which contains hemoglobin, is to transport oxygen. Each gram of hemoglobin can combine with 1.33 ml of oxygen, so the greater

the hemoglobin content within blood, the greater the oxygen-carrying ability.

During physical activity several changes take place to increase blood flow to active muscles. Greater blood flow to muscles increases delivery of oxygen and glucose and expedites the removal of products generated during metabolism (carbon dioxide).

The amount of oxygen transported depends on the concentration of haemoglobin. The haemoglobin is responsible for oxygen transportation in the blood. This means for a larger volume of oxygen to be supplied we have to increase the Hg level in the blood. Intensive training contributes to increasing Hg by increasing the volume of blood. Training at a high altitude and an increased iron intake will increase the Hg level. Training at over 2000m above sea level can have significant results after 3 weeks.

As a result of training, the muscles' oxygen supplies increases. Our purpose is to increase the systolic volume of blood, which can increase five to six fold during exercise compared to a resting state. Also, as a result of the correct type of training the muscle's oxygen absorption will increase. Although this oxygen utilisation is an inborn capacity, experience shows that with proper training it can be improved.

The effect of training on the arteries:

- The walls become more flexible;
- The number of arteries increases;
- They become wider in diameter
- Inside the walls: easier and faster to get rid of harmful materials.

12.6 MUSCULAR SYSTEM

Oxygen transported through the capillaries to the working muscles is passed through the capillary walls to the muscle cells. The oxygen is used in the conversion of fuels to energy. The capillary system around the muscles is improved by training. Hence, training should be specific to a sport by loading the muscles which are principally used in that sport.

12.7 INTRODUCING LACTIC ACID

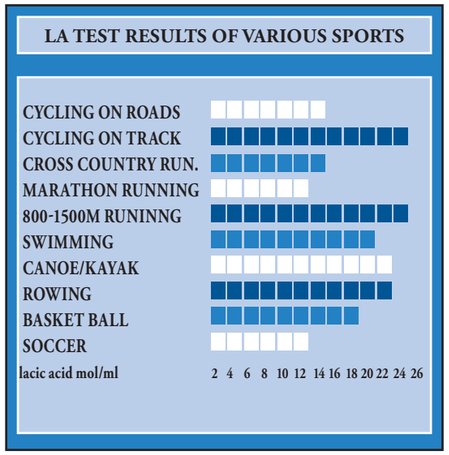
Even though glucose is being converted to lactic acid all the time in the body, at about 60%-70% maximal intensity, the lack of sufficient of oxygen to the muscles means lactic acid begins to accumulate in the blood and muscles. LA is a by-product of metabolism of glucose in the absence of oxygen.

Onset of blood lactate accumulation:
As exercise intensity gradually increases, the rate at which ATP can be supplied solely through aerobic respiration is exceeded, and therefore the further supply of ATP relies upon anaerobic respiration. Lactic acid begins to accumulate in the blood at a rate greater than it can be dispersed, which will lead to muscular pain and fatigue. Maximum or near maximum muscular effort lasting between 30 seconds and 3 minutes heavily depends upon the athlete's ability to produce energy via the anaerobic pathway and deal with the effects of LA accumulation.

LA remains in the blood stream until it is flushed out by excess oxygen. A high concentration of LA will block energy production in the muscle cells and demobilise muscle groups as it reduces the ability of the muscles contract. With specific training, the athlete's ability to work well despite high concentrations of LA can be increased although the rate of improvement will vary from individual to individual. The accumulation of LA causes pain in the muscles and leads to a slowing down of, or even stopping the activity (fatigue). Training improves an athlete's ability to tolerate the increased volume of lactic acid and improves the process of removal.

Amounts of LA in paddlers after a 500m or 1000m race or time-trial have been measured at 12-20 mmoll. After a 200m race, the LA level has been 2-15 mmoll, obviously produced in a much shorter time!

The following table shows the results of lactic acid tests for different sports:



LA elimination when an athlete has complete rest after a maximum effort:

Time	Elimination
After 25 min.	50%
After 1h 25min.	95%

With such long periods, a full cool down after intense physical activity is highly recommended in order to promote a much faster recovery. Failure to fully eliminate LA could lead to symptoms of over training!

12.8 THE RESULT OF A DEVELOPED CIRCULATORY SYSTEM

A developed cardiovascular system means:

- resting heart rate (beats/min) is reduced – – efficiency is increased
- heart muscles become thicker and stronger - volume of blood per beat increases
- volume of haemoglobin in the blood increases – more oxygen transported
- total volume of blood increases
- capillary system around the muscle tissue enlarges -- more blood/oxygen can reach the working muscles
- reduced LA accumulation in the muscles and blood due to a better oxygen supply
- LA is carried away by the blood more quickly
- recovery time (heart rate) is reduced after intense exercise

SUMMARY

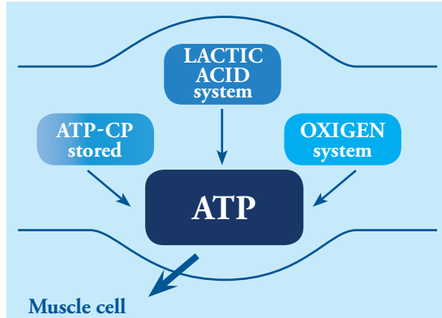
A developed respiratory system means:

- oxygen supply improves and breathing becomes more efficient
- working parts of the lungs increase = = greater volume of air in the lungs
- breathing becomes slower and deeper – – more efficient
- more volume of air per breath
- larger vital capacity

12.9 ENERGY SUPPLY

For any physical activity in which work is performed, energy must be consumed. Whether you are sleeping, awake, or performing physical activity, energy is needed to maintain your bodily functions. In addition, when performing physical activity, energy is needed by your muscles to generate force and create movement. Plant and animal products eaten as food are the fuel that provides the human body with energy. The chemical process of converting food into energy is termed a **metabolic reaction**. This process is similar in some ways to the burning of wood. Oxygen is needed for the burning of wood and also for the conversion of food into energy useful to the human body. During both of these processes, chemical bonds are broken and energy is released. When wood burns, energy is released in the form of heat and light; carbon dioxide (CO_2) and ash are produced. When food is metabolized heat, energy, water, and CO_2 are produced. Energy is produced in the form of an **"energy molecule"** called ATP (adenosine triphosphate).

The 3 energy mechanism



The energy system always produces a molecule called ATP cell from food stuffs (protein, fats, and carbohydrates) and/or from the fat stored in the body. The kind of food that produces ATP (energy) depends on:

- **Intensity** of the activity
- **Duration** of the activity
- **Physical condition (fitness)** of the individual

Physiologically, we can utilize energy via three biological mechanisms:

THE 3 ENERGY SYSTEM

ANAEROBIC ENERGY

1. ATP-CP and ADP-CP or PHOSPHOGENIC system /Adenosine Three Phosphate, Creatine Phosphate/
2. GLYCOLYSIS ANAEROBIC or Lactic Acid system

AEROBIC ENERGY

2. GLYCOLYSIS AEROBIC or oxygen energy system

12.9.1 CREATINE PHOSPHATE (CP) ENERGY SYSTEM

Oxygen is not required to initiate muscle activity, since contraction is an anaerobic process (anaerobic respiration does not need oxygen to produce energy and is used predominantly for short-duration, high intensity activity). The initial energy is supplied by the high-energy compound ATP, which is stored in the muscle in finite amounts. Almost as soon as ATP is depleted (broken down to ADP) it can be regenerated by a substance called creatine phosphate (CP). However, there is a very limited supply of CP and therefore the energy supplied by this process only lasts a few seconds at high intensity levels.

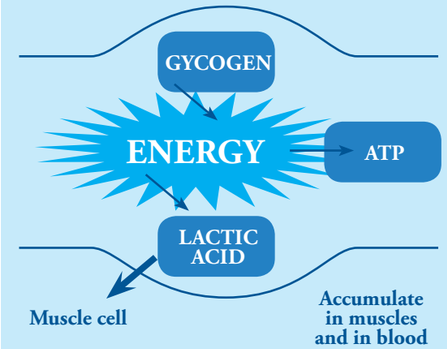
Energy supply from the CP system:

	ATP only	ADP + CP	Total ATP +CP
duration of energy supply	5-8 sec.	15-18 sec.	19-23 sec.

12.9.2 LACTATE SYSTEM (ANAEROBIC)

However, if intense activity continues, another process, called anaerobic respiration takes over. Energy, in the form of ATP is still produced (from glucose, supplied directly from the blood or from muscle glycogen) but because the inhaled oxygen is insufficient (i.e. anaerobic) lactic acid builds up in the blood and in the muscles preventing muscle contraction and causing fatigue.

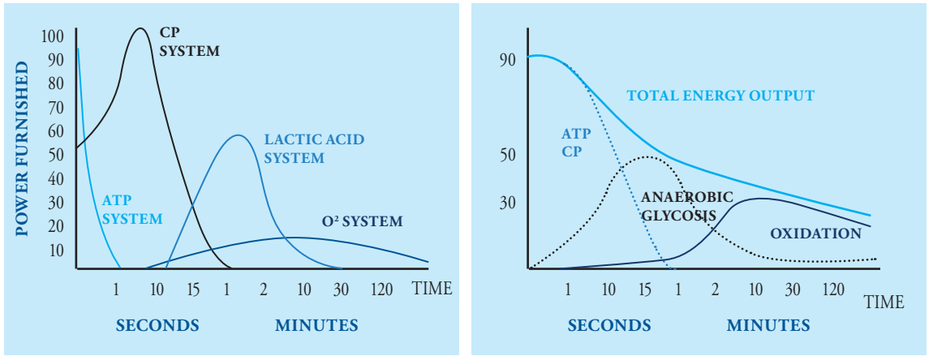
Anaerobic glycosis



12.9.3 AEROBIC RESPIRATION

Aerobic respiration (i.e with oxygen) is the main energy cycle at rest and during low intensity activity. The products generated by aerobic metabolism are energy (ATP), CO2 and water. Aerobic metabolism provides the majority of ATP needed to perform long-duration, low intensity physical activity. The supply of energy during the aerobic energy system comes from fats at low intensity and carbohydrate oxidation at higher intensity.

The 3 energy system



12.9.4 FURTHER INFORMATION ABOUT THE SUPPLY OF ENERGY

All the energy systems rely upon fuel from food to produce ATP from. The type of food that leads to the production of ATP depends on the intensity and duration of the physical activity undertaken. In the first 18-23 seconds, ATP (and CP) already stored in the muscles provides the energy for high intensity work. After that, if the high intensity lactate system is operating, the glucose being metabolised will have originated from carbohydrate sources. If lower intensity aerobic work is being undertaken, again the energy will have originated from carbohydrates but beyond 40-45 minutes energy can come from fats stored in the body.

Energy products of food if the period of work phase is approximately 2 minutes or less

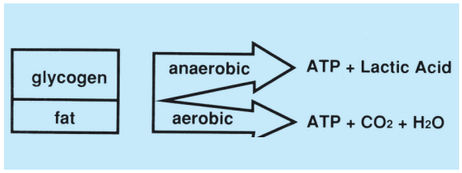
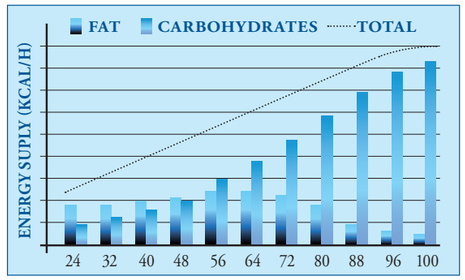


Table As the intensity (VO_2 level) of physical activity is increasing the energy supply from fat gradually change to carbohydrate energy surcease 30% to 35% of ATP produces mechanical energy whilst the other 65% to 70% produces thermal energy.

The different energy systems are used in different proportions over different racing distances:

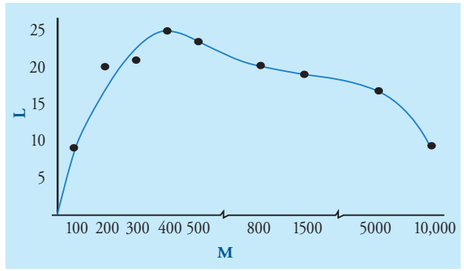


% emphasis	ATP – PC	LA - O_2	O_2
200m/ 35-45 sec.	60	40	0
500m/ 1.5-2.0 min.	30	65	5
1.000m/ 3.0-4.5 min.	20	50	30

Varying the training methods will have different effects and therefore develop the energy systems in different ways:

Training methods	Percentage Development		
	ATP+PC	LA & O_2	O_2
interval: anaerobic	80	10	10
interval: aerobic	10	10	80
sprint (max. speed)	90	6	4
repetition intervals 80% of max.	10	50	40
fartlek	20	40	40
marathon	2	8	90
jogging/ slow run	-	-	100

LA accumulation in the blood on different distances with maximal efforts



Following intense anaerobic activity, the recovery time for energy: after 30 seconds, 70% recovered; after 5minutes 100% recovered.
Following aerobic activity: LA levels reduced by 50% after 25 minutes and by 95% after 90 minutes.

12.9.5 THE ENERGY BALANCE

Our energy balance is under hormonal control but in spite of this nutrition can significantly influence the balance.
During a period of relative inactivity, glucose is a normal source of energy and is found in the blood in concentrations of around 90-100 mg/ml which is needed to preserve the proper functioning of brain and blood cells.

Initially, during training, the blood sugar concentration remains constant, even though far more is used, because the liver continues to supply it from its stores of glycogen. If the blood sugar falls below a particular level, the hormone insulin effectively pushes it back up again to normal levels. Over time, as glycogen stores become depleted, carbohydrates need to be taken in to maintain blood sugar levels. However, because of the controlling effect of insulin in response to carbohydrate intake, care has to be taken, particularly in competitions, to get the quantity and timing right.

It has been known for a relatively long time that training and diet can increase glycogen levels in the muscles. Lighter training and increased intake of carbohydrates in the days before competition can improve the energy balance and result in better performance.

RECOVERY
During continuous high intensity work, Lactic Acid accumulates in the muscles and blood. For rebuilding the phosphogen energy in anaerobic training adequate recovery period required.
The next table showing the required recovery times during a 8x30seconf interval training:

Table 12.1

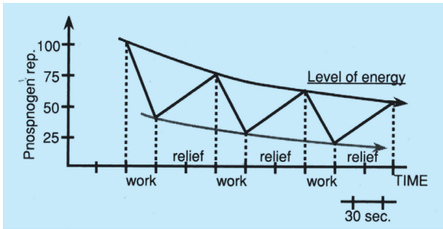


Table 12.2 Suggested recovery times following exhaustive exercise (Fox 1981)

Recovery process	Suggested recovery time	
	Minimum	Maximum
Phosphagen stores ATP - CP	2 min	5 min
Repayment of the alactacid O_2 debt component	3 min	5 min
Muscle glycogen resynthesis	5-10 hours	24-46 hours
Liver glycogen replenishment	Unknow	12-24 hours
Removal of LA from blood and muscle	30 min in exercise /1 hour in rest	1 hours in exercise /2 hour in rest
Repayment of the lactacid O_2 debt component	30 min	1 hours
Restoration of O_2 stores	10 - 15 sec	1 min

CHAPTER 13
NUTRITION

INTRODUCTION

To have enough energy for physical activity you need to consume enough energy! Getting a sufficient number of calories is one of the keys to a performance-enhancing diet. With too few calories you will feel tired and weak, and you will be more prone to injuries.

Nutrition refers to the intake of food stuffs, vitamins and minerals along with adequate water balance. Good nutrition needs to be an integral part of training and recovery! A well-balanced diet is important to ensure a healthy life, optimal growth and provide the energy necessary for physical activities.

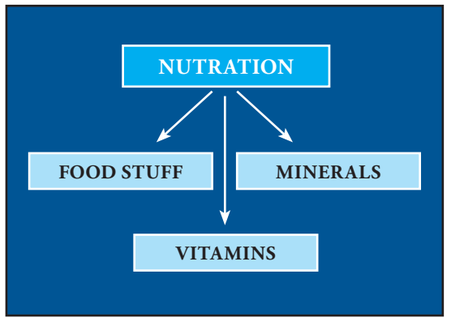
By eating a variety of foods containing a sufficient number of calories, you will satisfy your need for macronutrients (carbohydrate, protein, fat) and micronutrients (vitamins, minerals). A balanced diet is based on the food guide pyramid, which includes five basic groups: grains, fruits, vegetables, dairy foods, and protein-rich foods. Sugars and fats provide extra calories after the needs from the other groups have been met.

Sports doctors and scientists know, from medical tests, that the optimal performance of an athlete cannot be reached by purposeful and extensive training alone. It is necessary to maintain the correct diet before and during competitions.

The recommended daily calorie intake is approximately 2,400 kcal for non-athletes. For an athlete, depending on the type of sport and age, 4,000 to 6,000 calories per day are necessary. For example,15 to18 years old paddlers should have an intake of 3,500 to 4,500 kcal and seniors should have 5,000 to 6,000 kcal for

ATP

Food is broken down in the digestive tract to a form in which it can be used by the body as an energy source (ATP). The energy contained in food is expressed in kilojoules. A kilocalorie is the amount of heat needed to increase the temperature of 1 litre of water by 1 degree centigrade. One kilocalorie equals 4.18 kilojoules.



1 g carbohydrate makes 4.2 calories
1 g fat makes 9.4 calories
1 g protein makes 4.3 calories

The daily proportions in a normal balanced diet (%): Protein: 12-15; carbohydrates: 56-60; fat 28-30.

13.1 FOOD STUFFS

The three food stuffs that provide calories are: **Proteins**, **Fats** and **Carbohydrates**.

13.1.1 PROTEINS

Proteins are the major structural component of the cell and the most important dietary element for the building and preservation of the body and bodily functions. Proteins promote physical and mental ability. Proteins are responsible for growth, repair and maintenance of body tissue, as well as maintaining osmotic pressure in the plasma. Haemoglobin, enzymes and many hormones and antibodies for protecting the body from diseases are produced from proteins. Protein can also produce energy for the body but plays a minor role in energy production, contributing only 10% to 15% towards the energy used during prolonged exercise.

The average daily requirement for protein is approximately 1 g per kilogram of body weight (for athletes: 1.5 to 2 g/kg. This amount is relatively easy to eat, since a piece of fish or chicken will contain 100 grams or a cup of tofu or garbanzo beans will contain 20 to 24 grams of protein.

Protein is present in both animal and vegetable food sources. The amount and type of amino acids determine the biological value of proteins. The body must be regularly provided with the essential amino acids in sufficient amounts by eating high value proteins, as it cannot build them itself. A typical proportion in the diet is approximately 55%-60% from animal sources and 45%-50% from vegetable sources.

Animal protein is found mainly in meat, liver, milk, curd cheese and eggs. Vegetable protein is found mainly in beans, soybeans, grains, nuts and mushrooms.

PROTEIN IN ANIMAL SOURCES	%	PROTEIN IN VEGETABLE SOURCES	%
chicken meat	85	mushroom	54
cattle-liver	72	soy	41
curd	71	spinach	34
pig-liver	69	bean	26
ham	66	walnut	20
salami	32	potato	11
milk	3,5	rice	8
eggs	20	peas	22,5
fish	16	grape	3

13.1.2 FATS

Fat and carbohydrates provide energy for body heat and muscle activity. Within a limited range they can be substituted for one another. The body stores energy in the form of fat tissue, which is then available as an energy source. A diet rich in fat, however, is difficult to digest and an over-consumption of fat leads to the build-up of fat deposits.

Fat is important energy source, providing up to 70% of the total energy in rest and about 50% during light and moderate exercise. It is the primary energy source for athletes involved in prolonged, low-intensity exercise (for high-intensity, short-term exercise, carbohydrate is the primary fuel source). About 20% of the calories in a performance-enhancing diet should come from fat, most of it unsaturated fat such as vegetable and fish oils. Fat serves many other functions that are indirectly related to exercise performance. Furthermore, it is an essential component of cell membranes, nerve fibres and vital organs are supported and cushioned by it. All natural steroid hormones in the body are produced from cholesterol. Fat-soluble vitamins are stored in, and transported through the body via fat. The fat layer of the skin helps to preserve body heat.

Fat is found in significant proportions in the body and can be metabolized for energy production. An individual with 15% body fat has, theoretically, enough energy in body fat alone to run almost 1280km (800 miles)!

Fats can be found in both animal and plant products:

ANIMALS FATS	VEGETABLE FATS
fatty meat, bacon, butter, oil and skin	vegetable oils, seeds, coconut oil

The daily requirement for an athlete is 50 to 60g.

13.1.3 CARBOHYDRATES

Carbohydrates stored within the body provide a rapid and readily available source of energy. Carbohydrates are important as a source of energy for the brain and the muscles. In this category we find all forms of sugar (e.g. fruit sugar, cane, honey and chocolates), grains (e.g. flour) and starches (e.g. potatoes, rice, bread, pastry). While sugar is relatively quickly absorbed into the system, the process is much slower when carbohydrates are ingested in the form of grains. In this case, they are digested and absorbed over a period of hours. The daily carbohydrate intake should be approximately 65% of total calories. The body relies mainly on carbohydrate foods for fuel

during exercise, and the amount stored in the body will directly affect the athlete's endurance. A high-carbohydrate diet increases stores of glycogen (the energy for muscles) and therefore improves overall athletic performance.

Different carbohydrate foods can affect your energy level in different ways. Digestion rates are expressed as a "glycemic index" (GI). Foods with high GI release energy into the bloodstream rapidly, while foods with a moderate or low GI release their energy more slowly:

FOOD	GI Index	FOOD	GI Index
Baguette bread	95	Apple	38
White rice	87	Low fat yoghurt	33
Corn flex	84	Skimmed milk	32
Biscuit	78	Dried apricots	31
Chips	75	Red lentils	26
Fanta Drink	68	Soya beans	18
Mars bar	68	Peanuts	14

If you exercise for longer than an hour, your muscles become depleted of glycogen. By consuming 30 to 75 grams per hour of high GI carbohydrate in liquid or solid form during exercise, you can minimise this effect.

After a long workout or competition, your depleted muscle glycogen stores must be replenished, especially if you will be exercising again within the next 8 hours. Eat the equivalent of 1 gm of high GI carbohydrate per kg of body weight just after exercise (within 15 to 30 minutes), and consume a total of at least 2 gm/kg of high GI carbohydrate in the 4 hours after a training session. Moderate GI foods should be added for the next 18 to 20 hours, with a goal of consuming at least 8 gm/kg of carbohydrate during the 24 hours after an intense workout or competition.

13.2 VITAMINS

Vitamins, found in a normal balanced diet are substances necessary for life, but only small quantities are required for the metabolic functions of the body.

Vitamins have an important role in energy metabolism. They don't contribute energy themselves, but vitamins (and minerals) are integral to food metabolism and energy production. Vitamins encourage specific chemical reactions that take place in the cell. Some vitamins are involved in energy reactions that enable cells to derive necessary energy from carbohydrate, protein and fats.

Because the need of the body for vitamins is met by a well-balanced diet, taking additional vitamins is only useful in special cases. As an athlete with a good appetite, you can get a lot of vitamins in your diet. By choosing wholesome foods, you can double or triple your vitamin intake. For example, if you drink 300 ml of orange juice, you'll get 200% of the recommended daily allowance (RDA) of vitamin C! Without a doubt, fruits and vegetables are the best sources of important nutrients. The ones with the most vitamins are oranges and orange juice, cantaloupe, strawberries, kiwi, bananas, green and red peppers, broccoli, spinach, tomatoes, carrots, and sweet potatoes. These 'powerhouse' foods provide vitamins and may also guard against aging, cancer, heart disease, and other diseases.

Vitamins A, D, E and K are fat-soluble and can accumulate to toxic levels in the body. Vitamins C and B-complexes are water-soluble. Water-soluble vitamins are generally non toxic. Vitamins regulate metabolism, facilitate energy release (several of the B-complex vitamins), and have a very important role in the process of bone and tissues synthesis.

A
Main function or effect: Eye-sight, hair, skin, bone and teeth, resistance to infection.
To be found in: Carrots, bananas, liver, eggs, green leafy vegetables.

B1–B12
Main function or effect: Building muscle cells, increase body weight, conditioning, coenzymes used in metabolism.
To be found in: Meats (pork), liver, soya bean, whole grains, fish.

C
Main function or effect: Immune system - resistance against infection and tiredness. Essential for building block collagen, the structural material for bone, skin, blood vessels and other tissue. Daily intake for men is 90 mg and for women it is 75 mg. The body can only absorb a maximum of about 400 milligrams a day.
To be found in: Green pepper, cabbage, hips, lemon, oranges, green bell peppers, strawberries, broccoli, cantaloupe and tomatoes, turnip, sweet potatoes and okra.

D
Main function or effect: In early years of development, vitamin D, with calcium, helps build and maintain bones.
To be found in: Cod-liver oil, breakfast cereals, yolks, herring and sardines.

E
Main function or effect: Many of its function are not all well-known. However, it assists with physical power, conditioning, strengthening, recovery, builds proteins into muscles has a role in immune function, DNA repair, the formation of red blood cells and vitamin K absorption.
To be found in: Grains, ginseng, bread, wheat germ oil, sunflower seeds, cooked spinach, almonds, sunflower oil and hazelnuts.

K
Main function or effect: Has similar effects as vitamin C and used by the body to produce an array of different proteins.
To be found in: Kale, spinach, broccoli, asparagus, arugula, green leaf lettuce, soybean oil, canola oil, olive oil, eggs and tomatoes.

B12
What it does: Vitamin B12 is used in making DNA, the building block of genes, and in maintaining healthy nerve and red blood cells. Food sources of B12: B12 is bound to protein, so foods like meat, fish, eggs and dairy products such as yoghurt and milk are the principal sources.

Boost Your B6 - Eat B6 foods: bananas, chicken breast, garlic, brussel sprouts, collard greens, sunflower seeds, broccoli, red bell peppers, watermelon, avocados, and potatoes. Vitamin B6 plays a role in red blood cell metabolism, protein metabolism, and synthesis of the neurotransmitters, serotonin and dopamine, and increases the amount of oxygen carried to your tissues.

Eat omega-3-rich foods: salmon, sardines, mackerel, herring, flaxseeds, walnuts. DHA omega-3 essential fatty acid maintains healthy brain function and is vital for fetal brain and eye development.

13.3 MINERALS AND TRACE ELEMENTS

All of these substances are present in ample quantities in food. Periods of great physical exertion require increased amounts of salt and fluid. We can find those in electrolyte drinks and other types of mineral drinks and in coca cola and tea. Some athletes suffer a lack of iron, which causes tiredness and slower recovery, so they will need supplements to correct this. A lack of sodium can cause nausea, vomiting and cramps. A lack of potassium leads to states of weakness.

Iron and calcium are the minerals most commonly deficient in athletes, and strict vegetarians may be deficient in vitamin B12 as well. By consuming enough calories and following the food guide pyramid plan, your needs for all the important micronutrients can be met.

If you eat fewer than 1,500 calories per day, one multivitamin and mineral pill might be good. If you do not eat meat, iron and zinc supplements can be helpful. Note that some fortified breakfast cereals and energy bars provide 100% of the RDA for many nutrients.

Minerals: Magnesium, Calcium, Phosphorus, Potassium, Sodium, Chlorine and Foliate

SOME DETAILED INFORMATION:
Potassium
What it does: Potassium is involved in almost every vital body process: maintaining blood pressure, heart and kidney function, muscle contraction, even digestion. Sources: eat unprocessed foods as often as possible, especially fruits and vegetables, low-fat dairy products, whole grains, fish and lean meats.

Magnesium
What it does: Necessary for some of the body's most basic processes, magnesium triggers more than 300 biochemical reactions—most importantly the production of energy from the food we eat. The mineral is abundant in avocados, nuts and leafy greens including acorn squash, kiwi and almonds.

Foliate/Folic Acid
It is necessary for the production of new cells, including red blood cells.

Food sources: liver, dried beans and peas, spinach and leafy greens, asparagus and fortified cereals.

Trace elements: Iron, Copper, Manganese, Zinc, Cobalt, Iodine, and Silicon.

Zinc
Zinc is integral to almost every cell of the human body, from keeping the immune system healthy to regulating testosterone.

Food Sources of zinc: Oysters, cooked beef tenderloin, turkey, chickpeas, roast chicken leg, pumpkin seeds, cooked pork tenderloin, plain low-fat yogurt, wheat germ, tofu, dry roasted cashews and Swiss cheese.

13.4 FLUIDS AND WATER BALANCE

Drinking fluids throughout the workday and before, during, and after training and competition is essential for top athletic performance. Unfortunately, some paddlers tend to underestimate the importance of fluid replacements as an integral part of their sports diet. Because water is found in most body tissues (blood 80%, muscle 75%, bones 20%, and fat cells 0-10%), it plays a vital role in all body processes and functions during training and competition. Water carries energy to the working muscles and carries away waste products via the urine.
Water helps to maintain proper body temperature by regulating the removal of body heat via "sweating". Water is found in all body tissues so it serves as a "shock absorber" and "lubricator" for organs and joints.

The normal daily water intake ranges from 2.5 litres in winter to 3.5 litres in summer. During exercise, the body loses fluid through the skin as perspiration and as water vapour in expired air. The amount of loss depends on the ambient air temperature, humidity and altitude with a range between 0.5 and 1.2 litres per hour. Under extreme ambient conditions fluid loss can be up to 2 litres per hour or even more. When dehydration exceeds 2% of body weight a measurable deterioration of physical performance can be observed. A 5% deterioration will decrease strength and endurance and the performance significantly diminishes as well. A 10% reduction will lead to fainting and at 15% potentially death.

The recommended water intake at training:
45 minutes before training 300-400ml or more
10-15 minutes before training 200ml

During training 200-300ml per 30 min (depending on temperature and humidity)

After training immediately continue regular rehydration until urination

It is useful to rehydrate with liquids containing carbohydrate.

Water is probably the most important aid to performance, but because the body has a poor thirst mechanism, you must drink before you feel thirsty. Once you are thirsty you are already slightly dehydrated, and your performance will be diminished. The best way to tell if the body is well hydrated is by observing the amount and colour of an athlete's urine. Urination should be frequent throughout the day and it should be clear in colour. If the urine is dark and very yellow, more fluids are needed. Also measuring body weight before and after training is an effective method. For every 100 grams of weight loss (sweat), you should replenish with 150ml of fluids.

Water intake:
The day before a lengthy or intense training session or competition a paddler should drink as much fluids as she or he can tolerate and eat plenty of nutrient-rich carbohydrate foods that have high water content (fruits & vegetables). For

every gram of carbohydrate stored in the body, 3 to 4 grams of water is stored that are readily available for essential body processes. To stay well hydrated, two hours before a competition, a paddler should drink 500ml of water; sports drink or diluted fruit juice. Since the body takes roughly 1 to 2 hours to process fluids, the athlete will have time to empty the bladder before exercising.

If possible 10 to 15 minutes before training or competition, the paddler should try hydrating the body with another 200ml of water. During training, the paddler should drink as much as he or she can comfortably tolerate. For exercise lasting an hour or less, 250ml of cool water every 15 to 20 minutes provides optimal fluid replacement. During exercise that lasts longer than 60 minutes, carbohydrate/electrolyte drinks containing 5% to 8% carbohydrate should be drunk at the same rate to replace fluid and preserve muscle glycogen. After exercise, replace every 100 grams lost during exercise with at least 150ml fluid. After training or competition, the paddler should drink water and nutrient-rich drinks until he or she is no longer thirsty and then an additional 250ml. It is important to note that caffeinated drinks (coffee, tea, and soft drinks) and alcohol should be used with caution because they act like diuretics, which can cause dehydration. No alcohol should be consumed before or during an event.
Athletes should consume drinks that they like the taste of, do not cause stomach cramps or diarrhoea, and enhance absorption and performance. Fluid intake is very much a matter of personal preference.

Table 13.1
(all figures are based on a 200ml serving)

Item	Carbo-hydrate	Cal.	Potassium	Sodium	Vitamin C
apple juice	29 gm	116	296 mg	6,6 mg	2,2 mg
cola	26 gm	105	2,6 mg	8 mg	0
grape juice	32 gm	128	53 mg	5 mg	60 mg
ice tea	22 gm	86	50 mg	13 mg	0
lemonade	28 gm	106	40 mg	0	18 mg
orange juice	26 gm	112	472 mg	2 mg	96 mg

13.5 SUPPLEMENTS

The sport's world is filled with advertisements and stories about supplements, all claiming to improve speed, strength and endurance. The range is never ending and the promises are tempting. However there are no short-cuts to the top! Many of these supplements have either not been tested or have not lived up to their claims when tests have been conducted. It is also possible that the benefits seen by some athletes come from the power of positive thinking!

Creatine is a very popular supplement, and unlike many of the products that hit the headlines each month, it has undergone the scrutiny of scientific research. Sports scientists have found that creatine supplementation programmes can increase muscle stores of this fuel source, and enhance recovery between high intensity workouts with short rest intervals.

Beta Carotene
What it does: In the body, beta carotene is converted to vitamin A, a nutrient essential for healthy vision, immune function and cell growth. It also acts as an antioxidant that neutralizes free radicals. Eat plenty of dark green vegetables and orange vegetables and fruits (papaya, mango) weekly to meet your vitamin A needs and reap beta carotene's potential antioxidant benefits.

Vegetarian Athletes
There are a large number of athletes, who have adopted vegetarianism and eat only food from plant sources, although many do consume dairy products and eggs. Vegetarian athletes who consume dairy products and eggs are at a lower risk of poor nutritional intake because the diet is that much less restrictive.

For athletes who are strict vegans, it is necessary to select their foods very carefully to provide a good balance of the essential amino acids, a sufficient calorie intake and adequate sources of minerals and vitamins such as zinc, iron, calcium, riboflavin, vitamin B12 and vitamin D.

Lack of knowledge can sometimes mean vegetarian athletes experience decreased sport-

ing performance and impaired fitness. Vegan athletes should be referred to a qualified sports physician or sports dietician for help in creating a diet that maximises nutrient intake.

Sports Nutrition (Source: www.nutrition-australia.com)

During event - fluid and food intake
Dehydration is a gradual effect. For every increment of fluid loss there is a small rise in your body temperature and heart rate, and an increase in the perception of how hard you are working. Skills and concentration are also impaired. In other words as the fluid deficit grows, there is a continual decline in performance. You may be unaware of small and subtle changes and may only recognise the damage when it becomes extreme. Optimal performance means being at your best, not just escaping serious problems.

Post-Event Recovery
Refueling is a key priority in recovery from physical activity. Muscle glycogen storage occurs at a slow rate and it takes about 24 hours for muscles to restore depleted fuel stocks back to their resting levels.

Fuelling your Body
The fuel requirements for events of up to about 90 minutes in duration can be met by the normal muscle glycogen stores of a well trained individual. (Glycogen is the body's ready source of energy stored in the muscles.) To fuel up, all you need is 24-36 hours of rest or lighter training, and a higher carbohydrate diet. Although a high carbohydrate diet should already be on your menu, you may like to reinforce the focus on "fuel foods" on the day prior to competition.

Nutrition For Everyday Activity
A basic function for everyday eating is to replace fuel (energy or kilojoules) and fluid lost from the body due to daily activity.

Eat Most kind of food:
This base layer of food includes only plant foods: vegetables, fruits, nuts, dried peas, beans and lentils, breads and cereals (preferably wholegrain). These foods contain many different nutrients and should make up the bulk of the food we eat. Eating a variety of these foods each day should provide good amounts of energy from carbohydrate, as well as protein, minerals, vitamins and dietary fibre.

Water consumption: Six to eight glasses (1,8-2,4 l) each day is the recommendation at normal weather condition.

Eat Moderately:
Foods include fish, lean meat, eggs, chicken (no skin), milk, cheese and yoghurt. Eating a serving of meat, fish or eggs and three servings of dairy foods each day will provide protein, minerals (especially iron and calcium) and B vitamins.

Eat in Small Amounts:
Sugars and fats are in group. These foods should be limited because they lack a good supply of the nutrients needed for growth, good health and quick energy. While small amounts of fats, oils and sugar are acceptable, larger amounts of these foods will cause an inadequately varied food intake. Salt should not be added to foods.

Remember, in order to maintain body weight, food eaten (energy in) always needs to be balanced with physical activity (energy out).

Planning for the best quality on-water training sessions doesn't start when you sit in your boat. There are a number of simple things you can do to increase the benefits you gain from your training!

These include:

- *Ensuring that the last meal before the training session is higher in carbohydrates.* As the intensity of training increases your muscles switch more and more towards burning carbohydrates to produce the energy to do the work. Run out of carbohydrates and the intensity of training drops
- *Making sure you are hydrated heading into the session.* This can be done by drinking 10 ml/kg of fruit juice or sports drink in the 120-90 minutes prior to the training sessions. For morning sessions drink around 5 ml/kg with dinner and the same before going to bed and top up on the way to training.
- *Eating and drinking straight after the session is over.* Rehydrating and replenishing the energy stores straight after training not only helps you improve your response to the session you have just done, it also gets your body ready for the next session. The use of a liquid meal replacement can be carried in the coach's boat or in an insulated container in your boat and drunk as you finish the hard part of your session and paddle to get out.

Within the first 30 minutes to an hour of working out, your body has an anabolic (muscle building) and anti-catabolic (muscle sparing) window where you can capitalize on optimal gains. In order to achieve the highest yield on your workout investment, your body requires many different nutrients but there are six that are especially important: quality protein, quality carbohydrates and dietary oils, quality water, electrolytes, and enzymes.

CHAPTER 14
ENDURANCE

INTRODUCTION

Paddle-sport is among the so-called endurance sports that rely heavily upon the aerobic system. Therefore, the endurance capacity of an athlete is a vital element of his or her performance. In order to be able to maintain a certain speed for a longer period of time, it is necessary to improve the athlete's ability to endure the physical demands placed upon the body. This is called the athlete's endurance capacity.

Endurance or stamina can be defined as:

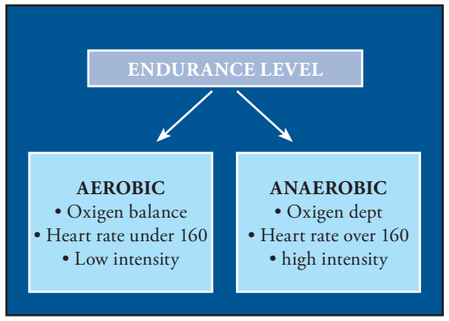
- the resistance of the organism to sustained high intensity work; or
- the adaptation of the circulatory system to increasing and sustained work; or
- the capacity of the athlete to resist fatigue.

The foundations of endurance lie in the athlete's circulatory system, described in Chapter 12. The typical duration of a race varies from 35 seconds to 5 minutes in 'sprint' racing and much longer in marathon races. In training sessions, endurance plays an important role.

Classification of Endurance	
short term	30 seconds to 2 minutes
medium term	2 to 8 minutes
long term	8 minutes to hours

Well-developed "short and medium term endurance" are essential for athletes training for races up to the maximum 1000m Olympic distance, whilst "long term" endurance is for long distance and marathon specialists.

With the correct training, oxygen utilization is improved; the muscle's oxygen supply increases and hence endurance is much better. Endurance can be categorised as **Aerobic Endurance** or **Anaerobic Endurance**.



14.1 AEROBIC ENDURANCE

The aerobic energy system supplies energy for low-intensity exercise over longer periods of time. Although paddling is a speed dominated event, **aerobic endurance is determining factor** in different proportions at all racing distances!

Aerobic endurance training is important factor in paddle-sport in order to develop a strong aerobic endurance base. It allows physical activity for a longer duration at higher intensities by delaying fatigue and allowing for an improved (shorter) recovery time. With aerobic endurance, all the necessary oxygen is supplied from inhaled air during sustained exercise. The paddler's aerobic capacity will be the maximum amount of work that he or she can do as determined by the amount of oxygen consumed and the efficiency with which the oxygen can be used by the body tissue. Paddlers and coaches will recognise this as the **steady-state condition**. Aerobic respiration is not capable of supplying all the energy needs during high intensity exercise. At this stage, the anaerobic energy system also provides energy to the body.

14.2 ANAEROBIC ENDURANCE:

Once exercise intensity increases beyond the aerobic threshold ("oxygen debt") the body uses anaerobic respiration to produce energy. The lack of sufficient oxygen causes lactic acid (LA) to be produced

in the blood and muscles, which leads to fatigue. Relatively high blood lactate concentration levels can be reached over 20mmol/l. However, activity at that level cannot be sustained for very long, and performance will decrease or stop completely.

14.3 ENDURANCE IN CANOEING

"Kayaking is a sport that relies heavily on aerobic power. Aerobic power refers to energy produced by the aerobic energy system which generally supplies energy for low-intensity exercise for a long duration.

Although kayaking is a speed dominated event, research has found kayakers obtain the majority of the required energy from the aerobic energy system during racing (Tesch, 1983). Values have been shown to be 73% for the 500m and 85% for the 1000m (Zamparo et al., 1999). These high values suggest the importance of aerobic work at kayak training to develop a strong aerobic base. This is important as it allows a kayaker to work for longer and at a higher intensity by delaying fatigue and allowing for an improved recovery time."

Both aerobic and anaerobic endurance are important in paddle-sport:

Distance	Oxigen Consumed	Aerobic	Anareobic
200m	20 litres	18%	82%
500m	35 litres	50%	50%
1.000m	50 litres	65%	35%
2.000m	80 litres	70%	30%
5.000m	180 litres	90%	15%
10.000m	280 litres	95%	5%

At 200m, 500m and 1000m, oxygen debt is considerable, and thus we must develop a good anaerobic capacity for potential success. On the other hand, aerobic capacity must be seen as the 'building block' of anaerobic capacity, and is therefore a training priority. High aerobic capacity provides a good base for high intensity training and racing. This means that the athlete who can exercise for longer aerobically, starts utilizing the rather limited anaerobic energy reservoir later than 'less fit' athletes.

Aerobic and anaerobic endurance demand in % regarding the duration of paddling with full efforts

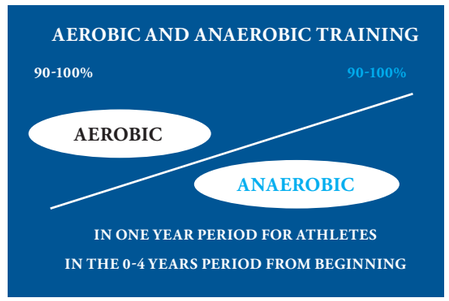
	10 sec	20 sec	40 sec	100 sec	4 min	2-3 hrs
Aerobic %	5	10	20	40	70	98-100
Anaerobic %	95	90	80	60	30	1-2
LA mmol/ l	0	4-6	10-12	15-18	18-20	1-2

14.4 ENDURANCE DEVELOPMENT

Well-developed aerobic and anaerobic endurance and strength are essential for paddle-sport! We need to develop strength and endurance in combination for the best results. For example, if training twice a day it is better to concentrate on endurance in the first session and strength in the second.

For the athlete to improve and retain the ability to perform at a higher speed for a longer period of time is a continuous training target. Improvement will come from specific paddling and supplementary training such as running, swimming, cycling, cross country skiing, rowing or speed skating. Although specific paddling training is considered more important for specific endurance development, supplementary training will develop the circulatory system as a strong base. It is beneficial to use both supplementary and specific training for paddle-sport.

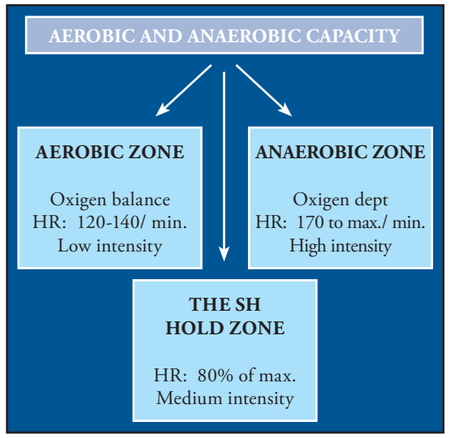
To develop endurance the first task is to improve aerobic capacity, and secondly anaerobic endurance. This is true both for beginners and for experienced athletes at the beginning of the season.



14.4.1 TRAINING FOR ENDURANCE DEVELOPMENT

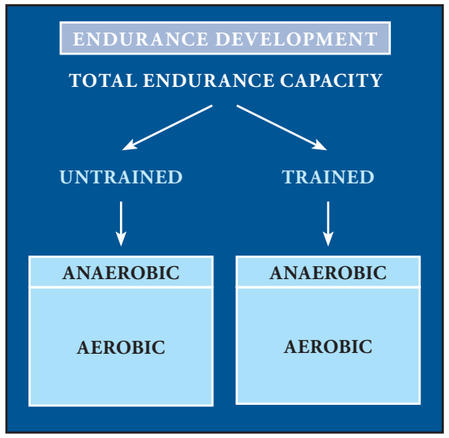
Aerobic	Anaerobic
Heart rate 120-150 bpm **Suggested Training:** long distance, fartlek, „over distance", slower intervals with short resting times **Low/medium intensity**	Heart rate: 170-200 bpm Lactic acid tolerance **Suggested Training:** fast intervals, short distance repetitions **High/maximum intensity**

By careful control of the heart rate we can achieve training targets and avoid overreaching aerobic capacity during training or overtraining generally. Also, it is very important to understand that increases in anaerobic capacity rely upon a well developed aerobic endurance capacity and **HIGH INTENSITY TRAINING**!



Endurance development training specialised for the racing distances

	200m	500m	1.000m	marathon
Race time	34-40 sec	1,5-2 mins	3-4 mins	2-4 hours
% of VO_2 max.	100	95-100	90-95	80
La mmol/ litre	8-10	16-18	18-20	3-4
Anaerobic/ aerobic (%)	80:20	65:35	50:50	5:95
SUGGESTED TRAINING IN %				
1. Anaerobic				
Alactacid system (8-10 sec)	30	15	5	0
Lactic acid (10-35 sec)	50	50	40	0-5
2. Aerobic	20	35	50-60	60
Aerobic II.	0	0	0	40



Example for endurance development:

ENDURANCE DEVELOPMENT TRAINING				
	200m	**500m**	**1.000m**	**marathon**
The times	34-40 sec	1,5-2 min	3-4 min	3-4 hours
% of VO_2 max	100	95-100	90-95	80
La mmol/ litre	16-23	18-23	18-20	3-4
Anae/ aerob %	80:20	65:35	50:50	5:95
Suggested training in %				
1. Anaerob				
a/ alactacid (8-10 sec)	30	15	5	0
b/ lactacid (10-35 sec)	50	50	40	0-5
2. Aerob I.	20	35	50-60	60
Aerob II.	0	0	0	40

14.5 TEST OF ENDURANCE

Aerobic endurance capacity is a measure of: the rate at which the body can breathe in oxygen; transfer oxygen from the lungs to the heart; deliver the oxygen through the blood to the working muscles; extract the oxygen from the blood; use the oxygen in the muscles for energy production (the circulatory system!). Aerobic capacity is expressed as the maximum volume of oxygen that can be taken up and used by the body. It is an indication of the athlete's level of fitness.

VO_2 max is a measure of the athlete's aerobic limit.

VO_2 MAX

- Measurment of the aerobic endurance
- The higher result means better endurance, delays fatique and LA accumulation
- The best age of it's development: 12-15
- The best VO_2 results can be reached at age 17-21
- VO_2 max. and anaerobic endurance could be developed well until 21 years of age

Oxygen uptake: $V0_2$ max test

A measurement is taken of the difference in oxygen content between the inhaled and exhaled air to find the oxygen uptake over a given time. The result is then expressed in relation to the athlete's body weight: millilitres of oxygen per kilogram of body weight per minute.

VO_2 max (athlete's aerobic limit)	
absolute rate (VO_2 l/ min) Litres of oxygen per minute	**relative rate** (VO_2 ml/kg /min) millilitres of oxygen per kg of body weight per minute

The result for a trained person can be over 80 ml/kg/min, whilst an untrained person will only be around 40 ml/kg/min. The relative VO2 max is usually higher on lighter individuals than heavier. Typical maximum oxygen consumption for paddlers during a maximal effort is about 5.5-6.5 litres per minute. These figures when related to body weight correspond to 50-80 ml/kg/min. For women these numbers are lower, approximately 3-4.5 litres per min (45-60 ml/kg/min).

Although aerobic endurance is measured by VO-2max, which will depend upon the trained level of the circulatory system, other factors will play a part:

- Oxygen partial pressure depends on attitude. At high attitude (over 2000m) partial pressure is less than at sea level. At altitude, oxygen debt will occur at lower intensity activity than at sea level,
- The VO2 level will be less when an athlete is unwell – where oxygen is not efficiently combined hemoglobin in the blood or the airways are narrowed,
- Oxygen up take will be less if there is a lower concentration of red blood cells and/or hemoglobin in the blood (i.e. low iron levels)
- The athlete's storage capacity of glycogen in the muscles and liver

The oxygen uptake test can be taken on a running tread mill, exercise bike, hand-pedalled exercise bike, kayak/canoe ergo-machine or in the boat using the so-called Douglas bag. Alternatively, there are tests that can transfer running performance into a VO2 max measurement (i.e. Cooper Test, Multi-stage Fitness Test ['Bleep Test'])

The Douglas bag is most commonly used for measurement, which is basically a collection bag for exhaled air. This bag with its associated instruments and devices can easily fit into a kayak or a canoe and often is used in the field. The collected air volume is measured and analysed for the content of oxygen and carbon dioxide.

The results of a VO_2 max test should be considered in the light of the way it was taken – using the legs or the upper body. Upper body exercise based tests will elicit lower rates of oxygen consumption than those observed during lower body or whole body exercise. For this reason, an individual rarely achieves their VO_2 max during up-

per body exercise; therefore the aerobic capacity for upper body work is commonly referred to as VO_2 peak rather than VO2 max. Hence VO_2 max data on road cycling or long distance running are

FIG. 14.1 - VO_2 MAX TEXT ON KAYAK ERGO MACHINE

higher than paddle-sport. For example the 7 time Tour de France winner Lance Armstrong recorded 84 ml/kg/min (5.5-6 L/min)

Typical values for VO_2 max of elite athletes in endurance sports

SPORT	Men	Women
	VO_2 (ml/ kg/ min)	
Long distance running	75 – 80	65 – 70
Cross-country skiing	75 – 78	65 – 70
Biathlon	75 – 78	X
Road cycling	70 – 75	60 – 65
Middle-distance running	70 – 75	65 – 68
Skating	65 – 72	55 – 60
Orienteering	65 – 72	60 – 65
Swimming	60 – 70	55 – 60
Rowing	65 – 69	60 – 64
Track cycling	65 – 70	55 – 60
Canoeing	**60 – 68**	**50 – 55**
Walking	60 – 65	55 – 60

The VO_2 data above is based on tread-mill test averages.

The VO_2 max requirement by body weight

Maximum O2 uptake /kg/ ml/ kg (for women -10)					
Body weight	Poor	Acc.	Good	Very good	Excellent
50-55	-52	52-63	63-74	74-86	86
55-60	-50	50-62	62-73	73-84	84
60-65	-49	49-60	60-71	71-82	82
65-70	-48	48-59	59-69	69-80	80
70-75	-47	47-57	57-68	68-78	78
75-80	-46	46-56	56-66	66-76	76
80-85	-44	44-54	54-64	64-74	74
85-90	-42	43-53	53-62	62-72	72
90-95	-42	42-51	51-61	61-70	70
95-100	-41	41-50	50-59	59-68	68

COOPER TEST

The most used running test to measure aerobic endurance is the Cooper Test: the distance that an athlete can run in 12 minutes. A good result for a male paddler would be over 3,300m and for female paddlers over 2,800m. The test should be conducted on a 400m track - participants run continuously as quickly as they can for 12 minutes, recording the distance covered in metres.

Using the result of Cooper Test we can use a formula to calculate VO_2 max.

COOPER TEST

RUNNING OF 12 MINUTES
AND MEASURED THE DISTANCE

VO_2 TEST BY COOPER TEST:

$$\frac{\text{Distance in m}}{12} \times 0{,}2 + 3{,}5$$

E.g.: 3.000m : 12 = 250 x 0,2 = 50 + 3,5 = **53,5**

See also **www.fitness.com** or **www.brianmac.co.uk** for an evaluation of aerobic endurance using the Cooper Test. You will need the distance covered and the age of the athlete to calculate VO_2 level.

Another VO_2 max test is called the 'bleep test'. The athlete runs between 2 marks, 25m apart at ever increasing speed in time with timer until he or she can no longer keep pace with the 'bleep'. The point at which the athlete fails is recorded to give a level. That level can be converted to a VO2 max score, using a conversion table (**www.brianmac.co.uk**).

Another version of the endurance test is for the athlete to complete a 3.000m timed run.

A good aerobic endurance paddling test is the 2.000m time trial. A good result for an elite male kayak paddlers will be less than 8 minutes and for women kayak paddlers and male canoe paddler under 9 minutes. Women canoe paddlers around 10 min.

Aerobic endurance can also be tested using swimming over a distance that can be completed in around 8-12 minutes.

As a result of frequent running training in canoeing the athletes perform good result at Cooper test, which much higher as the requirement from athletes generally.

The best 8 results of Hungarian athletes in 2014

	COOPER TEST		
	Seniors men	Juniors men	Girls 12-13
Place	Distance in meter		
1	3.610	3.475	2.750
2	3.577	3.430	2.127
3	3.550	3.425	2.770
4	3.535	3.400	2.689
5	3.397	3.380	3.152
6	3.387	3.369	2.625
7	3.338	3.325	2.510
8	3.309	3.305	2.491

THE EFFECTS OF LACTIC ACID (LA)

LA is a by-product of anaerobic respiration. Training improves the athlete's ability to tolerate the high level of LA accumulated in the blood and muscles.

CHAPTER 15
SPEED

INTRODUCTION

Whilst it is necessary to point out that the paddler's own qualities of good speed and agility are very important or even essential for paddle-sport, in this chapter we are considering the speed of the boat!

All training in paddle-sport is ultimately targeted to making the boat go faster! To move a boat faster, more force must be generated and transmitted efficiently into forward speed through good technique. Pitch, roll and snaking motions of the boat are counterproductive and slow the boats down hence these motions should be minimised as much as possible! Again, they are technical requirements.

Increased speed requires more power from the athlete and less wetted surface area to the hull of the boat, through boat design. The factors that influence the boat's speed:

THE SPEED OF THE BOATS DEPENDS ON:

- **Technique**
  - the magnitude direction of entry and draw
  - the angle of the blade
  - rhythm
- **Power on paddle**
  - the given power to the paddle (athlete's strength)
- **Length of stroke**
  - the length of a stroke when the blade in the water
- **Power transmission**
  - the transferred volume of the power from the paddle to the boat
- **Stroke rate**
  - the frequency the number of strokes/ min.
- **Boat design**
  - the design, length, weight, hidrodynamic, resistance, surface

The speed of a manpowered boat (besides the characteristics of the boat) depends on the paddler's technique, power, length of strokes and frequency of strokes (stroke rate).

The same speed can be reached either:

- with a shorter stroke and greater power or less power but a longer stroke; and
- with a shorter stroke on higher stroke rate or longer stroke on lower stroke rate

It's possible to increase the speed of the boat either by improving technique and efficiency, or increasing the stroke rate, length of stroke or power to each strokes. These factors are the elements of speed development!

The speed can be viewed in different ways:

- Maximum speed
- Travelling speed
- Training target speed

15.1 MAXIMUM SPEED AND STARTING SPEED

The top speed reached by paddlers under the highest intensity possible is a good measure of each paddler's speed condition. Usually, the maximum speed can only be maintained for 15-20 seconds; which is about 70-100m in distance. After this period the boat speed will be decrease. This is because maximum stroke rate with maximum power are determined by the limits of the energy systems referred to in Chapter 12. Even at maximum stroke rate it is still essential to use correct and controlled technique for smooth boat movement.

Every paddler has a speed threshold which is difficult to cross but maximum speed can be increased by a variety of training methods, taking care to balance correctly the length and number of efforts and the corresponding recovery, within and between sessions.

Starting speed during a race is usually maximum speed or very close to it. It depends on the racing distance and start strategy. Start practice is an important part of training for short distance races and for all paddlers during the racing season.

15.2 TRAVELLING SPEED OR RACING SPEED

Travelling speed follows the start phase and continues to the end of the interval or race. Travelling speed is always less that maximum speed. The average travelling speed is calculated over the whole racing distance by dividing the distance travelled by the time taken (metres per second or kilometres per hour). For example, a K1 paddler completes the 500m in 2 minutes. His speed in m/sec is: 500m/120sec. = 4.16 m/sec. The difference between the maximum speed and the average travelling speed is the so called **drop off speed**.

To relate travelling speed to maximum speed a simple division results in a meaningful quotient:

$$\text{“drop off” quotient} = \frac{\text{racing speed (m/sec)}}{\text{maximum speed (m/sec)}}$$

Drop off quotient indicates how close a paddler's maximum speed is to average racing speed (travelling speed). Using the previous example (athlete's travelling speed is 4.16m/sec) we can calculate the drop off quotient if we know the athlete's maximum speed. To measure the maximum speed we time the paddler at full effort over 100m with a moving start (“flying start”). For example, if the athlete completes the 100m in 18 second, the speed is 5.55m/s (100 divided by 18). Dividing the travelling speed of 4.16m/s by the maximum speed of 5.55 m/s the drop off quotient is 0.75. The closer this result is to 1.0, the better the speed-endurance of the athlete (speed- endurance will be discussed later).

ANOTHER WAY TO COMPARE MAXIMUM SPEED WITH TRAVELLING SPEED
(e.g. where the best time for 100 m is 18 seconds)

DISTANCE (METRES)	% OF MAX. SPEED	RACE TIME
100	**100**	**18 seconds**
200	95	38 sec.
500	88	1 min. 42 sec.
1.000	82	3 min. 40 sec.

To measure boat speed the coach can simply time using a stop watch over a pre-set distance but there are devices available such as speedometers or other kinds of devices such as Digi-Trainer etc.

15.3 TRAINING SPEED

Training speed will always depend on the requirements of the particular training phase. It is important to specify training speed for a given session in order to achieve the targeted training effect, with the ultimate aim of higher racing speed! This can be given by stating the required stroke rate or the time for a given distance. By deciding the required intensity for a session, the coach will then be able to tell the athlete the stroke rate to paddle at. During the training session, the coach will be checking to see if the athlete is meeting the stroke rate in order to fulfil the training effect. The table below can be a tool for coaches planning training for 1000m:

- Select the best time of the athlete in the 100% column (gren)

- Select the target time (intensity) for the session (data on the left of the columns indicates the speed in km/hr).

PACE											
110%		105%		100%	95%		90%		85%		80%	
15.8	03:47	15.1	03:58	**04:10.0**	13.7	04:23.2	13.0	04:38	12.2	04:54	11.5	05:13
16.0	03:46	15.2	03:56	**04:08.1**	13.8	04:21.2	13.1	04:36	12.3	04:52	11.6	05:10
16.1	03:44	15.3	03:55	**04:06.3**	13.9	04:19.3	13.2	04:34	12.4	04:50	11.7	05:08
16.2	03:42	15.5	03:53	**04:04.5**	14.0	04:17.4	13.3	04:32	12.5	04:48	11.8	05:06
16.3	03:41	15.6	03:51	**04:02.7**	14.1	04:15.5	13.3	04:30	12.6	04:46	11.9	05:03
16.4	03:39	15.7	03:49	**04:01.0**	14.2	04:13.6	13.4	04:28	12.7	04:43	12.0	05:01
16.6	03:37	15.8	03:48	**03:59.2**	14.3	04:11.8	13.5	04:26	12.8	04:41	12.0	04:59
16.7	03:36	15.9	03:46	**03:57.5**	14.4	04:10.0	13.6	04:24	12.9	04:39	12.1	04:57
16.8	03:34	16.0	03:45	**03:55.8**	14.5	04:08.3	13.7	04:22	13.0	04:37	12.2	04:55
16.9	03:33	16.1	03:43	**03:54.2**	14.6	04:06.5	13.8	04:20	13.1	04:36	12.3	04:53
17.0	03:31	16.3	03:41	**03:52.6**	14.7	04:04.8	13.9	04:18	13.2	04:34	12.4	04:51
17.1	03:30	16.4	03:40	**03:50.9**	14.8	04:03.1	14.0	04:17	13.2	04:32	12.5	04:49
17.3	03:29	16.5	03:38	**03:49.4**	14.9	04:01.4	14.1	04:15	13.3	04:30	12.6	04:47
17.4	03:27	16.6	03:37	**03:47.8**	15.0	03:59.8	14.2	04:13	13.4	04:28	12.6	04:45
17.5	03:26	16.7	03:35	**03:46.2**	15.1	03:58.2	14.3	04:11	13.5	04:26	12.7	04:43
17.6	03:24	16.8	03:34	**03:44.7**	15.2	03:56.5	14.4	04:10	13.6	04:24	12.8	04:41
17.7	03:23	16.9	03:33	**03:43.2**	15.3	03:55.0	14.5	04:08	13.7	04:23	12.9	04:39
17.9	03:22	17.0	03:31	**03:41.7**	15.4	03:53.4	14.6	04:06	13.8	04:21	13.0	04:37
18.0	03:20	17.2	03:30	**03:40.3**	15.5	03:51.9	14.7	04:05	13.9	04:19	13.1	04:35
18.1	03:19	17.3	03:28	**03:38.8**	15.6	03:50.3	14.8	04:03	14.0	04:17	13.2	04:34
18.2	03:18	17.4	03:27	**03:37.4**	15.7	03:48.8	14.9	04:02	14.1	04:16	13.2	04:32
18.3	03:16	17.5	03:26	**03:36.0**	15.8	03:47.4	15.0	04:00	14.2	04:14	13.3	04:30
18.5	03:15	17.6	03:24	**03:34.6**	15.9	03:45.9	15.1	03:58	14.3	04:12	13.4	04:28
18.6	03:14	17.7	03:23	**03:33.2**	16.0	03:44.4	15.2	03:57	14.4	04:11	13.5	04:27
18.7	03:13	17.8	03:22	**03:31.9**	16.1	03:43.0	15.3	03:55	14.4	04:09	13.6	04:25
18.8	03:11	18.0	03:21	**03:30.5**	16.2	03:41.6	15.4	03:54	14.5	04:08	13.7	04:23
18.9	03:10	18.1	03:19	**03:29.2**	16.3	03:40.2	15.5	03:52	14.6	04:06	13.8	04:22
19.0	03:09	18.2	03:18	**03:27.9**	16.5	03:38.8	15.6	03:51	14.7	04:05	13.9	04:20
19.2	03:08	18.3	03:17	**03:26.6**	16.6	03:37.5	15.7	03:50	14.8	04:03	13.9	04:18
19.3	03:07	18.4	03:16	**03:25.3**	16.7	03:36.1	15.8	03:48	14.9	04:02	14.0	04:17
19.4	03:06	18.5	03:14	**03:24.1**	16.8	03:34.8	15.9	03:47	15.0	04:00	14.1	04:15
19.5	03:04	18.6	03:13	**03:22.8**	16.9	03:33.5	16.0	03:45	15.1	03:59	14.2	04:14
19.6	03:03	18.7	03:12	**03:21.6**	17.0	03:32.2	16.1	03:44	15.2	03:57	14.3	04:12

PACE											
75%		70%		65%		60%		55%		50%	
10.8	05:33	10.1	05:57	9.4	06:25	8.6	06:57	7.9	07:35	7.2	08:20
10.9	05:31	10.2	05:54	9.4	06:22	8.7	06:54	8.0	07:31	7.3	08:16
11.0	05:28	10.2	05:52	9.5	06:19	8.8	06:51	8.0	07:28	7.3	08:13
11.0	05:26	10.3	05:49	9.6	06:16	8.8	06:47	8.1	07:25	7.4	08:09
11.1	05:24	10.4	05:47	9.6	06:13	8.9	06:45	8.2	07:21	7.4	08:05
11.2	05:21	10.5	05:44	9.7	06:11	9.0	06:42	8.2	07:18	7.5	08:02
11.3	05:19	10.5	05:42	9.8	06:08	9.0	06:39	8.3	07:15	7.5	07:58
11.4	05:17	10.6	05:39	9.9	06:05	9.1	06:36	8.3	07:12	7.6	07:55
11.4	05:14	10.7	05:37	9.9	06:03	9.2	06:33	8.4	07:09	7.6	07:52
11.5	05:12	10.8	05:35	10.0	06:00	9.2	06:30	8.5	07:06	7.7	07:48
11.6	05:10	10.8	05:32	10.1	05:58	9.3	06:28	8.5	07:03	7.7	07:45
11.7	05:08	10.9	05:30	10.1	05:55	9.4	06:25	8.6	07:00	7.8	07:42
11.8	05:06	11.0	05:28	10.2	05:53	9.4	06:22	8.6	06:57	7.8	07:39
11.9	05:04	11.1	05:25	10.3	05:50	9.5	06:20	8.7	06:54	7.9	07:36
11.9	05:02	11.1	05:23	10.3	05:48	9.5	06:17	8.8	06:51	8.0	07:32
12.0	05:00	11.2	05:21	10.4	05:46	9.6	06:15	8.8	06:49	8.0	07:29
12.1	04:58	11.3	05:19	10.5	05:43	9.7	06:12	8.9	06:46	8.1	07:26
12.2	04:56	11.4	05:17	10.6	05:41	9.7	06:10	8.9	06:43	8.1	07:23
12.3	04:54	11.4	05:15	10.6	05:39	9.8	06:07	9.0	06:40	8.2	07:21
12.3	04:52	11.5	05:13	10.7	05:37	9.9	06:05	9.0	06:38	8.2	07:18
12.4	04:50	11.6	05:11	10.8	05:34	9.9	06:02	9.1	06:35	8.3	07:15
12.5	04:48	11.7	05:09	10.8	05:32	10.0	06:00	9.2	06:33	8.3	07:12
12.6	04:46	11.7	05:07	10.9	05:30	10.1	05:58	9.2	06:30	8.4	07:09
12.7	04:44	11.8	05:05	11.0	05:28	10.1	05:55	9.3	06:28	8.4	07:06
12.7	04:42	11.9	05:03	11.0	05:26	10.2	05:53	9.3	06:25	8.5	07:04
12.8	04:41	12.0	05:01	11.1	05:24	10.3	05:51	9.4	06:23	8.6	07:01
12.9	04:39	12.0	04:59	11.2	05:22	10.3	05:49	9.5	06:20	8.6	06:58
13.0	04:37	12.1	04:57	11.3	05:20	10.4	05:47	9.5	06:18	8.7	06:56
13.1	04:35	12.2	04:55	11.3	05:18	10.5	05:44	9.6	06:16	8.7	06:53
13.1	04:34	12.3	04:53	11.4	05:16	10.5	05:42	9.6	06:13	8.8	06:51
13.2	04:32	12.3	04:52	11.5	05:14	10.6	05:40	9.7	06:11	8.8	06:48
13.3	04:30	12.4	04:50	11.5	05:12	10.6	05:38	9.8	06:09	8.9	06:46
13.4	04:29	12.5	04:48	11.6	05:10	10.7	05:36	9.8	06:07	8.9	06:43

15.4 THE STROKE RATE

Stroke rate is a very important aspect of paddling intensity because it's one of the basic elements that determines boat speed. STROKE RATE = the number of strokes per minute (in kayaking we count the strokes on both sides).
Intensity is also a function of stroke rate. Maximum intensity is achieved through maximum stroke rate provided the other factors referred to earlier are optimised. Maximum stroke rate is individual to each paddler and depends upon technique, experience, paddle size and muscular strength. There is a direct relationship between boat speed and stroke rate, applied power and muscular strength. An individual's maximum stroke rate can be measured over a short duration (i.e. 20 seconds) and is an indication of the individual's level of paddling. The recommended stroke rate will vary depending upon the distance or time being paddled or the training aims. It is important to stress that controlled, well executed technique is essential at maximum stroke rate in order to produce maximum speed. Only a controlled maximum stroke rate with maximum power will produce the fastest boat speed.

THE AVERAGE STROKE RATES
Measured in World Ch. 2007

	START PHASE	TRAVELLING PHASE
K1 500 men	156-144	130-115
K2 500 men	168-156	134-122
K1 1.000 men	138-132	114-102
K2 1.000 men	144-132	126-120
K4 1.000 men	144-136	126-120
C1 500 men	88-84	78-72
C2 500 men	90-84	84-72
C1 1.000 men	82-78	66-60
C2 1.000 men	84-78	78-72
K1 500 women	144-136	120-114

One of the ways to develop speed is to increase the average stroke rate over a given racing distance. The table below shows stroke rates for the elite paddlers at their maximum racing speed.

The following table shows the K1 500m finalists' stroke rates at various stages of the race in 2004 Athens Olympic Games.

ATHENS 2004. – OLYMPIC GAMES; K1 500 M - MEN - FINAL							
Place	**competitor/**	**Stroke rate**	**Stroke rate**	**Stroke rate**	**Stroke rate in**	**500m race**	**Average stroke**
1	van Koeverden	**146**	115	120	119	97,92	**125**
2	B. Nathan	**165**	131	123	133	98,47	**138**
3	Wynne Ian	**132**	122	128	115	98,55	**124**
4	L. E. Veraas	**142**	128	132	122	98,67	**131**
5	Vereckei Ákos	**135**	128	128	115	99,32	**126**
6	Altepos Lutz	**142**	118	121	115	99,65	**124**
7	A. T. Babak	**145**	123		133	100,19	**133**
8	Correa Javier	**142**	119	126	128	100,64	**128**
9	Facchin Andrea	**133**	119	117	112	101,58	**120**

With the introduction of 200m races stroke rates increased dramatically. Male kayak paddlers reach over 160 strokes/min whilst male C1 paddlers about 90 strokes/min. More information on 200m racing is found at Chapter....
Beginners, paddlers below international levels and technically weaker competitors will fall short of the above norms. It takes years before an athlete can efficiently maximise their own stroke rate.

Stroke rate can be measured using a stop watch with a special stroke rate function or just by counting the number of strokes over a given time.

15.5 THE SPEED AND THE STROKE RATE

It is very important to underline once again that stroke rate is directly related to boat speed because with more (well executed quality) strokes

in the same period of time, the boat receives more propulsion! However, this is only so if the strokes are well executed. If stroke rate is too high and technique is poor and weak such a high stroke rate might even reduce boat speed! Paddling is more efficient if an athlete can achieve the same time over a given distance with fewer strokes because each stroke will be moving the boat a longer distance! Efficient maximum stroke rate, producing maximum boat speed, is unique to each individual, developed through a sense of rhythm, power and skill.

The next diagrams show the relationship between boat speed, average stroke rate, distance per stroke, and maximum and minimum stroke rates in the women's finals at the 2012 Olympic Games.

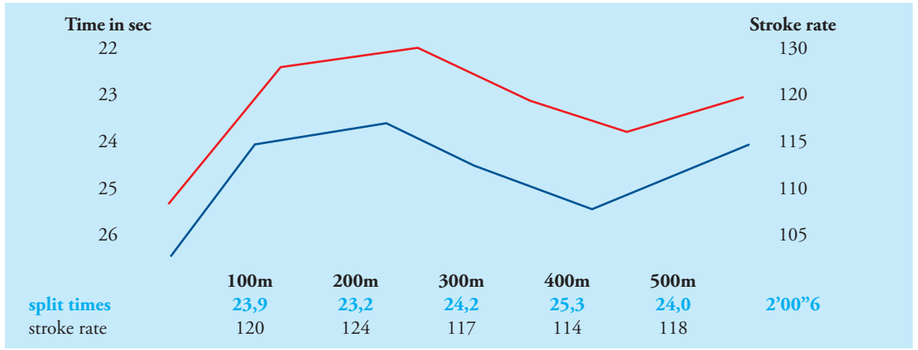
15.6 SPEED ENDURANCE

Speed endurance is a strong indicator of a paddler's level as it determines how much of maximum racing speed will be lost throughout the full race distance. Physiological and technically it is most efficient to paddle at the fastest possible uniform speed

K1W 200 M FINAL O.G. 2012							
NOC	**Total time (sec)**	**Speed (km/h)**	**No. of strokes**	**Strokes/ meter**	**Max. stroke**	**Min. stroke**	**Average stroke**
NZL	44,63	11,20	103	1,94	156	123	140
UKR	45,05	11,10	106	1,89	156	130	144
HUN	45,12	11,08	96	2,08	138	120	129
ESP	45,32	11,03	107	1,87	156	117	137
POL	45,50	10,99	107	1,87	165	123	143
RUS	45,96	10,88	96	2,08	135	116	125
GBR	46,16	10,83	100	2,00	147	113	129
POR	46,54	10,74	105	1,90	154	123	136
5,6 m/s head wind		**Average age: 26 • Heights: 168,4 cm • Weights: 65,1 kg Best time: 40,53 sec. in Semi Final**					

K1W 500 M FINAL O.G. 2012												
NOC	**Total time (sec)**	**Speed (km/h)**	**No. of strokes**	**Stroke (meter)**	**1st 250 m**	**Rank**	**2nd 250 m**	**Rank**	**Diff. (sec)**	**Max. stroke**	**Min. stroke**	**Avg. stroke**
HUN	1,51.4	4,49	203	2,46	54,53	2	57,23	1	3,00	128	102	**112**
UKR	1,52.6	4,44	237	2,11	53,67	1	59,01	7	5,34	140	112	**128**
RSA	1,52.9	4,43	199	2,51	55,14	5	57,78	4	2,64	126	101	**109**
SWE	1,53.1	4,44	211	2,37	55,05	4	58,15	5	3,10	116	106	**112**
ITA	1,53.2	4,42	213	2,35	55,76	8	57,46	2	1,70	129	100	**112**
GBR	1,53.3	4,41	227	2,20	55,67	7	57,67	3	2,00	132	114	**119**
DEN	1,54.1	4,38	235	2,13	55,28	6	58,83	6	3,55	151	114	**127**
FIN	1,54.3	4,37	225	2,22	54,60	3	59,73	8	5,13	133	114	**121**

K4W 500 M FINAL O.G. 2012												
NOC	**Total time (sec)**	**Speed (km/h)**	**No. of strokes**	**Stroke (meter)**	**1st 250 m**	**Rank**	**2nd 250 m**	**Rank**	**Diff. (sec)**	**Max. stroke**	**Min. stroke**	**Avg. stroke**
HUN	1,30.8	5,50	195	2,56	44,40	2	46,43	1	2,03	167	120	**135**
GER	1,31.2	5,48	203	2,46	44,63	3	46,67	3	2,04	153	125	**136**
BLR	1,31.4	5,47	199	2,51	44,27	1	47,13	4	2,86	154	115	**129**
POL	1,31.6	5,46	193	2,59	44,99	4	46,62	2	1,63	170	114	**129**
GBR	1,33.0	5,37	207	2,42	45,59	7	47,46	5	1,87	160	123	**136**
POR	1,33.4	5,35	208	2,40	45,97	8	47,48	6	1,51	161	122	**135**
RUS	1,33.45	5,35	198	2,53	45,15	5	48,31	7	3,16	164	113	**130**
FRA	1,35.2	5,25	206	2,43	45,39	6	49,91	8	4,52	152	121	**130**



SPEED AND STROKE RATE RELATIONSHIPS
Example from practice: WK-1 500m (2 min 0.6 seconds) - Stroke rate is well correlated to speed!

throughout a race. Most paddlers will significantly improve their results by developing their speed endurance. Therefore, it is important to look at training methods that will improve this ability.

Quite often, when observing races, we notice paddlers who "finish well" thereby beating the rest of the field. In reality, most of the time, such paddlers have only maintained an even pace, whilst others, due to fatigue, have fallen back. Repeated measurements of many races reveal that in the vast majority of cases, paddlers are never, or very seldom, faster than on the second 100 metres of the course on 500 and 1000m. In 200m the second 100m is always slower than the first. A high level of speed endurance is vital in order to maintain a good even pace throughout a race. It is useful to have a measure of a paddler's speed endurance so that improvements can be

SPEED ENDURANCE INDEX

Firstly, time the paddler over 100m (from a moving start) at maximum speed. Then, a few minutes later, time the paddler over a distance of 500m or 1000m at maximum racing speed. The split times for every 100m need to be recorded then compared with the maximum speed (timed 100m). For example:

100m time test at maximum speed with a flying start = 23.2 seconds

500 M TIME TRIAL	TIME (SECONDS)	DIFFERENCE IN SECONDS
Start to 100m	23,4	+0,2
100m to 200m	23,1	-0,1
200m to 300m	23,8	+0,8
300m to 400m	24,4	+1,2
400m to 500m	23,7	+0,5
		Total +2,6 sec

Therefore, the "speed endurance index" in this example is +2.6 sec. The index is always greater than zero, but the closer it is to zero, the better the performance. A scale for classifying performance based on the "speed endurance index":

0 to 2	excellent
2 to 4	average
4 to 5	below average
above 5	poor

The index is a good indicator for determining what should be the immediate objectives of the training programme to make improvements. If the index is good, the paddler's overall speed needs improvement, firstly by achieving a higher maximum speed, and then learning how to maintain it. If the index is poor, then training should concentrate on speed endurance development.

15.7 PACING

Physiological and technically the most efficient way for a paddler to race is to try and maintain one single top speed throughout. In other words, the paddler has to find and set his or her racing speed for a given distance. This is substantiated by two simple facts:

- Considerably more energy (as much as 3 times more) is required to accelerate the boat, rather than maintain a constant speed;
- The resistance of the boat increases by the square of its speed, so considerably more effort is required for just a small increase in speed. Speed endurance is one of the most important things to develop in order to tolerate the increased effort.

Logically, it follows that a steady racing pace conserves energy. Good paddlers will learn to paddle with minimum fluctuations in speed. Pacing ability is a complex skill to master but can be developed systematically over time.

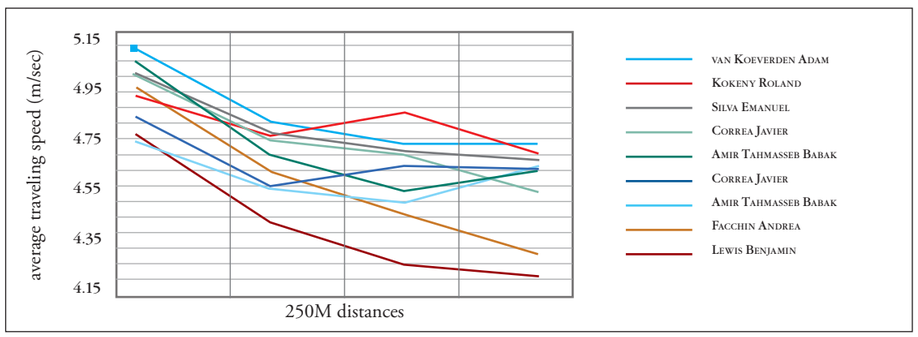
A helpful way to develop even pacing is to tell paddlers their split times at each 100m interval, therefore enabling them to correct fluctuations. Times could be recorded on a graph, and discussed with paddlers to develop an optimum race pace.

15.8 PACING IN COMPETITION

Pacing strategy will be different depending upon the race distances, although nowadays both the 500m and 1000m are very similar, requiring high intensity, 'all out paddling' throughout the whole distance. The objective is to accelerate the boat at the start as quickly as possible, then maintain an optimum pace for the rest of the race. At 500m, an even-paced constant speed is required, but as observations show us, it is difficult to achieve. The competitor may have the impression that he or she is moving at an even speed, but in reality only the exertion is even. The boat is gradually slowing down, due to the paddler's fatigue. Paddling becomes less powerful, or strokes are shorter, or stroke rate is reduced. In the 500m race this usually happens after about 1 minute between 300m and 400m ("hitting the wall"). Acceleration is still possible after this point, but the last 100m is seldom as fast as the second 100m (which is usually the fastest). For some outstanding 500m paddlers the fluctuation between 100m segments doesn't exceed 1or 2 tenths of a second. In crew boats the speed is more consistent than in singles, because the average speed is higher, meaning racing time is shorter, and the crew help each other through the "dead point".

For inexperienced paddlers fluctuations in speed will be considerable. Often, after an overly intense start, the paddler "dies off". Conversely, the paddler starts too cautiously then suddenly realises that he or she could paddle faster and accelerates toward the end. Paddlers need to begin learning even pacing at from the beginning of their careers, preferably by timing 100m segments and making regular adjustments in order to improve.

Holding a consistent pace is important on all distances but increasingly important on the 1000m race or longer distances.
Pacing examples in World Championships:

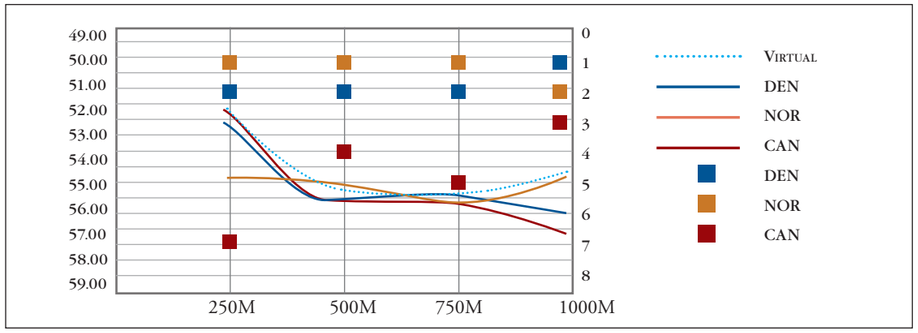


The next two pacing examples are from the 1000m Finals A and B in a 2012 World Cup.

FINAL "A"

The first 3 athletes were very close at the finish (only tenths of a second). They are world class athletes and their pace is quiet consistent, except at the start. The fastest paddler over the first 250m was third at the end by a very small margin. If he'd gone for a slightly slower start, might he have won? The split times show that that the winner (Denmark), after his first (faster) 250m kept a very consistent pace for the following 750m. The most consistent paddler was the Norwegian athlete who finished in second place. Perhaps, if he'd started a little faster he might have won the race (he was only 7th at the 250m mark). The graph also shows that the Canadian athlete, with a very quick first 250m was the leader until 750m (or further) but could not maintain or increase the pace and finished in 3rd place.

FINAL A

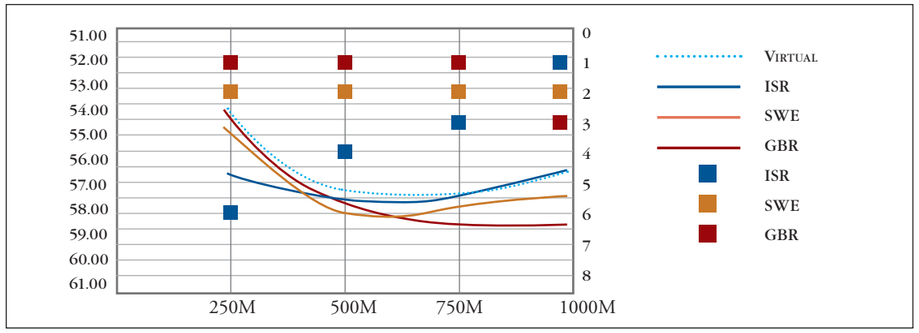


	250 m		500 m		750 m		1.000 m	
	Split time	pos.	Split time	pos.	Split time	pos.	Split time	pos.
DEN	53,02	2	56,24	2	56,48	2	56,80	1
NOR	55,18	7	55,56	4	56,68	5	55,25	2
CAN	52,30	1	56,24	1	56,72	1	57,62	3

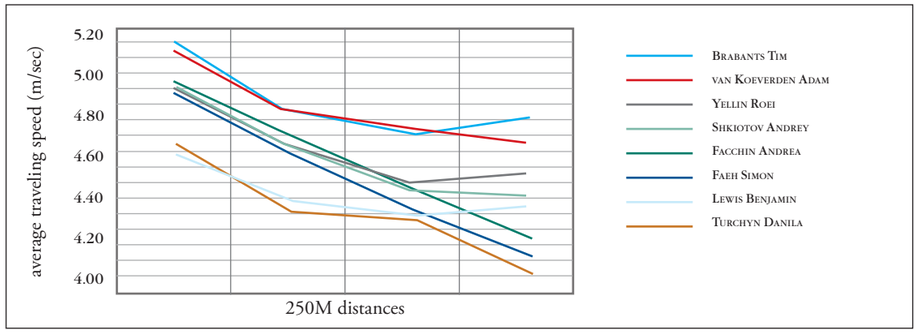
FINAL "B"

The graph displaying split times shows that the Israeli athlete who won the race was only in 6th position after the first 250m, 4th at 500m and 3rd at 750m. Unusually, his final 250m split time was 2 seconds faster than the previous two split times. The 2nd athlete (Swedish) was the most consistent on the course but was not able to increase his speed significantly at the end. The British athlete was the leader of the race to 750m but was not able to maintain a winning pace and slowed down, moving from 1st place to 3rd place.

FINAL B



	250 m		500 m		750 m		1.000 m	
	Split time	pos.	Split time	pos.	Split time	pos.	Split time	pos.
ISR	56,90	6	58,00	4	58,06	3	56,20	1
SWE	54,82	2	58,83	2	58,67	2	58,09	2
GBR	54,14	1	58,36	1	59,60	1	59,58	3



K1 1.000 M (MEN)				
Competitor/ crew	**250m average traveling speed (m/ sec.)**	**250m -500m average traveling speed (m/ sec.)**	**500m -750m average traveling speed (m/ sec.)**	**750m -1.000m average traveling speed (m/ sec.)**
Brabants Tim	5,19	4,85	4,75	4,79
van Koeverden Adam	5,23	4,84	4,78	4,69
Yellin Roei	4,97	4,67	4,50	4,57
Shkiotov Andrey	4,96	4,67	4,47	4,47
Facchin Andrea	4,99	4,73	4,49	4,32
Faeh Simon	4,93	4,64	4,37	4,20
Lewis Benjamin	4,68	4,48	4,35	4,43
Turchyn Danila	4,72	4,41	4,34	4,11

CONCLUSION

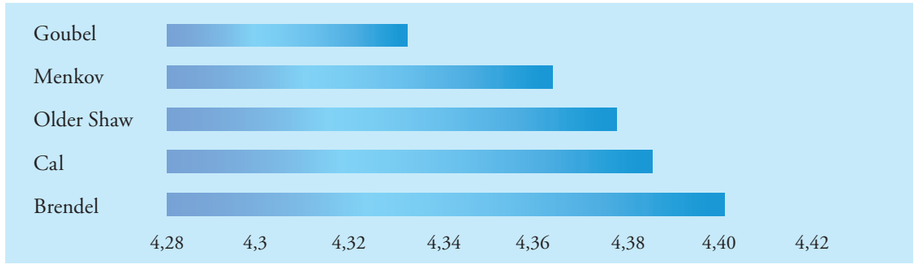
The first 250m is the fastest part of a 1000m race. Experienced elite athletes can keep a consistent pace throughout the race, possibly with a small increase in speed towards the end! Most of them paddle the distance with less than 1 second's differences between each 250m split. The resistance of the boat increases by the square of its speed, so considerably more effort is required for just a small increase in speed. Fluctuations in speed are inefficient so it is best to maintain a constant speed throughout a race.

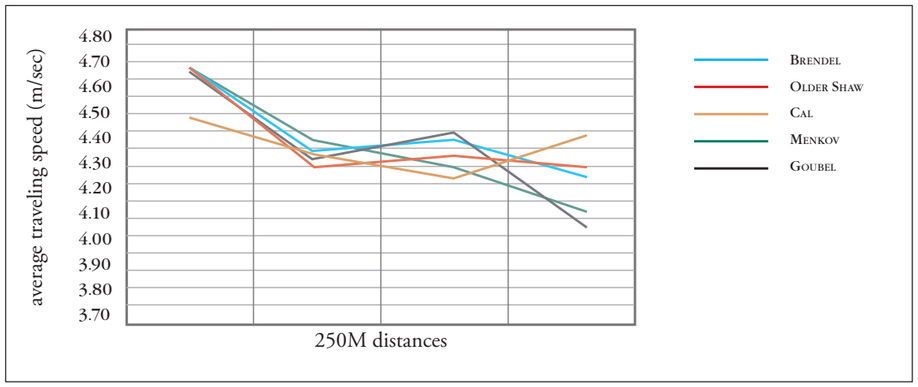
2012 OLYMPIC FINAL IN LONDON

Analysing of the C1 1.000m Final in the o.g. 2012 by istvan Vaskuti

RESULT OF C1 1.000M FINAL			
Rank			**Time**
1	Brendel Sebastian	(GER)	3:47.176
2	Cal Figueroa David	(ESP)	3:48.053
3	Older Shaw Mark	(CAN)	3:48.502
4	Menkov Vadim	(UZB)	3:49.255
5	Goubel Mathieu	(FRA)	3:50.758
6	Vajda Attila	(HUN)	3:50.926
7	Zhukou Ski Aliaksandr	(BLR)	3:51.166
8	Shtokalov Ilia	(RUS)	3:51.535

COMPARISON OF 1.000M AVERAGE SPEED M/S





MY CONCLUSIONS ON THE TACTICS AND PACING OF THE FIRST 4 ATHLETES:

Sebastian Brendel
Brendel was aware prior to the start that he was the best; he should win!
Tactics:

- Not to make any mistakes
- To stay with the leading boats in the early stages
- To make sure he was ahead of Cal well before the finish
- Start the drive for the finish from 650m

Comment:
Brendel was successful in executing his race plan. Overall, he could have paddled even faster!

David Figueroa Cal
Tactics:

- Not to start too quickly
- To close up to the leading paddlers before half-way
- To be very close to the lead with 250m remaining
- To take the lead for the final 100m

Comment:
Cal was largely successful in accomplishing his race plan. Had his third 250m been quicker, he probably would have closed the gap to Brendel but left himself too much to do in the final part of the race, enabling Brendel to keep 1st place.

Mark Oldershaw
Tactics:

- Not to risk anything
- To paddle his own optimal pace (practiced in training) for the entire race distance

Comment:
Oldershaw wanted to perform at his best. He managed this. Oldershaw's tactics were successful and as a consequence he took the bronze medal.

Vadim Menkov
Menkov wanted to win. He risked everything. He was unrealistic about his chances against Brendel.

Tactics:
To dictate a strong pace from the start that his competitors could not keep.

Comment:
This "over speeding" ultimately made him too tired and his speed decreased as he got closer to the finish-line. Menkov took a risk but his race plan was unsuccessful and he probably missed out on a medal he was capable of.

15.9 SPEED DEVELOPMENT

As the basic aim is a race over a course in the shortest possible time, the most important thing is to increase the speed of the boat! Speed development is the principal aim of all kayaking or canoeing training!

Ways to develop and improve boat speed:

- Improve paddling technique;
- Improve paddling efficiency;
- Improve the paddler's maximum strength;
- Increase stroke rate over a given distance;
- Improve speed endurance;
- Improve the paddler's strength endurance;
- Improve the paddler's 'explosive strength' (power);
- Learn good pacing;
- Improve starting speed;
- Use special methods to overcome the boat's threshold:
  - Riding on a faster boat's wash;
  - Paddle in a crew boat;
  - Using a smaller paddle with a higher stroke rate;
  - Pulling the paddler using a power-boat with a rope.

15.9.1 SPEED DEVELOPMENT TRAINING CONCEPTS

For speed training, paddling intensity and boat speed exceed racing speed!

Speed training usually uses the lactic acid system and the heart rate is approximately 170bpm to maximum.

Paddling intensity and stroke rate are at maximum levels: rest periods are 2-5 times longer than the working interval.

The most useful intervals are between 5 and 30 seconds.

Some special speed training methods:

- wash hanging a faster boat or power boat;
- pulling the athlete's boat using a speed boat with rope;
- stroke rate development using a h smaller or shorter paddle.

CHAPTER 16
STRENGTH DEVELOPMENT

INTRODUCTION

The movement of any object requires the use of appropriate force. A boat will gain greater speed by finding less resistance or by applying more power. We can't eliminate water resistance on the hull but we can increase the athlete's strength in order to achieve an increase in the boat's speed. Muscular strength plays an important role in paddle-sport. Without proper physical development, success in racing is impossible. There is a direct correlation between strength and speed. All muscular-endurance sports such as paddling require strength and endurance. Therefore, knowing how to optimise both strength and endurance development is one of the keys to success.

16.1 MUSCLE ANALYSIS

Before looking into strength development let's examine the human muscle.

All human beings have 3 kinds of muscle groups:

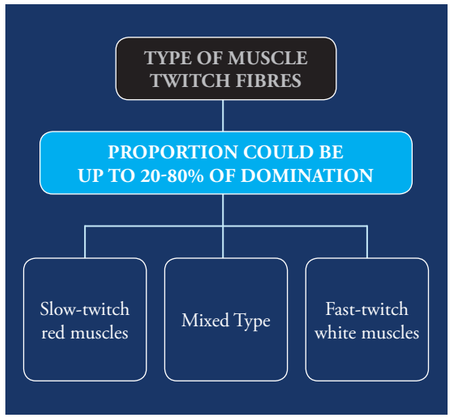
a.) Skeletal muscle: more than 700 voluntary muscles in the human body.

b.) Smooth muscle: a large range of involuntary muscles, for example in the digestive system, that are not controlled consciously.

c.) Cardiac muscle: involuntary muscles found in the heart that pump blood around the body.

Skeletal muscles can be made of 2 different types of muscle fibres: Red ('slow twitch' or type I) and white ('fast twitch" or type II). Muscles contain a combination of these fibre types, influenced by genetics, hormonal profile, training, and function of the muscle. In general, most untrained individuals have about 50% type I and 50% type II fibres. The proportion can be considerably different (e.g. 15-20:80-85%) for elite athletes. For example, elite endurance athletes typically demonstrate a predominance of type I muscle fibre (70–85%), whereas elite sprinters typically demonstrate a predominance of type II muscle fibers (65–70%). For elite performances, one must bring to the event a unique set of genetic predispositions including an optimal muscle fibre type. Although not the only factor needed for elite performances, fibre type is important for reaching a high level! For example, in athletics a sprinter's red/white proportion could be 27%/73%, whilst a marathon runner could be 60%/40%.

The red muscle fibres contract relatively slowly and determine endurance. They have a higher metabolic rate and are resistant to fatigue. The white muscle fibres contract relatively quickly and produce higher force, assisting explosive power for sprinting. If the proportion is near to 50-50% then we can consider an intermediate type of muscle.



The relative proportion of fibre types is inborn! From a practical point of view the question arises: is a human able to change one fibre type into another? The answer is:

- from fast lo slow is possible by training
- from slow to fast is little or no change is possible

Slow twitch fibres (red):

- Contain high concentrations of myoglobine, mitochondrions and capillaries;
- Produce ATP through the aerobic system and use at relatively slow speed;
- Resistant to fatigue and found in high concentration in posture muscles;
- Main fuel store – Triglycerides;
- Speed of contracting vibration - 10-30 Hz.

Fast twitch fibres (white):

- Contain low concentration of the myoglobine, mitochondrion's and capillaries;
- Have high concentrations of glycogen and use ATP at a very fast rate;
- Become exhausted quickly;
- Major fuel store – Creatine phosphate, glycogen.
- Speed of contracting vibration - 30-70 Hz.

Oxidation fast twitch fibres (mixed type):

- Contain high concentrations of myoglobine, mitochondrion's and capillaries;
- High capacity to produce ATP by oxidation and use at high rate, achieving high speed of contraction;
- Resistant to fatigue but less so than slow twitch fibres;
- Main fuel store – Creatine phosphate, glycogen.

Therefore, athletes can be classified as:
Explosive type - Endurance type - Mixed type

Consequently, it is important when developing strength to apply specific training methods which maximise the improvement of specific muscles and the development of certain types of muscular strength.

The key to increasing strength is to activate protein synthesis after strength training. The load on muscle is directly related to the activation of protein synthesis. In practice, this means that the heavier the weight or the greater the amount of power produced, the better the muscle growth will be (hypertrophy)

Protein supplementation before, during, and after training

Protein supplementation in the form of protein bars or protein-rich sports drinks may be of value not only to individuals performing resistance training, but also to those performing endurance training. This is especially true for athletes performing high-volume and high-intensity training, because they have increased protein needs. High volumes of endurance training, can damage the muscle tissue and adequate protein intake is needed to repair damaged tissue. Protein and carbohydrate immediately prior to, or after, a resistance training session increases protein synthesis following a resistance training session.

The most important muscle groups used in canoeing:

a.) Musculus deltoideus
b.) Musculus triceps brachi
c.) Trapezius brachi
d.) Biceps brachi
e.) Rectus abdominis
f.) Latissimus dorsi
g.) Pectoralis major
h.) Obligus externus abdominis

16.2 MUSCULAR STRENGTH

Strength is generally defined as the ability to exert force against a resistance. In canoeing the force of a single stroke is approximately 16-30kp, depending on whether its kayak or canoe, size of the blade, gender and power of the athlete. Most power is applied at the start, after which the force drops to approx. 20kp per stroke in kayak and 25kp in canoe. To provide continuous propulsion this stroke force must be repeated over many strokes at a high rate. Therefore, in order to sustain the required boat speed, power applied to each stroke must be maintained. Therefore, excellent strength endurance with relatively high power is very important for canoeing. Furthermore, the strength of the athlete should be specific to paddling! Strength development should go parallel with specific paddle-sport training from the very beginning of a paddler's career. Of course, the athlete's body-type, physical and mental traits and age must be considered.

We have to differentiate between different kinds of strength as:

- Maximum strength
- Strength endurance
- Explosive strength

All three types of strength are essential components of the paddlers' physical profile, boat speed and continued success. Each contributes to technique and boat speed so we must develop all three types of strength in athletes. Furthermore, paddle-sport primarily relies on dynamic strength, which means DYNAMIC EXECUTION of strength training is vital for effective strength development! The speed of muscle contraction is an essential factor. Therefore most exercises should be executed vigorously. Muscles developed via slow exercises perform poorly under fast exertion, whilst rapid exercises build muscles that perform equally well in both slow and fast exertions. Fast, explosive, dynamic muscles are indispensable for every paddler.

16.2.1 MAXIMUM STRENGTH

The ability to exert maximum force against a resistance. Maximum strength is most important in sprint races and starts, when the boat must be accelerated to its maximum speed in the shortest possible time. Experience shows that stronger paddlers start better than weaker ones with equal technical expertise.

Of equal importance is the proportion of maximum strength expended on each stroke, because it will determine the onset of fatigue. Additionally, stronger paddlers can maintain an optimum stroke rate with a larger blade or longer paddle, which will result in higher boat speed. Furthermore, the maximum strength applied on each stroke also depends upon balance, technique and the ability of the paddlers to expend power throughout the action.

Different methods of maximal strength development are:

- Isometric
- Isotonic
- Isokinetic
- Auxotonics

Strength gains should be greatest when training with forced lengthening contraction against a very high load! The recommended number of repetition in one set is 10.

Diet is an important aspect of strength development. For stimulating enzyme activation, it is recommended taking 6-8g of protein (from drink or snacks) before strength training and also eating a protein and carbohydrate-rich meal within one hour after training.

RELATIVE MAXIMUM POWER PERFORMANCE TEST:

$$\frac{\text{MAX BENCH PRESS (KG)} + \text{MAX BENCH PULL (KG)}}{\text{BODY WEIGHT}}$$

Reference: men 2,7 women 2,4

16.2.2 STRENGTH ENDURANCE

Strength endurance is the very foundation of the repetitive action of paddle-sport as it determines the athlete's ability to apply adequate strength during each stroke but at the same time resist fatigue. It is also vital that the force applied on each stroke should not diminish during races or training sessions. Strength endurance applies equally to aerobic and anaerobic activity. Strength endurance development is one of the basic tasks for all athletes in paddle-sport!

16.2.3 EXPLOSIVE STRENGTH

Explosive strength is needed to accelerate the boat and paddle at a high stroke rate. Explosive strength is indispensable for 200m specialists, and extremely important for all kayak and canoe competitors.

Methods of explosive strength development

- Auxotonics
- Explosive
- Plyometrics

16.2.4 MUSCLE STIFFNESS

High volume and intensity training workloads can cause muscle stiffness or pain. There are two explanations for this condition:

1.) The working muscles have not received sufficient volume of blood (and hence oxygen) during intense exercise (oxygen debt). This means lactic acid (LA) increases in the muscles, which enlarges the fibres and causes pain.

2.) During lower intensity but high volume training micro-tears occur in the exhausted muscles, which are felt as muscle soreness.

Even where LA disappears, painful or stiff muscles may remain for days! To speed up recovery, a number of things can be suggested, all of which increase blood circulation: low intensity 'cross-muscle' activities such as swimming; showers changing between cold and hot temperature; light massage; sauna; sports-creams.

16.3 TRAINING METHODS FOR STRENGTH DEVELOPMENT

The aim of strength training is to develop the athlete's strength as well as muscular coordination – the neuron-muscular system has to be 'taught' how to perform.

Strength gains occur as a result of systematic and progressive exercise of sufficient frequency, intensity and duration to cause adaptation. However, the high load of strength training needed for hypertrophy can be harmful to the tendons.

Strength development training methods:

Isotonic or **Dynamic - Isokinetic - Isometric**

A.) ISOTONIC
The muscle shortens or lengthens as resistance is increased. This is the most common method of strength development training used in paddle-sport. Strength increases over time as muscles or muscle groups are overloaded. The muscles exercise against sub-maximal or maximal resistance. The load must be increased over time for further gains in strength.

B.) ISOKINETIC
This is based on the use of specific cable or ergo machines which simulate paddling movement. Paddling machines are becoming more and more popular, recreating paddling movements indoors. They can be a very good way to train muscles specific to paddling in a boat. The resistance varies depending upon the athlete's strength or the target set for the training. Training programmes can be the same on the machine as in the boat.

C.) ISOMETRIC
The muscle develops tension but does not change in length. A maximum load is used and the duration of one exercise is usually 12-15 seconds.

16.4 STRENGTH DEVELOPMENT – ISOTONIC

One of the ways to increase the boat's speed is to increase the strength of the paddler! In order to progressively strengthen the athlete's muscles it is necessary to provide an appropriate stimulus through strength training.

For an isotonic training session you will need to select:

- the number and type of exercises to be completed
- the number of sets for each exercise
- the number of repetitions for each set
- the load for each exercise

Loads could be:

- unchanged with the same number of sets and repetitions, for example bench press with 40kg for 6 sets of 15repetitions
- unchanged with different number of repetitions, for example bench press with 40kg for 4 sets with decreasing repetitions (40, 30, 20, 15) or increasing (15, 20, 30, maximum) or a 'pyramid'

- changed loads and repetitions, for example bench press with 40kg (20 reps.); 50kg (15 reps.); 60kg (10reps.); 70kg (6 reps.)

Sets could be:

- completed one exercise at a time, for example complete all the sets on bench press, then move to the next exercise and so on. The rest time between sets an vary but could be determined by two athletes working together, i.e. when one is exercising the other rests
- completed by pairing two exercises and executing one set of each at a time

Duration could be:

- for a pre-determined fixed time (usually good for endurance) or for a fixed number of reps as quickly as possible (usually good for explosive strength development),for example 20 pull ups in the shortest time.

Circuit training can be used, where any number of stations (exercises) can be included in one circuit with varying rests or even no rests.

16.4.1 MAXIMUM STRENGTH DEVELOPMENT

Maximum strength development requires high loads and explosive movements.

There are two different concepts to developing maximum strength:

a.) High or maximum loads (80%-100% of maximum strength);
- number of repetitions 12-2;
- number of sets 4-6;
- number of exercises 6-8;
- total number of sets for the training session 32-40.

For example, 5 sets, 'half pyramid' increase of weight with decreasing number of repetitions in each sets:

% of max	80	85	90	95	100
No. of reps.	10-12	8-10	6-8	3-5	1-2

b.) Sub-maximal loads (60-80% of maximum)
- number of repetitions 15-8;
- number of sets 6-10;
- number of exercises 6-8;
- number of sets for the training session 36-45

There is an inverse relation between the number of repetitions and the load:

(load) % max.	No. of repetitions
95-100	1-2
90-94	2-3
85-90	4-5
80-84	6-8
75-80	8-12
70-74	12-15
60-70	15-20
60-71	20-30
50-60	30-40
40-50	50-60

An appropriate number of sets is usually 4 to 6 per exercise. A training session would usually consist of 6-12 exercises, depending upon the type of training. Rest intervals between each set can vary between 1 and 4 minutes. When training for strength endurance, rest periods will be short or training might even be "non stop".

For maximum strength development, single sets of 8 to 10 repetitions with two or three assisted forced reps are preferred. Dynamic execution of each exercise will result in the best strength development. The speed of execution is a factor of maximum strength development. A study showed that athletes who used higher speeds to execute exercises increased their strength by an average of 7.6 kg in six weeks.

Over a period of time, loads must be increased if strength is going to improve. Within and between training sessions, sufficient recovery time is important. It can be 2 to 3 minutes between sets (e.g. heavier resistance will mean a longer recovery time) and 36 to 48 hours between two sessions that target the same muscle groups.

Recovery: after strength training the body begins recovery by replenishing the oxygen supply, phosphate and glycogen stores. It is worth eating a mix of 6g protein and 36g carbohydrate.

16.4.2 EXPLOSIVE STRENGTH DEVELOPMENT

For explosive strength development the speed of execution is decisive. Typical requirements:

- load 50%-70% of max.;
- number of repetitions 10 –12;
- total no of sets 40.

Each exercise is executed dynamically and quickly. The rest between sets will be 3 to 5 minutes and between sessions 24 to 48 hours.

16.4.3 ENDURANCE STRENGTH DEVELOPMENT

Two types of strength endurance are required for canoeing: aerobic and anaerobic.

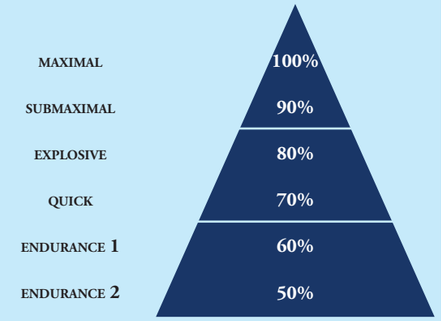
Development principles:

- Train with lower loads (approx. 40%-60% of max.)
- Higher number of repetitions
- Number of repetition per set: 15 to 60 or even higher
- 6 to10 sets and 10 to 15 exercises in one training session
- The number of repetitions/sets will depend on the aim of the endurance development - aerobic or anaerobic
- Executed at optimal speed continuously when using the aerobic system and with maximum speed when using the anaerobic system.
- Rest between sets: 30 seconds to 2 minutes, between sessions 6 to 24 hours.

As a guide, the required proportions of maximum, endurance and explosive strength:

Distance	Max. %	End. %	Expl. %
200m	75	15	10
500m	60	30	10
1.000m	35	60	5
Long dist.	20	75	5
Marathon	15	80	5

LOADS OF STRENGTH DEVELOPMENT



16.5 SUMMARY

Training effect	Intensity %	No. of repetitions	No. of sets	Total No. of exercises	Total No. of sets	Rest (minutes)	Speed of exercises
Maximum							
a.) method	80-100	10-2	4-6	6-8	32-40	2-4	optimal
b.) method	60-80	15-8	4-6	6-8	36-44	2-3	explosive
Explosive	50-70	15-12	4-6	6-8	30-36	2-3	explosive
Fast	40-60	20-15	4-6	6-8	26-30	2-3	fast
Endurance							
Aerobic	40-60	100-20	10-4	8-10	30-36	1-2	optimal
Anaerobic	40-60	30-20	8-6	6-10	30-36	1-2	fast

16.6 WHEN TO EXERCISE AND HOW MUCH?

The importance of the 'overload principle' in training is well established but the exact frequency, intensity and duration of workouts to maximally increase strength is still open to debate.

An intensive and continuous strength development programme is vital from puberty onwards and throughout the whole career of paddlers. Exactly what form the training takes will be determined by the athlete's physical and mental characteristics, gender and age.

Generally, between the ages of 10 and 13 years only 'body weight' exercises are used. Later, between the ages of 13 and 18 years the load can be gradually increased but care must be taken to avoid excessive stress on the athlete's spinal column. The human body is most receptive to muscular strength development between the ages of 14 to 19 years. Over time strength development will move from general exercises to those specific to paddle-sport. Strength development exercises will constitute a minimum of 30%, and up to 50% of the time spent in a training cycle. The length of workouts will be 30 minutes to 2 hours (depending on the aims of the training) and undertaken 3 to 5 times a week. Rest time between two strength training sessions is usually 24 to 48 hours, although this could be less depending on the type of training and if different muscles groups are being targeted.

Response to training:

- The training effort where the muscle fatigues
- The recovery phase (between exercises and sessions)
- The adaptation phase
- The return phase with gained strength

The key to muscle growth is to find an optimal training zone!

Frequency of training sessions

It is generally accepted that a training programme of 3 to 5 sessions per week will produce significant gains in strength. The total number of strength development training sessions per week can reach 7 but in the week of the race would only be one or non at all. Strength development or its maintenance must be continued during the paddling season because muscular strength rapidly diminishes if training is limited to paddling only. With training, primary biochemical changes appear in a few hours but for structural and functional changes in strength, generally a minimum of 6 to 8 weeks are needed.

The main effects are neural adaptation and muscle hypertrophy. Hypertrophy will appear after 8 to 10 weeks.

Recommended number of strength training sessions

Period of the training	No. of sessions (per week)	Duration of sessions (min.)
Basic preparation	4-7	60-90
Spec. preparation period	3-4	45-60
Racing period	2	30-45
Race week	1-2	30

Generally, maximum strength and endurance should be trained simultaneously in a weekly programme although the overall requirements of the athlete's training will need to be taken into account. Male and female athletes should be trained according to skeletal and structural differences. Women have a lower mean body mass and about 13% to 20% body fat, whilst men have 5% to 10%. Although the nervous systems are the same, strength development will have a different effect because hormones are different.

Characteristics of strength development training in various training periods:

- Basic preparation period
  - Maximum strength and endurance
- Special preparation period
  - Strength endurance and explosive strength
- Racing period
  - Explosive strength

16.7 PLANNING THE TRAINING PROGRAMME

Firstly, the coach must define the objectives of any type of training. It is important to decide what the effect of training will be: is it to develop maximum or explosive strength or a type of strength endurance? It is unusual to work only on one type of strength or muscle group. There is likely to be some overlap.

The construction of an optimal weight-training (isotonic) programme requires the following:

- The type of strength to be developed;
- The targeted muscle groups: general or specific;
- The exercises to be used;
- The number of exercises;
- Intensity or loads to be used;
- Number of repetitions per set and the total no. of sets;
- Rest intervals;
- Total time of training;
- Specificity and arrangement of exercises;

a.) The target of the strength training

As mentioned before, first the coach has to decide what the target of the planned training session is. For example, it could be a general or specific strength development workout and it could focus on maximum strength or endurance. Additionally, a decision needs to be made as to whether the training target is to improve or maintain the level of strength.

b) The target muscle groups

The coach must decide which muscle groups need developing. This is especially so with maximum strength training where only 1 or 2 muscles groups will be targeted.

c) The exercises to be used

There are many kinds of exercises with similar or the same effects. The choice will depend on the available equipment and/or the athlete's specific requirements.

d) The number of exercises

This is likely to be in the range of between 4 and 12.

e) Intensity

Here, the overload principle of progressively increasing resistance applies as well as the correct choice for the type of strength to be developed: maximum strength, explosive strength or strength endurance.

f) Number of repetitions

The number of repetitions will depend on the training target. Basically, for maximum strength development we need fewer repetitions (with the heavy loads).

g) Specificity and arrangement of exercises

There are many variations in exercises and how they are performed. The coach has to deal with the training venue, the equipment, the number of athletes training, the order of exercises etc. Good planning and preparation is important to ensure a successful training session.

16.8 WARM UP AND STRETCHING FOR STRENGTH TRAINING

Warming up is very important before every training session, particularly at the start of strength training sessions, to avoid injuries and to be ready for increasingly heavier resistance. Never start an exercise with a heavy resistance or weight. Increase gradually! When working with heavy or maximum weights you will need a longer warm up!

Stretching should be an essential part of the workouts, not only at beginning, but also during and at the end of sessions.

16.9 CONDITIONING AND STRENGTH DEVELOPMENT EXERCISES

16.9.1 BODY WEIGHT EXERCISES

a.) Climbing a rope, pole or wall bars:
b.) Pull-ups with different position and/or grip:
c.) Push up's, dip's etc.
d.) "Window wipers" on a pull-up bar
e.) Trunk muscle exercises - abdominal
f.) Trunk muscle exercises - back
g.) Swiss-ball exercises
h.) Wrestling

16.9.2 WEIGHT TRAINING EXERCISE EXAMPLES USING FREE WEIGHTS OR MACHINES

For Chest:
Barbell bench press; flat-bench dumbbell press; flat/incline Smith-Machine press; incline dumbbell press; decline barbell press; dips; flat-benches fly; cable crossover:

For Shoulders:
Seated behind-neck barbell press; seated dumbbell press, standing military press; machine press; front raise; front cable raise; lateral dumbbell raise; lateral cable raise; bent-over lateral dumbbell raise.

For Upper- back:
Pull–ups; lat pull-down; front pull-down; close-grip pull down; reverse-grip pull down; straight-arm press down; seated cable row; bent over row; T-bar row; one-arm dumbbell row.

For Lower- back:
Back extensions; lower-back machine; dead lift; high pull; lying torso raise.

For Trapezius:
Barbell shrug; dumbbell shrug; machine shrug; upright row

For Biceps:
Standing barbell curl; standing dumbbell curl; seated alternate dumbbell curl; dumbbell incline curl; machine curl; concentration curl; one or two arm cable curl.

For Triceps:
Lying triceps extension; dumbbell overhead extension; cable overhead extension; seated overhead EZ-bar extension; bench dip; machine dip; dumbbell kick back; close-grip bench press; reverse-grip p**ress down.**

For Abdominals
Decline-bench crunch; crunch; cable crunch; reverse crunch; hanging knee raise; seated knee-up; hip thrust; twisting crunch;

16.9.3 EXERCISES WITH CABLE MACHINES

Some exercises examples, which are most useful for paddlers:

a.) One arm rowing - with straight arm and body rotation
b.) Pulling overhead with one arm in front of or behind the body
c.) Pulling down with two straight arms in front of the trunk

16.9.4 SPECIFIC STRENGTH DEVELOPMENT EXERCISES FOR PADDLING

"Specific strength training includes all the training load which contributes to increased strength potential in the single cycle by using higher or lower resisting forces with elements of competition movements or competition exercises" (Schnabel and Thiess 1987)

For this reason the best specific strength development happens in the boat or in a paddling tank.

a.) In boat

With additional resistance	With decreased resistance
additional weight in boat	paddling downstream
paddling with a "break" on the boat	paddling in the wave of a faster boat
paddling in shallow water	paddling with shorter paddle
paddling in upstream	paddling with decreased paddle blade
increasing paddle length	
increasing paddle blade area	
increasing paddle weight	

For additional resistance, the best and most easily available method is paddling with a 'brake' on the boat. It is not useful to paddle with too high a brake, because it will decrease the speed of the boat and the frequency of strokes too much. Sufficient braking can be achieved by attaching things such as a rope, can, strap or tennis ball onto the hull of the boat. Another method is to add weight to the boat (5-15kg). The disadvantage of this method is that the balance and the feeling of the boat will be different because the boat becomes more stable, but it does help to feel better how power is transmitted from the paddle to the boat. Specific strength development training can be used in all seasons but the best periods are the preparation and racing periods. In the preparation period, longer sessions are recommended but in the racing period shorter, intense efforts can be more useful.

In the preparation period, the training sessions will include intervals longer than 1 minute with a total paddling time of approximately 20 to 45 minutes, depending on the amount of resistance.

Intervals in intense training sessions, using extra resistance, will last approximately 10 to 60 seconds with a total session time of 5 to 15 minutes depending on the intensity of paddling. The best effect of specific resistant training is achieved during the highest possible intensity of paddling. This type of training might take up between 5% and 15% of total paddling time. Frequent use is not recommended because of the slower boat speed.

b.) Indoor: paddling tank or canoe/kayak simulator

Because the athlete is using the same, or similar muscles as in the boat, this results in specific muscle development. In a tank, paddle with relatively large blades (the usual tank blade is 8-15cm wide or regular sized with holes) or against circulating water in the off season. A guide to number of sessions would be 2 to 3 times a week for between 45 and 90 minutes.

Paddling machines can be useful for specific strength development as the training can be similar to training on the water. Some of the newer designs use computer technology, such as the "Concept 2" rowing machine

16.10 EXAMPLES OF STRENGTH DEVELOPMENT TRAINING

16.10.1 MAXIMUM STRENGTH DEVELOPMENT

a.) Exercises based on the individual's maximum strength.

First the athlete's maximum strength has to be established for each exercises, e. g. if the maximum bench press is 100 kg, the following are possible programmes:

Intensity %	Weight (kg)	Repetitions
60	60	15-20
70	70	10-15
80	80	8-12
90	90	6-8
100	100	1-3
80	80	8-12

Rest period: 2 to 4 minutes between sets

Intensity %	Weight (kg)	Repetitions
70	70	15-18 (2 sets)
80	80	12-14 (2 sets)
85-90	85-90	10-12 (2 sets)

Rest period: 2 minutes between sets

b.) Sets method
Firstly, the athlete selects an appropriate weight, based on his/her individual performance, i.e. 80-90% of maximum. This weight is the used throughout, e.g. if an athlete's maximum bench press is 100kg:

Weight	Repetition	Sets	Rest
80 kg	6-10	5-8	2 mins.
90 kg	4-6	5-8	3 mins.
95 kg	2-3	4-6	4 mins.

c.) Pyramid method: changed loads or changed repetitions
Increasing - decreasing load. The athlete starts the exercise with a weight of 70% of maximum, then increases the load by 5 to 10kg each set until he/she is unable to execute the exercise. When he/she fails, he/she should make one more attempt (with assistance). After that, the weight is decreased by 5kg to 10kg for each set until the starting weight is reached.

For example, if an athlete's maximum is 100kg on bench press the following training pattern could be achieved: 80kg-90kg-95kg-100kg-95kg-90kg-80kg

At each attempt the maximum (or almost) number of repetitions would be completed, with a rest time between sets of 2 to 4 minutes.

(Note: from time to time the athlete should try to increase his/her maximum, but by approaching it gradually and with ample warm up.)

d.) Changed repetitions - unchanged load

The athlete selects 70-80% intensity of weight at the first set and then increase the number of repetitions -by 2 or more until it is possible in each set, then decrease it.

e.g.: weight is 80kg; *rep./set:* 8 - 10 - 12-14 - 11 - 10

An alternative is to work with an unchanged weight with attempt the maximum repetition at each set. The repetitions naturally will be decreasing.

e.) Exercises utilizing the athlete's weighted body

The exercises already mentioned under "exercises utilizing athlete's body weight can be increased with heavy loads, which the athlete just able to handle.
E.g.: pull ups with 10-30kg extra load mounted on waist belt or on legs.

- climbing rope with loads as above
- trunk rotation on incline bench with weights
- sit ups or rotation with loads
- back ups or rotation with loads
- dips with loads etc.

Sets or pyramid methods can be used with 2-4 min rests.

16.10.2 EXPLOSIVE STRENGTH DEVELOPMENT

It is important that these exercises are executed with faster speed of movement. Basically you can perform similar training to the maximum strength development, but you must select suitable load and repetitions.

a.) Example for a training regimen

- 5 different exercises:
  - *pull up's:* 10, 12, 15, or 20 repetitions
  - *bench press:* int.: 40% idem repetitions
  - *bench row:* int.: 40% idem repetitions
  - *leg raise or sit ups:* idem repetitions

Performance test: the athlete does 5 x 20 pull-ups with 1-3 minute rests in between. Each set is individually timed and then we proceed with the next exercise repeating 20 repetitions again, doing 5 sets, each being timed. When all four exercises are completed and timed, we compute an overall number that is useful for the comparison of athletes or will measure an athlete's improvement in a certain time frame. The result should be calculated as shown below:

EXERCISES	TIMES					
	1st set	2nd set	3rd set	4th set	5th set	Total time in sec.
5x20 pull-ups	16	17	20	19	19	91
5x20 bench-press	14	14	15	14	13	70
5x20 bench row	12	10	13	11	12	58
5x20 leg lift	27	32	36	35	40	170
Total times	**69**	**73**	**84**	**79**	**84**	**389**

b.) "Who can do a set of exercises faster?" (similar to circuit exercise method)

We select five to ten exercises to make up a circuit. It is practical to design a circuit, which will not take longer than 1-2 minutes assuming no more than 10 15 repetitions of each exercise.

Weights should be about 40 500/00 of the maximum. Execution on a command: Go. The athlete begins the first exercise /e. g. 10 pull-ups/after completion the athlete rushes to the second station/e, g. 10 trunk twist/and so on, to the end of the circuit, then, the next athlete can start. A practical rest between circuits is 3 5 minutes, because a pulse rate of 180 should be reached with vigorous execution of the exercises. Usually 6-15 circuits in one training session yield good results.

We can design a good regimen by using the following exercises with 10 repetitions: pull-ups; trunk rotation; bench press; chest pull; push-ups snatch; leg lift.

16.10.3 ENDURANCE STRENGTH DEVELOPMENT

Endurance strength in the kayak canoe sport is considered tantamount to excellence. Applied resistances should not exceed 20%-60% of the athlete's maximum strength. The primary characteristic of these training regimens is the high repetition with short rest periods.

CIRCUIT TRAINING

The best known and used type of training! Its benefit that several athletes can exercise together and in relative short time good effects could be achieved.

Any number of stations (exercises) can be included in one circuit with varying ways of execution rests or even make the circuits continuous.

a.) Variable components of strength endurance development circuit training (needs to be determinate for training)

- Number of exercises
- Kind of exercise
- No of repetition at each set or
- Working times in sec
- Resting times or period between the sets/ circles
- No of circuits (laps) or total training time
- Load or intensity

The intensity is determined by whether endurance training is aerobic or anaerobic.

Aerobic type of strength endurance circuit training:
Duration: 20-45 minutes
Execution:

- "non - stop" (the rests are only to change from one exercise to another or set resting times between exercises, e.g. 20 seconds on 20 seconds off.
- load of 20% to 40% of max
- the number of exercises in one circuit could be the same as the number of athletes taking part but at least 10 to 12
- no. of repetitions can be decided by the time taken or a set number

Anaerobic type of strength endurance circuit training:

- *Duration:* 2 to 4 minutes per circuit
- *Number of exercise:* 4 to 6 in one circuit
- *Resting time between circuits:* 6 to 10 min.
- *Load:* 40% to 60% of max
- *Circuits:* 4 to 8 in one training session

Execution is determined by the number of repetition or time taken. Athletes perform each circuit with maximum effort and speed without rests between each exercise.

The possible proportion of exercises for a 12 station circuit training based on different muscle groups:

Muscles	No. of exercises
back	3
shoulder	3
chest	2
biceps	1
triceps	1
abdominals	2

In a continuous circuit the number of repetitions or time spent on each exercise are set. The coach also must keep in mind that certain exercises may take twice as long as others which may result in congestion at different stations. Additionally, problems may arise when athletes of different strength participate in the circuit, because the selection of optimum weights is difficult. It is also practical to include many different types of exercises, to avoid monotony and engage several different muscle groups in the work. A well-designed circuit session can be 15 to 60 minutes long.

Various ways of organising a strength endurance circuit:

- one athlete works at each exercises (station) then moves to the next one (the same number of exercises as the number of athletes)
- two or three people on each station (more athletes than stations)
- athletes stay at one station for 2 or 3 sets without changing the exercise
- the exercises chosen target a range of different muscle groups
- the exercises chosen target similar muscle groups

EXAMPLES FOR CIRCUIT TRAINING

Defined by length of work at each station and resting time between exercises:

Work period (sec.)	Rest period (sec.)
15	15
20	20
20	10-15
25	15-20
25	20-25
30	25-30
30	10-20
45	15-30

Alternatively, the exercises could all have to be completed within 30 minutes, or we could specify the number of complete circuits in one session. Another variation is to have a "leader station", for example pull-ups where the required repetitions is 20. The athlete at this station calls "change" after completing 20 reps and all athletes move to the next station.

Example of a strength endurance circuit with 15 exercises (could be "non stop" or with defined work/rest periods):

The circuit consists of: pull-ups, push-ups, trunk rotation, sit ups, bench press, bench row, snatch, dips on parallel bar, one arm pull, leg lift, incline press, leg raise, jogging or hoops, bicep curls, tricep curls. The exercises are performed for 30 minutes having rests only while moving from one station to another. Alternatively, the session could consist of 5 to 10 circuits at 30 seconds on and 30 seconds off with the rest between circuits at 3 to 5 minutes.

"Small circuit" anaerobic endurance training:

A better outcome can be achieved with so called "small circuits" consisting of only a few stations. Again, we either set a time or the number of repetition for a session. In small circuits, there will be fewer participants than number of stations e.g. 4 stations but only 2 or 3 participants. This kind of training, with rapid execution is aimed at anaerobic endurance development!

Examples of small circuit training:

- 4 stations, 10 repetitions on each, four minutes non-stop
- 4 stations, 10 repetitions on each, 3 continuous circuits non-stop
- 4 stations, 20 seconds on each, for a total of 4 minutes non stop
- 4 stations, 20 seconds on each, for 3 continuous circuits;
- 3 stations, 10 repetitions on each, in two minutes, etc.

Small circuit programmes can be designed to achieve intense loading on various muscle groups or on specific and similar muscle groups.

Example of exercising opposing muscle groups:

- *Circuit 1:* chest pull - seated press - back muscle extension;
- *Circuit 2:* pull-ups - bench press - snatch;
- *Circuit 3:* dips - one arm pull – butterfly;
- *Circuit 4:* sit ups - pull over/weight overhead in supine position - trunk rotation.

10 repetitions on each station are performed and each circuit should be completed in 4 minutes, with 2-3 minute rests between circuits.

Example of exercising similar muscle groups:

- *Circuit 1*: bench press - dips - push ups or 45° bench press;
- *Circuit 2:* pull-ups - bench row - two arm rowing on machine;
- *Circuit 3:* trunk rotation with weight on incline bench - trunk rotation sitting with barbell on shoulders - leg rotation on the pull-up bar.

The workout can be determined in terms of time or repetitions. These are very effective circuits, but the possibility of muscle stiffness is more frequent, thus stretching and loosening exercises between sets are recommended.

Set methods for aerobic endurance strength development:

A session based on sets could consist of 6–8 different exercises, e.g.:		
leg lift	12-20	4-8 sets
chest pull	10-15	4-8 sets
bench press	10-15	4-8 sets
dorsal with twist	12-20	4-8 sets
pull ups	12-20	4-8 sets
snatch	8-15	4-8 sets
one arm pull	12-20	4-8 sets

Exercising with two different muscle groups regimens:

Two different exercises are performed alternatively without rest until reaching the prescribed number of repetitions. For example, the athlete completes 10 pull-ups, 10 push-ups, 10 pull-ups, etc. repeating as many times as scheduled. A typical combination of pull-ups with push-ups

3 sets non-stop
10 x – 10 x
10 x – 10 x
10 x – 10 x

Decreasing
20 x – 20 x
15 x – 15 x
10 x – 10 x

Increasing
10 x – 10 x
15 x – 15 x
20 x – 20 x

Pyramid
10 x – 10 x
15 x – 15 x
10 x – 10 x

Other possible pairs of exercises:

Bench press – bench row: 12 - 12 reps X 2-3 sets continuously

Sit-ups – dorsal: 15–15 reps X 2–3 sets continuously

Sit-ups on incline board: 15-20 reps and leg lift 15-20 reps, 3 sets

Bench press: 5 reps and seated press 15 reps, 3 sets.

Pull ups: 15 reps and chest pulls 15 reps, 3 sets.

High repetition or extended duration exercises:

High repetition sessions must be designed with the athlete's maximum capacity in mind. Usually 30-40% of the maximum load allows about 50 repetitions, e.g. if the athlete can bench press 100kg once, he should be able to press 30 to 40kg 50 times. If we want to prescribe the duration of the exercise, again, first we must know the athlete's maximum performance.

Sessions would consist of:

- 4-6 exercises;
- 1-2 sets;
- number of reps per set: 40 –10;
- rest 5-8 minutes;

A typical session would be:

- 1 min pull-ups
- 1 min bench press
- 1 min chest pull
- 1 min leg and arm lift in supine position
- 1 min one-arm pull;

The session can be repeated 2-5 times, with 2-3 min rests between exercises and longer rests between sets. Alternatively, sets of each exercise are completed, e.g. 3 x 1 minute pull-ups, then 3 x 1min bench press etc. This method will be much more exhausting.

Often, the number of repetitions for each exercise is stipulated. For example, pull-ups 30 reps, leg lift 20 reps, bench press 40 reps, one arm pull 40 reps, chest pull 50 reps, trunk rotation on inclines board with weight 30 reps, push ups 30 reps. The session would be repeated 2 to 4 times.

Sets method for various types of strength development:

These are the most popular types of workouts. Usually no exact rest period is given. For example if three athletes are working out in one group, two can rest, while one exercises.

A session based on sets could consist of 6–8 different exercises, e.g.:		
leg lift	12-20	4-10 sets
chest pull	10-15	4-10 sets
bench press	10-15	4-10 sets
back up's with twist	12-20	4-10 sets
pull ups	12-20	4-10 sets
snatch	8-15	4-8 sets
one arm pull	12-20	4-10 sets

Usually, all sets on one exercise are completed before moving to the next exercise. Repetitions within sets can be altered to form a 'pyramid' or 'half pyramid' session:

E.g. 1: Pyramid session	
leg lift	10x–12x–14x–16x–14x–12x–10x or
pull up's	12x–14x–16x–18x–16x–14x–12x

E.g. 2: Half pyramid session	
leg lift	10x–12x–14x–16x–18x–20x–22x ... etc.
pull up's	12x–13x–14x–15x–16x–17x–18x ... etc.
or backwards e.g.	
leg lift	25x–23x–21x–19x–17x–15x–13x ... etc.

Rests between exercises can vary between 20 seconds and 2 minutes.

Greater training benefits can be achieved if the rests are timed, either constant, increasing, or decreasing e.g. pull ups 5 sets of 15 reps:

- Rests: 30 seconds between each set (constant rest periods)
- Decreasing rest periods of 25, 20, 25, 10 seconds

Endurance exercises in a gym or outdoors:
The essence of this type of workout is that the exercises are interconnected with running.

EXAMPLE:

At each corner of the gym is an exercise station:

- rope climb (1 rep)
- prone hyperextension with 5kg weight or ball in hand
- sit ups from supine position with 5kg in hand (10 reps)
- push ups (20 reps)

The athlete runs from station to station upon completion of the exercises. A number of circuits are completed within a prescribed time. The variation of number of stations and the order in which they are performed gives unlimited possibilities, which makes this kind of workout popular.

Exercises with special apparatus:
There are many different resistance and isokinetic machines, wall pulleys, spring expanders, rubber cords etc. Depending upon the intensity of the exercises done using such apparatus, endurance, strength or speed, and general or "sport specific" muscle groups can be improved. There are unlimited possibilities:

EXAMPLES		
Work		Rest
4x	12 min	3 min
3-4x	10 min	2-3
4-6x	8 min	2-3
6-8x	6 min	2
6-10x	4 min	1-2
10-15x	2 min	0,5-1
20-30x	1 min	1-0,5
10x	4 min	2 min rest or
10x	4 min	30 secs, 1 min 1,5 min, 2 min, etc.
3x	4 min	2 min
4x	2 min	1 min rest, etc.

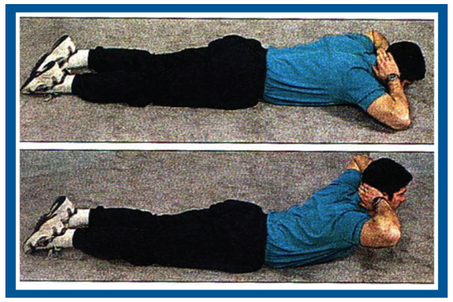
Conditional test for relative strength			
	Bench press	Bench rowing	Time
Men	50 kg	55 kg	max reps for 2 mins
Women	45 kg	51 kg	max reps for 2 mins

Results:
max. reps bp + max reps br/ body weight in kg

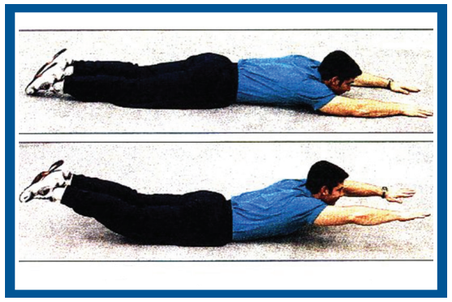
Strength development exercises by dumbbells

FIG. 16.1 - STRENGTH DEVELOPMENT EXERCISES BY DUMBBELLS

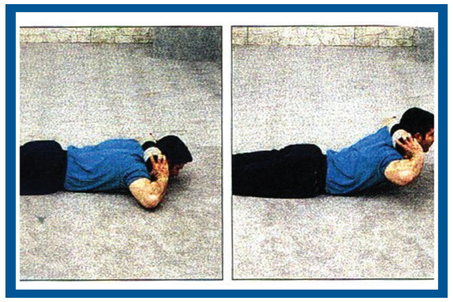
EXERCISES FOR "BACK"



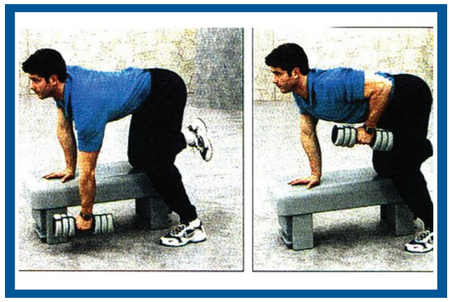
HYPER EXTENSION



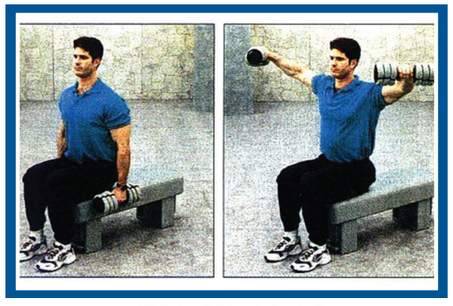
SUPERMANS



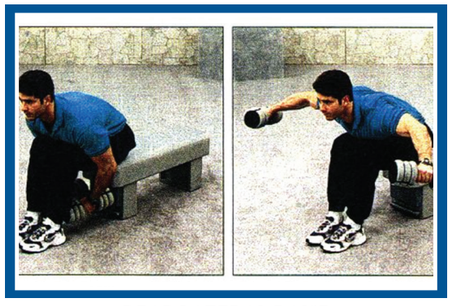
HYPER EXTENSION WITH DUMBBELL



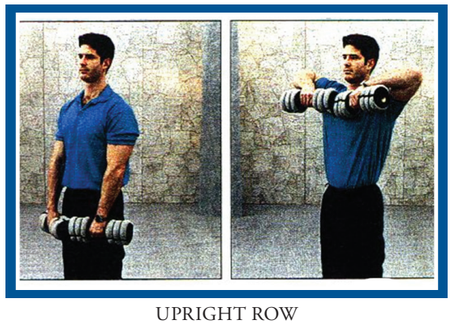
DUMBBELL ROW CLOSE GRIP



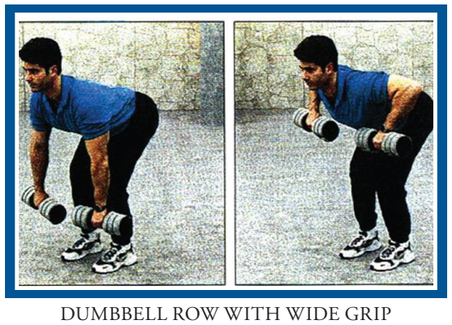
SIDE LATERAL RAISE



REAR LATERAL RAISE



UPRIGHT ROW



DUMBBELL ROW WITH WIDE GRIP

CHAPTER 17
TRAINING GENERAL

INTRODUCTION

The purpose of training is to increase the athlete's physical abilities and technique.

Kayak and canoe sport requires unbroken training throughout the year in all seasons. The athlete must develop their physical condition by following a progressive and continuous training program.A successful paddler must have perfect technique combined with speed, strength and a competitive spirit. All these are aspects required to get good results in canoeing. Canoe /Kayak sport requires both strength and endurance and specific resistance and endurance methods can be used to enhance athletic performance.

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When endurance and strength training programs are performed concurrently, the body tries to adapt to both. However, endurance shows greater improvements than strength whilst resistance training will not decrease endurance performance!

The primary adaptations to endurance training are related to the need to better utilize oxygen and enhance muscular endurance.

A serious athlete must train regularly with a well-planned, well-balanced and well executed program. Training in canoe racing makes high demands against the athlete in part from the high load and intensity of training but also through training in cold weather, strong winds, rain, and when tired. The readiness to perform in training, testing and racing requires high concentration and strong physical and mental abilities to overcome these factors.

In order to design an efficient training regimen, you must know the exact effects and responses of the physical exercises involved. You must also define the objectives and know the methods for achieving them.

Autumn is the best period of the year to start canoeing in countries where there are four seasons. This is because novices can learn paddling skills in a paddling tank and develop their fitness over the winter months before starting paddling on open water in spring. In other climates -where water training is possible in any season of the year- novices could start at any time but should also following the order of the concept in this article.

At first the beginners should do gymnastic and resistance type training in a gymnasium or outdoors, as well as lots of open air running, stretching exercises, swimming and, in snowy regions cross-country skiing. By doing this the athlete can achieve a good general basic fitness, which is essential to be able to cover the necessary kilometers in canoe or kayak that will allow the development of proper and efficient movements in the boat

The above system can be followed in countries with hotter climates as the teaching of paddling should always be accompanied by conditioning training!

A paddler can begin learning to canoe at the age of 10-12 years old, but always through games, having fun and enjoying the activities. The development of paddling technique is a continuous task for athletes and it is recommended that this should not be forced at too fast a rate. It is important to take the time at this stage to properly develop the correct movement patterns.

In the case of the canoe category, since it is an asymmetrical type of technique, beginners (children) should paddle on both sides in a team canoe at training. The canoe paddlers are then gradually able to develop control of the canoe in a more stable craft whilst reinforcing good technique.

The right technique and good physical condition is the base of success! Both abilities are necessary in canoeing therefore should be developed simultaneously!

Whilst the recommended age to begin canoeing is the pre-teenage ages there are several very successful paddlers who have started kayaking or canoe at age around 15-20 although they are extreme examples. In these cases all of these athletes had a strong physical and physiological background gained in other sports activity e.g. in swimming or cross-country skiing.

The International Canoe Federation defines the junior category as 15 to 18 years. This is the best age to engage fully in the competition world. In a few years the athlete acquires his/her best form and this can be maintained until the athlete is able to train hard and achieve the required results without age barriers!

17.1 PRINCIPLES OF TRAINING

- Frequency and duration;
- Overload, yearly training load;
- *Progressions:* the intensity of workouts must increase in logical progression;
- Goal setting: short term and long term goals;
- *Specificity:* training effects are specific;
- *Adaptability:* must be flexible -individual differences to avoid over training;
- Considerable-fitting to the racing calendar.

17.1.1 THE FREQUENCY AND DURATION OF TRAINING

Paddling is a physically and physiologically demanding sport. For successful performance the athlete must train frequently and often at high intensity in order to progress. An athlete throughout his or her sport career will skip perhaps only a few weeks of active training yearly. Recommended training frequency for various age groups is shown below / reaching the international top requirement/.

Age group	Age	No. of training per week	Hrs of training per week
Juvenile	10-14	3-5	8-12
Junior	15-18	6-10	14-20
Senior	18-	10-14	20-30

In training camps, however, even 3-5 of shorter duration training sessions per day could be done. E.g. two or three paddling session, one running and one strength development.

Another kind of training programme can be beneficial to those who have the opportunity for only one training session per day (I.e. students.) the so called combined or **"complex"** training session. These types of session have different modes of exercise within one session, e.g.:

- paddling and running;
- paddling and strength development;
- running and strength development;
- pool paddling and running or
- pool paddling and strength development;
- combination of three from above types of training.

These combined training sessions will enable the athlete to increase the workload effectively. It is also a benefit if the locations of different training are at the same or close spot.

Required training volume for high-performance

Period	No. of training	Duration hours	Distance km (paddling)
day	2-3	3-5	30-40
week	12-18	30-35	200-350
year	500-550	1.100-1.200	5.000-5.500

The required number of different types of training

	Number of training per week		
	Paddling	Running	Strength
Beginners	2-3	2-3	1-2
Advanced	5-8	2-3	2-3
Professional	10-12	3-4	3-5

Required volume of paddling training

	1 day		1 week	
	kayak men	women and canoe	kayak men	women and canoe
Adv.	14-20	12-18	80-120	70-100
Prof.	24-40	18-30	160-200	140-200

It is also important to find the right balance between the general conditioning and paddling training. Higher level athletes gradually need to increase their specific training and reduce general training.

General and Specific training in %

Level	General training %	Specific training %
Beginners	70	30
Advanced	30-40	60-70
Professional	10-20	80-90

The fundamental physical requirements of the kayak-canoe sport are: endurance, strength and agility (speed). Furthermore a good technique and a good overall physical stature are essential.

The next table summarizes the relative importance of these physical abilities in relation to racing distance.

	Distance			
	200m	500m	1.000m	5.000m
Aerobic endurance	negligible	helpful	important	essential
Anaerobic endurance	essential	essential	important	helpful
Speed	essential	essential	important	helpful
Muscular strength	essential	essential	important	helpful
Technique	helpful	helpful	important	essential

It is the function of a coach to know the basics of physics, biology, teaching and psychology to utilize the athletes to the best advantage.

17.1.2 THE YEARLY TRAINING LOAD

The training load consists of the quantity (volume) and quality (intensity) of work. Distance, time or number of sets and repetition etc represents quantity. Quality means the intensity of the exercises, the heart rate, the stroke rate or the amount of weight lifted.

Kayak and canoe is not a seasonal sport! When paddling is not possible due to weather conditions we substitute it with various supplementary sports and exercises, which should be performed with the same workload and intensity as paddling training.

There are three types of training systems determined mostly by the climate of the region:

a.) outdoor paddling is seasonal training, limited to 6-9 months, usually from spring to winter. The rest of the time paddling is done in the tank (where it's available), and supplementary sports are pursued 3-7 times weekly. This is mainly in the Central and Northern European countries. This system was born out of necessity, yet many world-renowned competitors can attest to its success. This system allows more time for strength development, leaving a well defined period for outdoor paddling and peaking for the main events of the season. The paddler develops a "hunger" for paddling during the winter months /off-paddling/, and will paddle with more motivation than if he/she had paddled almost every day. This is also reflected by the fact that the paddler's enthusiasm usually subsides by end of the outdoor paddling period. The drawback of this system is that the athletes do not get into paddling shape as early as with the other two systems.

a.) Outdoor paddling pursued year round. Can be of benefit especially for beginners. In these places athletes could paddle i.e. 30% more in a year than where an 'off' paddling season exists. But the supplementary sports training should not be neglected. Sometimes the unbroken paddling period in a year or years make it boring. Paddling all year is monotonous, may build lethargy, and thus makes it very difficult to maintain a keen interest in the sport year after year. The proper racing calendar should be helpful, because the athletes have various training periods and motivation.

a.) The combination of above two systems. There is a main outdoor paddling period, i.e. from end of February to November, followed by the conditioning period with intermittent outdoor paddling /alternating the supplementary exercises with outdoor paddling/. This means either travelling to a warmer part of the country -or to another country in warmer climate- or braving the winter's cold.

The combination system seems the most practical, because it breaks up the monotony of training. In this system the time following the main paddling period /since you have no races/ is the most suitable for the development of special skills or strength. This prevents the paddler from debilitating his/her sport specific muscles; rhythm, balance and general feel for the boat.

An important aspect of a training programme is that continuous high intensity training cannot be maintained effectively year around. The training season must be divided into periods of alternating intensity.

17.1.3 THE PRINCIPLES OF PROGRESSIVE WORKLOAD

The same amount of work /workload/ and intensity applied repeatedly will yield no improvement after the athlete becomes accustomed to it. Only by exceeding the former limits of stimuli can one achieve improvement. Therefore, the repetition, the amount and the intensity of the training must be gradually and systematically increased. The intensity of the training should never be less than 70% of the athlete's capacity, but on many occasions has to reach 80-100% of it. Progressive increases of the training workload should be extended through days, weeks, months, even years. The key to improvement of a physical ability is that the training stimuli must be constantly increased. The amount of work, then the intensity should be increased repeatedly whilst taking into account the detrimental or harmful physical or psychological effects of over training.

17.1.4 THE IMPORTANCE OF SETTING GOALS

The coach, and most of all, the athlete should always set definite goals. The goals can also be established for a whole group, but never disregarding the individual athlete. The plan should include both immediate and long range goals. If the athlete can identify with these objectives, his motivation will be greatly enhanced, thus he/she will cope with the grueling training workload more easily. It is also important to set realistic goals because "chasing the rainbow" can be very counterproductive. The coach should also expose the athlete to the "sweet smell of success". Without ample gratification, even the most ardent paddler will quit the sport. This is especially important when training younger athletes.

17.1.5 SPECIFICITY OF TRAINING

Appropriate training depends on several factors, which are considerable at the planning:

- the paddler's target and motivation for canoeing
- the paddler's competitive level
- the paddler's age and gender
- the paddler's fitness
- the frequency that the paddler can attend training

17.1.6 AGE AND GENDER

We can determinate the ages from the aspect of sport as: chronological - biological - athletic.

There is a recognizable distinction between the "biological age" and "chronological age". While the latter denotes one's age by the calendar, the former can be more or less than the "chronological age" depending on whether the youth in question is physically over-or underdeveloped. Thus the real training workload is determined by the "biological age" and "athletic age". The "athletic age" means the number of years an athlete actively pursued paddling, or some other competitive sport, e.g., a 14 years old youth who swam or wrestled for 5-8 years will be much more developed physically than one who has never participated in any sport. Accordingly, the

swimmer will have good endurance and a wrestler will have superior muscular strength, while a non-participant has probably not developed his/ her physical abilities at all. Naturally, these three individuals will require vastly different training methods.

The sex of the individuals does not greatly influence the training load, because the basic difference is in the muscular strength and not in the endurance.

17.1.7 ADAPTABILITY OF THE TRAINING AND OVER-TRAINING

In making an appropriate training plan coaches have to consider all principles and effects of training. Only in this way can a suitable program leading to progress and good performance be created. A programme with too little load or stimulus can prove pointless whilst and programme with too much load or intensity could be harmful and lead to injury.

The overloaded (too much) training means that the training load or intensity -or both- is continuously more than an athlete can adapt to and the resting time is not sufficient for recovery and tiredness accumulates. This effect leads to over training, where there is a drop in performance. With the proper training programme over training should be avoided!

Over training usually happens with less experienced athletes and/or coaches as a result of the athlete continuously overexerting themselves or a wrongly planned training regimen. If the resting time or period is not long enough for proper recovery between the training sessions and this is accumulating from day to day, the athlete feels oneself becoming more and more tired, which has two effects: physiological and psychological.

Symptoms of over training:

- increased resting pulse;
- reoccurring feelings of tiredness;
- loss of appetite and body weight;
- decreased performance;
- sleeplessness;
- bad mood;
- aggressiveness or lethargy;
- lack of self-confidence;
- "escaping" to illness.

If overtraining is diagnosed it is vital that the athlete makes every effort to return to their normal condition as soon as possible. This requires physical and mental rest. The athlete first should have some full rest or easy training. This can last for 1-2 days or could involve some other activity or unrelated sport away from formal training. It is then possible to start paddling training again at a low intensity before starting regular training with increasing intensity. It is very important that the paddler is mentally ready and feels eager to start training again!

17.2 PHYSIOLOGICAL TRAINING EFFECTS

Overview of physiological adaptations to training

a.) Lungs: increased lung capacity (vital capacity)
b.) Heart: increase in stroke volume and strength,
c.) Blood: improved oxygen carrying capacity, number of blood cells, Hg and tolerance to LA
d.) Muscles: increased capillary density; strength of fibers, tolerance to LA, larger glycogen stores,

All training has a primary intended physiological effect, which is related to the aerobic and anaerobic energy system:

Heart rate range	% of maximum heart rate	Physiological effect
130 to 150	65 to 75 %	utilization mainly fats
140 to 160	70 to 80 %	utilization mainly glycogen
160 to 170	80 to 85 %	anaerobic threshold
170 to 190	85 to 95 %	transportation between
max	max	anaerobic

The basic concept is that an activity at 80% of the maximum heart rate is cardio type training where the energy comes from carbohydrate whilst at 60% of maximum heart rate the energy is supplied from fat stores.

Characteristic of training

Zone	Heart rate	LA mmol/ l	Training time (min)	Type of training
Aerobic	130 - 150	1,5 - 2,5	up to 150	Long distance 1
	150 - 170	2,5 - 4,0	15 - 60	Long distance 2
Treshold	160 - 180	4,0 - 7,0	1 - 3 x (8-15)	Endurance 3 zone
	170 - 180	7,0 - 10,0	1 - 3 x (2 - 8)	Speed end. interval
Anaerobic	180 - max	10,0	0,4 - 2 or 0,15 - 0,40	Speed end. + speed
	individual	over 10,0	up to 0,2	speed, short interval

The threshold level could be increased by aerobic training (the LA accumulation will happen over threshold zone) by various training methods.

17.3 THE TRANSITION OF TRANING SYSTEM AT VARIOUS AGE

To reach a high level in sport requires long years of continuous and appropriate practice. Training usually starts at a young age (depends on sport) of around 10-12 in canoeing and finishes at an age between 30 and 40. The different age classes, experience and background in canoeing requires different training methods with increasing volume and intensity of training. This is a continuous procedure from the beginning until the end of a sporting career without sharp or drastic changes to the long-term plan.

17.4 CHILDREN AND EXERCISE

We need to acknowledge that children (about 8 to 12/14 of age) are not miniature versions of adults! The physiology of a child and his or her responses to exercise, as well as adaptations to an extended training regimen, are, in many ways, different from the adults!

These differences must be taken into account when prescribing exercise for children as well as the effects of training on growth! This concept needs to be considered when designing strength training programme.

Strength training can be safe and effective if using proper resistance training techniques and by considering the following points:

- Children in pre-teenage age should avoid competitive weight lifting, power lifting, body building, and maximal lifts until they reach physical and skeletal maturity
- Specific training exercises should be learned initially with no load (resistance). Once the exercise skill has been mastered and muscular strength increased extra loads can be added to the workout
- Progressive resistance exercise requires successful completion of 15 repetitions in good form before increase weight or resistance
- Strength training programs should be carefully planned and shall include a warm-up and cool-down component
- General strengthening program should address all major muscle groups and exercise through the complete range of motion
- Any sign of injury or illness from strength training should be evaluated before continuing the exercise in question
- Proper calorific intake maintenance

Endurance:

- There is no significant difference in the maximal aerobic capacity per kg of children compared with adults
- During endurance exercise of the same intensity, the heart rate of children is higher than that of adults, but the working muscles of children are more effective in extracting oxygen from the blood delivered to them.

THE CHANGING OF TRAINING METHODES IS A CONTINOUS PROCEDURE!

The athletic career of both worldclass and less athletes is highly dependent on the earlier period of

LONG-TERM PREPARATION

That usually begins in childhood

The main change, or we could say challenge, comes when an athlete finishes his/her junior age category. This is a milestone of an athlete's life as they must decide whether to continue the sport at the same level, stop or become more serious and committed to their training.

17.4.1 INFLUENCING FACTORS OF SPORT CARRIER AT AGE 18 (MAIN CHANGES PERIOD)

- Personal orientation in education and sport
- Success in sport
- Targets in Sport
- Social situation of the athlete
- Move to another place for school, training, coach and condition of life
- Cope with his/her position in the senior's ranking

Starting age in sports:
The most favorable period for improvement of general motor coordination is at ages 9 to 12.

Coordination ability increases at an older age as well, but its improvement rate is lower.

General tendency is that all sports start selecting and training athletes at as young an age as possible!

Interesting statistics in ice hockey regarding time of born and place of originated from the most successful athletes:

- Athletes who were born in the first 3-6 month of a year are more talented than who was born in the 2nd parts in the year. This has been a consideration when recruiting,
- The most successful players originated from cities, which size of 50 to 500 thousands habitants

Differences in Female and Male Anatomy and Physiology

Although a women's physiological adaptations to exercise training are similar to that of men—both endurance and resistance training —there are some gender-specific anatomical and physiological factors that must be taken into account when examining the effects of exercise in women.

Despite many similarities in physiological adaptations between men and women, there are also inherent differences in anatomy and physiology. These differences are related to body composition, strength, power, endurance, and aerobic capacity. With respect to body composition e.g., women typically have lower whole-body and muscle mass, but a higher percentage of body fat than men.

The same exercise for both endurance and resistance training (strength training) with respect to intensity, frequency, and duration may result in similar improvements for men and women. Hence women obviously can exercise at the same intensity and frequency as men and will achieve positive adaptations of the same scale.

It can be stated that despite the presence of inherent anatomical and physiological differences between men and women, adaptability to exercise training does not appear to be notably influenced by sex!

The effect of the menstrual cycle on performance

In general, research has indicated that physical performance is independent of the menstrual cycle and that there is no need to adjust either training schedules or competitive events to accommodate the stage of the cycle.

17.5 STAGES OF LONG-TERM PREPARATION (ADAPTED FROM FIBA AND PROF. ISSURIN)

Sport training for children.
Sports activity must be considered as an element of the overall education of a person and should be introduced to children at early age and stretch over several years.

Sports training should start for children at an early age as it is a fundamental factor in producing successful performance in sport at a later stage.

Starting sports at an early age does not mean it's an early specialization for a sport. Rather, it means showing children all of the motor abilities of their bodies with respect to movements, speed, physical efforts, discipline in the sport and development of will power.

Unfortunately many sports force an early specialization and as this become more and more widespread, competitions become more intense and the level of the athlete's increases higher and higher. In many sports children have been trained from the beginning to achieve the highest possible results. This leads some coaches to conduct exaggerated training at an early age to win the competitions at any cost in their age immediately. The result of this situation is that many children drop out of canoeing and undermine the development of future high performance!

To prevent the negative effects of high volume and/or intensity of training for children the coach must not drive practice periods too hard and should take into account the significance of chronological and biological age, gender, sport background and individual abilities.

Spacing the objectives over several years makes it possible to consolidate motor patterns, gradually develop motor skills and teach correct execution of canoeing technique.

Division of the athlete's stage (are not to be considered rigidly):

Stage I:
multilateral (general) preparation (6-11 years)

Stage II:
beginning of sport specialization (11-13 years)

Stage III:
continued specialization (14-17 years)

Stage IV:
advanced sports specialization (over 17years)

4 STAGES OF LONG TERM PREPARATION
Based on Issurin

Stages	No. of years (12-18)	No. of workouts per week	Duration of w.o in minute	Yearly training hours
Preliminary preparation	1-2	3-4	45-60	120-170
Initial preparation	1-2	4-5	75-90	250-300
Advanced specialised	2-3	6-9	60-120	500-750
Sport perfectation	non determi-nated	9-12	70-150	750-1.400

PRELIMINARY PREPARATION (1-2 YEARS)

Abilities	Main training direction
Technical	Development of sport specific and general skills, coordination & balance
Physical	All-round development of motor abilities with increasing training capacity
Mental	Formation of stable motivation; adoptation of fundamental moral principles i.e. team spirit

INITIAL SPECIALIZATION STAGE (1-2 YEARS)

Abilities	Main training direction
Technical	Further development of sport specific skills, increase the technical coordination abilities
Physical	More specialized development of motor abilities. Adoptation to typical training workloads of canoeing
Mental	Progressing self-confidence and willpower at training and races
Other	3-4 competitions per year are recommended

ADVANCED SPECIALIZATION STAGE (2-3 YEARS)

Abilities	Main training direction
Technical	Attaining efficient/ effective technique, stabilization of individuel style to reach the highest speed, elimination of technical drawbacks
Physical	Further enhancement of sport specific motor abilities as endurance and strength
Mental	Maintenance of high self confidence and willpower; high motivation to attain sport excellence

CHAPTER 18
TRAINING METHODS

INTRODUCTION

Most of the methods in canoeing are based on empirical facts and observations of world-class competitors' performances. The best results have been produced with methods adapted from swimming and running. Similarly to other sports, the kayak-canoe sport cannot identify with one well-defined training methodology. Of course the basics are very similar to each other on the basis of science but the actual workouts are different. "There are many different roads to reach the peak."

Nevertheless, all the known successful training methods have one common denominator: intense workout!

18.1 THE TRAINING METHODS IN CANOEING:

Warming up: Every training session must start with warm up exercise that includes physiological preparation of the body.

A cold body without good blood flow militates against good technical paddling.

Warming up is also necessary for the neural connections between brain and muscles; which are are essential for good coordination.

The training methods in canoeing and for other cyclical sports:

- Long distance training or marathon or so called long lasting workloads
- Fartlek, "speed play" training
- Repetition training
- Over distance training
- Interval training
- Concurrent training
- Special paddling methods

Summarize table of training methods

Training methods	Type of training	Developmen't for	Speed of paddling	Heart rate/ mimute
Long distance or marathon	10km - 40km	Aerob endurance	Uniform with 70%-80% effort	130 - 140
Fartlek or speed play	Various program	Aerob + anaerob endurance	Varying	130 - 170
Repetition	Short, medium, longer distances	Aerob + anaerob endurance, speed endurance and speed	Depend on distance, racing speed, maximum speed	140 - 180
Over distance	520m - 600m or 1.050m - 1.200m	Aerob + anaerob endurance, Speed endurance	slower or close to racing speed	150 - 170
Interval	Cardic aerob-anaerob specific	Aerob + anaerob endurance, speed and speed endurance	Varying maximum, fast, medium	150 - maximum

18.1.1 LONG DISTANCE TRAINING

A regular long duration workload executed with relatively constant speed. Long distance training involves paddling 6 -40km (4 -25 miles) at a uniform speed with approximately 70-80% effort, which maintains a heart rate about 120-150 beats per minute. This distance and intensity may have a large-scale variation with athlete's age or level of expertise. Variation also depends on whether it is a preparation period training or takes place during the racing season. This training method is primarily for the development of aerobic endurance, as it develops the cardio vascular and the capillary system. The sustained "steady state" workout also provides opportunity /because of the relatively low intensity/ for the development and polishing of technique. Long-distance training is an indispensable part of every paddler's schedule, regardless of the distance of specialization.

18.1.2 FARTLEK TRAINING

Fartlek training or "speed play" /originated in Sweden/ is a method for the development of cardio vascular endurance.

It is a type of interval training, without stop and rigorously prescribed distance, time or recovery periods - usually no special program. It consists of paddling 6-20km /4-10 miles/in spurts, alternated with easy "recovery paddling" with a heart rate of 120 -170 beats per minute. This is also a transition to the interval training, because there is no rest period; the stress is lower, and allows recuperation, while improving circulatory endurance and sometimes the speed.

In one type of fartlek training, the paddler is given the distances and the speed or length of time the paddler should perform during one session. For example: non stop paddling 5 laps on the 1000m course: 500m hard then 500m easy.

Special effect fartlek training is when the paddler gradually increases the intensity with higher and higher stroke rate (increasing the speed of the boat) and holds it the maximum for 5-10 seconds, then reduces intensity but paddle continuously. Fartlek training also enhances capacity for speed.

18.1.3 REPETITION TRAINING

This type of training involves paddling over various distances repeatedly. The number of repetitions is determined by the intensity and vice versa. Nevertheless, it is not recommended to paddle the race distance with 100% speed more than 2 times in a given training session. The coach may use staggered starts, or simulate actual racing conditions with a group start. The use of this kind of repetition training also depends on the period of the season.

Repetition training could improve the muscular system, speed and aerobic or anaerobic endurance depending on the intensity and on the resting times.

The repeated distances can be various as:

- Short 50-250m
- Medium 300-1000m
- Long 1000-3000m

Training examples for speed development using the repetition method

	I.	II.	III.
Distance	30-50 m	50-75 m	50-100 m
Time	5-12 sec	10-20 sec	12-30 sec
Repetition	10-15	8-12	6-10
Rest	2-3 min	3-4 min	3-5 min
Intensity	100%	100%	100%
Stroke rate	100%	100%	100%

18.1.4 OVER DISTANCE TRAINING

This is a type of repetition training, but the distance is determined by the official race distance. The training distance is then set 5-10% longer than the race distance.

The over distance workout develops the travelling speed endurance.

The intensity of this training depends on the required number of repetitions; the speed is equal with the racing speed but slower than maximum.

The distances are:
210-220m or 520-550m or 1040-1080m
Repetitions 3-10 –depends on intensity

18.1.5 INTERVAL TRAINING

Interval training was used by sprint and endurance athletes to improve performance since the 1930s.

The concept of interval training is that a greater amount of intense training can be performed if the training is interspaced with rest periods, with a greater amount of intense training resulting in greater fitness gains.

The different level of paddling intensity changes the heart rates (bit/minutes) in wide range. Therefore its training methods called cardio-vascular training.

This method consists of working /paddling/ a series of set time or distances with controlled rest periods in between and the required intensity. The principle of the method is that the rest interval is long enough for partial recovery, thus fatigue will be delayed. It is imperative to paddle at the appropriate level of intensity for the aim of training. In the resting time after the given working period the high heart rate decreases to 80- 120 beat/min.

The interval methods are the most widely used training methods in canoeing.

The total number of intervals performed is dependent upon the number of intervals performed in a set, or repetitions per set, and the number of sets performed. It is also important to note that the duration of intervals can be varied during different sets of an interval training program.

With interval training method we can develop:

- endurance /both aerobic and anaerobic/,
- speed and
- speed endurance

For the better understanding of the effect of interval training we should determine two things:

a.) *Physiology system:* cardiac type or aerobic or anaerobic endurance type of interval training

b.) *Aim of training and effect of interval methods:*

- Endurance development training (aerobic or anaerobic)
- Speed development training
- Speed endurance development training

18.1.5.1 DIVISION OF INTERVAL TRAINING

Interval training can be divided into its effect on speed, speed endurance, and endurance development (aerobic or anaerobic) or into aspects of the physiological system. The best way for coaches to divide the interval training is by its training effects.

Endurance		Speed	Speed endurance
Aerobic	Anaerobic		
Heart rate (bpm)			
120-150	160-200	180-200	150-180
Wroking time per set			
2-15 min	5-60 sec	5-20 sec	20-120 sec
Repetitions per set or in a training			
20-3 x	12-6 x	12-3 x	12-4 x
Total working time in a training session			
60 min	12-30 min	6-12 min	15-30 min
Rest periods between repetitions			
1:1 or less	1:1,5 - 3	1:3 - 5	1:1 or longer

Division of interval training on endurance development effects:

- **Aerobic** type of interval training involves paddling distances that exceed racing distances/time or shorter but with short resting time below racing speed with relatively low intensity. The resting time is always shorter than the working /paddling/time. The heart rate should be no higher than approximately 150 beats/min.
- **Aerobic and anaerobic** threshold (Lactic Acid type) Heart rate approx. 140-170 beats/min (85% of the max heart rate), intensity of workout is 90% of maximum speeds, resting times are the same or a little shorter/longer than the working period.
- **Anaerobic type:** heart rate high or maximum 170- 200 beat/min.

The intensity (speed and stroke rate) close to the max. or at the max. The working times are relatively short, the resting time longer than the paddling.

The training effects or the physiology effects of the circulatory system can determinate interval training.

Interval training for endurance development

Effects of training	Heart rate in the working period	Proportion of working and resting	Working time in a set
Aerobic	130-150	1:0,5 or less	4-20 min
Aerobic and Lactic Acid	150-170	1:1-3	1-4 min
Anaerobic	170-200	1: 3-5	5-60 sec

Cardiac type: when we are considering with the paddler's heart rate between the heart rate after just finished one interval and before start the next period. Its drops to the basic level of 60-80 beats/minute in the rest period before restarting the next interval or the paddler resumes paddling when his/her heart rate reaches approximately 120 beats/min. In that situation the recovery period is shorter, /1 –2minutes/ which means the intensity of paddling will be lower than if the heart rate drops to the basic resting level.

If a pulse-rate monitor is not available it is difficult to count heart rate in the boat. To check it the best method is counting within I0 seconds of finishing a working period and count to 10 or 15 seconds. Then 6x or 4x can multiply the result. E.g.: An athlete's heart rate is 24 beats per 10 sec so his heart rate 144/min.

The first variation can be used for speed training, the second for endurance development.

Division of interval training by physiological effects:

Training for	Heart rate at the working period	Heart rate at the end resting period	Resting time approx.
Endurance	130-160	110-120	1-2 min
Speed	170 - max	70-80	2-5 min

18.1.5.2 PLANNING OF INTERVAIL TRAINING

Well-planned interval training should consider:

- The aim of achievement (endurance – speed – speed endurance)
- The length of working period, which can range 5 sec to 20 min.
- The number of repetition, sets and the total working time on a session
- The length of the rest between reps and sets is essential -from the point of view of the required effect.
- The intensity of work /paddling/. Only with proper intensity can the desired effect be reached. The measurements of intensity: the speed of the boat /speed meter or time of an exact distance/; by heart rate or by stroke rate.

18.1.6 CONCURRENT TRAINING (COMPLEX TRAINING)

This type of training means the combination of endurance and strength development in one training session.

Usually we try to enhance endurance capacity or strength in separated training for achieves the best result. It is logical that endurance development with endurance type of training and strength development with strength training. But in certain cases like limited time for training (OF BEGINNERS) we can combine endurance and strength development in one session.

If the primary goal is endurance development in a given workout then endurance training should be held first, followed by circuit strength training. This combination could increase the effectiveness of the endurance capacity.

18.1.7 SPECIAL TRAINING METHODS FOR PADDLING

These methods are aimed at the improvement of certain paddling skills or special abilities as:

- pacing;
- strength development with extra resistance or weights;
- paddling technique and style refinement;
- technique and rhythm practice for team boat:
- wake riding-hanging practice;
- practicing starts;
- learning to turn around buoys, taking place on long distance races;
- specially tailored methods for athlete's weak points.

18.2 EXAMPLES FOR INTERVAL TRAINING

18.2.1 AEROBIC ENDURANCE DEVELOPMENT TRAINING

Working time (min)	Resting time (min)	No. of repetition	Intensity (%)
12	2-4	2-5	70-80
10	2-4	3-6	70-80
8	2-3	4-6	75-80
6	2-3	5-8	80-85
5	1-2	5-10	80-85
4	1-2	6-12	80-85
3	1-1,5	6-15	80-85
2	0,5-1	10-20	85-90

Training examples for aerobic development:

- 2 sets (8'-6'-4'-2'min) *int.:* 80% *rests:* 4'-3'-2 '; between the sets 3-6 min.
- 1 set 10'-8'-5'2.5'-5'8'-10'min; int. :70-80% rests are 2 min.
- 10x2 min; rests are 1 min; int.: 80%
- 8x3 min; *rests:* 100sec-80sec-60sec-40sec-30sec-20sec or *opposite:* 20sec-30sec-40sec -60sec-80sec-100sec; *int.:* 70- 80%

Another variation is when the paddling distance and resting distance are specified:

- 6–10 x 750m; *rest:* 250m; *int.:* 80%
- 8–10x 400m; *rest:* 200m; *int.:* 80%

or a mixed example:

- 3–5x 750m; *rest:* 250m and 3–5x 400m; *rest:* 100m *int.:* 80-85%

18.2.2 AEROBIC AND ANAEROBIC ENDURANCE DEVELOPMENT (THRESHOLD) FOR SPEED ENDURANCE:

Working time (min)	Resting time (min)	No. of repetition	Intensity (%)
2	1,5-2/3	10-20	85-90
1:45	1-1,5/2	10-20	85-90
1:30	1-1,5/2	10-20	85-90
1:15	0:45-1/2	15-20	85-90
1	0:30-1/2	15-25	85-90
0:45	0:30-1/1,25/1,5	15-30	85-90

Training examples for speed endurance development:

- (1 - 2 – 1 min) X 4 sets
  - 1'-1.5'+3'min rests
- (12× 1' min) rests are 45"sec
- (10 x 1 min) 2 sets rests are: 1 min
- (30sec- 45sec-60sec-45sec-30sec)×3-5 sets

Rests: double as the working times and 3 min between sets.

- (4x 30sec) 4-6 sets

Rests: 30sec between reps and 3 min between sets

- (200m on - 300m off) ×10 sets

18.2.3 ANAEROBIC ENDURANCE DEVELOPMENT IS FOR SPEED DEVELOPMENT

Working time in seconds	Resting time between reps in seconds	Resting time between sets in minutes	No. of repetition in one set	No. of sets	Intensity (%)
5	10-20	3-5	6-12	6-10	100+
10	10-30	3-5	4-6	6-10	100+
15	30-60	3-5	4-6	6-8	100+
20	60-90	3-5	3-6	6-8	100
25	90-120	3-5	1-4	6-8	100

Training examples for speed development:

- (10"-20"-25"-) 4- 6 sets
  - Int: 100%
  - Rest: 20" -40"; 3'min between sets
- (20"-15"-10"sec) × 6-8 sets
  - Int.: 100 +
  - Rest: 60"- 30 + 2-3min between sets
- (5"-10"-15"-20"-15"-10"-5") × 4-6 sets
  - rest 30 seconds between the reps and 4 min between sets
- (4×15"sec) × 6-8 sets
  - rests are: 45" sec and 2-3 min between sets

Various "mini interval" training with different working times:

- 12× 5 sec
  - rests: 15 sec
  - sets: 4-10
- 6×10 sec
  - rests: 30 sec
  - sets: 4 -8
  - int.:100%
- 4×15 sec
  - rests: 60 sec
  - sets: 4-6; the rests between sets 2-3 min

By determination of distance:

- 6-20 × 50m
  - rest: 150 -200m (slow paddling)
- 6-15 × 75m
  - rest: 200-300m (slow paddling)
- 4-12 × 100m
  - rest: 300-400m (slow paddling)

or mixed distances:

- (50m 100m-50m)× 3-6 sets

18.3 TRANING ZONES

The training can be determined either by its physiological effect or by the aim of the training. Of course every physical activity has a physiological base and effect, but we use various terminologies when making the training programme, depending on its target. For example we can plan an aerobic type of training what we can call endurance development. If the plan, and execution, is correct we will achieve the desired target. The simple way is to divide the paddling training sessions in to three main target areas. These are: endurance – speed-endurance – speed development training. The majority of coaches work this way, because this determines and brings clarity to the training targets, which also provides more understanding for the athletes. However endurance training has different zones like aerobic and anaerobic. In addition the aerobic zone has different levels in accordance with the intensity, heart rate and LA concentration. Therefore we need to give consideration to both physiological effect and the desired training outcome or target.

The next table contains the characteristics of the three different training targets but also indicates the physiological effects of that kind of training as heart rate, LA concentration and energy sources.

The Characteristics of 3 basic training targets

Dispositions	Training for developing of		
	Basic Endurance	Speed endurance	Speed
Boat speed	60-80%	85-90%	95-max
Str. rate kayak	60-80	80-100	max.; up to 160
Str rate canoe	36-45	45-65	max.; up to 100
Heart rate	130-150	85% of max.	180 - max.
Blood LA level	2-8 mmol/ l	8-24 mmol/ l	3-6 mmol/ l
Distances	12-40 km	100-500m phases	10-100m
Time interval of reps	8-12 min or non-stop	30 sec - 2 min	5 sec to 25 sec
Total training time	60-90 min	up to 30 min	up to 16 min
Work/ Rest ratio	Non regulated	1:1-3	1:4-5-6
Energy surcases	Aerobic glycolisis	Anaerobic glycolisis	Lactic Acid system

As mentioned before, the endurance training can be divided in to different zones according to intensity and energy supply.

The 4 zones of endurance training

Training zones	Zone 1 (Z1)	Zone 2 (Z2)	Zone 3 (Z3)	Zone 4 (Z4)
Training for	**Compensation**	**Aerobic 1**	**Aerobic 2 Treshold level**	**Racing distance endurance**
Intensity % of max	75-80	80-85	85-90	90-95
Heart rate	120-130	130-150	85% of max HRT	170-180
LA concentrate	0-2	2-4	4-6	8-12
VO_2 max. %	60-70	70-80	80-90	90-98
Training time	60-90 min	60 min	30-45 min	20-25 min
Str/min MK 1.000m	60-70	75-80	85-95	95-105
Str/min MK 1.000m	65-70	70-75	75-85	85-100
Str/min MK 1.000m	36-40	40-46	46-55	55-60

Endurance training can also be divided on the physiological effect on the base of energy supply.

The training on the base of energy supply

Physiological effects	Heart rate	LA mmol/ l	Training time (min)	Training zones
Aerobic	130-150	1,5-2,5	up to 150	Endurance 1 Z1
	150-160	2,5-4	3-4 x (15-60)	Endurance 2 Z2
Treshold	160-170	4-7	1-3 x (8-15)	Endurance 3 Z3
	170-180	7-10	1-3 x (2-8)	Speed endurance Z4
Anaerobic	180 - max.	10,0	0,4-2 or 0,15-0,40	Speed and Speed endurance Z5
	maximum	over 10	up to 0,2	Speed development short interval Z6

The following table is a summary of the 6 Training Intensity Zones, which we can distinguish from each other quite clearly. These zones represent different kind of physiological effects and training targets.

Intensity Zones of Training

Zones	Name of the training	LA mmol/ l
Z1	Restoration compensation	0-2
Z2	Endurance 2	2-4
Z3	Endurance 3	4-6
Z4	VO_2 treshold	5-8
Z5	Racing speed (2-6 min duration)	max. up to 24
Z6	Over racing speed	Not informative

It is important to adhere strictly to the training zones when developing the training programme, in order to achieve the desired targets.

The following table gives information on paddling distances for the four training Zones (Z3-Z4-Z5-Z6). The distances represent five different difficulties from the extremely long to the extremely short. The selection of the distance for a given training session should be determined by the training target; which in turn is determined by, the level of athletes, period of the year, gender, age, specialisation to one racing distance and weather condition etc.

Workloads (paddling distances) on different training zones

The workloads limits (km) related to different training intensity zones				
Load level and energy surcase	**Zone 3**	**Zone 4**	**Zone 5**	**Zone 6**
	Aerobic	Aerobic Anaerobic Mixed	Glycolitic	Alactacid
Extreme volume	24 - 30	7 - 8	3,3 - 3,8	1,6
Large	18 - 24	4,5 - 7	2,3 - 3,3	1,2
Sustain	14 - 18	2,5 - 4,5	1,3 - 2,2	0,8
Medium	8 - 14	1 - 2,5	0,5 - 1,2	0,6
Small	6 - 8	0,5 - 1	0,2 - 0,4	0,3

In using the 6 Training Intensity Zones the next table provides a guideline for planning the exact training programme for the required target and zone.

Training at treshold level

Training zones	Aerobic treshold	Anaerobic treshold
LA level	2 mmol/ l	4 mmol/ l
Time/ duration	1 - 3,5 hours	up to 45 min
Intensity	50-60%	70-90%
Heart rate		
adults	130-150	160-180
children	145-180	175-195

Characteristics of key-exercises for the 6 training intensity zones

Training zones	Targeted ability	Work interval	Work / rest	Intensity	No. of reps	No. of series
Z6	Maximum speed	7 - 15 sec	1 : 8/10	maximal	5 - 8	2 - 5
Z5	Anaerobic glycolitic power	30 - 50 sec	1 : 4/5	sub maximal	4 - 6	2 - 4
Z4	Anaerobic endurance	1 - 1,5 min	1 : 3	high	8 - 12	1 - 3
Z3	Aerobic power	1 - 2	1 : 1/0,5	intermediate	5 - 8	1 - 3
Z2	Aerobic endurance	1 - 8	1 : 0,3	medium	4 - 16	1 - 3
Z1	Restoration	20 - 90 min	-	low	1 - 3	-

18.4 TRAINING AT VARIOUS AGES

A paddler can begin learning canoeing when he/she is about ten years old, but canoeing can be started at all ages.

Athletes can be divided for the following groups regarding their back ground in canoeing:

- **Beginner**: there is no sharp distinction;
- **Advanced**: the development is a continuous process
- **National** and **International standard**

a.) **Beginner paddlers** (1-2 years of paddling experience) Young athletes must get used to a regimented systematic and multifaceted training schedule and the coach should provide a good foundation for the continuous development of the athlete's potential. Besides teaching the rudiments and technique of paddling, the coach should also develop the athlete's physical and psychological abilities. Only after an overall workout period can the athlete gradually develop the sport specific features.

b.) **Advanced paddlers** (2-4 years of paddling experience) The previously described training is continued, but should be more result oriented. The coach should begin to prepare the paddlers specifically for competition and acquaint them with the heavy stresses of the sport. The coach should demand sportsmanlike behavior, clean lifestyle and the motivation for higher achievements.

c.) **National** and **international class paddlers** (5-6 years of paddling experience). The paddler should reach top performance and sustain the accomplishments for as long as he/she can. Personalised training methods and workload are essential. An important task is the preservation of the paddler's high motivation and the increase of training stimuli.

In the following, we will see a changing training methodology adapted to the actual or chronological age of the athlete.

The percentage distribution of specific training throughout a calendar year

Age	Endurance	Strength	Speed
10 - 13	70% - 80%	15% - 20%	5% - 10%
14 - 15	50% - 60%	25% - 30%	20% - 25%
16 - 18	40% - 50%	30% - 40%	25% - 30%
18 +	30% - 35%	35% - 40%	35% - 40%

THE PERCENTAGE DISTRIBUTION OF SPECIFIC DURING PADDLING SEASON						
Age	Endurance		Strength		Speed	
	basic season %	racing season %	basic season %	racing season %	basic season %	racing season %
10 - 13	70-80	60-80	10-15	5-10	10-15	10-30
14 - 15	55-65	35-45	15-20	10-15	20-25	40-50
16 - 18	45-55	20-25	20-25	15-25	25-30	60-65
18 +	35-45	15-20	20-25	15-20	35-40	70-80

18.4.1 TRAINING OF 10-13 YEAR OLD PADDLERS (BEGINNER)

A.) GENERAL

The most important task is the foundation of a good paddling technique, with a diversified body development. This is the age when the paddlers must start developing dexterity, coordination, skill, flexibility and a competitive spirit. At this age the adaptation to training is difficult and will require more time. Training represents not only a physical but also a psychological stress. However, ambition and competitive spirit will often stimulate young athletes to work beyond the normal capacity for their age. A good coach should recognise these situations and keep the training intensity at a level, which is not detrimental to the health of the young athlete. If the coach does not monitor this properly a serious backlash can be expected in the form of declining improvement, lethargy, loss of spirit, injury etc. Excessive drive and training at this age will certainly hinder further improvement in the later periods. This unfortunate situation occurs often in practically all competitive sports. In other words, the effects of over training are never as serious as at this young age.

The development and refinement of the neuromuscular coordination is also of considerable importance at this stage. Finally, the coach should carefully increase the training workload to the point where it does not cause a change in the fluidity of paddling coordination or the distortion of the technique. Recommended training: 3-4 times a week; 2-2.5 hours each time. The recommended training methods are:

B.) ENDURANCE DEVELOPMENT

The aerobic /oxygen-using/ type training methods improve the cardio-circulatory and cardiopulmonary system of the athlete. Aerobic endurance refers to such work, when the body's oxygen supply is in balance with the oxygen demand or consumption. The body attains a so-called "steady state", which typically occurs when paddling long distances with a heart rate approx, of 130-160 beats per minute for children. In that age of beginner paddlers the aerobic endurance development is the most important task, it should constitute about 70-80% of the training load.

Anaerobic endurance is operative when the intensity of training is as high as the oxygen demand exceeds the oxygen supply. The heart rate is between 160-max. In this age group the anaerobic type of training can represent only a small percentage of the training load.

C.) STRENGTH DEVELOPMENT

A versatile workout method should be emphasized. In this age group the thickening /strengthening/ of the muscle fibers is a slow process; on the other hand, the capacity for work can increase considerably. The preferred exercises are of the anti-gravity type that is utilizing one's own body weight / for example: chin ups, push-ups, rope climbing and apparatus gymnastics/. Weight training can be introduced gradually and with supported torso to avoid spinal injury or deformation.

D.) SPEED DEVELOPMENT

The main task is the improvement of the neuromuscular and kinetic coordination, which is achieved through the repetitious refinement of the paddling technique which ultimately increases speed. This should constitute 5-10% of the training programme.

18.4.2 TRAINING OF 14 – 15 YEAR OLD PADDLERS (1-3 YEARS BACKGROUND)

A.) GENERAL

The main aim is the continued improvement of the physical and psychological abilities, paddling technique, and the confident handling of the single racing boat. Training frequency should be increased to 6-8 times per week, 1.5-3 hours each session. The diversification of the workouts should continue. A recommended typical weekly schedule is as follows:

Weekly training programme

During outdoors paddling period	During off-paddling period
paddling every day 10-30km	pool paddling 2-4 times
running 2-3 times	running 3-4 times
strength exercise 2-3 times	strength development 3-4 times
games 1-2 times	swimming 2x per week
	games 2x

A good coach is never orthodox in following prescribed methodology to the letter, but rather "customises" the workouts according to the physical and technical readiness of the paddler. Now is also the time for teaching special paddling skills, such as wake-riding and paddling under adverse conditions /wind or choppy water etc./. Psychological traits of the paddler must also be further improved because at this stage the intensity of the workouts will increase considerably. The recommended training methods are:

B.) ENDURANCE DEVELOPMENT

The coach should gradually introduce sport-specific endurance workout regimens. Anaerobic work should be increasing and be about 40-50% of the endurance development training. Recommended training methods:

- fartlek and extended high load paddling;
- repetition paddling with long rest;
- paddling race distances at high intensity and for time;
- interval training for speed endurance and speed development.

C.) STRENGTH DEVELOPMENT

We begin to focus on the sport specific muscle development along with the general strengthening of the body. Isokinetic exercises should dominate at this stage of development, i.e., the paddler should work with progressively increasing resistance within the scope of his or her physical capacity.

Strength development exercises should be about 25-30% of the training regimen, in this age group.

D.) SPEED DEVELOPMENT

The capacity of human speed is an entity which does not transform readily, i.e.: fast running or swimming will not directly translate into fast paddling, however natural speed is a strong factor in the ability of an athlete.

Special paddling training methods must be employed to achieve speed in the boat. Accordingly, the proportion of repetition and sprint training has to be increased. Furthermore, since speed is a function of strength and technique restricted by the individual's neuron-muscular coordination, it cannot be developed by itself but only through improved muscular strength and paddling technique.

The amount of speed development training will vary with the time of the paddling season. Naturally, very few or maybe only one of these will be scheduled for the period of preparation /basics/ but should be predominant in the racing season.

18.4.3 TRAINING OF 16-18 YEAR OLD ATHLETES (3-5 YEARS BACKGROUND IN CANOEING)

A.) GENERAL

These are the years when the paddler's skills and abilities need reinforcement. Endurance, speed endurance and strength must be increased,

speed intensified and paddling technique further refined. With these objectives in mind, the training regimen should change as follows:

- Increase the number of workouts to 7-12 per week;
- Increase intensity and workload;
- Improve technical efficiency;
- observe individual traits and characteristics to develop personalised training
- Increase overall workload to reach the pain-threshold at least 2-3 times weekly;

B.) ENDURANCE DEVELOPMENT

Main emphasis is on building anaerobic endurance. Therefore, the proportion of anaerobic work must be increased in relation to the aerobic exercises. Recommended training:

- Frequent interval training with heart rate reaching 170-200 beats per minute;
- Use the hypoxic* or controlled breathing training in canoeing or in running, swimming

*From hypoxia, meaning lack of oxygen in the blood and in muscle cells. Hypoxic training requires controlled breathing. For instance the athlete forces hypoxia during exercise e.g. swim as long as possible with one breath.

C.) STRENGTH DEVELOPMENT

This is the age bracket when muscular strength can be increased the most efficiently. Weight training is done at sub maximal, less than max, and with maximal weights enabling the athlete to do 3-4 repetitions or just a one-two all-out effort. Muscular strength development should be about 50% of the training load during the winter months.

D.) SPEED DEVELOPMENT

As a consequence of increased muscular strength the paddler's speed will also increase. The coach must frequently push to exceed the paddler's speed threshold. Mini interval training and team boat paddling can facilitate this. It should be mentioned that speed development in the preconditioning period implies the rapid execution of strength building exercises and pool paddling.

18.4.4 TRAINING OF ABOVE 18 YEARS OF AGE OF ELITE ATHLETES

For athletes who have already "peaked", the most important and difficult task is the maintenance and improvement of a top level performance year after year. For the sake of this rather difficult objective, highly personalised training methods and schedules are needed. The coach must look for new stimuli, motivation and realistic goals. Endurance, strength and speed should be maintained if improvement is no longer feasible. In the other words, the athlete should try to reproduce his or her past achievements. In the latter years the workload may be reduced, but not the intensity. The training should emulate racing conditions. Also, the paddler should achieve certain time standards, i.e., the workouts must be specifically targeted and always purposeful; otherwise a psychological backlash may occur if time appears to be wasted.

This book gives much information on the proper and necessary volume and intensity of the various training methods for coaches and athletes.

Athletes with no paddling experience at this age should follow the development methods of the beginners.

18.5 VOLUME AND INTENSITY OF WORKOUTS

Different studies suggest using high(er) intensity of training for the better effects in shorter duration! For endurance development 30minutes paddling continuously could have less effect for VO2max development as 8x sec high intensity paddling with 10 seconds rest!

CHAPTER 19
THE INTENSITY OF TRAINING

INTRODUCTION

The intensity of training is a pivotal factor as the success of the entire programme depends on the optimal application of intensity. However, there can be difficulties in defining paddling intensities which need to be avoided in order to achieve the best results.

Here, we must refer to the paddler's maximum exertion as the 100% intensity in terms of speed, strength, stroke rate and will power. This of course must be translated into boat speed to become a measurable entity. Choosing the length of the rest periods is also a decisive factor in the design of training workload. The proper selection of rest (or recovery period will have an effect on the objective of the training session. In the course of an interval training session we must decide on the length of rest periods as well as the total time of efforts, reps and sets, in order to improve certain traits.

To achieve the greatest improvement in boat speed, training intensity should be varied and adjusted to the individual paddler or team. The evaluation of performance is relatively easy in sports like swimming, where there is a sheltered training environment and the only factor to be concerned with is the water's resistance, which is constant. The situation is different in kayak-canoe sport where wind conditions or the water surface and depth(temperature significantly affect performance.

As we have seen so far the planning of a training schedule and using the correct methods is a very complex task. It is important to remember that it is impossible to prescribe a fail-safe programme that works for every athlete in the same way. There are many variations that can be made to a training programme that provide many different ways to reach excellence.

19.1 TRAINING INTENSITY MEASUREMENT

The objective measurement of maximum oxygen uptake (VO2 max) can provide useful information when monitoring improvements through training. By using maximum oxygen uptake testing it is possible to find the most effective training methods that improve the athlete's ability for specific events.

Some studies (I.e., by Tabata, JPN) suggest that high intensity interval training is the best method for VO2 max and anaerobic capacity improvement. This type of training involves working at maximum capacity for a short period such as a 20 second effort with short periods of rest around 10 seconds which taxes both the aerobic and anaerobic system.

For paddle-sport, there are different practical methods on which training intensity can be based. They are: heart rate or pulse rate, boat speed and stroke rate or a combination of all three.

The most important thing is to realistically establish the maximum (upper limit) for a given paddler and determine the intensity percentage from either scientifically or experimentally obtained data. Each intensity training method used should be understood by the paddler and have an immediate feedback for accurately controlling and monitoring training. Technology is here to assist coaches and paddlers to gain the maximum benefit from individualised intensity training.

19.2 HEART RATE BASE INTENSITY TRAINING METHOD

Heart rate or pulse rate is a standard measurement of the related cardiac functions. Heart rate is expressed in beats per minute and usually two different ones are measured, namely, maximum and resting pulse rates. The maximum heart rate indicates the highest pumping frequency of the heart under maximum workload. This measurement is unique to an individual, but it can be increased by physical training and can reach 200-220 beats per minute.

The heart rate level depends on the age. The basic calculation for maximum HR is 220 HR/min minus the age and this can be considered as the maximum intensity of training at 100%, 85% is the proper training zone for training on anaerobic level and 65% of max is for aerobic (fat supplied ATP energy). Between 85% and 65% is the threshold zone, when LA accumulates.
Resting heart rate, in comparison, indicates the lowest possible pulse rate under complete rest. Factors that affect resting heart rate are the following: age, sex, and ingestion of food, emotions, body temperature and environmental conditions.

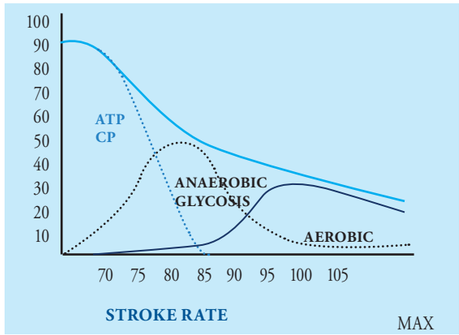
Cardiovascular conditioning is often measured by the difference between the maximum and resting heart rate. A greater difference indicates a higher level of conditioning. The target zone for aerobic exercise is about 60% to 80% of the maximum heart rate, for anaerobic exercise that is 80% to100%.

To calculate the target zone, first subtract age from 220 to get the maximum rate of training zone. Multiply this maximum heart rate by 60% (0.60) to get the lower target figure.
For example: For a 25-year old paddler, the maximum heart rate is 220-25=195 beats/min.
His aerobic target zone will be between 117 beats and 156 beats per minute (195X0.60=117 and 195×0.80—156).

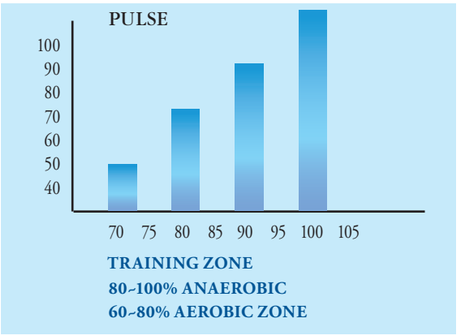
Currently the common practice in paddle-sport is to measure heart rate during and or after a workout piece. The paddler stops and counts the own pulse rate for 10 seconds and multiplies by 6 to get the actual figure. This method is hardly satisfactory for intensity percentage training because the desired upper limit percentage must be monitored during the workout piece. In other words the paddler should know at any point during the interval piece how much his or her heart rate is and how close this rate is to the percentage intensity for that exercise. It is also important to note that when training in groups at a certain speed greater demand will be put on the slower or less conditioned paddlers trying to keep up with the fast ones.

The recovery or rest period is very critical for interval training. As the intensity of workout is increased beyond a certain point, recovery is no longer completed in the rest period unless the rest period is also increased proportionally. The next piece of work at the anaerobic level should not be started until the individual's heart rate has reached the lower limit. If it doesn't happen within 2 minutes the condition of the athlete is poor.

INTENSITY ZONES OF TRAINING

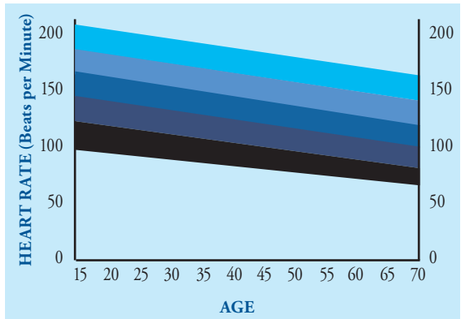


HEART RATE BEAT/MINUTES



RANGE OF HEART RATE TARGETS
(25 years old athlete)

HEART RATE BASED TRAINING ZONES



The following table shows the accepted heart rates of training Zones 1- 5 in consideration with age:

TRAINING ZONES	HEART RATE		
	%	AGE 15-20	AGE 15-20
5 extremely hard	100 - 90	210 - 205	205 - 200
4 very hard	90 - 80	205 - 190	200 - 186
AEROBIC THRESHOLD ZONE*			
3 hard	80 - 70	170 - 152	164 - 145
2 medium	70 - 60	152 - 134	145 - 123
1 easy	60 - 50	134 - 110	123 - 105

* Aerobic threshold can be calculated from the maximum heart rate minus 30

19.3 BOAT SPEED INTENSITY TRAINING

Boat speed is the greatest concern of paddlers and coaches. It is simply the distance travelled divided by the elapsed time. If the paddler is interested in maximum speed, the travelled distance should be short; on the other hand, travelling speed is computed over the racing distance of either 500 or 1000 meters. For the purpose of analysis, the starting speed is measured for the first 100 meters of the race. However, because the interval timing is given at 250 meters, often this data is used for starting speed measurement. Controlling starting speed and maintaining travelling speed are the two most critical components of racing strategy. It is more important on the 1000m races than on 500m. Controlled starting speed reserves energy to properly execute the racing strategy and minimize the lactic acid build up in the active muscle groups. Maintaining travelling speed puts less demand on the active muscles and often leads to better results.

Boat speed is totally dependent upon the aero and hydrodynamic resistance of the boat, the generated propulsive force (driving force), and the efficient transmission of the force from the paddle to the boat, otherwise known as technique.

To use the curves on figure, a paddler should enter the best average racing speed for the given distance. To find the relationship between average speed and racing time, enter figure 201 with either value. The intersection of this value and the selected distance curve will give 100K travelling intensity.

Boat speed (m/sec) and intensity percentage relationship

INTENSITY	SPRINT		500M		1000M	
	SPEED	%	SPEED	%	SPEED	%
100	5.10	100	4.85	100	4.40	100
95	4.96	97	4.70	97	4.25	97
95	4.96	97	4.70	97	4.25	97
85	4.62	91	4.37	90	3.95	90
80	4.46	88	4.20	87	3.76	85
75	4.28	84	4.03	83	3.58	81
70	4.09	80	3.84	79	3.35	76

The most effective way to measure speed intensity in training is to have a speedometer installed in the boat. These small boat speedometers are readily available commercially. A speedometer is an immediate feedback device, giving results usually at five seconds intervals. With a carefully designed individual training programme, speed intensity training can be very effective. By using a speedometer the coach can make an exact individual programme, prescribing the required speed for a paddler on the given training session.

19.4 STROKE RATE BASE INTENSITY TRAINING

Since the stroke rate is directly related to speed the stroke rate also determines the paddling intensity. It simply means that paddling with a higher stroke rate leads to faster speeds and to higher intensity. In this way we can make a measurement of the intensity of paddling in connection to stroke rate.

If a paddler has trained with and understood stroke rate intensity training and has total control of it then there should be an increase in speed with increased stroke rate.

The next table shows the times and the starting and travelling stroke rates in the finals of an international competition where the winner' time in MK1 was 1:40.13. Since that dates the times improved to around 1:35, which indicates higher stroke rates as are in the following table (the information on 200m is in the Chapter 25):

EVENTS	TIME	STROKE RATE	
		START PHASE	TRAVLING PHASE
K-1 500 M	1.40:13	156-144	144-126
K 2 500 M	1.:27	168-156	144-132
K 1 1000 M	3.37:26	138-132	114-102
K-2 1000 M	3.16:10	144-132	126-120
K-4 1000 M	2.54:18	144-136	126-120
C 1 500 M	1.51:15	88-84	78-72
C 2 500 M	1.41:54	90-84	84-72
C-1 1000 M	4.05:92	82-78	66-60
C-2 1000 M	3.37:42	84-78	78-72
K-1 500 W	1.51:60	144-136	120-114
K 2 500 W	1.40:29	144-136	138-126
K 4 500 W	1.38:32	144-136	138-128

19.5 HIGH TECHNOLOGY SUPPORT FOR TRAINING

The measurement of the individual physiological affect of training in comparison with the planned target can normally be done after training. There are, however, new devices which give information to the coach or cardiologist during training.

DigiTrainer and TechniqueStudio data analysis software.

In today's competitive sports, the reaching of the desired goals is not only dependent on the coaches' knowledge or the physical abilities and talent of the athletes. Scientific research and development also plays an important role in increasing athletic performance. Besides new nutritional and training methods, the technical innovations are of great importance to sports: the exact measurement of technique and performance is necessary for better results.

DigiTrainer's great advantage over the various ergometers on the market today, is that it provides data not only on the ground (like the machines), but under real training conditions on water. Furthermore it doesn't require the boat to be customized or altered in any way by installing cables and sensors; it can be easily mounted on any boat without any cabling. Due to its small size and weight, DigiTrainer does not influence the gliding of the boat or restrict the movement of the athlete. Based on the collected data, the athletes' technique can be analyzed and compared, which had only been possible through the coaches' observations or video recordings. Moreover, beyond the usual parameters which can be measured on an ergometer, it provides data on the stability (tilt) of the boat, which is impossible with ground measurements. With this new measurement technique, the movements can be inspected under real circumstances by the analysis of parameters which have not been measured before. This instrument can be used to improve technique and performance not only in kayaking, paddle-sport and rowing but in many other sports as well.

The DigiTrainer, when mounted on a boat, measures and records the movement of the vessel for further computer analysis. During training, the momentary stroke rate (stroke/min) and speed can provide important feedback to the athlete since their ratio describes the efficiency of the paddling technique. The DigiTrainer continuously displays the stroke rate, speed, the distance covered, and heart rate data. This information helps the athlete in planning and economizing the energy usage during a race.

The instrument measures the acceleration of the boat in all three directions (up/down, left/right, forward/backward), records the GPS coordinates and heart rate, and stores the data on its memory card. Further analysis can be made from the collected data. The acceleration data provides important information regarding the paddling technique: power symmetry between left and right strokes (kayak), power distribution of single strokes, tilting of the boat, and the change of the technique through the training session. Besides all these, numerous other technical details can be observed, which can help both coach and athlete in the improvement of the technique in order to achieve better results.

The Training Partner feature can simulate racing against a virtual opponent, whose speed-time characteristics (racing tactics) can be programmemed in any desired way. This helps the athletes learn a given course tactic, or to practice racing against one of their real-world opponents.

The state-of-the-art accelerometer embedded in the device continuously tracks the movement of the boat and records the data more than one hundred times per second. The collected data can be sent to a computer in real time via Bluetooth. This allows the coach to monitor the athlete during training and give instant feedback or instructions regarding the paddling technique and performance. The recorded data can be downloaded to a computer after training through USB connection.

The DigiTrainer system also includes the Technique Studio software, which offers easy display and more detailed analysis of the collected data. The position of the boat is drawn on a satellite-based map and the measured data is displayed on various charts, which can also be synchronized to a video recording. This new instrument opens new perspectives in the perfection of technique and enhancement of performance.

DigiTrainer is a new device incorporating the latest state-of-the-art technologies in order to measure performance and technique of kayak, canoe, and rowing athletes. It contains a GPS, heart rate monitor, and an accelerometer, which can measure the movement of the boat in all three directions. From the data collected, parameters such as stroke rate, stroke power, boat stability, speed, distance, heart rate can easily be observed. This information is also displayed in real time on the instrument, helping the athletes improve their technique and performance during training.

FEATURES:

On the water:

- accelerometer
- GPS
- Heart rate monitor
- Speed display
- Stroke rate display
- Virtual partner
- Data logging

Computer analysis:

- Speed, stroke rate, heart rate graphs
- Observation of catch, power, and release phases
- Drawing course over satellite-based map
- Data display synchronized to video

Telemetric connection within athletes and coach and(or cardiologist

Another new device for assisting with training is the online or offline telemetric connection, which gives information on heart rate, stroke rate, speed and stroke length etc.

The chest-strap on the athlete has a microcomputer, which sends the data to the receiver device with the coach. The coach gives information and instruction to the athlete via earphone.

Legend: black: heart rate; stroke rate: grin; Intensity: red; stroke rate and intensity proportion: blue

FIG. 19.1 -

FIG. 19.2 -

CHAPTER 20
CONDITIONING WITH SUPPLEMENTARY SPORTS AND EXERCISES

INTRODUCTION

Paddle-sport water training is seasonal in most countries due to climatic limitations. As a general practice in the countries with four seasons, paddling ceases from November to the end of February or, at best, is limited to a few actual outdoor paddling training sessions. Nevertheless, training cannot stop! The outdoor paddling is replaced by conditioning, which involves supplementary sports and special exercises. These activities are vitally important and some are carried over into the training regimen of the paddling season. However, the development of endurance and strength are not specific in the off-season but aim to develop general fitness. For example, with running we can improve aerobic and anaerobic endurance and increase the capillary system in the leg muscles. These improved abilities will be transmitted partly to paddling.
Conditioning is mainly aimed at improving the physiological and muscular systems. The advantages of an improved circulatory system and muscular strength have been discussed already; however here is a short reminder of the main principles:

Improved respiratory system means: more air can be inhaled by one breath, increasing the number of active alveoli in the lungs, the vital capacity improves, the breaths become slower and deeper – the oxygen supply to the muscles is improving.

Improved cardio-vascular system means:
a. reduction of the resting heart rate; higher intensity can be achieved on a lower heart rate, the LA accumulation is delayed,
b. increased oxygen transport to the muscles
c. reduction in the time of recovery of the heart rate after prolonged exercise;
d. reduced accumulation of lactic acid in the muscles.

Improved muscular system means:
a. increases in the thickness of the muscle fibres;
b. increases in the number of capillaries in the muscle tissues.

20.1 SUPPLEMENTARY TRAINING FOR ENDURANCE DEVELOPMENT

20.1.1 RUNNING

Running is the simplest exercise, requiring no special technique or facilities; it is well suited for the intensive development of the circulatory system under almost any climate. Running training should start with the onset of paddling and should observe the same principles as that of paddling: A progressive increase in workload and intensity over time. Running should be emphasized during the winter workouts starting with 2-3 runs per week, and then increased to 5-6 times weekly. Running should also be continued during the paddling season at a rate of 3 times per week. Running training has numerous variants, all of which suit paddle-sport. The various types of running training can be classified by terrain:

Cross country running, flat terrain on roads or in track, uphill running, and stairs running.

Running on changing terrain is the most preferred form of training to the changing environment, which makes the workload more tolerable. Running on an ascending terrain uphill is a very high intensity type of exercise. Consequently, the heart is heavily taxed in this exercise. Therefore it is recommended only for athletes with years of running background.

Running on sandy terrain such as open sandy shoreline is also unusually demanding. The pliant sand provides a poor foot support in the forward motion, thus larger exertion is necessary to maintain running speed. Running on roads is usually the most accessible form of training although it is recommended only in lack of other course. A well-fitting pair of running shoes is a must to cushion the often harmful pounding of running on hard surfaces. Usually air pollution is higher on roads due to automotive fumes; therefore this kind of environment should be avoided if possible.

Running on tracks is naturally the most ideal choice, because the distance or time can be measured and a controlled training regimen can be conducted.

The following 3-week running training programme, with five running workouts per week, is suitable for athletes with several years of running background in the off-paddling season.

symbols C = cross country running
T = track running
U = uphill running

(All workouts should be preceded by 10 minutes warming up and finished with cool down)

EXAMPLES FOR RUNNING:

1ST WEEK
Mon: C 6km
Tue: T 3-5 X 1200 or 1500m with 4-6 min. rests
Wed: U 6-10X 90sec - 150sec and return easily for rests
Thu: -
Fri: T Cooper test / measure distance covered in 12 min, or 3000m running
Sat: C long distance running 6-15km
Sun: -

2ND WEEK
Tue: C 5-8 km Mon T 3X/800m-400m/ rest: 2-3 min
Wed: U 4X4' up and return just lightly
Thu: -
Fri: T 5 km continuous, alternating with sprints /fartlek/
Sat: 6-10 km for time
Sun: -

3RD WEEK
Mon: T 2x/1500m-800m-400m/with 2-3' rests
Tue: C 5-6 km
Wed: U 10-15 X 1' up, and return easy
Thu: -
Fri: T 10 laps /4000m/sprint in one straight of each lap
Sat: C 8-12 km marathon
Sun: -

LONG DISTANCE	FARTHLEK	REPETITION	INTERVALL	UP HILL
4-20km in var. terrain	Cross-country 4-10 km	2-3 x 3000m	10"on-40"off	15-20 sec sprint
		2-3 x 2000m	15"on-45"off	1'-2' min. hard
For example: flat street track cross-country		2-4 x 1500m	20"on-20"off	3'-4' min. hard
	Hard-easy type:	2-6 x 1200m	30"on-30"off	Rest: slowly back to the start
	400m-400m x 10 lap	3-6 x 800m	30"on-20"off	
	200m-200m x 8-10 lap	6-10 x 400m		
	100m-100m x 6-10 lap		Rep 10-20 sets	
	100m-300m x 6-10 lap			
		Rest 2-5 min		
	for time:			
	30" hard-30" easy x 20			

20.1.2 SWIMMING

Swimming training can start at a very early age without any danger of harmful effects because of the uniform resistance of the water. Swimming develops breathing, circulatory system, and oxygen utilization, in a manner similar to the requirements of paddlers. Generally, it is a great advantage if a novice paddler has some previous swimming experience at the racing level.

Swimming is used primarily in the winter months as a supplementary sport (during the paddling season swimming should be avoided because it tends to loosen the shoulder muscles). A duration of 1 -1.5 hours three times a week is recommended, which should be enough to cover 2000- 4000m in each session. Again, the possible sessions are numerous.

Freestyle swimming is the most highly recommended, interspersed with other styles (breast and back strokes). The increase of the training load can be achieved by swimming using the butterfly stroke. This is especially suitable if the athlete has a few years of swimming background. The workload can also increase by swimming in a T- shirt. A further increase of workload or intensity can be achieved by setting time standards, for example:

A session of 20 x 100m, where each 100m effort must be within 6 -12 seconds of the best time achieved by the athlete. If the athlete is unable to meet this demand, we could increase workload instead, by prescribing an extra lap for every athlete who swims too slowly. This method is also useful to motivate the athletes for higher intensity (the same method can be used for running training).

It requires several swimming sessions and thorough knowledge of the athlete's abilities to set optimum time standards. Setting too high or too low standards will not yield the desired training effects. In other words, the training schedule must be "customised "and recorded for consistent follow up, e.g.

NAME	BEST TIME	REQUIRED TIMES	AT VARIOUS	REPETITIONS
	100m	10x100m	20x100m	30x100m
"A"	1'05"	1 '10"	1 '15'	1'20"
"B"	1'12"	1 '17"	1 '22"	1 '27"

Naturally, other distances can also be introduced into the programme. A good variation is swimming with controlled breathing, which particularly develops the oxygen utilization of the athlete. It consists of breathing once for every 3 to 6 strokes, or swimming to the longest possible distance with one breath of air. These are also called the hypoxic swimming exercises. These training techniques should be pursued for 4-6 weeks in the winter season. Swimming training should be designed with the same principles as paddling, that is, the workload and intensity should be progressive. Also, keep varying the workouts to avoid them seeming monotonous for the athlete. For example, in a three training week schedule we should have three different kinds of workouts.

Example of swimming training in off season (three swimming sessions per week):

1ST WEEK

1. 2000m swimming with the least number of stops or non-stop:
2. 400m warm-up; 10x1 length with one breath or as long as possible; 2x1000m (5 min off. 3-4 strokes per breath);
3. 400m warm up; 3X200m medley; 5X400m (3 min off. 3-4 strokes per breath).

2ND WEEK

1. 300m warm up, 6 x one length with one breath as long as possible and 1 x 1000m then 1º500m timed (rest 3' - 5')
2. 400m warm-up, 4 x 100m butterfly (with 2 min off) and 10 x 200m (30 sec off)
3. 400m warm up, 10 x one length hypoxia swimming, 6 x 300m timed (2'off) and 1 x 200m butterfly or medley;

3RD WEEK

1. 300m warm up, 3X 1000m timed (4 to 6 min off)
2. 400m warm up, 5x200m medley 15-20 length (50m or 66m or 100m) with 20 sec off and 1X300m;
3. 400m warm up, 20x100m at 100% and 5 x 1 length sprint (30' off)

4TH WEEK

1. 300m warm-up; 1 X 200m butterfly and 2000m for time;
2. 100m warm-up; 1X 300m 6-7 strokes per breath, and 3 x (300m- 200m -100m). Rests – 2 min to 3mins, and 4x50m butterfly;
3. 400m warm up; 4x200m medley (2 min rest), and l0 x 100m with 20 sec off, and 10 x1 length sprint with 30 sec off. 300m relaxed freestyle.

20.1.3 THE PADDLING TANK

Training in a paddling tank is the closest to real paddling in its effects. Besides technique, specific strength and endurance development can also be conducted in a well-designed tank. The circulation of the water, mirrors on the wall or live monitoring can significantly increase the benefits of the tank training. But where a paddling tank is unavailable an indoor or outdoor swimming pool could be used or if this is not available, an outside facility on natural water. To create a satisfactory movement the paddle blades must not be more than 10 -15cm wide, while the length is the same as normal. Even then, a good stroke rate can be achieved only with circulating water. Paddling tank training can be monotonous so should be limited to 60 minutes.

In a paddling tank it is also possible to use modified boats.

A few session examples for pool paddling workouts are listed, but the same methods can be used as for normal water training.
TRAINING EXAMPLES FOR ONE SESSION:

10 minutes warm-up paddling, then:

- 4x10 minutes/ 3 min rests:
- 6x6 minutes/ 2 min rests;
- 10x4 minutes/ 2 min rests;
- 15x2 minutes/ l – 2 min rests:
- 2x1 minutes/ 20 - 60 seconds rests:
- 3x (4min – 2 min – 1 min) / 1 min rests:
- x(4 x 30 sec) / 10 - 30 sec rests:
- -10x (30sec – 45sec – 60 sec) with various rests: 10" - 60";
- 2-3x (5min - 4min – 3min – 2 min – 1min) with various rests 30" – 2 min.

20.1.4 CYCLING

Cycling is also well suited for endurance development and is particularly preferred by those who are prone to foot injuries in running. Here again, we can apply long distance, fartlek or interval principles in the training sessions. Indoor, stationary cycling is also well suited because the resistance can be increased without possible injury. Unfortunately cycling on roads can be dangerous, and air pollution is also a disadvantage.

20.1.5 CROSS COUNTRY SKIING

If a suitable course is accessible it is the best supplementary exercise for paddlers, because in addition to the endurance development the shoulder muscles are effectively worked by skiing. The training schedule should be similar to running, with longer distances or times. Since cross-country skiing adds variety to winter training, it is ideal to organise skiing training camps.

CHAPTER 21
PLANNING A TRAINING PROGRAMME

INTRODUCTION

Planning is an essential component to successful coaching!
In order to design an efficient training regimen you must know (as far as possible) the exact responses and results of the physical exercises involved. The results should be evaluated by objective measurement and observation.
You also must define the objectives and know the methods for achieving them.
Planning the training to meet each paddler's needs is an important part of coaching. You must be able to determine what training is needed, when that training should occur, resting and recovery for adaptation and how to fit all training from a single practice to the whole season together. The training programme should be understood by the athletes to get the best result.

Planning the training regimens and schedules for the development of beginners and/or for the maintenance of the peak performance of top-class athletes is an ever-ongoing process. The success of a training method is determined by the knowledge of the physical and physiological responds of the applied system (volume, intensity, resting and recovery) as well as the coach personality, pedagogy and psychology. It is the function of a coach to know these basics and to utilize them to the best advantage of the athlete.

The coach should consider the principles of training at planning for a period, which are:

- Frequency and duration
- Increasing of the training load by period to period and year to year:
- Adaptability -volume and intensity of the training periods
- From general to specific training
- Considering the age and sex;
- Specificity
- Goals of the group or individual
- Consideration to the Racing Calendar

The principle target of training is the best performance in competitions. Therefore in making a training programme for year duration we need to determine the date of the races and there importance before an adequate programme would be planned! The racing calendar is at the core of planning the training programme..

The concept of planning a training programme is to find **the balance between the workload – intensity and recovery.** The athlete(s) need to be able to execute the programme while having enough time for recovery.

A pre-condition for the effective execution of a high intensity workload is for the athlete to be physiologically and mentally fresh.

The controlling of the physiological effect of training is an important part of the overall training regime. Whilst monitoring the result of training of an individual can inform the future training volume, intensity and orientation.

21.1 COMPONENTS OF A YEARLY TRAINING PROGRAM

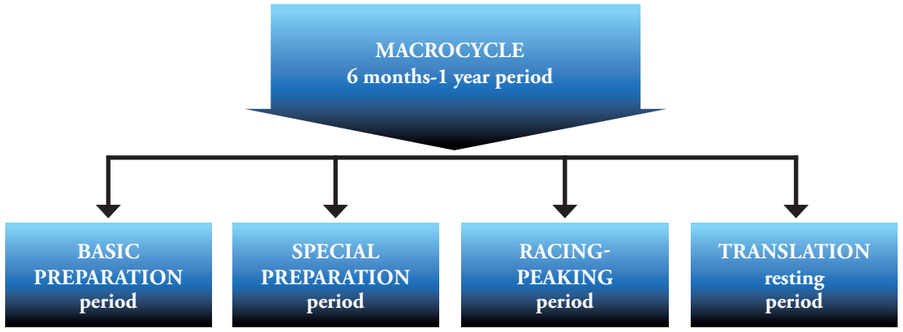
Many scientists, coaches and athletes have tried to build a training system that would yield the best performance results. In the following part the so called traditional periodization of a year will be introduced, which basically concentrates on achieving the best result one time in the year. (One peak) This kind of concept is the base for the LONG TERM PLANS (2-4 years); SHORT TERM-ANNUAL (1 year) or MACROCYCLE PLANS; MEZCYCLE (4 weeks); MICROCYCLE (1week) and TRAINING SESSION PLANS.
At the second part of this chapter another periodization system will be described adapted from Prof. Vladimir Issurin.

THE ANNUAL PLAN
The annual plan is important in that it directs and guides athletic training over a year. It is based on the concept of periodization and the principles of training. The objective of training is to reach a high level of performance (peak performance) and an athlete has to develop skills, bio motor abilities and psychological traits in a methodical manner

THE TRADITIONAL PERIODIZATION

COMPONENTS OF A YEAR-ROUND TRAINING PROGRAMME

Annual training programme is divided for:



2. Each PERIODS are divided for:

3. Each MACROCYCLES are divided for :

4. Each MICROCYCLE is divided for:

A **Macrocycle** refers to an annual plan that works towards peaking for the goal competition of the year. In canoeing there are four phases in the macrocycle, which are the basic preparation; special preparation, competitive, and transition period. (Some authors divide the year in to 3 periods only as preparation – competitive and transition.) The 4 phases apply to countries where they are able to paddle in the off-season. That is the basic preparation phase.

The preparation period is the longest training period of a year. The preparation phase should be around 2/3 to 3/4 of the macrocycle. The preparation phase broken up into general and specific preparation of which general preparation takes over half.

The competitive phase can be several competitions, but they lead up to the main competition with specific benchmarks. The aim of this period is to reach the best results in the main competition. Testing can be included in any part of the phase and can assess different parameters. We can test physical abilities; speed on various distances, physiological level etc.

The **transition** phase is important for psychological/mental and physical reasons. The duration of this period is varies, but no more than 2-3 weeks is suggested.

The Mesocycle represents a phase of training with duration of between 2 – 6 weeks. In most of the plan the duration of one mesocycle is 4 weeks or one month. This period can be depending on the racing calendar, duration of a training camps etc. During the preparatory phase, a mesocycle commonly consists of 4 – 6 micro-cycles, while during the competitive phase it will usually consist of 2 – 4 micro-cycles.

The goal of the planner is to fit the mesocycles into the overall plan timeline-wise and then to determine the type of training, with the proper workload and intensity.

The Microcycle is typically a week because of the difficulty in developing a training plan that does not align itself with the weekly calendar. Each microcycle is planned based on what is the target in the overall macrocycle.

The Training programme for one day (or more training sessions in a day) is a detailed plan for each workout.

Nov	Dec	Jan	Feb	March	Apr	May	Jun	July	Aug	Sept	Oct
Preparation period						Competition period					Translation
General preparation			Specific preparation			Pre-competitions		Competitions			Regeneration

21.2 TRAINING PERIODS

The year is divided into main periods, which focus on the basics target of training.
There are:

a.) basic preparation or preconditioning period
b.) special preparation period
c.) competitive period and peaking;
d.) transition (resting/recovery) period.

A.) BASIC PREPARATION OR PRECONDITIONING PERIOD

Preconditioning is aimed primarily at the development of the athlete's physical fitness capacity. This period is characterized by large workload, at low intensity. This period is in the off-season in the countries where the all season paddling is not possible regarding the weather condition. The improvement of muscular strength, muscular and cardiovascular endurance is the most predominant during this time. The supplementary sports such as running and strength development exercises are the most important kind of training, which can be combined, by paddling tank training, swimming, cross-country skiing and games. These are common types of training at the preconditioning period complemented with outdoor paddling when it is possible. The aims of this period should also be continued at the start of paddling season, when the emphasis is on paddling. The duration of this season is approximately 3-4 months.

B.) SPECIAL PREPARATION PERIOD

The basic preparation period –often the off season- following by the special preparation period when the paddling season starts.

The main aim of this period is specific paddling endurance development with the continuation of physical condition training. The aerobic endurance type of training progresses to speed endurance training and finally to speed development training as the period is being.

The overall training volume decreases whilst the intensity increases.

Another function of this period is the correction and polishing of the paddling technique and the improvement of the overall style. The duration of this period is approximately 2-3 months.

C.) COMPETITIVE PERIOD

This period can be divided in to two phases, the "Preparation of Competition" and Training before the main Competition".

The training schedule must be changed at the onset of the racing season. This is the main period of the sport, but of course it is built on the basics of preconditioning periods. Naturally one cannot, and should not, peak for every race at 100% of performance, therefore the coach must target the most important race or races for the athlete or the group at the beginning of the racing season. As the paddler approaches, race by race, the "target race" he/she should perform at the best level, but by planning and gradual improvement should peak only at the target race.

In this period the workload should decrease, while the intensity and the number of high intensity -speed/anaerobic- training should increase. The characteristic of this training period is the development of speed and speed endurance "ability to sustain speed" however the aerobic endurance still remains in the training programme. The duration of this period can last for 2-4 months.

D.) TRANSITION PERIOD

This interval is for the physical and psychological recuperation of the athlete. A brief full rest /2- 3 weeks/ is followed by an active rest when the workload and the frequency of workouts are low. This is the time for individualised instruction and the polishing of the paddling technique with the correction of any particular issues.

This is also the time when the paddler has a chance to recover physically and mentally.

The duration of this period can last for 1-2 months.

Nov	Dec	Jan	Feb	March	Apr	May	Jun	July	Aug	Sept	Oct
Preparation period						Competition period					Transistory
General preparation			Specific preparation			Pre-competitions		Competitions			Regeneration

21.2.1 THE MEZOCYCLES

The four basic periods of a year should be divided into smaller training periods, which are the so-called mezocycles. Each cycle focuses on the principal target.
We must define our main objective in each cycle. Experience shows that a measurable improvement of a certain skill or ability takes at least 4-6 weeks. A mezocycle lasts for 3-5 weeks. The general practice is that coaches create training programme for 4 weeks. The concept of the four week training programme is the gradually increasing volume/intensity for three weeks followed by one easier (adaptation/regeneration) week programme within the mezocycles. The basic concept can be varied in accordance with the training background of the athletes. This can be named the pyramid concept.

Therefore, for instance, if we work in the framework of 4 weeklong cycles, it is practical to fluctuate the weekly (micro cycle) training workload and intensity as shown:

Fluctuations of Weekly Training Workload in a Mezocycle

1ST WEEK				
70%	or 80%	or 90%	or 90 %	or 80%
2ND WEEK				
80%	90%	100%	100 %	90%
3RD WEEK				
90%	100%	100%	80%	100%
4TH WEEK				
60%	70-80%	80%	100%	90%

21.2.2 THE MICROCYCLES

These are the components of the mezocycles, which last usually for one week.

We can divide the micro cycles into days and training sessions. The workout is the shortest period in a training plan used to develop a specific component of sports.

The intensity and load within one micro cycle (one week) may be varied according to several patterns:

	a. or	b. or	c. or	d.
MON	80%	80%	90%	OFF
TUE	90%	100%	100%	90%
WED	100%	100%	100%	100%
THU	80%	OFF	OFF	80%
FRI	90%	90%	90%	90%
SAT	100%	100%	100%	100%
SUN	OFF	90%	OFF	90%

When two or more training sessions per day are possible the variation of the intensity is different, but the most important is that the athlete's maximum physical tolerance should not be reached more than once a day. Similarly, only 2-3 training sessions per week are permissible with maximum workload or intensity.

21.2.3 TRAINING OF A DAY/SESSION

The final part of the divided yearly training programme is the daily training.
This part of the programme describes in detail what training an individual or groups should do that day including detail of number sessions and type of training. The workouts must incorporate the following elements: kind of training; training methods; duration (time or repetition); volume (total time, distance or load); intensity and rest.

21.3 ELEMENTS OF A YEARLY TRAINING PROGRAMME

Division and definition of the training season according to the racing calendar and the agreed goals for the year:

Division of the training season into:

- Main periods (preconditioning; special preconditioning, competitive; transition)
- Mezocycles (3-5 weeks –the most suggested duration is 4 weeks)
- Microcycles (1 week)
- Days
- Training sessions per day

With consideration of:

- racing calendar
- target of the individual or group
- training possibilities (number an duration)
- effects of extraneous factors
- paddler's readiness.

22.3.1 SELECTION OF THE ACTUAL OBJECTIVES OF A TRAINING REGIME, WHICH CAN BE:

- Improvement of aerobic-anaerobic endurance and power;
- Improvement of speed;
- Improvement of speed endurance;
- Improvement of muscular strength ;(maximal, endurance, explosive)
- Improvement of technique
- Specific objectives e.g.:
  - technical targets;
  - special strength and strength endurance;
  - team boat specification,
  - learning to pace;
  - Improvement of start speed/ technique, etc.

21.4 TRAINING SCHEDULE FOR A YEAR

There are three stages in the planning of a one year training programme. First is evaluating the athlete's status in the last period and the demands of the event in the planning period. The second is planning the programme for the given period itself. The third is the evaluation of the results of the programme (testing or competition) and the modification if it's necessary.

The best procedure of a creation of a training programme for a year is first to decide which is the most important competition of the year, to know when the paddler will have to peak. From this target date we plan backwards, dividing the year into the already discussed periods. Then, we divide each period into mezocycles then into micro-cycles then into days and finally into actual training sessions.

In the Canoe Sprint the official racing distances are 200m, 500m and 1000m which determinate the training tasks.

It should be mentioned here that the paddler's distance of specialisation is usually chosen at a later stage, when the individual's physical traits and skills are established.

When planning we must also consider the available facilities for the various kinds of training. For paddling we must know if we have a measured course? If it is not available, then the workload must be defined in time and not in distance. E.g.: 10 X 200m but rather 10 × 45 seconds. The coach must consider the paddler's overall level, which is revealed by some objective factors such as:

- Best Time on a distance
- Resting pulse rate –endurance level
- Recovery time of heart rate after training/ session
- Lactic Acid level after various intensity of training
- PH of the blood

There are also some subjective factors, which nevertheless can be very helpful:
The athlete's behaviour, mood and reactions
Training motivation

The next step is to define the workload.
When a coach is planning a specific training for an individual or for a team he/she must consider all the following factors in the design of the overall work load. The training regime should define the following:

- Target of the training;
- Used training method:
- Length/duration of training (i.e.: distance, no. of sets, repetitions, rests)
- Intensity of the training by the required speed, heart or stroke rate
- Extraneous factors /weather and water conditions/
- Physical and psychological profile of the paddler
- Other specifications i.e. training for team boat etc.

21.5 REACHING TOP PERFORMANCE -"PEAKING" OR "TAMPERING"

Certainly one of the most important and also most difficult tasks for the coach is to reach the best

performance of their athlete at the required time, which is the main competition of the year or even a four year period. The successful participation at that race is the main target for athletes, coach, leaders and those who are involved in the sport.

To reach the possible highest performance level of a team or an individual at a given time is the result of, professional knowledge, many experiences, maybe medical and psychological help, and in addition good luck.

The physical, physiological and the psychological condition of the athlete are closely associated to their performance.
For top performance all these abilities have to be in excellent condition.

Generally there are three kinds of competitors:

- One who is able to perform in a race, above his/her usual level;
- One who's performance in a race is below his/her usual level;
- One who's performance is consistent and equal with his/her usual level.

The physical base of top form is a well-planned and executed training programme. To prepare for the best performance the athlete must taper and peak. Tapering refers to reducing the volume and increasing the intensity of the work done.

Reduction in training volume and/or intensity for a short period of time, results in recovery from the previous training, and ideally an increase in performance capabilities.

The interaction between training intensity and volume is important for achieving the purpose of training.

Reductions in training intensity, even if training frequency and volume are maintained, result in decreased aerobic capabilities in highly trained athletes.

To maintain aerobic capabilities during periods of reduced training volume, training intensity must be maintained!

According to the previous chapters the principles of peaking procedure from preparation to the competition are the following:

- The workload volume is decreasing
- The intensity (quality) of training is increasing
- Proper resting time for daily recovery

The orders of the training principal during one competition season are:

- Basic endurance and technical development, strength development preconditioning,
- Long- medium and short endurance capacity development and technique
- Speed endurance development
- Pure Speed development
- Peaking period (about 3 weeks before the goal competition)

It is not easy to make a proper training program for each athlete because neither its effects nor its adaptability are the same for every individual.

THE EFFECTS OF TRAINING CAN DEPEND ON:

- The actual performance of the athlete;
- The background /experience/of the athlete;
- The actual physical condition of the athlete;
- The actual psychological condition of the athlete;
- The skill of the athlete;
- The motivation of the athlete;
- The effect of the environment, etc.

The appropriate training program in the last few weeks before the competition is crucial.

SOME SIMPLE RULES OF TRAINING AT PEAKING PERIOD:

- Do not load the training over but the high intensity of paddling is necessary.
- The resting and recovery time are equally important to the training.
- Besides the suitable physical training the mental preparation is also essential.

The real self-confidence of the athlete is very important as well as good motivation. You don't over or under-estimate your athlete, and do not let others do so. The result of too much pressure on a paddler can easily cause a failure.

TRAINING BEFORE THE COMPETITION "PEAKING"

PRINCIPLES OF PADDLING TRAINING

- LESS VOLUME
- HIGH INTENSITY (SPEED training)
- INDIVIDUALIASATION
- MEASSURE OF THE ATHLETES' CONDITION daily
- MONITORING OF PERFORMANCE

Using the results of a medical or physiological and psychological test by the coach can make the peak performance more scientifically and easier to achieve.

Unfortunately most coaches often tend to just rely on support from his/her own experience and knowledge. It is important that when getting closer to the competition that the coach should listen to their athletes more and also to the psychologist.
Individual program - individual treatment!
The feedback from athletes can be very useful for planning and adjusting the training more properly.

How you can assess an athlete's performance? The most obvious way of course, is shown in the result of a time trial or competition, but often that is not totally precise. Besides this a time trial may not always be useful close before the race, or my not motivate athletes.

The following facts also help to decide the performance of the athlete:

- The results of physiological test /LA tests, blood PH, protein in urine, etc./
- The result of psychological test;
- The general physical and mental fitness;
- The behaviour of the athlete;
- The verbal information of the athlete.

Daily written information by the athletes also could be useful for the coach. E.g. you should make the next questionnaire form, and then every athlete fills it in every morning.

NAME	DATE:
RESTING (MORNING) PULSE RATE	
BODY WEIGHT	
HOW DID YOU SLEAP?	
HOW DO YOU FEEL GENERALLY	

Key: excellent	*5*
Good	*4*
Okay	*3*
Bad	*2*
Terrible	*1*

21.6 THE BLOCK PERIODIZATION BY PROF. VLADIMIR ISSURIN

Traditional theory of periodisation, basics and limitations

Training periodisation was founded during the 1950s in the former USSR and was established as a scientific concept by Matveyev in 1964. This theory spread to Eastern Europe and later to Western countries and constituted a compulsory part of training in high-performance sport. In general, periodisation exploits the periodic changes in human biological and social activities. For a long time, this theory was accepted as the universal basis for training in any sport and for athletes on any level of competency.

The first criticisms and calls for reform appeared in the early 1980s in elite sport as the experience of top coaches stood in contrast to the entrenched theories.

New approaches proposed by creative coaches and scientists appeared. Let us first examine the basics of traditional theory and their limitations from the viewpoint of high-performance sport.

Traditional presentation of annual cycle with one macrocycle (one-peak) annual periodisation):

Quadrenial *(Olympic cycle)*	4 years
Macrocycle	1 year
Mezocycle	Several weeks, usually 4
Microcycle	1 week or several days
Training sessions	Hours or minutes

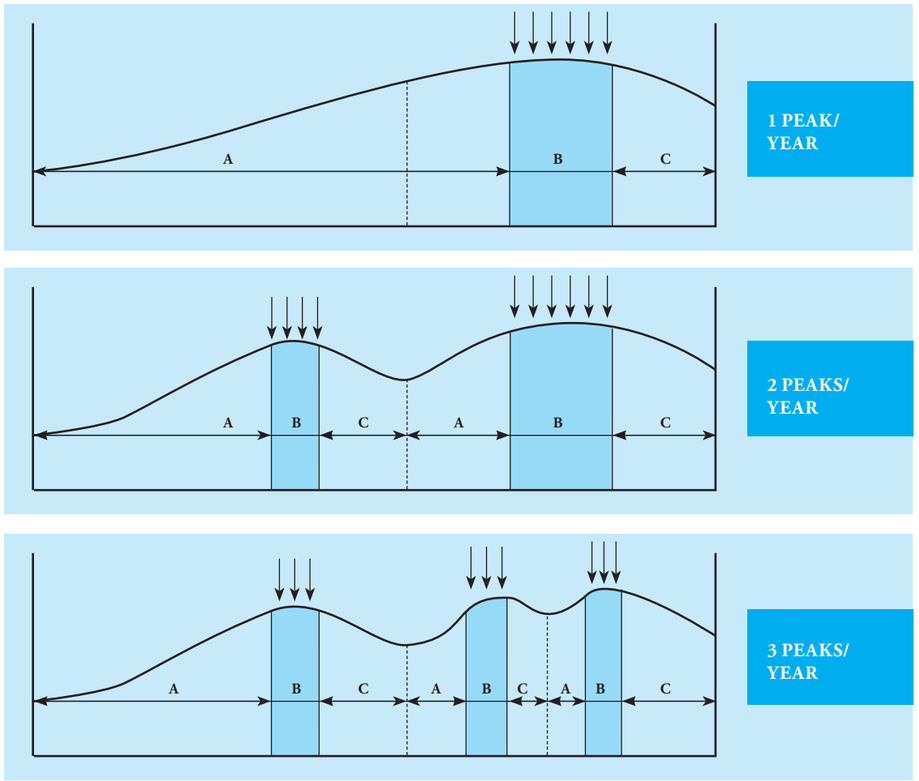
The later modifications of the periodisation had two and three macrocycles within the annual cycle. Each macrocyle was subdivided into three periods characterized by specific combinations of training objectives and workloads.

The basic difference of the traditional and block periodization

In simply speaking the special block periodization means that there are more full periods in a year with various durations, which determinates the training targets. In each period has preparation – racing/peaking and resting phases; called: Accumulation – Transmutation – Realization.

In the Accumulation phases the high workload, in the Transmutation the high intensity training while in the Realization the maximal speed development are the main targets.

BLOCK PERIODIZATION FOR 1 -2 -3 PEAK A YEAR



A PREPARATORY PERIOD **B** COMPETITIVE PERIOD **C** TRANSMISIONAL PERIOD

CHAPTER 22
RACING

INTRODUCTION

For all sports the main goal is the athlete's / teams best performance in a competition or match.

It is very important to have the first race in good time. For the novice, these races may initially appear easy, but they are highly demanding both physically and mentally. Therefore it is important to participate in races compatible with the athlete's level of expertise and when the paddlers feel self confident.

Those getting into paddle sport at an early age (10-12 years) should by all means give canoe sprints a serious try. It often takes 5-8 years of hard training and preparation to develop a paddler of high international level; thus, this kind of racing favours the young beginner!

In the first races, whether the athlete can win or not should not be the determining factor. Winning requires a great deal of experience as well as training. The successful competitor should develop a special physical constitution enabling aerobic and anaerobic performance at high intensity work, good technique and muscular strength.

Whenever the magnitude of the event demands it, the competition is conducted on a buoyed 6 to 9 Lane course, where all the racing rules apply. Therefore, it is important that you be familiar with these regulations. In low technical levelled courses only the start and finish lines are marked and the lanes are imaginary. This "partially set" course demands a high degree of sportsmanship and attention to avoid colliding with or obstructing any other boat during a race. Another situation that can arise is if one athlete takes advantage by "wake riding"; which can provide them with a great advantage over their opponents. Sometimes the turbulent water created by the other boats makes it difficult for the boats behind them, causing them to leave their own lane Canoe Sprint competitions are generally organised by Clubs, National Federation, Regional or Continental Associations, International Canoe Federations, International Olympic Committee and Continental of Intercontinental Multi-Games organisations.

The official distances for Canoe Sprint are 200, 500, 1000 and 5000 metres. In addition a 4x200m single boat relays. The Youth Olympic Games has a special competition format. That is the Head to Head competition on a circuit course about 500m its entire distance with two turnings. (The course design attached) Unofficially, races outside of ICF's rules can be organised over any distance.

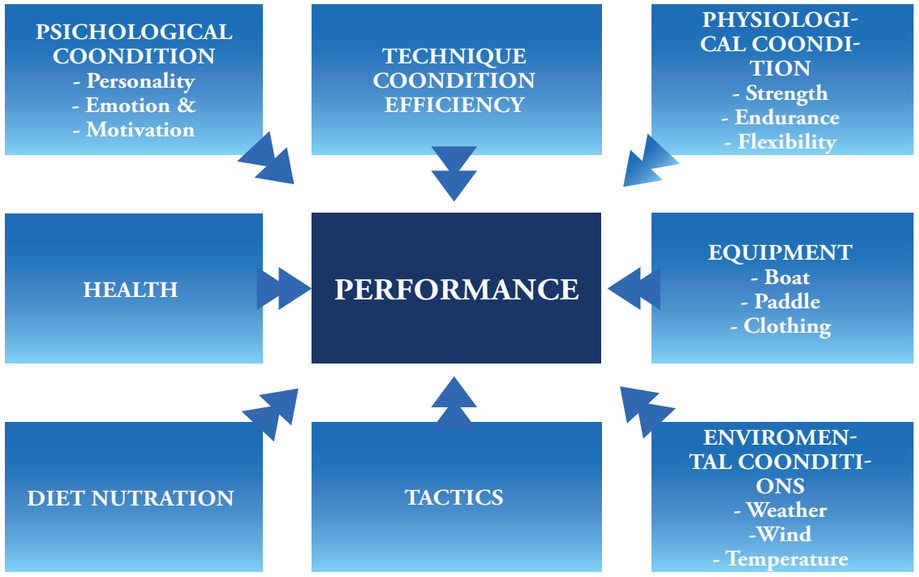
In the races up to 1000 metres, a large number of competitors will progress through a number of stages such as heats, semi-finals and final A and final B of the different events as determined in the racing rules.

The long distance races are performed with all the competitors starting at once, in a direct final. The athletes paddle on a circuit course with turns.

Kayak and canoe racing have become highly specialised in respect to racing distance and boat category. There are a few exceptional athletes who are able to compete successfully on more than one distance or in both single and team boat events in the same competition and perform well. The double or triple up is also very demanding due to the short interval for recovery from one event to the other.

A paddler may compete in several events without ICF' limitation rules upon his/her ability. The significance of each race may be different

to every competitor and winning is not always achievable.Preparation for a successful competition requires consistent and often high intensity training, a healthy life style, good physical and psychological condition, a good peaking programme, proper equipment and the thorough knowledge of every facet of racing. See the determinate factors of performance in the next table:



22.1 THE WARMING UP STRETCHING AND RECOVERY

This is necessary before any training, but absolutely essential before competition. Any training session consists of a warm-up, training and cool-down. Warm-ups including flexibility training or stretching have a considerable effect on performance. From a practical perspective, prior to an event the athlete should perform a dynamic warm-up with low-level i.e. jogging, gymnastic and moderate static stretching.

An active warm-up consists of physical activity performed before training. Active warm-ups can be divided into general and sport specific warm-up.
A general warm-up consists of activity not specifically related to the task or training to follow aerobic activity for 10 to 15 minutes, stretching, and calisthenics.
A sport-specific warm-up includes activity that is specifically related to the canoeing such as easy paddling on simulator in boat.

Lack of adequate warm-up is often the source of injuries or substandard performance in a race. The warm-up is the tuning of the body to enable the athlete to perform efficiently with maximum exertion. To this end, blood circulation and pulse rate must be increased with good dilation of the capillaries, which increases the oxygen supply to the muscles.

In cold weather or in the morning and for older-age we need more through warm-up than in warmer weather or in the afternoon. The intensity of the warm-up also depends on the distance about to be raced. The shorter distances (sprint) like 200m and 500m distance require more intensive warm-up than the longer distances. It is recommended to establish a permanent warm-up system for a team or each individual, which can be followed as routine at competitions. We know that some athletes will need to do longer and more intense warm-up exercises than others.

If a competitor participates in more than one consecutive event repeated warm-up is necessary before each race, but it can be shorter and lighter. A good massage concentrating on the tired muscle groups should suffice. This procedure is similar to that used if a paddler completes more than one session of a day.

The good execution of the paddling technique requires the flexibility of joints and muscles. Therefore the stretching shall be a part of training and warm-up.

Recommendation of stretching:
Start stretch easy, gentle and carefully in tension for 8-12 seconds without motion. Then you can stretch more and stronger with motion until the point where you can feel pain. Before activity which requires maximum strength, only moderate stretching recommended. Stretching is more important after training and racing.

It is difficult to prescribe a warm-up regimen to satisfy everybody's physical needs. Warm-up regimens must be tailored for the individual and also taking in to consideration the weather conditions, temperature and distance. The essentials of typical warm-up regimen are the following:

a.) About an hour prior to the start the paddler should begin some moderate physical activities! Such as stretching, jogging-running, general and muscle-specific gymnastics, massage of active body parts, which may be enhanced with some specialization, simple muscle effected exercises (pull-ups, push-ups etc) besides checking the condition of the boat and its parts' installation. Check the paddle to make sure the shaft is not greasy or slippery. Clean it to rub the paddle grip and the hands with fine sand paper or soil (etc). Take some fluids.

Later, about 20-25 minutes before the start, the paddler should get into the boat, paddle easily for 5-8 minutes, followed by intense 80-85% padding for about 2 minutes. Some easy paddling should follow, again with an even more intense 85-90% phase lasting about 30-40 sec. Rest, or rather easy paddling again then one-two 95% sprint for 8-12" seconds or 15-20 strokes should follow. In the next 2-4 minutes preceding the start, the paddler should cruise around easily, but without stopping. Strong perspiration should indicate a through warm-up. The heart rate at the start should not be less then 120 beat/min.

b.) Another often used warm-up regimen is when the paddler first warms up lightly on land then paddles the racing distance at 80-85% intensity about one or more hour before the race. This is then followed by some active rest and more warm-up exercise included stretching and light massage if available on land as described in the previous protocol. At the conclusion of this warm-up and 15 minutes before the start, the paddler gets on the water, and cruises with various speeds in the vicinity of the start line. Some short spurts are useful too.

Warm down and recovery
After the race, especially the last race of a session, about 10 minutes easy paddling is recommended, until the heart rate reaches the normal level. This routine aids quicker recovery.

Drink and eat some carbohydrate after the warm down and stretching finishes.

22.2 THE START

A well-executed start is an indispensable of all races, especially on the shorter distance as the 200m and 500m. Any length of time, even a fraction of a second, lost due to a slow start is a serious physical and psychological handicap that is difficult to overcome in the remainder of a sprint race. Even on long distance races it is an advantage to gain an early lead over the opponents.

The start should be learned only after the novice feels quite confident (stable) in the boat. If the paddler has acquired the necessary paddling technique he/she should learn and regularly practice starts in the racing period. The main purpose of the start is to accelerate the kayak or canoe to its maximum racing speed as fast as

possible, without depleting the body's energy for the sprint that follows.

The start has physical, technique and reaction parts. All need to be practiced!

Before the start an "aligner" official lines up the boats. The "line-up" requires special dexterity on the part of the competitor especial in strong wind and waves. The paddler must know how to back-up and be able to keep the boat correctly.

In higher level competition assistants navigate and hold the stern of each boat at the start line. At the main competitions the start are executed with automatic starting machines. There is a mechanism, which prevents the boats from moving over the starting line. With the start command those gates rapidly submerge and open the way for the boats to proceed in the lanes.

22.2.1. KAYAK START

FIG. 22.2.1. - KAYAK START

The boat should be lined up, almost parallel, at a small angle in relation to the course, to the first stroke side to the wind, and in the centre of the lane. This requires some manoeuvring by the athlete at start.

Execution of the start:
The first 3-5 strokes are accelerating rapid, explosive, deep, powerful and shorter as a normal stroke.

The kayaker's arms are slightly bent, (the paddle shaft is closer to the athlete chest) and the trust hand is lower than it is usual at start. Most of the strength is derived from explosive and powerful trunk rotation and the shoulders. At the start the athlete should use their maximum strength. This is important as the rapid acceleration of the stationary kayak demands extraordinary expenditure of strength. The normal draw length is reached only after the kayak has been accelerated to the required highest speed and highest stroke-rate at 25-50m. Then the speed/stroke-rate slows down to the travelling speed; which is dependent on the racing distance

Once the speed has decreased from the maximum to the optimum travelling speed at about 50-60 metres, the stroke rate starts to lower relevant to the race distance and the paddling technique become normal. This technique, power and rhythm changeover must be rhythmical and continuous so as not to upset the smooth forward glide of kayak. The power application phase should always be proceeded by 3-4 very deep breaths to increase the oxygen in take of the lungs. During the initial 3-4 strokes there is no exhaling, thus a completely firm musculature is maintained for good power transmission.

22.2.2 CANOE START

The start with single canoe is usually executed by positioning the canoe at an angle determined by the course conditions and the paddling side. Starting from this position the paddler doesn't have to steer in the first 2-3 strokes, because the powerful start strokes straighten out the canoe. Full power can be used for the strokes because the steering movement, which slows the speed down, can be ignored. However, if, this angle is too great, the canoe needs a longer course (curve) to attain a straight direction. If, on the other hand, the canoe is parallel with the course at the start, steering is required with the first stroke, which translates into a slower start. Naturally, every C-1 paddler must master this start technique.

The position of the canoe:

- The bow of the boat reaches the start line or boot at automatic start machine
- The axis of the boat is about 15-20 degree with the course to the paddling side of the athlete – or simply the rear of the canoe is out from the center of the lane by 1m

- The athlete put his/her centre of gravity in front of the boat
- The puling side is close to the water
- The paddle about vertical to the water (shorter entry)
- It is suggested to hold the paddle lower by a palm width compared to normal paddling.

Exec ution of the start:
Upon the start command or signal the paddler executes his first catch. The canoe paddler must anticipate this command with his paddle blade in the water, and their waist and hips in a forward rotation. From this position his first action is the catch, thus no time is lost and he does not propel the stationary canoe backwards with the first trunk rotation. This can cause a serious handicap at the start.

The first 4 strokes

- The strokes are shorter than regular paddling, about half the length, but rapid and deep
- The paddle should be pressed down with full strength while the upper body stays in front over the water. At this stage the paddler does not exhale
- The strokes are slower even with the shorter distance of a stroke
- The strength applied to the paddle in this phase determines the quality of the start
- The rotation and movement of the hip force the boat forward
- The air-work is short and quick
- The trunk does not move/ swing much

Acceleration from 4th to12th strokes

- With the increasing velocity of the canoe, the length of the strokes gradually increases at the entry phase, until the optimal length is achieved
- The puling hand slides back to the normal holding position
- The trunk moves normally
- The power is applied at maximum force
- The body swing increases
- The distance per stroke reaches the maximum
- Start to steer the canoe by stroke by stroke; which was not necessary at the first 3-5 strokes in accordance with the angle of the boat position
- The paddler movements is coordinated with the gliding of the canoe in a smooth way
- Usually the first 12.5m requires 6 strokes whilst 4 strokes necessary to the second 12.5 m
- The stroke rate is at its highest in this phase, reaches up to 80-90 str/min

Pick up the travelling speed

- Establish the traveling speed (stroke rate) in accordance with the racing distance
- The given power to the paddle becomes less at the entry and draw phases
- The body swing is the driving force
- The distances per stroke becomes longer
- The athletes body movements is coordinated with the boat gliding

22.3 THE FINISH

FIG. 22.3. - THE FINISH

Approaching the finish line the athlete tries to accelerate the speed of the boat by using all their remaining energy in an all-out effort, in the 150 to go at 500-1000m distances.

In reality the majority of the time, this final effort just maintains speed, and very few athletes are able to increase his/her speed if they have paddled at their highest possible capacity during the rest of the race.

Another part of the finish is when athletes use their body movement to accelerate the last stroke with a dynamic change of the centre of gravity. They will drop backwards to transmit a final forward thrust to the boat. This pushing movement

can often lead to the athlete losing their balance and capsizing. If the boat has reached the finish-line before capsizing, this will not affect the result! It's also important to do the described movement at the correct time! This requires practice and knowing the exact position of the finish line:

- The athlete should check (before the race) the exact position of the finish line
- About 25m before the finish line the athlete needs to prepare for the surge to the finish. (Focus on the finish line) The athlete needs to estimate the point when the last stroke will be made together with the body back- thrusting movement. The place/time of that stroke will become more focused as the athlete gets closer to the finish-line. If it is necessary the last few strokes should be adjusted i.e. shortening to achieve the best position for the last stroke and kick/shoot the boat across the finish line
- The last stroke should be made when the boat is about 3-4meter for single kayak and 6-7m for single canoe from the finish line.
- The last stroke starts with a regular entry and finishes with strong body movement. The athlete braces on the paddle and pushes the boat forward with the legs and hips to the finish line with a strong and quick body drop movement.
- The canoe paddlers kick the boat forward strongly with their front leg and jumping back in to the canoe during the middle of the last stroke. They then sit or lay down back in to the boat. In this time the paddle keeps the balance by feathering on the water.

22.4 BREATHING DURING A RACE

Breathing becomes progressively faster during the race, due to the fatiguing muscles that consume more oxygen. The human body can utilize only a fixed proportion of oxygen from the inhaled oxygen. Breathing is a function of the stroke rate physical exertion. When paddling at a comfortable pace, one inhales and exhales would be for every stroke. Inhaling is in the recovery, before the catch while exhaling occurs during the exit. At a higher stroke rate this breathing rhythm is impossible, thus there are two or three strokes for every breath or more for the start phase. This unbalance demands that the paddler breathes deeper and more efficiently. A forceful exhaling in order to use the full capacity of the lungs be comes useful and necessary.

The breathing in the kayak cannot be fully co-ordinated with the usually high stroke rate. Breathing frequency is developed individually, depending on the paddler's pulmonary efficiency /oxygen utilization/. Body posture in the kayak and canoe is not conducive to easy breathing; therefore special attention must be devoted to deep breathing, involving both the stomach and chest. Leaning forward excessively or keeping the knees drawn up high prevents deep inhaling and should be avoided.

22.5 LONG-DISTANCE

Long distance and marathon racing demand a special type of training. Skills, techniques, wake riding, turning, positioning, change of pace and rhythm, endurance and tactics are all important. The distance of the CSP long distance races is 5000m, (approx. 25minutes) which is relatively not so long when comparing it with official marathon, and other long distance races.

Since the 5000m is not Olympic event not many national federations and athletes specialise in long distances races, and the preparation of these competitions. Usually the 5000m races are organised only in the programme of the World Championships and sometimes in World Cups. Therefore in practice the athletes who took part in 1000m events compete in long-distance races as well, which are scheduled at the end of the Championships.

The athletes who focus towards long distance races need to have specific training programme. The main goals are to improve their aerobic endurance, learn to wash ride and practice the turning phases of the competition.

22.6 WAKE RIDING OR WASH HANGING

Wake riding or wash hanging is a technique of utilizing the "pull" of a wake created by another boat ahead similar to the technique adopted by bicycle racers, or runners, when a competitor rides or runs close behind another in order to decrease the air/wind resistance. This system may have originated from the flocks of wild geese in flight; which always form a V shape and the leader changes frequently. Wake riding is very important in long distance racing and useful for training because the paddler is able to save about 30% energy while moving at the same velocity as the wake-causing boat in front. The wake of a boat is larger, and hence provides more benefits for the following boat, if the draft of the boat (heavier boats) or the paddler's weight is greater. Positioning the boat on the crest of the wave actions the "riding" of the wake and lifts the stern up; which gives the boat a continuous "downhill" glide. This is done by positioning the rider boat's bow in line with the body of the athlete in lead boat; more precisely at kneepad in canoe and at the cockpit level in kayak about 100 to 130cm away from the lead boat.

Control the kayak with the rudder and with the paddle in canoe. Pushing the boat away from the lead boat until the athlete feels the drowing effect of the wash hanging, gives reduced effort for the same speed. The riding boat needs to "find" the exact position by manoeuvring to the most beneficial position and this needs to be learnt through training.

To master this technique we should learn about the hydrodynamics of wake riding. First, it must be recognized that the wake of the leading boat will push the stern of the rider away, thus "sucking" the bow close to the leading boat, which may cause a collision if not anticipated.

It is also possible to hang on both sides of the lead boat and there is a difference between ridings on the first, second or on the third wake of the leading boat. The first wake generated by leading boat is the deepest and therefore utilized with the best efficiency, while the second and third wake barely lift the stern of the boat.

Another type of wake-riding is when a boat is in the cradle/"V" (between) the two leading boats. This position gives even more benefit for the rider but can have disadvantages. The paddler in that position is behind the leaders and will be difficult moving forwards from that position.

Wake riding in C1 or C2 is more difficult than in kayaking due the lack of rudder control. Canoeists have their own technique depending whether they are riding on the "good or bad side". When one approaches the lead boat on the paddle side, it is "on the good side". To prevent collision, the paddler leans his boat to the paddling side pushing the bow away from the lead boat with every stroke. (C strokes) This is the preferred side for wake riding. On the other hand, if one approaches the leading boat with the side opposite to the paddle, there will be an even stronger suction, which demands stronger steering, thus this is the "bad side."

22.7 RACING / TRAINING IN STRONG WIND AND ON ROUGH WATER

Regardless of its direction, wind does affect the velocity of the boats and paddling technique, especially for canoeing; therefore the paddler must learn to adjust to prevailing wind conditions.

Tail wind is encountered when the wind is in the same direction as the boat movement. Tailwind increases the speed of the boat, but also decreases its stability, because the water catch becomes less firm due to the difficulty of leaning onto the paddle particularly in canoes. For both kayak and canoe the entry phase must be executed faster at a smaller/acute/angle and the stroke rate must be increased. It is recommended that the paddler should use shorter strokes with higher stroke rate.

Head wind is experienced when wind is opposing the boat's direction, which obviously reduces the speed of the boat because the aerodynam-

TABLE OF THE EFFECT OF THE WIND'S VELOCITY IN

1.000m HEAD WIND

m/s	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
6.0	-23.0	-21.0	-19.0	-17.0	-15.0	-13.0	-10.5	-8.5	-6.5	-5.0
5.5	-21.0	-19.5	-17.5	-16.0	-14.0	-12.0	-10.0	-8.0	-6.0	-5.0
5.0	-19.0	-17.5	-16.0	-14.5	-12.6	-11.0	-9.0	-7.5	-5.5	-4.5
4.5	-17.0	-15.5	-14.5	-13.0	-11.0	-10.0	-8.0	-7.0	-5.0	-3.5
4.0	-15.0	-13.5	-13.0	-11.5	-10.0	-8.5	-7.0	-6.0	-4.0	-2.5
3.5	-12.5	-11.5	-11.0	-9.5	-8.5	-7.5	-6.0	-5.0	-3.5	-2.0
3.0	-10.0	-9.0	-8.5	-8.0	-7.0	-6.0	-5.0	-3.5	-2.5	-1.5
2.5	-8.0	-7.5	-7.0	-6.5	-6.0	-5.0	-4.0	-3.2	-2.0	-1.0
2.0	-6.0	-6.0	-5.5	-5.0	-5.0	-4.0	-3.0	-2.5	-1.5	-1.0
1.5	-4.0	-4.0	-4.0	-3.5	-3.5	-2.5	-2.0	-2.0	-1.0	-0.5
1.0	-2.5	-2.5	-2.5	-2.0	-2.0	-1.5	-1.5	-1.0	-1.0	-0.5
0.5	-1.5	-1.5	-1.5	-1.0	-1.0	-1.0	-1.0	-0.5	-0.5	0

TABLE OF THE EFFECT OF THE WIND'S VELOCITY IN

1.000m TAIL WIND

m/s	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
0.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	0.5	0	0
1.0	2.0	2.0	2.0	1.5	1.5	1.0	1.0	0.5	0	-0.5
1.5	2.5	2.5	2.5	2.5	2.0	1.5	1.0	0.5	0	-0.5
2.0	3.5	3.5	3.5	3.5	2.5	1.5	1.5	0.5	0	-1.0
2.5	4.0	4.0	4.0	4.0	3.0	2.0	2.0	1.0	0	-1.0
3.0	5.0	5.0	5.0	4.0	4.0	2.0	1.5	3.5	0	-1.5
3.5	5.0	5.0	5.0	4.5	4.5	2.5	2.0	1.0	0	-2.0
4.0	5.0	5.0	5.0	4.5	4.0	2.5	0.5	0	0	-2.5
4.5	5.0	5.0	5.0	4.0	3.5	2.0	0	0	-0.5	-3.5
5.0	5.0	5.0	5.0	4.0	3.5	2.0	0	0	-1.0	-4.5
5.5	5.0	5.0	5.0	4.0	3.0	1.5	0	0	-1.5	-5.0
6.0	5.5	5.0	5.0	4.0	3.0	0.5	0	-0.5	-2.0	-5.0

Kretschmer, Albert and Karbe

ic drag is increased. To counter this impending effect, lower stoke rate, paddle is longer in the water than in the air and more powerful. The paddler should reach further for the water catch and lean ahead deeper to minimize wind resistance (reduced posture)

Broadside wind /cross wind/ affect the boat on the side; which may disrupt the path of the paddle and requires adjustment to gain straight forward movement.

Excessive wind puts a torque on the boat, which may be countered by leaning the boat into the wind.

The cross wind strongly effects the paddling in canoes as the steering is done with the paddle and not the rudder. How much the crosswind influences the control of a canoe depends on the velocity of the side of the wind.

Where the wind comes from the paddling side it may ease steering of the boat if it is not too strong. If it is strong then the canoeist can use C direction strokes, finishing a stroke behind the kneepad.

If the wind comes from the "wrong direction" opposite side from the paddling side in the single canoe or in a C2 then a much more powerful steering stroke is required. The result is to slow the boat and also puts extra stress on the paddler's shoulders. In this case it is helpful to kneel slightly back in the canoe and tilt the canoe into the wind. The velocity and direction of the wind has strong effect to the boat speed. The next table shows generally how the racing time is influenced by wind:

Rough water can reduce stability, therefore a lower seat is recommended for kayaks and lower kneepads for canoes. A paddler in kayak should keep his paddle in lower position than usual. The canoeist should keep his torso lower, shifting his centre of gravity more on to the paddle; which helps then to support on the paddle if they lose balance. The recovery, "air-phase", in both kayak and canoe should be faster and lower; which makes quick bracing easier if needed. In tail waves the paddler should use the boats momentum to break the crest of the next wave and be ready to surf.

22.8 NUTRITION AT THE COMPETITION

Nutrition is important for optimal physical performance and an essential part of a thorough preparation for competition and also during the competition!

The pre-competition meal provides a final opportunity to top up the muscle and liver fuel stores. A high-carbohydrate, low fat meal is the best choice. You might like to adapt one of your everyday meals to suit your event timetable, or you may have some special pre-competition eating rituals. Larger meals should be consumed 2-4 hours prior to your event, whilst lighter snacks can be consumed 1-2 hours beforehand. For events later in the day you may need to combine these strategies. We are all different when it comes to what feels comfortable and gives us confidence.

Guidelines for meals before competition:
- Meal consumed 3 to 4 hours before competition and easily digested solid food. If a meal is consumed within 1 hour of exercise it should be a liquid meal

- The consumed meal should not leave the athlete hungry nor with undigested food in the stomach at the start of a competition
- The meal should be low in fat and fiber
- The meal should contain approximately 200 to 300 grams of carbohydrate

As a general rule, eat little protein and more carbohydrate 2-3 days prior to and during racing. However, even carbohydrate consumption should be controlled to avoid high blood sugar, which may be overcompensated by the body's insulin, resulting in low level of blood sugar. The daily diet should consist of approximately 15-20% protein, 30% fat and 50-55% carbohydrate. Fatty foods/fried

and deep fried food, oily foods, etc. should be avoided prior to and during competition. Similarly, strong seasoning, too spicy food, hard to digest food/raw cucumber, radish, lettuce, etc. food causing bloating/leguminous vegetables, and very sweet food such as honey, candy, etc. should not be consumed before or during racing. The digestion of even light food takes about 1-4 hours. Since most of the competitions are two-three days in duration, and a paddler may compete several times in one day, it is important to satisfy a strong hunger sensation. In this case the consumption of liquid and fruit, egg, toast, cookies or a piece of chocolate (carbohydrates) is recommended. Avoid junk food, popcorn, potato chips, etc., and the intake of salt, unless it becomes necessary due to extreme heat. Well balanced diet usually provides enough vitamins and minerals; therefore additional consumption of these nutrients is not necessary. The use of a special energy drink can also be useful.

Water intake.The adequate volume of fluids is also essential before the race and between races. Drinking water before, during, and after exercise is important to maintain hydration and replace lost fluids. However, caution is needed so as not to drink too much water. (Over drink)

Aerobic capabilities can be compromised by dehydration. Track and field athletes dehydrated by 2% of total body mass show declines of performance in 5,000- and 10,000-meter races of approximately 5% and 3%, respectively. These performance decreases would make the difference between winning and not winning a competition.

Supplements

Surveys show that about 50% of athletes taking supplements whilst the other 50% of athletes don't use them for reaching their personal best. This means that supplementation doesn't determinate the success, however some supplements (such as vitamins and minerals) can play a valuable role in a winning diet.

22.9 ERGOGENIC AIDS

DRUGS: the use of stimulant drugs /amphetamines/or anabolic steroids are not only ethically unacceptable, and harmful for the organism, but also prohibited by international regulations. They all have predictable serious side effects on the user's health, therefore every conscientious coach and athlete should unequivocally reject any form of drug use.

The IOC established the World Anti- Doping Agency (WADA), which is an independent institute for doping control around the world. All sports are under their rules on national and international level. The ICF follow WADA regulations and on that base established the ICF Anti Doping rules. Testing of the athletes can happen everywhere at every time out or in competition.

The offense against anti doping rules leads to serious consequences and penalties!

Some banned for use substances:

Anabolic Agents • Androstenedione • Boldenone • DHEA • Nandrolone • Testosterone • THG • 19-Norandrostenedione
Stimulants • Cocaine • Ephedrine (Ma Huang) • Methamphetamine • Synephrine
Street Drugs • Heroin • Marijuana • Tetrahydrocannabinol (THC)
Diuretics and Urine Manipulators • Bumetanide • Probenecid • Finasteride
Peptide Hormones and Analogues • EPO • Human growth hormone (HGH)
Anti-Estrogens • Clomiphene (Clomid) • Tamoxifen
Products Containing Banned Substances

22.10 BEHAVIOUR, SLEEPING, REST AND LIFESTYLE

As an athlete approaches the date of the race he or she is under increased stress. The training intensity coupled with the psychological anticipation of the competition can easily lead to both emotional and physical distress. Many

times competitors will be seen to have changed behavioural pattern, or in extreme cases, feel very tired or even ill. This changed behaviour may manifest itself in many ways just before and close to the start.

The common patterns are:
- "Withdrawal", the athlete avoids talking to anyone or is uncharacteristically unfriendly to people.
- The opposite is also usual: the athlete is over talkative, laughs, acts silly, for no apparent reason.
- Others fuss around, action busy, or read motionlessly to avoid to thinking about the coming race.
- Some are opposite, trying to concentrate.

As a result of extreme stress, one may go to the washroom frequently, have stomach cramps, perspire excessively, or even throw up.

These so called "race fever" behaviour patterns should be recognised as such and the coach should be understanding and find the best psychological approach to ease the athlete's physical and mental stress.

The intensive training regimen preceding competition heavily taxes the athlete both mentally and physically; therefore sleeping 10-12 hours daily is normal. The best rest and recovery happens in sleeping.

It is prudent to retire before 10 p.m. because the beneficial and recuperative deep sleep occurs usually before midnight.

Having enough rest is also important between races if there is more than one race during a session. The best rest is a combination of both passive and active phases.

A serious athlete must have an appropriate lifestyle, to maintain the best condition for training, and for the races. Athletes should avoid smoking, drinking of spirituous liquor and taking any drugs.

Having sex is a natural situation at a certain age, and should be considered when planning recovery. It is recommended that sex should be avoided at least one-two days before a race however there is no objective evidence of its effects, and some people believe that sex in the evening prior to the competition can have positive effects of the outcome of the results.

22.11 ENVIRONMENTAL FACTORS OF A COMPETITION

The effects of the environmental and weather factors strongly influence the body's responses and an individual's ability to perform exercise, particularly when conditions become extreme. The rate of influence depends on the athlete's sensitiveness, self-confidence, physiological and physical condition, performance and as well as the athlete's experience, skill etc.

Proper exercise training and progression, under different environmental conditions, will help to offset some of the physiological stress and performance deficits.

The factors of environment:
- Altitude, micro climate;
- Height above sea level;
- Jet leg
- Unaccustomed cold or hot temperature and humidity;
- Strength and direction of wind;
- Quality of water surface /smooth or rough/;
- Depths of the water;
- Sort of food;
- Condition of sleep, etc.

Some effects can be an advantage for some paddlers and a disadvantage for others. Let's see a few examples:

- Those who live in hot macro-climate will feel very uncomfortable if the decrease in temperature is 15-25°C colder than that to which they are accustomed. They will be

always feeling cold; they will need to wear extra clothes, which could disturb their motions, etc. This effect can be the opposite for athletes who live in colder macroclimate and go to compete in the unusually hot or/and humid weather;

- It has already been mentioned how differently the strong wind affects paddlers and particularly the side wind for the canoeists. This can be a great advantage or disadvantage for paddlers depending on which side of canoe they paddle on.
- The type of water surface is also a consideration. Paddlers who are used to train on smooth water could potentially be troubled paddling on rough water. Lack of balance strongly disturbs the technique, the power of strokes, and in turn the speed of the boat. However for those who often train in rough water conditions or on the sea may well have an advantage in the same situation.

In addition, negative environmental factors can influence and create psychological problems for an individual. Mental stress can lead to physical stress; which often results in under performance of the athlete. A good coach or a psychiatrist can help to eliminate this problem by talking about the positive side of the athlete strengthening his/her self-confidence.

Since we can't control the location of a race or its environmental conditions, we have to prepare the athletes for the possible situations both, mentally and physically. It is essential to train in every condition! Train on rough water, in strong and various directions of wind, when the weather is cold or hot, etc.

If you know the likely conditions for an important competition, train in similar condition, or/and travel earlier to the location.

22.12 CHECK LIST OF COMPETITION

As a part of the proper preparation for participation in any competition a responsible person should check and consider the following:

- Check lodging and meals.
- Check competition's licence, if it is needed, or passport of each paddler.
- Check the material that will be used at the competition.
- Check personal equipment of each paddler.
- Check the transportation.
- Set an adequate hour for meeting, loading the material and depart.

If the invitation does not specify otherwise:

- Arrive at the competition's site at least two hours before the start of the first event. A competitor in any case should be at the competition venue a minimum one hour before his/her race will start.
- Get the Programme and all the latest information for the competition,
- Check the elimination system,
- If possible, check the course and any local peculiarities in the long-distance races (dams, turns, portages, etc.)

During the competition:

- Prepare the equipment and numbers (boat and body);
- Be sure to compete within the rules and with good sportsmanship;
- Be sure the warming up and the embarkation to the start is on time;
- Be sure you receive the programme of semi final and final on time;
- If a paddler is disqualified, the written notice should be received in 20 minutes and, if you do not agree, present the written appeals in the printed form provided by the officials to the Competition Committee within 20' of receiving the notice.,
- Gather the material and load it.
- Be present at the awards ceremony in proper clothing;
- Upon returning to the club:
- Store the material in place and present the report on the competition with results, expenses, comments, etc.

CHAPTER 23
PSYCHOLOGY

INTRODUCTION

It was previously stated that success in paddle-sport is determined by efficient technique, strength, endurance and speed combined with a winner's psychology in the athlete.

The psychological aspect of any sport is a determining factor of the results, and can account for about 1/3 or 30% of the total -necessary abilities of the sport.

Successful athletes must have the kind of personality that allows them to train at high volume and intensity and to have a "fighting and winning spirit" at competitions and in training. High accomplishment in terms of training and racing requires high motivation to keep up this spirit.

It is an advantage if paddlers:

- Love what they do and are competitive on the water.
- Are able to work through the pain of hard training;
- Are able to suffer and to keep going during demanding training or racing
- Are well motivated to be the best at training and racing

Elite athletes have the following characteristics compared to non-elite athletes:

- Clear daily goals
- Greater confidence
- Lower anxiety of failure
- High levels of motivation
- Self-regulation
- Ability to control the effects of training
- Mental toughness
- High competitiveness

23.1 MOTIVATION

Motivation plays a very important part in all sports because sport is not compulsory. Those who take up paddle-sport face many challenges before they become an accomplished paddler. Continued success after this stage is largely determined by motivation. Motivation can be self-motivation or external or the combination of both.

For beginners, self-motivation is most important, but this also needs to be accompanied by extrinsic rewards such as praise and prizes. At this level, the benefits of the sport are often not enough to train and compete only for self-satisfaction. Without self-motivation it is not possible to reach high level in any sport. High competitive performance requires enough self–motivation for athletes to be able to "die a little" in training and competitions.

External motivation can come from those close to the athlete such as the coach, family, friends, fans etc. One of the tasks of a coach is to find a way to improve the self-motivation of athletes. Coaches should be giving real goals, and making a commitment to helping the athlete achieve these, and helping them achieve success by giving them self-confidence. In my opinion this is one of the most difficult but most important sides of the coach's job.

23.2 INDIVIDUAL BEHAVIOUR OF ATHLETES

We can describe different types of athlete as extrovert and introvert. Their behaviour and reactions vary. The coach has to know paddlers well to be able to help them solve their problems. Both external and internal anxiety can affect performance in a positive or negative way. The paddler that can fully control all anxiety before and during a race and concentrate only on the race itself, will

be a winner! A paddler with a tough attitude, the willingness to take extra pain at the critical spot, is able to concentrate on every stroke and can block out the possibility of failure, will perform well.

Psychological preparation is commonly divided into two distinct areas of training and racing. Some paddlers dread the daily toil of training, but will perform above expectations during competition. Others are the opposite.

Usually, in special situations such as elite-level races, it is not the physical condition of athletes, but the psychological side that determines the result. The winner will be the one who is mentally stronger and better motivated.

We can currently refer to human behaviour observing three functional domains:

The social-affective domain: refers to emotions, sensitivity, pleasure, disapproval, and the influence of other people.
The cognitive domain: refers to knowledge and understanding.
The psycho-motor domain: associated with the acquisition of information through the perception and decision making.

These three functional domains are interdependent, influencing each other whilst establishing reciprocal relationships.

This simple model of the performance of an individual indicates that in sports such as paddlesport, the learning process depends on much more than the physical movement we observe as a result of practice. As instructors of beginners we should also take into account the paddler's emotions, fears (such as falling out of the boat), motivation, physical condition, experiences, age and social background.

SOCIAL-AFFECTIVE	COGNITIVE	PSYCHO-MOTOR
Emotion	Knowledge	'Know-how'
Pleasure	Understanding	Perception and expression
Fear		
Social influences		

23.3 WILLPOWER

Willpower is also decisive in the matter of victory or defeat. Willpower, that extra 'bit or weapon' is a decisive factor for any athlete! Willpower definitely can help an athlete through a hard training session or a head-to-head competition. Without strong willpower nobody can be a successful competitor.

For example, if the race has too fast a pace, or during the course of the race the pace is raised beyond the individual's capabilities, the athlete will experience an oxygen deficit that will lead to fatigue. Willpower can become the decisive factor at the finish of a race. Even those athletes in a well-trained physical condition can suffer from exhaustion, which must be fought against in order to avoid falling behind.

23.4 METHODS OF MENTAL TRAINING

Progressive muscular relaxation:
Tense a muscle group for a short time – hold to feel the tension - then relax;
Autogenic training (relaxation therapy):
Intentionally do not think of paddle-sport/ training/competition - forced relaxation;
Imagery:
Mental rehearsal or visualisation of a competition or race;
Self-talk:
Talk to yourself: This can be silent or vocalised;
Breathing:
Learn to control your breathing –slow and deep;
Listen to music:
Individual selections of music e.g. "pump up" .

CHAPTER 24
THE COACH' JOB

INTRODUCTION

Coaches play a central role in guiding the development of athletes. Coaching is as much about relationships in a social environment as it is about technical knowledge and expertise. It requires the building of effective working relationships with athletes and implementing sound ethical practices.

From a pedagogical point of view, it is not enough to have accumulated knowledge about technique, tactics and physical conditioning for a certain sport or discipline. It is also necessary to know the individuals to whom the teaching efforts will be directed: the child who begins at the club, the people who wish to practice paddle-sport as a recreational activity only etc. They form different groups of people with specific characteristics and different motivations. Even so, all of them can be helped with their performance.

It is necessary then, to try to understand, how each individual acts and reacts, and in most cases a coach will also be responsible for many other tasks as a result of his or her position in a club. These additional tasks will be described in this chapter.

Tasks of the coach include everything connected with the development of paddle-sport. The coach will have to undertake many tasks. He should be an instructor, a teacher, a trainer, a psychologist, a disciplinarian, a boat-paddle master, a motor boat and car driver, a manager, an administrator and also a scientist and a student of the sport.

Even though motor-skills and physical development are the priority for the coach, directly or indirectly, the coach's role is much more than teaching a sport.. In addition to professional knowledge, the coach's teaching methods and personality will affect athletes' personalities, social and cognitive behavior, education, way of thinking, judging situations and emotions. The coach can form athletes' attitudes or even reform poor social behavior that has resulted from the athlete's environment. We know that some young athletes, without a good coach could even be involved in crime. In many cases, the coach and athlete relationship forms a strong bond that provides the opportunity for both to achieve a high level in sport!

COACHING COMPETENCE

- Set the vision and strategy for the development of athletes
- Recruitment of paddlers
- Introduce athletes to paddlesport and progress them through a long term development programme
- Oversee life, health and safety of athletes
- Performance and results in competitions
- Deliver an effective and sustained programme (planning)
- Conduct training and take part in suitable competitions (tactics, motivation, advice etc.)
- Discipline of athletes and adhering to the rules
- Different tasks connected with position of coach
- Shape and develop the environment through facilities, resources equipment etc.
- Build relationships with athletes, other coaches, parents and officials

24.1 RECRUITMENT OF PADDLERS

As discussed before, the best age to start paddle-sport is between 10 and 14 years because the neuromuscular system during this time is at its best for learning coordination skills. Also, physio-

logically it is the best age for development of endurance and strength. Starting at an older age can also be successful but usually only with 'talented' athletes who are already at a high level of physical fitness and in a position to be able to train.

Usually a coach has to look for and find paddlers for the sport and then keep them! One way is to make good contacts with schools and physical education teachers. To start with, a coach can handle 20 to 40 paddlers at the same time, decreasing to 6 to 15 as they require greater input. At international level, a coach might only be working with 1 to 4 paddlers.

Before starting the first training session the coach should ask for beginners' medical details, parents' permission and test their swimming ability.

24.2 INTRODUCTION TO PADDLE-SPORT

The objective of the introduction is to create within the beginner a real interest in, and desire to train for paddle-sport, as a means to improving personal development, social relationships, as well as a knowledge and respect of the natural environment.

The coach will want to dispel any fears the beginners may have and develop a spirit of collective co-operation related to personal safety and that of the group.

24.3 HEALTH AND SAFETY

When working with beginners (not only children) safety is the most important thing. Everything else is secondary. Coaches must always consider health and safety issues. Beginners should wear buoyancy aids or life jackets. Water training should be covered by a rescue boat or motor boat. The coach should find a place where he or she can see all beginners, hear them and be close enough to help them or be able to give clear instructions or rescue them if necessary.

Teaching beginners means using step-by-step methods to avoid early failure and loss of self-confidence. It is better to progress slowly at the beginning with more basic and fundamental activities in order to achieve greater gains in the long run.

24.4 RESULTS OF COMPETITIONS

Good results are the main aim for a coach. All the other tasks are directed to this end. The athlete's results are a good measurement of a coach's ability. Of course, to have a great athlete requires good luck but improvement depends on a coach's work!

24.5 PROGRESS OF ATHLETES AND CLUB

It is not enough to have one success. A coach should be responsible for the athlete's continued progress as well. This means an athlete should improve year by year, getting faster and faster, by following the coach's training plans and teaching. If the athletes trained by one coach improve, then the results of the club will improve too.

24.6 PLANNING AND DIRECTING OF TRAINING

Suitable training is necessary for different levels and athletes. Good training plans are essential for good results. Making appropriate programmes is the art of good coaches, achieved through knowledge and experience, even the best programme only forms the basis of good coaching with athletes. Coaches have to motivate athletes to complete the planned training well. For athletes to train to achieve the required improvemenst is not easy to do. Intensive training is not harmful but it can be painful and to get through it needs a lot of willpower. Coaches have to help their athletes to train at the required intensity because only in that way can they progress.

24.7 DISCIPLINE OF ATHLETES AND RACING RULES

Among the members of a team or sporting community, the coach is leader, but mustn't forget that

sport is not like the army! Of course, athletes have to be conscientious and respectful towards coaches but the relationship should be more friendly than formal. If the coach only gives orders to athletes, it is not as useful as explaining reasons to the athletes. Understanding the athlete's point-of-view leads to a more effective workout, and better and faster improvement. Competition can be a good focus for discipline and a community spirit within the team. Wearing the same team colors is an outward demonstration of unity but consideration and respect to each other is more meaningful. It is also important to respect to the racing rules, judges and officials.

24.8 DIFFERENT ORGANISATIONAL TASKS

Only in a well-organised, structured and active club or community is it possible to work well enough to achieve progress. The key individuals are the coaches! They should have good connections with athletes, club leaders and officials, sponsors, parents, schools, former members etc.

Coaches organise training sessions, training camps and participation in various competitions. At competitions, be responsible for: completing entries on time; travelling and boat transportation; arranging accommodation; check the condition of equipment; attending the Team Leaders' meeting; following the programme and racing schedule; supporting the athletes; lodging protests and appeals if necessary.

24.9 DEVELOPING FACILITIES

A good environment, facilities and equipment form the basics of proper training. Paddle-sport generally requires:

- Adequate type and quality of boats and paddles
- Boathouse or storage for boats and equipment
- Coach's boat (power boat), which is suitable as a rescue boat
- Buoyancy aids or life-jackets
- Pontoon or proper place for launching
- Changing room and toilets
- Indoor or outdoor facilities for strength development
- Paddling tank (or machines) for teaching beginners and winter training

Coaches should be responsible for keeping these facilities and equipment in good condition, and for ensuring their careful and correct handling and use.

24.10 SOME ADVICE ABOUT TEACHING AND COACHING

The skilful coach is adaptable, tolerant, confident, logical and just!

Recommendations:

- A coach never stops learning how to be a better teacher – a coach is always looking for ways to improve his or her skills.
- A coach is an example to athletes – the coach should set high standards of personal behavior. Athletes should respect and follow the example set.
- A coach is an expert and good psychologist. The ability to motivate athletes is more important than technical knowledge!
- Praise often and discipline if necessary, but don't be indifferent!
- Be trusted and liked by athletes
- Have the ability to listen
- Don't give orders. Explain targets and tasks and afterwards evaluate.
- Organise training and related tasks well
  - paddlers will see and appreciate your careful work
- Be patient, tolerant and try to be in a good mood. You can achieve much more in training if the atmosphere is good!
- Use information coming from the athletes
  - vital feedback!
- Feedback works both ways between coach and athlete:
  - from the coach: provides paddlers with information about their skills, performance and their errors;
  - from athletes: provides coaches with information about how they are feeling, physical condition, effects of the environment of the training

Good communication between coach and athlete(s) is essential!

Many of the successful coaches have the ability to build a close bond between themselves and their athletes. Often this is the key to their success.

Recommendation:

- Reduce any „status awareness" between you and the group - develop the appropriate level of language for the situation.
- Use as many channels of communication as possible.
- Try to eliminate any sources of interference, disruption or distraction.
- In most situations, face to face communication is best because it allows dialogue between the parties involved.
- Simple, uncomplicated language which avoids the use of jargon until it is fully understood is often the most effective.
- Learn to listen to the responses of the receiver of your information since this will often enable you to adjust the delivery of your next piece of information.
- Try to be aware of the subliminal or body language messages.

24.11 PEDAGOGICAL ADAPTATIONS TO DIFFERENT AGE GROUPS

The coach/instructor working with a group of adults:

Adult age, contrary to what is commonly believed, is not an age at which you can be sure of completing a teaching task without too many problems. Adults often have characteristics that prevent them adapting to the traditional teaching style, by which we mean the style based on the teacher presenting all his or her knowledge to the group. On the contrary, the adult is often skeptical, taking the form of distrust at all levels - „Is the material OK?", „Is the instructor capable?" And this can be more obvious when a fee has been paid for the introductory course!

Adults have status and titles and they like them to be respected. They do not want to follow a fixed schedule but equally do not like the „play" situation and resent being treated as children. The adult's intellectual curiosity is not as strong as that of a child or a teenager. He or she does not appreciate at all „being back at school". They don't appreciate corrective remarks and, frequently, don't demonstrate a strong desire to progress. They don't like theory, since, frequently, their daily activity is full of practical objectives.

Consequently, pedagogy should be personalised and it will not be efficient unless the adult:

- Is motivated.
- Is personally involved in the training.
- Understands that the training is necessary to meet objectives and needs.
- Participates actively.
- Is able to recall previous experiences or abilities in other areas.
- Establishes a direct relationship with the coach.

To achieve these conditions, the teaching scheme should follow certain simple principles:

- Define the concrete objectives of the training.
- Give responsibility to the adults in the different activities.
- Avoid following the teacher-pupil method.
- Be aware of the dynamics of human relations.

Usually, a teaching task will only become relevant when the adult accepts his or her lack of knowledge on the subject. Accordingly, it is useful to start with exercises that give them an appreciation of their need learn or improve so that they are more receptive to the teaching.

The coach/instructor before a group of children and young adults
Whilst adults need to be directly and personally involved in their training, children and young adults will readily follow the training set. These groups will have total confidence in the coach, provided he or she demonstrates knowledge and understanding. The coach will need to adapt his or her teaching style depending upon the nature of the group, which may vary widely, for example between children (7 to 13 years) and young adults (14 to 18 years). In either case however, the coach should make use of the natural curiosity of young people, varying the type of activity, venues, type of boats, etc.

As children grow older, there is more opportunity to use abstract concepts to explain things. It's always important to state the objectives for the session, remembering that children and young adults will need plenty of encouragement to keep going. It's worth keeping explanations simple and straight forward. Do not jump from subject to subject. Choose one or two points in each session and look at how different situations might apply to each one. Keep the activities varied and don't spend too long on each one. Role play can be a good tool for learning or appreciating young people's ability to imitate (with remarks such as: „Look at him!"... „Do just as he does it").

24.12 COACHING CHECKLIST (ADAPTED FROM FISA COACHING COURSE)

A.) HOW A COACH SHOULD TEACH A GROUP:

a.) Introduction
- Get the group's attention;
- Arrange the group so all can see and hear;
- Explain the reason for learning it.

b.) Demonstration
- Prepare the group for the demonstration;
- Demonstrate the whole skill and then the parts of it;
- Demonstrate the old or previous skill if the group has already any experience of that;
- Answer relevant questions.

c.) Practice
- Arrange the group for the appropriate practice (venue, equipment etc);
- Motivate the athletes to practice the skill;
- Correct their errors;
- Practice.

d.) Feedback
- Observe and evaluate the performance;
- Provide feedback after performance as soon and as frequently as possible;
- Give effective feedback.

B.) EVALUATION

a.) Activity Selection
- Was the activity challenging to the team?
- Was it possible for the group to be successful?
- Are the athletes making progress?
- Did you present a good model of the skill?

b.) Instruction
- Are the athletes aware of the objectives of the session?
- Did you provide effective feedback with verbal, visual and kinesthetic cues?
- Did you provide paddlers with time to apply the skill?
- Did you allow for individual differences?

c.) Participation

- Did you reduce talking time to a minimum?
- Were your instructions clear?
- Did you organise the group effectively?

d.) Equal opportunity

- Did you provide for less able athletes?
- Did you provide for those who were experiencing difficulty in following your coaching methods?
- Were presentations suitable for all participants?

e.) Safety

- Was the equipment checked before the practice?
- Did you present the information in the context of safety?
- Did you prepare all the necessary things for first aid and rescue?

f.) Motivation

- Were the participants successful?
- Did the group enjoy the session?
- Were you satisfied with yourself?

24.13 COACHING AND SCIENCE

Evidence-based practice is the process of using the scientific facts to direct the conduct of professional practices in a field. Research plays an important role in advancing any profession. Practices are developed from the use of scientific laws and principles, and theories from research. Research increases our understanding of a topic and results in practices that are based on the scientific method. Coaches can use research to advance their practice. Often, research findings and/or experts' suggestions are not conclusive when it comes to putting them into practice. Consequently, coaches have to keep an open mind and use their experience to make good judgments in trying to achieve the best results. Coaches often use what is familiar to them - what they did themselves as athletes or what they have seen from other coaches. Successful traditional methods may be good to follow but constantly need to be evaluated. Coaches may also follow their intuition (the ability to know or do something without any reasoning), which might result in a for good decision. Often, it's a case of trying something and seeing if the desired outcome is achieved, but even then, what is good for one athlete may not work for another.

CHAPTER 25
TALENT IDENTIFICATION

25.1 SPORT FOR CHILDREN

Sport training for children (adapted from FIBA)

Sports activity must be considered as an element of the overall education of an individual and should be introduced to children at an early age. General sports training for children should be seen as fundamental for successful performance at a later stage but without the need for early specialisation in a particular sport. Rather, it means encouraging children to develop motor skills, movement, speed, physical fitness, discipline and mental abilities.

Unfortunately, in recent years, many sports (including paddle-sport) have moved to early specialisation, as sports become more and more widespread, and competitions become more intense and performance levels improve. In many sports children have been trained from the outset to achieve the highest possible results, leading to excessive training at an early age to win competitions at any cost. This situation has resulted in many children dropping out of sport without ever fulfilling their true potential!

To prevent this negative impact, coaches must pay attention not only to chronological age but biological age, as well as gender, sporting background and individual abilities, when planning the training. In paddle-sport, the objectives can be achieved over several years making it possible to develop and consolidate motor skills and teach correct technique.

DEVELOPMENT STAGES:

STAGE I: General preparation (6-11 years)
STAGE II: Beginning of sport specialisation (11-13 years)
STAGE III: Continued specialisation (14-17 years)
STAGE IV: Advanced sports specialisation (over 17years)

25.2 TALENT IDENTIFICATION

The principal aim of sports talent programmes is to raise the standard of sporting achievement. Talent Identification Programmes (TIP) have three phases:

- **Identification:** Identify those applicants who show good potential for paddle-sport according to pre-determined criteria.
- **Selection:** Select those candidates who show the greatest potential and have an interest in paddle-sport.
- **Development:** Development of those selected becomes a priority for clubs and coaches, in providing the best training opportunities.

First we need to determinate the factors of sport talent:

- Anthropometric
- Physiological
- Psychological
- Physical
- Sociological
- Genetic (hereditary)
- Trainability

Factors determining athletic talent

Factors	Characteristic
Body build and composition	body height, arm lengths, shoulder width, muscle mass
Physiological	alactic and glycolitic anaerobic power, peak blood lactate, strength endurance
Psychological	selfconfidence, motivation, concentration, anexiety control
Sociological	parental support, socio-economic background, coach-child interaction

25.2.1 DETERMINING INNATE ABILITIES AND TALENT

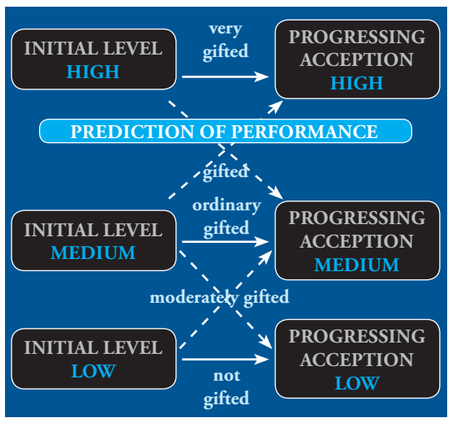
Innate abilities are considered to be genetically transmitted (hereditary) properties of an individual. In sport, properly developing such innate abilities implies attaining excellence. Deciding what constitutes an innate 'gift' can be based on unchangeable inherited predictors of talent. However, identification of innate talent in endurance sports like paddle-sport can take two to three years of training to establish.

The aim is to identify *'gifted'* individuals who may be *talented* in a particular sport.

25.2.2 PREDICTION OF ULTIMATE COMPETITIVE PERFORMANCE FROM A STANDARD STARTING POINT

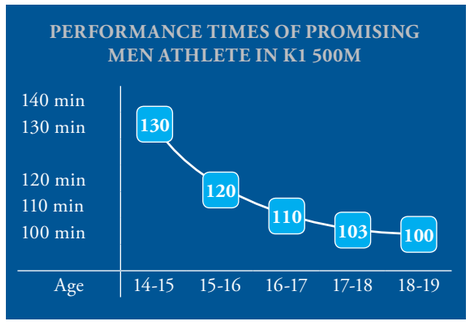
Although 'giftedness' can be tested using various physical activities and standards at any time, paddle-sport requires 2 to 3 years to identify talented athletes, because of the technical demands and unstable boats. Even though the development of endurance will be seen through a general programme of supplementary sports, the real measure of endurance will only be found eventually through training on the water.

The following table shows how initial levels are only a part of the process of predicting talent:



Meeting required times as a predictor of future successful performance (500m K1 Men):

Table Canada



Predictors of future performance. An example (Ice Hockey, Canada):

- Athletes born in the first 3 months (or even up to 6 months) of the year were ultimately more successful than those born in the second half of the same year.
- The most successful players originated from cities, with a size of 50.000 to half a million inhabitants

25.3 TALENT IDENTIFICATION (ADAPTED FROM DR. HAMID AGHAALINEJAD)

Talent Identification and Selection is a complex area of the sports sciences as it requires multidisciplinary models to be developed. This may include consideration of anthropometry, physiology, psycho-social influences, biomechanics, perceptual-motor and decision making processes and sociology. This should be interfaced with an awareness of growth and maturational issues across the developmental cycle.

The principal aim of sports talent programmes is to raise the standard of sporting achievement. A supplementary aim of talent programmes is to increase the standard and depth of competition at the domestic level by maximising the number of gifted athletes participating in certain sports. This results in a flow on effect that should improve international sporting performance.

There is no one correct model for talent identification and selection. It is dependent on the complexity of the sport (from a predictive perspective) and the infrastructure of the sport at a local and national level.

Paddle-sport has been identified as a late specialisation sport, which means that most competitors will not achieve their maximum potential until their twenties. This means that athlete development is a long term process. A solid foundation of movement, technique and fitness is critical for everyone, especially athletes participating in late-specialisation sports. In order to reach their maximum potential, paddlers need to build physical literacy as children – the mastering of fundamental movement skills and fundamental sport skills – by participating in a wide variety of sports and physical activity when they are young. If specialization occurs at an early age in paddle-sport, it might harm long term development!

TIDP defines a clear development pathway for coaches and athletes of what they need to do and when they need to do it in order to excel at the elite level. In order to predict those who are talented for paddle-sport we need to be clear about the main principles of paddle-sport, namely technique, endurance, strength, speed and mental strength.

A TIDP HAS THREE PHASES:
Talent Identification: The screening of children and adolescents using selected tests of physical, physiological and skill attributes in order to identify those with potential for success in paddle-sport.

Talent Selection: The screening of young athletes currently participating in paddle-sport using experienced coaches and/or physical, physiological and skill tests in order to identify those most likely having further potential in paddle-sport. These paddlers should keep training!

Talent Development: Following the talent identification and/or selection process athletes must be provided with adequate infrastructure to enable them to develop to their full potential. This includes the provision of appropriate coaching, training and competition programmes along with access to facilities, equipment and sports science and medical support!

Maintenance: It is important to keep talented athletes in the sport and this requires special care to provide educational and social support for these athletes.

Benefits of Talent Identification, Selection and Development

- Provides talented youngsters with the opportunity to develop their sports' skills
- Optimises the potential for all individuals to achieve sporting success
- Provides motivation for continued participation. If a child/adolescent is involved in a sport that better suits their abilities they are more likely to enjoy and/or achieve success in that sport. As such there is less chance of them withdrawing from sport, especially during the critical adolescent years.
- Steers children away from sports they are not suited to and prevents time being 'wasted' by coaches and parents
- Effective in broadening the participation base and in enhancing sporting performance.

Why TIDP is useful and/or necessary?
Progressing International competitiveness: all sports at a global level have become more competitive and are constantly evolving! There is a need for innovation and continuous improvement in order to remain international competitiveness. It is no longer sufficient to rely on 'the system' alone to deliver talent. There is therefore a need to be proactive and identify and select talent for further development.

Population of countries: Countries with relatively small national populations have recognised that there is a need to maximise their talent pool through actively searching out athletes. A country with a moderately sized population could also benefit from such a system by increasing the size of the talent pool.

Low levels of participation in paddle-sport: A number of sports have relatively low levels of participation at a base level. Consequently, any talent initiative could have a substantial and faster impact on sub-elite domestic level performances and ultimately international standards.

Exposure to a sport: Without introducing paddle-sport to a large number of people, for example through TIDP in schools, there is a greater chance of talent 'slipping through the net'.

Retention rates: Some sports have adequate base level participation, but this is not always translated into elite level performance. This may be due to a gap in the participation pyramid where juniors, especially females leave the sport ('drop-out').

Resource implications: With limited financial and technical resources the best athletes, and those with the most potential should be supported.

Cultural factors: Paddle-sport is an important sport in some countries, culturally and in terms of international success. To keep its profile high in those countries, paddle-sport must be proactive in its talent strategies.

Scientific Issues

Talent Identification (in the purest sense) assumes that there is a genetic basis underlying performance. That is, some individuals are born with innately better or higher capacities and/or trainability of these. There is good evidence of a genetic basis to performance in a number of areas relevant to sporting success, including anthropometric, physiological and motor attributes. However, environmental and sociological factors also heavily influence the development of elite athletes.

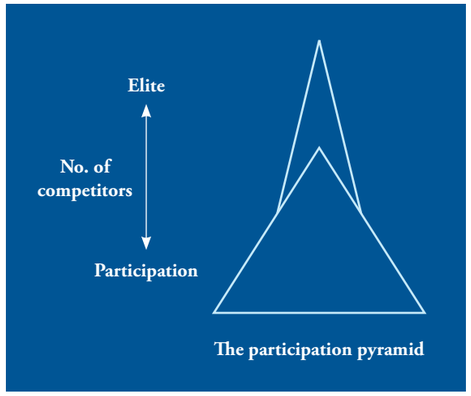
Performance prediction: The key to talent identification and selection is to determine how much of the performance outcome you can measure. If the requirements for success in the sport are relatively predictable, such as paddle-sport, then we can use identification and selection initiatives.

It is also important to note that the dynamic of performance factors changes over the maturational cycle. That is, predictors of success at a junior level are not always the same as those at the senior level. Through performance monitoring of athletes in developmental programmes these interactions are gaining a better understanding.

Age of Selection: the TIDP should have two phases. The first is the selection of athletes 'gifted' in the acquisition of skills at the age of 10 to 12 years. The second selection should be made at 17 or 18 years of age to determine the likelihood of successful competition in the senior age group.

The size of the TIDP should depend on:

- The number of available clubs with suitable coaching staff
- Adequate infrastructure (equipment) to support talented athletes
- The current number of young athletes and competition programmes for talented young athletes
- The participation pyramid (the number of athletes in different age groups)



The smaller base of participation in paddle-sport means there is a need to implement talent identification programmes to increase numbers and quality. In general, talent programmes will have a faster and more substantial impact on paddle-sport where there are existing low levels of base participation.

Evaluation of the current position in paddle-sport with regard to talent:

- Examine the current opportunities for success. Is there a need to prioritise disciplines or events?
- How effective are your current systems for identification and development of talent?
- Are there effective links between each part of the structure?
- Are the numbers and distribution of coaches adequate for developing talent?
- Within your development programmes are there enough talented athletes currently in the sport to achieve domestic and international success?
- Are your current competition programmes adequate for identifying, developing and tracking talented performers?
- Does the structure of the competition programme encourage progression?
- Is the age at which you currently identify performers appropriate?
- Have your coaches received sufficient training to identify and develop young performers?
- Given the current resources available, how would you describe the approach you would take to search for and develop talent? If more resources were available would this change the nature of your approach?
- Are current recruitment strategies encouraging the correct type of athletes into the sport? Lower profile sports can end up with second tier athletes, who do not have the prerequisite ability to succeed at the elite level of paddle-sport.
- Is the talent development infrastructure suitable – i.e. does the sport have a high retention rate? Some sports may have good base level participation, however there are gaps in the performance pathway making it difficult to achieve success at the elite level.

There are 7 stages that make up the Paddle-Sport TIDP Model. It develops a framework that allows athletes to be successful at every stage. However it's important to note that in reality, there are not precise separation points between ages as the table might suggest. For example, the age of "Training to Train" and "Learning to Compete" can be merged and "Training to Win" could start during the junior age limit (18 years).

potential.

- They should demonstrate a strong 'feel' for learning to paddle
- Have a background in a range of sports
- Have an interest in and/or affinity for paddle-sport
- Have a knowledge of how to swim (preferable)

Quantitative assessments might include:

- Preferably having a larger arm span and height
- Higher sitting height than average

Suggested TIDP tests:

- Height and predicted height
- Sitting Height
- Arm Span
- Body Mass
- 12 min run test

VO_2 max (ml/kg/min) = (distances covered in 12 min run – 504/9) ÷ 44/73

- Pull-ups
- Sit -ups
- Push-ups
- BESS Balance Test

Note: the physical tests at age 10 to 12 years are not an important determining factor, since these abilities can be developed well by training.

Recruitment tests & selection index for canoe/kayak

SELECTION CRITERIA						TEST		
Girls			Boys					
12 yrs	11 yrs	10 yrs	12 yrs	11 yrs	10 yrs			
165	160	155	170	165	160	Height (cm)		1
90	85	80	90	85	80	Sitting height (cm)		2
170	165	160	175	170	165	Arm span (cm)		3
55	50	45	60	55	50	Body mass (kg)		4
						BMI Index		5
-	-	-	-	-	-	Triceps	Skinfolds (mm)	
-	-	-	-	-	-	Calf		
-	-	-	-	-	-	Sub scapular		
40			45			VO_2 max.		6
						Cooper or 1.500m running		7
35	30	25	40	35	30	Sit-ups in 1 min (repetition)		8
25	20	15	30	25	20	Modified push-ups in 1 min		9

CHAPTER 26
SPECIALITY OF 200M RACING

The information in this chapter has been collected and adapted from various sources: Sarah Bedwell BCU, Ken A. Van Somren, Zsolt Komka, Zsolt Gyimes, Zoltan Bako (Hungarian Master Coach) and other authors' available materials.

THE 200M RACING DISTANCE

The introduction of 200m racing for paddlesport found most coaches lacking detailed knowledge of the type of training required to achieve the best result for this distance. The demand to establish a precise training programme for the 200m specialist became even more important when the event was included in the 2012 Olympic Games. Early on, it was appreciated that the 200m racing distance requires special physical, technical, physiological and psychological qualities.

26.1 COMPARISONS BETWEEN THE 200M AND THE 500M AND 1000M

Stroke rates (men's kayak)

Stroke rate (min)	Maximum	Average	Travelling
200m	175	160	150
500m	165	130	120
1.000m	132	106-118	100

The total number of strokes on 200m is 70-80 and can reach 180 strokes per minute. An elite male kayak paddler takes 3 strokes per second at top speed!

Speed (men's kayak)

Distance	Total time (sec)	Average time (sec)	Speed increases
200m	35	17,5	+10%
500m	96	19,2	+7%
1.000m	206	20,6	0

Speed (women's kayak/men's canoe)

Distance	Total time (sec)	Average time (sec)	Speed increases
200m	40	20,0	+10%
500m	110	22,0	+8%
1.000m	237	23,7	0

Energy sources

Distance	Aerobic	Lactacid	Alactacid
200m	30%	50%	20%
500m	40%	50%	10%
1.000m	60%	35%	5%

The LA accumulation in the muscles on 200m racing (13mmol -15mmol or even higher) is similar to the LA accumulation at 500m/1000m distances but it accumulates in a much shorter time!

The 200m distance requires high energy levels from Anaerobic and Aerobic sources!

200m sprint requires Anaerobic Energy sources!

The purpose of the anaerobic alaktacid training is for:

- the increasing of the effective usage of the high energy providing phosphates storage in the muscles
- the maintenance of the paddling technique at high speed

Execution:

- The speed is maximal or very close to it
- Low number of repetitions in a set (2-4)
- The phases of the one reps is 6-8sec (i.e. 3x 60-70m or start exercises
- Longer resting time for full recovery (6 to 50 minutes)

Some training examples:

- 2x (200m - 300m - 400m -300m -200m)
  int.: 80%; *rest:* 2min
- 2x (10x100m)
  int.: 95% *rest* and 12 between sets
- 6x 150m *int.:* 90%;
  rest: 5min plus 1x500m *int.:* 95%;
- 2x (3 x80m)
  int.: 95-100%; *rest:* 3min
- 3x300m *int.:* 95%; *rest:* 12 min
- 2x (50m -100m -150m -200m)
  int.: 95-100%; *rest:* 2-3-5-12min
- 3x 200m
  int.: 100%; *rest:* 20min
- (6 x10sec)
  int.: 100%; *rest:* 1min and 5min

26.1.1 TECHNICAL, PHYSIOLOGICAL AND PSYCHOLOGICAL REQUIREMENTS

Technical considerations

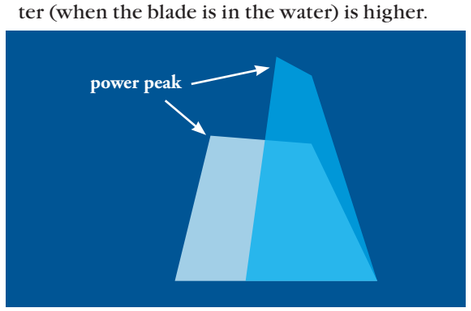
The paddling technique on 200m is considerably different, based on the higher pace, speed and stroke rate. Athletes race at full speed and do not use traditional tactics seen in the 1000m or even 500m (maximum speed at start, consistent travelling speed, increased pace before the finish).

Time for one stroke (men's kayak):

- *Marathon* 0.55 sec
- *1.000m* 0.34 sec
- *200m* 0.2 sec (3 strokes per second)

The length, power and characteristics of 200m kayak strokes:

The next figure shows that the stroke is shorter but the power applied at the catch and thereafter (when the blade is in the water) is higher.



In comparing the boat speed at the various racing distances we can appreciate how significant the speed is on 200m races.

K-1 200m Men:

The speed at 200m is faster by 18% than on 1000m races. The 200m K1 speed is equal to 1000m K4 speed! Maybe this explains why a 200m specialist can take part in a K4 team.

K-1 200m Women:

The speed at 200m is faster by 10% than at 500m. The average speed is equal to K2 500m speed (20 secs/100m). This also could explain why 200m specialists can take part in a K2 500m team.

C-1 200m Canoe Men

The time for canoe men is a little faster than the K1 women's times, but usually not more than a second.

The greater speed on 200m requires modification of technique, physical and physiological factors.

26.1.2 THE PRINCIPLES OF THE GOOD TECHNIQUE FOR 200M RACING, COMPARED TO 500/1000M RACING

1. GENERAL DIFFERENCES

- The higher speed requires higher stroke rate;
- The stroke rates are extremely high;
- The length of the stroke (power transmission phase) is shorter but with maximum strength;
- The catch is even more powerful;
- The distance and time of the "air work" or relaxation is shorter;
- The birthing need to be held for during 2-3 or longer strokes;
- The connections (structure) between the various body parts (legs, hips, trunk, shoulders and arms) are stronger;
- A good start is essential including the time (distance) of acceleration to maximum speed.
- The winner of the event will be among the leading boats at 60-80m after the start. To reach the highest speed, 40-60m is necessary for the elite paddlers.

- It is important to keep the highest uniform pace possible to maximise the energy systems, technique and balance. Not one "bad stroke" or lost balance can be made through the entire distance for the best result!

2. CHANGES FOR KAYAKING:

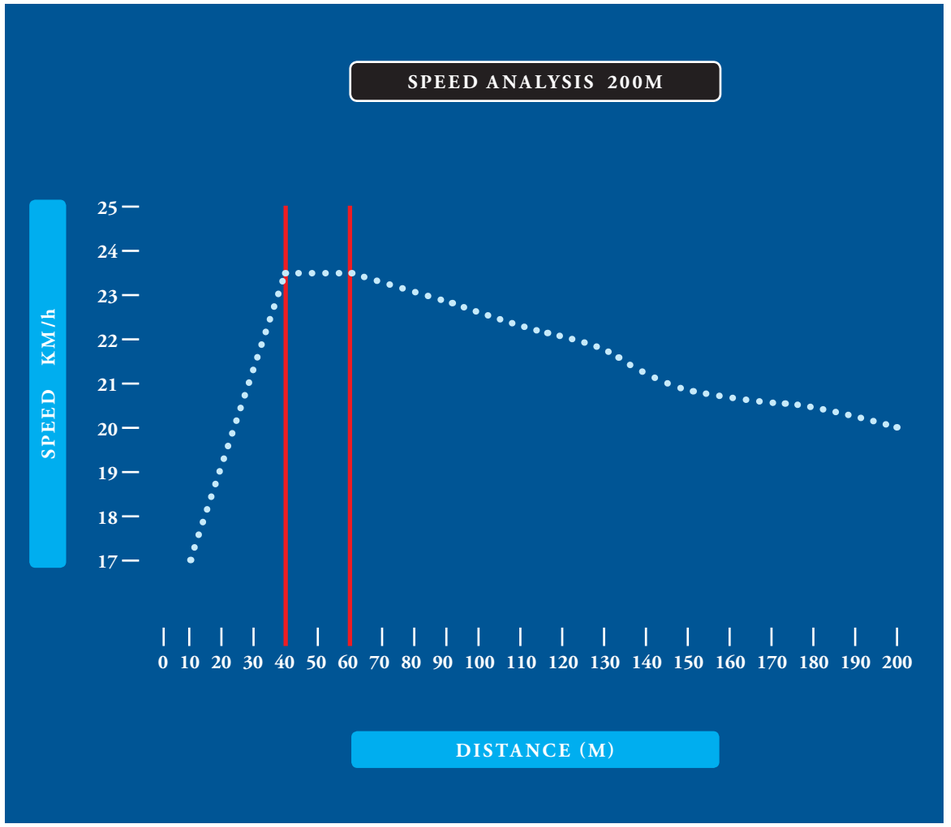
- Technique is based on muscular strength and high stroke rate, not on the 'body swing' movement;
- The arms mainly bend and stretch without changing position significantly;
- The paddler presses very hard between the seat and foot-rest;
- Leg-work is more powerful - before the exit the leg and the trunk start to move to the opposite direction in preparing the next stroke;
- The paddler's seat is a little higher and forward – at a high stroke rate with high applied power the boat is gliding optimally.

3. CHANGES FOR CANOE PADDLERS

- Larger paddle blade with shorter shaft
- Greater role for the arms and shoulders instead of the trunk

26.1.3 RACE ANALYSIS

Shows that athletes reach the maximum speed at about 40m after the start and able to keep this speed up to 80-90m, after which the speed starts decreasing slightly and continuously to the finish line. The maximum speed at 40-60m is about 22-23km/h for top athletes and by the end has decreased by about 15% to 19km/h:



SPEED, STROKE RATES AND PACING

K1W 200m Final O.G. 2012

K1W 200 M FINAL O.G. 2012							
NOC	Total time (sec)	Speed (km/h)	No. of strokes	Strokes/ meter	Max. stroke	Min. stroke	Average stroke
NZL	44,63	11,20	103	1,94	156	123	140
UKR	45,05	11,10	106	1,89	156	130	144
HUN	45,12	11,08	96	2,08	138	120	129
ESP	45,32	11,03	107	1,87	156	117	137
POL	45,50	10,99	107	1,87	165	123	143
RUS	45,96	10,88	96	2,08	135	116	125
GBR	46,16	10,83	100	2,00	147	113	129
POR	46,54	10,74	105	1,90	154	123	136
5,6 m/s head wind		Average age: 26 • Heights: 168,4 cm • Weights: 65,1 kg Best time: 40,53 sec. in Semi Final					

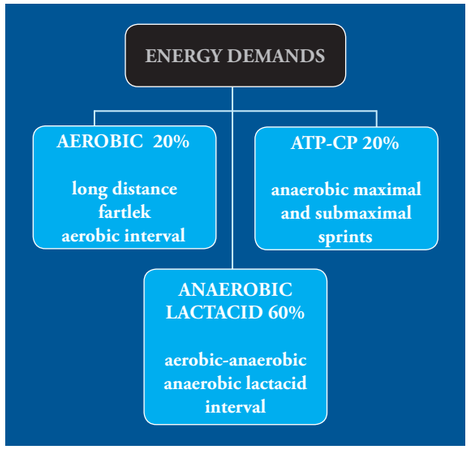
The training methods adopted for 200m racing have tended to follow those found in athletics and swimming, where there is a wealth of experience and advanced scientific research on events of similar time duration, and therefore similar physiological demands. Additionally, for 200m racing, we could consider the physiological characteristics of 500m speed skating or 500m track cycling. Speed, speed endurance and explosive strength development play important roles for all these events.

Looking at the racing times for 200m paddlers (33-40 sec) and the times of the fastest 400m runners (43-44 sec for men) the endurance and energy supply requirements for both events are very similar, as well as the training methods for best improvements.

It is interesting that different scientists and experts have quite a range of views on the **aerobic and anaerobic endurance** demands for 400m runners:

MEN 400 M RUNNING	Aerobic %	Anaerobic %
	64	36
	47	53
	43	57
	37	63
	30	70
Average	44	56
Canoeing (est.)	40	60

P. Thomson, 2004 describes the proportion of aerobic and two types of anaerobic energy as 20-60-20% for 400m runners:



The same is true of 200m racing for paddlers whose time is about 40 seconds. If the time is closer to 30-35 seconds (men kayak) then the proportion of the endurance demands would be changed slightly - less aerobic and higher anaerobic proportions.

The training targets are different in various periods of the racing season! Basically, 40% speed and 60% endurance training should be undertaken. The 60% endurance training should be divided between aerobic and anaerobic endurance training,

but the proportions will change depending upon the period of the year, for example in the preparation period the aerobic endurance training will be 50 % whilst in the racing period only 10%.

26.2 TESTING OF 200M SPECIALISTS

Ken Van Someren, Physiology of Kayaking, conducted various anthropometric and physiological tests to determinate the parameters of successful 200m competitors. The tested athletes were in 3 different levels, with the elite category containing British national team members, who are among the most successful 200m paddlers in the last few years.

The aims of the tests were to:

- determine the physiological demands of 200m racing;
- determine the 'best' anthropometric and physiological profile of athletes and the effects of particular qualities;
- establish proper training methods on the basis of the results.

The results of the 200m paddling test:

- The VO2 max (3.3 L) is less than results at 500m and 1000m where there are greater aerobic energy requirements than the 200m
- Max heart rate: 170 bpm
- The average LA concentration in the blood was 6.7mmol/l but the best athletes reached 8.8 to 10 mmol/l. However, this is less than on 500m and 1000m.

These results show that a well developed anaerobic capacity is required although the maximum capacity will not be fully used during a 200m race.

Anthropologic and Physiological Characteristics (39 athletes tested at maximum intensity for 30 seconds on kayak ergometer)

- Body mass: 85kg ± 5 kg.
- Chest circumference: 106.9 cm ± 2.4 cm
- Upper arm circumference: 36.9cm ± 1.3cm
- Lower arm circumference: 31.3 cm ± 1.1cm
- Generally well developed muscles especially upper body
- Vital capacity: 6.31 ± 0.671
- High strength and speed endurance: at maximum LA level, 167 ± 19 Watt output and at maximum VO2, 251 ± 32 Watt output.

The tests show that several anthropometric and physiological characteristics strongly influence an individual's potential performance at 200m. Aerobic and anaerobic endurance are equally important but the development of speed endurance is essential for successful performance at 200m racing.

The most important factors:

- the total work capacity during 30 second sprint test;
- anaerobic capacity
- the total work capacity at max LA level
- the total work capacity at max VO_2 level

Another test programme targeted 6 weeks training in the preparation period:
There were two groups, each with 8 youth athletes. Group A concentrated their training on anaerobic capacity development. Group B, as a control group, trained traditionally.

Weekly training programme for Group A:

- Speed development training - 1 session per week
- Anaerobic capacity development training - 2 sessions per week
- Strength development - 2 sessions per week
- LA tolerance training - 2 sessions per week
- Aerobic endurance training - 1 session per week

Results: The average anaerobic capacity in Group A increased by 6.9% after 6 weeks, whilst in Group B it was 4.1%. The aerobic capacity did not increase significantly for either group.

26.3 CONCLUSION, THE PRINCIPLE REQUIREMENTS FOR 200M

- High level aerobic and anaerobic capacity.
- Strong upper body muscles. Development of maximum strength and fast twitch muscle development (hypertrophy) is essential.

- High stroke rate! Up to 180 strokes/min (kayak) and 100 strokes/min (canoe) executed with good technique.
- High levels of speed and speed endurance.

Additionally, a good aerobic endurance capacity is necessary for the 200m specialist because it:

- forms the base of general fitness and enables a higher anaerobic capacity
- delays the LA accumulation in the muscles
- helps develop correct paddling technique (the extremely high stroke rate is counter to the basics of good technique)
- speeds up regeneration after high intensity training (training balance).

26.4 TRAINING FOR 200M

In light of the above, clearly 200m racing is for the specialist with a specific type of training. In order to achieve the best results, recovery and resting times and periods are as important as the training load and intensity. Progression can only be achieved with well balanced training. High speed training requires high levels of physical and mental conditioning. Cooling down and stretching play an even more important role for 200m athletes than for those training for longer distances, in speeding up recovery.

Early specialisation for the 200m distance is not recommended because the high stroke rate and intensity is not conducive to future performance (although the ICF has introduced 200m racing for juniors). Early specialisation also means concentrating on maximum strength development, which can be harmful for young athletes and block further progress.

Because of the longer rest periods between efforts, or sets of efforts, during interval training, the total training time can sometimes be longer for the 200m specialist than for those who are training for 1000m!

TRAINING TARGETS AND ENERGY SYSTEMS

The proportion of aerobic:anaerobic demands for 400m running, 500m speed skating or 500m bicycle sprint (about 33 to 45 secs) are from 64:36% to 28:72% according to different experts. Transferring this information to the 200m race (32-40 seconds) we may determine the aerobic:anaerobic energy demands about 30:70%. The proportions may differ slightly depending upon whether athletes specialise in single, doubles or fours, i.e. higher speed and shorter times equates to higher demands upon the anaerobic energy source.

As a guide, the suggested proportion of training targets (P.Tompson 2004):

- Aerobic training 20%
- Anaerobic lactacid training 60%
- Anaerobic alactacid (ATP-CP) 20%

Aerobic training
This is required mainly in the preparation phases following the same methods as for the middle distances (500m and 1000m).

For example:
- Distance paddling (14-20km) or running (30-40 mins)
- Fartlek training - spontaneous or pre-planned
- Interval aerobic training - total working time of 30 - 60 mins per session
- Interval training (mixed aerobic and anaerobic– the transition phase) - total working time of 20 - 30 mins per session

Anaerobic Lactacid Training
(Mainly during the competitive and pre-competitive phases, and partly in the preparation phases):
- 3–4 times per week in the pre-competitive phase
- 2–3 times per week in the competitive phase
- Twice per week in the preparation phase

A one week typical training programme during the racing period (adopted from swimming):

	MON	TUE	WED	TUE	FRI	SAT	SUN
AM	Aerobic	Alactacid	Lactacid	Lactacid	Alactacid	Sprint LA Test	Rest
PM	Lactacid	Lactacid	Rest	Aerobic	Aerobic	Lactacid	

Intensity = sub maximal (90-95% of maximum effort)

Examples:
a.) 16 x 200m (moving starts, starting every 2 minutes)
4 x 50m sub.max – 150m
4 x 60m sub.max - 140m
4 x 70m sub.max - 130m
4 x 80m sub.max - 120m

b.) (10 x 100m) x 2 sets. 50m max. speed/50m easy, starting every 45 secs.

Interval training: the number of repetitions in a set should be as many as possible for the athlete to complete well with suitable rests between repetitions and sets. Total working time in one session: 10 -15 mins.

Repetition training will often be over shorter distances (or time) but at higher than racing speed, i.e. 10 x 50m; 8x 100m; 6 x 150m with long resting periods.

Time trials ('racing conditions') over 200m: 2 to 4 times with 20-25 minutes rest.

Anaerobic Alactacid Development (ATP-CP System) (Mainly in the racing period, 1-2 times per week)
Intensity: maximum or over maximum racing speed. Efforts are approx. 6 - 15 seconds duration, with long and full rests, and low numbers of repetitions.

Examples:
a.) 15 x 200m; standing start and until 50m max. speed then150m easy: start in each 2min
b.) 10-12 x 100m: as first 50m max. speed then 50m easy: start in each 1min

Central nervous system (CNS)
The CNS is involved in every aspect of sport performance. The CNS affects performance, whether aerobic or anaerobic activity, endurance or sprint. When faced with fatigue due to lengthy or intense endurance activity, the CNS may shut down or at least slow down the athlete's ability to continue working. The CNS also controls anaerobic energy metabolism, for example, a 'sprint to fatigue workout', may result in the athlete coming to an abrupt halt!

When training speed (to move the body parts as fast as possible when paddling on the highest stroke rate) the signal transference through the CNS needs to be as fast as possible. This is achieved by training at the highest speed for as long as possible in order to overcome the very intense fatigue signals from the CNS. In other words, exercises should be performed for as long and as quick as possible, to 'stress' the CNS, hence developing athlete's performance.

Special methods for speed development (alactacid energy system)
The number of speed sessions during the racing season will be about 4 per week. In addition to the regular speed development training (lactacid and alactacid type training) the following special speed development methods can be used:

Start exercises
Speed at the start depends on the reaction, strength and technique of the athlete. The boat need to be fixed to a stable point such as a pontoon using an elastic rope. The athlete starts and stretches the rope, keeping the boat at a marked point for about 20 strokes. If he/she is not doing this exercise well (the catch is too weak or the air-work is too slow) the rope will pull back the boat. This exercise is repeated 10-12 times with 4-5 minutes rest between efforts in one session, and 1-2 sessions per week during the season.

Moving start exercises
Start exercises with the boat already moving. Two possible training methods:
- increasing the speed continuously to maximum (over racing speed) and holding it for about 10 seconds
- accelerate the boat to maximum as quickly as possible and hold it for 50m or 10 seconds.

(8-10 repetitions for one training session with 3-5 min active rest between efforts)

Stroke rate and speed development
The athlete's boat is connected to the coach's powerboat by rope. The power boat pulls the kayak

or canoe for 20-30 seconds at a speed faster than the athlete could reach by paddling. This exercise forces the athlete to paddle at a higher stroke rate than he/she could reach by paddling alone. This method helps the athlete break through the athlete's speed plateau. This exercise is similar to a runner training by running down a slope.

Alternatively, training in a K4 encourages athletes to paddle at a higher stroke rate, with a stronger catch and faster air-work.

Paddling with resistance
The resistance (rope or ball etc.) doesn't need to be very strong – it shouldn't reduce the maximum speed by more than 20%. Resistance training encourages a stronger catch and power transmission. The resistance can be increased or decreased, even within a session. It is best when the rate is not less than 100 strokes/min (kayaker) and 60 strokes/min (canoe).

Training for Speed Endurance (Lactacid training)
Speed endurance is a very important aspect at all distances but especially so for 200m, so the majority of training (50-60%) should develop this.

Training for Aerobic Endurance
Aerobic endurance is the base for all paddling but training methods depend upon the race distance that is being targeted. As the various tests show, we shouldn't ignore aerobic endurance development, even for 200m specialists. Training should use 'short endurance' development methods, such as distance paddling, fartlek, over-distance efforts and interval training. In using interval training the working times should not be longer than 4 minutes, and generally between 3 and 4 minutes.

Again, training targets will be different during the various periods of the season. Overall, the basic percentages will be 40% speed training and 60% endurance training. However, endurance training is divided between aerobic and anaerobic endurance training. The proportion of each will change throughout the year, e.g. in the preparation period aerobic endurance training will make up about 50% of all training, whilst in the racing period only 10%.

Speed development (reaction, strength and technique)

a.) Aerobic-anaerobic threshold or repetition training

- between 150m and 500m, or 25 to 100 seconds
- number of repetition: 4-6
- rest between reps.: 4-6 minutes
- intensity: 85-90% of maximum speed
- no more than three times a week

b.) Anaerobic lactacid training
- higher than racing speed
- 6-10 repetitions per set. Total number of repetitions: 10 to 20
- Working time: 10-20 seconds per effort
- High LA level requires proper resting times

c.) Racing distance training
- 200m distances at maximum pace
- 2-3 repetition
- 20 minutes rest between intervals

Strength development
The most successful 200m athletes are visibly well built and physically strong! Shoulder width and upper body muscles are significant. Muscular strength is one of the determining factors of success for 200m athletes. Well developed strength, both maximum and explosive strength are essential! Explosive strength development is the main training target of strength development!

Strength development training will depend upon the training phase and should be individualised! The suggested number of strength training sessions is 3-4 times per week in the preparation period, 2-3 times in the pre-competitive period and twice in the racing period.

Key to the success of strength development is transferring increased muscle mass by general training methods into effective paddling technique (see more details on strength development in Chapter 16).

Maximum strength
Maximum strength is important at the start for accelerating the boat as quickly as possible against the resistance of the water. Generally, the stronger the athlete, the faster the start! The strength of the muscle is directly proportional to its cross section. Therefore, the aim of strength development is the enlargement of the cross section of muscle fibres. This development requires high intensity strength training with maximal or sub-maximal resistances.

Explosive and quick strength
Maximum speed and stroke rate requires the mobilisation of the athlete's strength in the shortest possible time. The quick and explosive strength is important for the acceleration of the boat speed to the maximal in the shortest time. The existing muscles need to mobilise for the given resistance quickly.

This effort requires great power. Hence, explosive / quick strength development is essential!

For the progressing of the quick strength the resistance should be about 75% of maximal; 6-8 repetitions in one set with 2-5 minutes rest between sets.

Physiological demands (endurance, energy supply, and biochemistry)

This chapter has defined the essential characteristics for successful participation at 200m racing, and how they can be improved by training:
- high level of aerobic and anaerobic capacity (energy supply)
- ability to train in the alactacid zone (LA tolerance)
- a well developed circulatory system: oxygen supply to the muscles

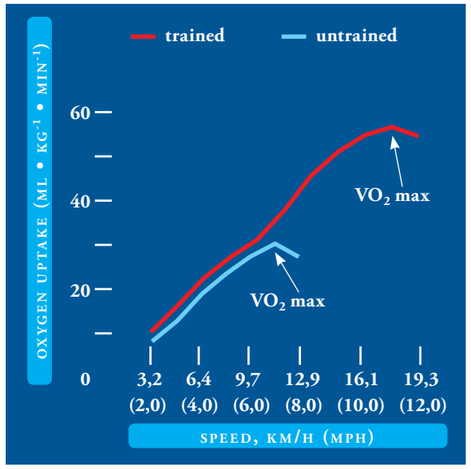
The intensity of training determines the energy system being used but the athlete's fitness level will determine the point at which he or she moves from one zone to another. Well trained athletes, with higher aerobic endurance capacity will only have to use anaerobic energy sources at a higher intensity, meaning the onset of fatigue will be delayed. It is also worth noting that the production of adrenalin at the start has an important role in the mobilisation of ATP energy.

Energy supply and intensity of work

	AEROBIC		ANAEROBIC			
			Lactacid		Alactacid ATP-CP	
	"A" type	"B" type	"A" type	"B" type	"A" type	"B" type
Training time phase	30 min +	3 - 4 min	2 min	30 - 60 sec	20 sec	6 - 10 sec
Intensity	Consistent speed up to exhaustion	VO_2 max intensity	High intensity until exhaustion	max. or sub-max efforts	max. efforts CP system	max. efforts ADP-CP energy
LA level	0 - 4 mmol/ l	4 - 10 mmol/ l	12+ mmol/ l	8+ mmol/ l	Not significant or low	Not significant or low
Develops	Aerobic endurance	Aerobic-anaerobic endurance	Speed endurance	Maximum speed	Maximum strength	Explosive power
Paddling distance	6 - 7 km	700 - 1.000m /reps	500m/ reps	200m	100m	30 - 50m
Aerobic energy	98% - 99%	80%	70%	15%	0%	0%
Anaerobic energy	1 - 2%	20%	30%	85%	100%	100%

Some studies have stated that the LA level can reach 20-25 mmol/l over 200m but that the high LA concentration will not affect the output of well trained athletes, due to the short time.

Oxygen uptake at various speeds

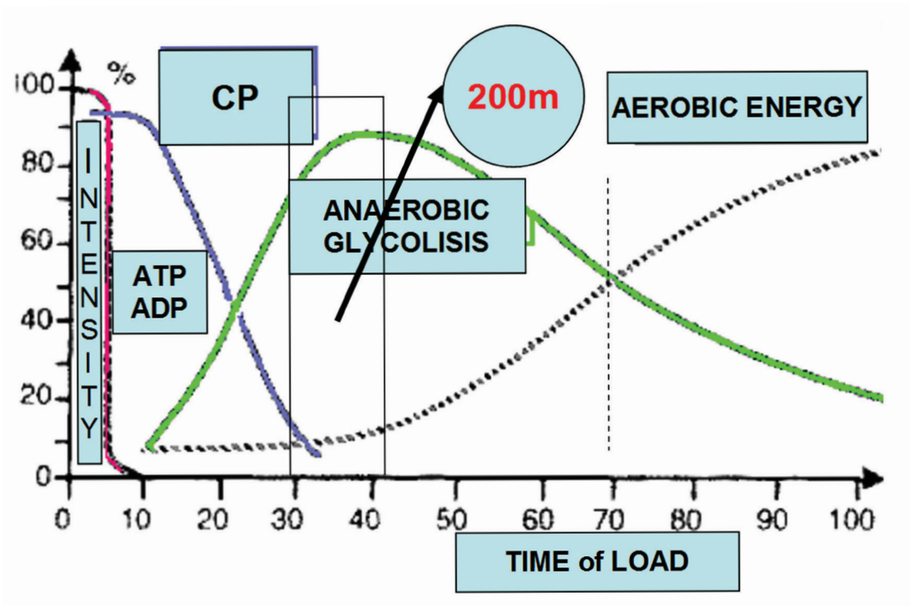


By regular endurance training the maximum oxygen uptake will be increased and the higher volume of oxygen supports the possibility of progressing boat speed. The graph shows that the trained athlete's VO2 max is much higher than the untrained athlete and is able to keep going longer at a higher speed!
The following table shows that working times for speed training should be from 10 sec up to 30 sec and for speed/strength endurance development working times should be from 35 sec up to 2 minutes.

Information on energy supply

Training for	Speed	Speed endurance, strength
Working times	10 - 30 sec	35 sec - 2 min
Heart rate	180 - 200	180 - 200
O_2 uptake (VO_2 max)	100%	100%
Aerobic energy	10%	20%
Anaerobic	90%	80%
Anaerobic alactacid	30%	15 - 30%
Anaerobic lactacid	60%	50%
Aerobic/ Carbohydrate	10%	20 - 25%

The next table shows energy supply, intensity and duration of work. Anaerobic glycolisis provides the energy source for 30-40 seconds of high intensity effort.



Energy supply starts with the ATP-CP system whilst in the last third of the 200m supply comes from anaerobic glycolisis. Therefore, glycogen stores should be full before training and races and replenished immediately after.

26.5 PSYCHOLOGICAL DEMANDS FOR 200M

The psychological preparation of athletes for any event is an important part of the overall process and no less so for 200m specialists. At the start, concentration and quick reactions are essential, and require frequent practice in the pre-competition and competition periods. During the race, concentration is required for pacing, stroke rate and strength application. The development of these abilities should be a main aim of training. Trust, co-operation and partnership between athletes and coaches will improve performance of psychological aspects. Communication, analysis and feedback between coach and athlete are essential.

Off season period: Oct, Nov, Dec

	MON	TUE	WED	THU	FRI	SAT	SUN
AM	Running 30 min aerob latter up to 40 min and increase the pace	Swimming 3x1.000m, then 8x300m - 6x 100m or 10x200m 8x100m or 3x 200m, 20x100m	Running 8x800m, Rest: 4 min int: 90-95% Pool paddling aerob	Swimming 8 x 200m /R 4' 8 x 100m /R 3' 8 x 50m (or 66) /R 2'	kayak ergo or pool paddling paddling 3 x 10 min R: 4 min	Cross-country running 30-35 minutes or uphill running 8x2min/ 4' 8x1min/ 2'	Rest
PM	Strength development circuits training gen. 50% of max str. 2x 25min games 1hr or easy paddling	special strength dev. max strengt 1hr	Games 1,5 hr (basketball or soccer)	Strengt development max str. 1,5 hr	Strength development explosive str. 70% of max. str. 1 hr	Rest	Rest

ED MCKEEVER

APPENDIX 1

DR. MIKLÓS FISCHER, HUNGARIAN PSYCHOLOGIST
COOPERATION WITH THE HUNGARIAN KAYAK-CANOE TEAM

Introducing In the past three years of my eighteen years of experience as a psychologist I have had the opportunity to work with the Hungarian Canoe Federation and National Team for the preparation of the Olympic Games London 2012. Some of the athlete that I was working with achieved great success at the Games. This essay is summarizing the psychological secrets of their success. I will describe the tools of sport psychology, the therapy how we worked together, as well as the results achieved by the athletes in team boats and individually. Their success is also the success of sport psychology, as a great deal of experience and mental work behind those victories.

Results of the Hungarian Kayak-Canoe Team at the London Olympics: 3 gold medals (6 persons), 2 silver medals (6 persons), 1 bronze medal (1 person), and two 6th placements (2 persons).

First, I build personal contact with the coaches and the sport doctor and masseurs then with athletes. I collected information on the typical problems which were described by the athletes. I gained information about their personal life, their own successes and failures in canoeing.

The athletes approached me mainly by the following reasons:

- Some athletes considered themselves to be training performers and suffered of good performance in competition. They could not achieve the same level of performance in a competition as during preparations;
- Others had problems with their further progress
- Some were more prone to injuries or had difficulties in returning to their sports career after an injury.
- Several of them had concentration problems.
- Certain competitors came to my attention due to having problems in their personal life, or with conflict of handling that, having doubts of whether to quit professional sports or not, or for having a dispute with their coaches or the leadership of the federation.
- Athletes turned to me for consultation with typical symptoms like severe anxiety before and during competition, as well as experience of loss which inhibited them from performing well. Many of them regularly failed at execute proper technique, mental block, disappointment, defeat, sleeping disorder before competitions, difficulty in integrating in the team were also among common complaints.
- Some were curious what the sport psychology could do to improve their performance. It was important whether the athlete thought of going to a psychologist him or herself, or heard it from a sports mate who managed to improve performance with the help of a sport psychologist. The most efficient cooperation when the athlete met the sport psychologist as a result of their own drive and their coach.

In some occasions the sports doctor advised the athlete to come to me because the symptoms were assumed to be psychosomatic, or hypochondria was presumed. It is important to know what expectation the athlete cannot fulfill. There may be a communicational dispute between the competitor and their coach, or the existence of a problem due to some recent life event. Some athletes came for counseling through their parents. In these cases it was worth asking about the sports career of the parent. Were there siblings whose performance could be measured against the athlete's performance? Were there unfulfilled dreams in the family, putting the burden on our client to make them come true? General frames of cooperation between the sport psychologist and the athlete The physical frames of the cooperation needed to be monitored by the psychologist. The scene of the consultations was chosen to be discreet and with no external stimuli. The size of the room was indifferent; however therapy cannot be done in a dressing room or at a coffeehouse. The length of a session always had to be determined, usually 45-50 minutes long. Keeping the frames, predictability, punctuality was especially important when working with athletes. Therefore starting and finishing on time was greatly emphasized. To be able to pay attention to each other, prohibiting the use of a mobile phone and the rules of canceling a session were important, which is in accordance with the regulations of other kinds of psychotherapy. We chose informal language in our cooperation which is often unidirectional in Hungary, but in our case it was important to be bidirectional. Beside meetings after trainings the most important scenes for mental preparation were training camps and the location of competitions.

Contact with the athletes and anamnesis at first interview.

The first phase of our cooperation was the anamnesis and first interview. This is a determining part of working together, this is where I deepened information earlier obtained from the coach, and set the goal of the therapy based on my knowledge of the athlete. This is where I evaluated their internal and external characteristics and their personality traits based on my impressions. We searched together for those focus points where we could start our mutual work.

The most determining points of the biographical anamnesis and first interview are: the athlete's childhood, physical, mental and social development including education. How was the start of their sporting career and its circumstances? Who took them to do sports and why? Were there goals set? Were there friends and acquaintances around them in sporting? Who of the parents follows their sporting career and to what extent? What is the athlete's approach to success and defeat? How is the relationship with their coach? Did their parents or grandparents do professional sports and with what kind of results? What are the expectations of people around them regarding their performance? I asked questions regarding the athletes' personal life, their relations to the wife/husband; parents, girl/boy friends, and friends. Then we continued with self-esteem, introducing their positive and negative traits. I directed problem specific questions at them, e.g. how do you feel what the problem is with you, what should be changed to be able to perform better? What methods did they use to eliminate the problem? Was there any method that helped, how did the parents and how the coach motivate them? In case of junior athletes: the role of parents, pairs and coaches, how they feel about them, what they like the most / the least in sports, how they can manage the balance of school time, sports and privet life? It was also necessary to evaluate what kinds of goals the athletes set for themselves. Where do they calibrate themselves in their own sport? What time frame have they set for their sports career? Whose wishes they want to comply with and how? What kind of material, financial and physical desires do they have?

As a closing point of the first interview came the question of „what can I help you with? The most frequent responses to this question were the following:

- I'd like to concentrate better in competitions
- I'd like to notice my breaking/week points and overcome them as fast as possible
- I'd like to perform in competitions as good as during trainings
- I'd like to keep my parents away
- I'd like to be understood by my coach. -
  I'd like to bring the maximum in me
- I'd like to balance out my imbalanced performance.
- I'd like to have my personal life in order.
- I'd like to stand on the podium in worldwide competitions, in the Olympics.

Following this questions I expressed my observations and suggestions regarding the session, and

emphasized the points where I could offer my help to the athlete. While in most psychotherapies focus needs to be appointed as broad as possible, in case of athletes we need to provide specific goals and ways to achieve them. E.g. I needed to state that I could help in teaching them how to concentrate more successfully, to correct mistakes by certain techniques, to overcome personal life issues, etc. After a few sessions my experience was that most of these competitors were remarkably determined, goal-oriented, experienced athletes who had Olympic wins and worldwide success behind them. There was almost nothing they would not know about kayaking and canoeing, but mental preparation was something they gladly took. I felt enormous trust from Olympic and World champions with great anticipation towards what possibly could be our mutual added value.

Contracting the athletes

Time factor and determining the therapeutic goals were extremely important for competitors. For them everything was measured in time units therefore they thought that their mental performance could also be modified within a certain unit of time.

There were the following possibilities for cooperation:

- Psychological tests: in order to refine diagnostic work
- Counseling: in cases when quick decisions need to be made because of closely approaching competitions.
- Psychodynamic short therapy (e.g. focal therapy): suitable for preparation, for enhancing performance, for achieving various goals in focus. Its panned timeframe is e.g. 5 sessions at first which can be extended on request. - Psychotherapy without time frame: This method suggests approximately 10-15 sessions, where we can solve various problems of anxiety, inhibition, imbalanced performance, personal issues by using psychoanalytically oriented methods even. Most of sport psychologists are similar to other therapists working in different fields. They don't adhere to one typical direction or method; rather try to find the most efficient combination of methods in an eclectic and integrative way to suit the ever changing personality and problem.

One of the sport psychologist's methods is participation on trainings and at competitions. I watched the athlete's motivation, attention span, concentration, and help them in it. Not every competitor would need a psychologist's help but cooperation is essential to most of them.

It is worth mentioning that the current psychological culture in Hungary is undervalued by many athletes and coaches, so I had to face and struggle with the stereotype that „lunatics" use the help of a sport psychologist. Another question that came to surface by the athletes, how the psychologist could help a person and their two other rivals at the same time. This occasionally raised mistrust. It was difficult to convince the competitor that information and secrets do not stream with the help of the psychologist. The psychologist is able to give a tailor-made advice to each competitor. The most commonly used tests in sport psychology, without attempting to be comprehensive, are: CPI, CSAI-2, ACSI 28, Spielberger, Aspiration level test (screw-test), Pieron, Wartegg, Koch's Baum Test If I saw the necessity I also used deeper psychological testing in order to get to know the athletes more in detail, e.g. Szondi and Rorschach tests. I always returned to the athletes with the results and observations of their tests. The most useful time for doing these tests was during training camps.

Cooperation with the athletes

It was important for me to learn the competition system and the current annual competition calendar of the kayak and canoe sport. This was the only possible way to plan the process of the sport psychology work flow. I had to know which periods are calm and free of competitions when more time can be assigned to a possibly needed exploration and healing therapy, and which are those important days packed with competitions when problems may be isolated, wrapped away,

and we focus on preparing for competing. At those times it was recommended to more carefully observe the athlete's physiological condition, how they arrived at the session, the speed of their talk, what current tension they were venting, if that was really the actual problem what they talked about, or what they kept silent about. When it was necessary I used the Szondi test during those months because it increases the efficacy of our work by more easily filtering words from the athlete's sentences where there are real problems lying beneath. Which ones can be ignored, or when does the athlete use defense mechanisms like displacement or reaction formation, which, in case we do not pay attention, can set back the effective help. It was useful to observe the most commonly used expressions by the athlete, the feelings behind them, metacommunication and nonverbal signs connected to them, the change of clothing, choice of colors, hairstyle, typical characteristics of their thinking, and the apparent flaws in thinking. With special attention to flaws affecting self-esteem, like disqualification of positive things, exaggerating negative things, generalization, polarization, „mind reading", „must/have to" thinking – I had to question behind these and ask for an example of the opposite. If the time was appropriate we also explored the background of how these had evolved so that the athlete could become capable of permanently keeping their thinking within the useful frames of reality.

It is especially important for an athlete to handle the impacts of the competitions in the most efficient way because underperforming can have serious consequences in their living circumstances: they may lose their sponsor, their scholarship or the cost refund by their club may be discontinued, which ultimately can force them to give up their sporting career. This is a possible serious burden for those competitors who maintain their living or the living of their family from the income of their sports performance. To make a living of professional sports these days, to plan a sports career for 10 to 15 years is „a house of cards built on sand", but it is an honorable risk-taking at least. It's useful to know all of this in order to be aware of our responsibilities. If the athlete suffers some kind of trauma during the competition period or carries some serious burden from personal life, it may be necessary to work on it even by taking time away from the psychology of competing. A venting opportunity provided in a situation like this, an analytical exploration, questioning, confronting, or recharging with the help of guided affective imagery or symbol therapy exercise can many times push the competitor over the breaking point, thus it will be easier for them to focus their attention on their tasks. It is good if the sport psychologist is aware of the types of trainings done in different period, because e.g. differing symptoms of overexercising occur for athletes in macro-cycles of the preparation period when aiming at developing various skills. There are Addisonic and Basedowic types of overtraining depending on whether parasympathetic or sympathetic processes of the nervous system dominate. One of them is characterized by dejection and desire for more rest which is reflected in increased waking pulse. The other isn't reflected, however the athlete can sense it by sweating under circumstances when other times they don't, their breathing becomes futile, their actions precipitant, superficial and inaccurate, they feel rushed, they get „overexcited". They react to sensory-organ stimuli on a lower threshold level thus becoming querulant, mentally more irritable, their anticipation tolerance may reduce. This can cause conflicts in training camps due to being „locked up" and in constant rivalry. „Most common reasons of over-training: neglecting rest, quick increase in load and as a consequence adaptation does not finalize, quick increase in load after forced resting times (injury, illness), long-lasting maximal and sub-maximal exercising without sufficient resting time, forced technical training of complicated movements without sufficient and active resting time, excessive number of competitions frequently disturbing personal life or with lack of training, one-sided exercising, lack of trust towards trainings. Factors that lower the performance:

Lifestyle: too little rest at night, irregular daily routine, alcohol, nicotine, (drugs), insufficient living

circumstances (noise, congestion, insufficient lighting), lack of free time, in-proper way of spending spare time, lack of releasing tension, insufficient diet, stressful lifestyle. Environment: excessive number of family errands which take up strength and abilities, tension in the family, love disappointment, jealousy, overload at work or in education, family environment against sports, excessively exciting entertainment. Health problems: illnesses with fever, gastrointestinal disorders, chronic or focal processes in the body (tonsils, sinusitis, ovary infection, neglected teeth), after-effects of contagious illnesses or medication (e.g. antibiotics).

Symptoms implying over-training: increased irritability, pointless resistance, being more prone to arguments, lack of keeping contact with the coach, hypersensitivity to criticism or strongly phlegmatic, lack of eagerness, moodiness, signs of depression, insecurity. Changing coordination of movements: more convulsive movements, inhibitions, feel insecure, problem with the rhythm of movements, lack of focus, reduced ability to correct mistakes, reduced endurance, deteriorating speed performance, reduced freshness and explosiveness. Reduced level of fighting skills, fear of competitions, failure in difficult situations, especially in implementation, panic-stricken in a fight, giving up on own tactical ideas, hypersensitivity to receiving demoralizing effects, prone to giving up competition." Almost all of the above listed problems occurred among our athletes. I had to give feedback to the competitors and their coaches about these. It was especially worth it to pay attention when the athlete was in an elated state. They were capable of rushing themselves into over-exercising when this happened, which was followed by a lasting breakdown. The same consequence followed when they tried to direct their attention away from a love disappointment or from the memory of a low-performance competition by exercising harshly.

Situation before the Olympic Qualification 2012

In a qualification type of international competition it is the other Hungarian competitor who is the main rival for a Hungarian athlete because besides their own performance the rival's result can influence the qualification for the European or World Championships, or the Olympics. Before a significant race the participating athlete's inner tension increased from hour to hour. Breaking the frames could become more frequent at these times: text messages or emails about practice results, phone calls that seemed insignificant about a blood count, sports-tool, sports equipment. The unconscious goal of these may have bee to provoke reassurance and encouragement. Athletes with histrionic traits may introduce „mysterious" states of fever, vomiting and diarrhea, but if we do our job well the athlete will soon be excited to show how much they have developed recently. One of the athletes had hand tremor before each larger competition and even maintained this symptom as a mascot. They got scared eventually when the feeling didn't occur. This means that negative sensing can often be turned into positive, which stimulates magical thinking.

In the first phase of the psychological preparation I often heard from the athlete saying „I must race well!" or „I must do this well!". These thoughts can act as blocking, raise blood pressure, worsen the coordination of movements, and stiffen muscles that were loose until then, narrow down thinking and make movements convulsive. They can take away the essence of sports, the joy of doing an auto telic activity, spending time out of passion, being playful, so they reduce the act of sporting to be rather hard labor, thus generating natural failure.

This is why it is important that we question why it is a „must", why they „have to". First we might encounter some resistance mixed with shock displayed on the athlete's face: „Is this why I came to a sport psychologist to talk me out of success? Both my father and my coaches taught me for years that we must want good results." We can continue questioning until we indirectly make the athlete realize: this is their choice. They do what they do because they want to do it, they feel like doing it, they enjoy this lifestyle; they wish to finish a race with a good result. This revelation frees them from the external pressure of a good

performance and transforms it into an internal motive (NLP technique: transforming pressure into purpose). Over-mystification of will is typical to the world of professional sports. If the athlete qualified for an international competition and got scared of the challenge, I asked if there was any of their mates who had participated in the qualifying competitions also with the aim of qualification however did not manage. So what was he or she able to achieve, what characteristic does he or she possess to be the one who qualified? This way I made them realize that one joyful goal had been fulfilled. They could participate in the earlier desired international competition. (Combination of NLP time-line and resource techniques.) It is quite typical that mental state of the athletes changes in a special way before major competitions. One of these typical changes is that they become more impatient with their environment, because they already turn to the inside, mentally they're already at the competition, anticipating events to happen, the small things make them angry which would not cause problems at other times. Bearing their partner, parents or small children gives them a hard time, and the small everyday errands annoy them as well.

They often feel that they would like to be a few days older already, to bring events forward. This is a dangerous anxious state, anticipating accidents even, as they cannot focus on the present as much as it is needed. The sport psychologist's task is to notice this modified mental state and to show a technique how to overcome this tormenting, tingling feeling and the weakness in the limbs caused by the anxious state, as well as to give solutions and make the athlete practice how to stay in the „here and now", how to maintain necessary attention. It is useful to verbalize (without understatement!) why this forthcoming competition is so important, what they can lose if they underperform, and what to win by it if they succeed (keeping this order is important because first we bring their unconscious fears to surface this way, and then we make them collect resources). We may call this analyzing the stakes. It is also worth to always ask before the athlete travels to a competition where they would prefer to be instead. After some thinking and a few funny ideas the athlete usually states that exactly the place where they're heading. They can experience the feeling this way that boarding the plane or bus is a reward already. A smile appears this time on their face following that „aha"-feeling, realizing what this unusual questioning has been about, and the psychologist receives reinforcement regarding how useful some methods of NLP can be in sport psychology, like in this case reframing was.

It is worth recalling in modified mental state what they did right at action level during their previous successful competitions, as well as how that series of well done action and the following success felt (NLP resource seeking), who are the people with them, thinking of them, cheering for them (grandstand technique). It may hide danger during the forthcoming competition that the athletes tend to forget what serious effort, occurring pain, collected manners and good concentration the previous well-performed competition needed. After a successful competition and before the next one it is especially important to recall all the efforts, pain and concentration the well-performed competition took, because most of the time they register something successful afterwards as if it had been easy, and get surprised when the forthcoming competition demands concentrating or pain-tolerating efforts. By the time they detect this and it becomes conscious without being tuned to it, it is often too late already. I had a dilemma how long I could let the athlete stay in euphoric state after a successful competition. It is difficult to provide sufficient level of concentration in the excited, hyper-vigilant state of euphoria.

Competitions that demand great concentration level are often followed by a state of emptiness, often weeks are needed to pass so the athlete can get motivated again, as they say, to „bite" for the competition. It is useful to teach the athlete how to assess the CSAI-2 test thus giving a self-regulating method in their hands which they can openly turn to while we are not present. With the help of the self-assessment sheet of the CSAI-2 test the

competitor can realize whether it's their somatic or cognitive anxiety level that is high, and if their self-confidence is at an appropriate level or not.

If the somatic anxiety level is high, they can use autogenic training or any other relaxation method. If it's the cognitive one, it is worth going over the races of the following day in the mind: what kind of personal formula they would use and where in order to bring forth the desired performance, or they can go over the races in mental training, and write a schedule in the evening of what they need to do the day after. If self-confidence is low, they can recall the most successful race from their earlier competitions, they can make an inventory of their strengths, good competitor qualities, and they can mark and repeat the helping personal formula for a good performance. Releasing anxiety: We often find anxiety in the case of athletes which may have occurred already in childhood as they have been under great pressure (performance pressure). The real or anticipated lack of expected performance (especially in a situation at stake) generates fear and anxiety. Many times the athlete doesn't feel it even though several vegetative reactions and symptoms denote it. They can't differentiate it (they need to be taught), they experience it globally, they resist it, repress it, deny it, or they do experience it but cannot verbalize it (pseudo alexithymia). I had to get acquainted with the diagnostic and dynamic elements of anxiety in order to be able to help, to have an overview of the situation, to understand the problem, and to be able to decide what plan (therapy) to follow. Diagnostic elements: what symptoms of anxiety occur: somatic, of the vegetative nervous system, emotional (mainly related to danger), or cognitive reactions (e.g. anticipated „what will happen if ...”), what the circumstances are when they feel anxiety (triggers, analyzing situations), how often (frequency) and for how long (time period), intensity, to what extent it limits performance. Dynamic elements: revealing unconscious anxiety beside conscious fears, evaluating personal and social resources, like the athlete's primal instincts, controlling mechanisms, regulation of their self-esteem, self strength and weakness, social object relations and their relationship to these, as well as realization of these (on what level). It needs to be explored how they cope with anxiety, what techniques they use to reduce it and how successfully, to map defense mechanisms whether they gain sickness benefit from it and in what way. Primary sickness benefit: how they „maintain” it, secondary sickness benefit: how others contribute to it, but this is less typical to athletes. Once we evaluate all these elements we can form a picture of the athlete and the role of anxiety, as well as its weigh in the athlete's life. It was important to draw their attention to it that being angry and furious about unchangeable circumstances can greatly deteriorate attention and performance, just as much as starting to celebrate themselves does, before they have crossed the finish line. It was necessary to recognize these mental phenomena, to make them conscious and to change them, all within a fraction of a second. Crossing the finish line in the condition of fatigue is an individual science. Our competitors said that they felt such pain before the finish line as if a wall of concrete had been pulled in front of them. One can cross this wall not by power but by heart, by emotions and by conditioned movements. We could see after most of the competitions what leaden tiredness the competitors were having, almost collapsing.

In most sports the „cool forehead” exercise of autogenic training can be well used as it facilitates objective, rational thinking, and a state where the process of movements can be well executed. If someone is bothered by the presence of an audience, in order to close this off we can recommend the image of a shell similar to a car with tinted glass windows (which is transparent from the inside), in case of a double fight the opponent should be clearly visible (torch flash technique), or to imagine the audience in darkness. (Things to consider: extraversion, disposition for exhibitionism, or introversion, desire for hiding, and the shell-image is rather contraindicated with claustrophobic condition). The aim of symbol therapy exercises in sport psychology is to separate and differentiate things that are useful or harmful to competing well, and to make the athlete become aware of them. We can make them write down, make a drawing of or explain the pictures that surface. This can be an exciting experience both for the client and the sport psychologist, and develops the client's self-awareness exceptionally well. After a less successful competition or at the end of the competition period it can be useful to invite e.g. the „second-hand dealer” exercise of symbol therapy, whom the competitor can get to take away whatever they would gladly leave behind at the given competition or of the latest competition period.

Days between qualifying sessions and finals have their own problem points (post and pre-stress on the same day). Part of the competitors sees the day after a successful qualifying session as if they were over the whole competition already. Knowing to be qualified after a whole day of strained mental and physical work can create a state similar to exhaustion, which does not help either revitalization or mental preparation for the next day. Attention may scatter. Thus the tasks for the day of the final, the necessity of refreshed concentration and pain tolerance can take the athletes by surprise. It was a task to be resolved both for the coaches and for me what kind of work to give for the athlete which facilitates revitalization in an active way and maintains the level of task-consciousness. As focusing is important for athletes, we can teach them a concentration and attention focusing exercise on a session. We would all love to constantly repeat the good feelings that successful moments of our life give us, therefore I made the athlete collect two or three memories from their earlier life which – because they were successful – made them feel filled with happiness. We compiled short, 20 second long films of their memories which were manifestations of successful and happy moments. During the imagination I made the athlete recall the senses of as many sensory organs as possible, e.g. made them see themselves together with their relatives at a nice Christmas celebration, or when they got their first dog, or when they achieved their greatest sports success. I made the athlete edit a 1-2 minute long programme of these short films, which was only theirs. During concentration time before a competition they would recall the joy of success and keep the world out with the help of this. This series of experiences generates an internal smile for the athlete, they feel the atmosphere of their success and will want to repeat it. They get into a phase of flow where win and relieved racing will get closer to them. For example everyone had their own „film” for concentration by the time the London Olympics started. Another method which our athletes used at different sports locations is setting the safety or reality point, which they could look out to any time during the competition whenever it was necessary. It may be a flag, a lamp, the edge of a stand, etc. which they can communicate with in a glimpse. This point represents for them the reality of the race, the power of determination, and the actual time and place. It can give a new boost, a new revitalization in long-distance (1000m) competitions. If the athlete can't see or hear the coach or the coach is not present for some reason, this point can help them to notice their breaking point, to press „reset” at a losing point, or to give more strength when winning. Because of common magical thinking in the case of athletes, this exercise can be utilized and easily fit in with the circle of different rituals. A similar exercise is the operational control of the athlete's body parts, before a competition starts. The exercise takes approximately 30 seconds. During this time the competitors move their body parts in a seated or standing position, keeping off external stimuli, focusing only on themselves. It is important for them to know that whatever runs through them this time is like the computer system of a car, which checks everything after ignition. Thus the athletes will check and get each and every body part of them in motion from their toe up to the top of the head, by the control of their central nervous system. I also found it important during our mutual work to deal with aggressiveness of competitors, which none of the sports would go without. Striving for a win does not exist without aggression. If the personality of an athlete lacks aggression, it needs to be developed by different techniques in order to boost performance. Aggression used in case of athletes differs from that needed in everyday life. Special cooperation with members in team boat Being selected as member in team boat usually happens based on physical performance. Competitors get selected by coaches and sport leaders

who evaluate their previous and current physical condition. Their experience, routine level and cooperation skills also play a role. The task for the sport psychologist in case of these units is to form mental cooperation and sensitivity towards each other among members. Necessary generating conversations wit the teammates about everyday life as well as intimate questions in certain cases, clashing positive and negative characteristics of each other. Individual preparation of the members revealed that all four of a K-4 had a different way of thinking in certain life situations and that they had no knowledge of how the other would react in various circumstances. In case of K-2 and K-4 these joint discussions helped a lot in providing world class performance by members of different age and experience level. Besides having conversations about sports performances, we openly talked about personal life, sex, religion, etc. without taboos.

Relaxation

It is essential for athletes to learn at least one relaxation method as a skill because of their lifestyle and objectives.

„We refer to those healing methods to be called as relaxation which aim to develop the psycho vegetative balance with the help of attuning affective-vegetative mechanisms.

From a physiological aspect relaxation has a resting and regenerating effect. It means a pleasant emotional state, calmness without tension. Relaxing is a condition when the body, mental and emotional state calms down without necessary passivity or total emptiness, it rather enhances action tonicity and creativity in a way that it makes parasite muscle action reduce. Based on this we can categorize relaxation to be a process which regulates affective-vegetative mechanisms." Schultz's autogenic training (AT) „The point of AT is to learn how to conservatively switch to a relaxed tone through rational practice. „The basic level of AT consists of the following6 exercises: 1., The exercise for feeling heavy – neuromuscular system, 2., the exercise of feeling warmth –vasomotor system, 3., the exercise of the heart and 4., the exercise of breathing - cardio respiratory system 5., the solar plexus exercise - gastrointestinal system 6. the cool forehead exercise is about regulating vasomotor functions of the head.

Mental training!!!

„There have been several imaginative techniques developed by which the athlete performs movements in imagination, either in a seated or laying position, with eyes closed. They analyze their moves, the tone in each muscle, similar to how they do during training but by paying more attention. They can observe in a slow motion what and how they do. There can be more emphasis on details therefore this can have a significant role in learning and correcting movements. During the imaginative practice they have the option to dwell on certain critical points, they can see themselves from outside as well as they can feel from inside how the body and muscles work, if they use their imagination to learn and remember moves. The aim is not only mental practice of physical activity but also to frame the mind by meditative elements. The so-called „inner mental training" can be divided into three phases:

1. Mental conditioning – reaching modified mental state and relaxed condition
2. Mental technical training – achieving self-control by suggestive sentences
3. Training of mental firmness and endurance through which a state of focus can be obtained regarding moods, self-esteem and following objectives."

We used other types of mental training as well for a few athletes. We walked or drove their competition distances several times along the race courses. We marked and enforced those points externally which were important during the competition. This was another point of view for the competitors as they had known this feeling until then only from being on the water. We also visualized the race courses at their accommodation, drawing them on paper or on bed sheets. According to the athletes these drawings and the marks and steps on them were important in order to achieve maximum concentration. Rhythm, inner music is also a certain kind of mental training. I asked that the athletes create a collection of music they liked which matched the rhythm of their top performance. Many of them used this conditioned music which they listened to several times, and found it very useful during competition and preparations as well. The internal rhythm helped them fight fatigue, to keep their own rhythm, and to avoid breaking points and haste that competitions bring. Symbol therapy It is an imaginative, meditative and expressive method. It is a method whereby we work on and with thematic images visualized in modified mental state caused by basic relaxation exercises. With its help we managed to successfully influence body functions and reactions of the personality. In modified mental state it is possible to create or to come feelings, images, and relations, experiences into existence which is partly or completely independent of reality. However it is possible to experience with it situations and successes which become an aim to feel. The role of induced modified mental states and images in sport psychology is: transforming the focus of attention, attitudes, labeling, evaluation, emotional charge, experiences (images), and creating goals and directions. Symbol therapy mixes Coué's autosuggestive method with Schultz's autogenic training and Leuner's guided affective imagery. It is suitable also to make the client conscious of problems and solutions during therapy which they would not want to talk to us about.

The closing of our work together There are certain phases of the cooperative work and contract between the athlete and the psychologist. Phases usually end with the realization of focus points, like World and European Championships, the Olympics, etc. After these events we must do a recap which will close the work of the previous period. The closing of the therapy ends with evaluating the mutual work of the athlete and therapist. If we feel that answers have been given to problems raised by the athlete, that they are more successful compared to previous performances, then we can feel free to ask our client regarding what they achieved by working together with a psychologist. Let them tell in details what they see differently now, what they have got through, what they have developed in, and what future tasks lie ahead of them. We analyze and interpret their observations and opinion, and compliment them for their efforts if possible. As we usually need to give feedback after the cooperation to sport leaders, we need to mention again the facts of confidentiality. We need to tell them that what they haven't prohibited or don't claim during this conversation to be a secret, we would willingly use in our feedback to the coach, etc.

Feedbacks

I had to give feedback about the work with the athletes many times already during the process, but most of the time after we had closed our cooperation. In situations like this I certainly had to follow the above mentioned procedure, maintaining discreetness. I had to share what motivates the athlete the most, what phase of their life they're in based on my observations, what significant events motivate them. If I had the opportunity I tried to tell as few negative points as possible. After the success at the Olympic Games it became apparent to everyone that working with a sport psychologist added to the outstanding results our competitors had. Returning from London our athletes found themselves in the focus of media and public attention, however these „stage lights" did not pay off, leading to mistakes. I want to give an exceptional thank you for her cooperation in professionally supporting my work to Katalin Szilárdi psychologist, coach of the Rudolf Dombi - Roland Kökény Olympic gold medalist kayak duo.

APPENDIX 2

ATTILA SZABÓ (HUN MASTER COACH): THE PRICE OF REACHING THE OLYMPIC CHAMPION TITLE FROM THE ASPECT OF A COACH

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Keywords: increasing performance, work of a coach, association operational framework

As a world champion canoeist I took part in the Olympic Games and my greatest achievement of my coaching carrier is an Olympic Champion title in 2000. Besides this result my trainees were successful in European and World Championships as well.

With this article I would like to summarise my long years of experience in canoeing as athlete and coach regarding the connection with athletes for achieving their best performance.

It is very important for a professional athlete and his/her coach to make good decisions at the right time! This could determinate the entire career and influence the private life as well. These decisions concern every aspect of our lives; however it is even more important in our profession. The coach's work is to consider all the alternatives then to choose the right way. The only thing that is sure, that we can achieve our aims only if we have enormous humility towards the coach profession and the sport itself. It is necessary to indoctrinate our athletes with this ethical attitude in order to they become world class athletes.
Among the several circumstances, the most important is the creation of the training system based on the individual performance, in which the athlete can endure the workload that fits for his/her age. This system was built based on the tradition of this sport in Hungary, experience and the specific training methods learnt through the years. The main issue of the sport is how to introduce the talented young sportsmen into the world famous adult team. In our days successful coaches often have to face this problem but we tend to ignore them. Of course, professional sportsmen are provided with everything by the Kayak Canoe Association which is necessary for their preparation but this is not the case with the second line sportsmen. It is a thankless task to decide who should be promoted for the future Olympic athletes and this decision is made by the coaches. It does not always please the elder professional sportsmen so a conflict can arise against a less experienced but talented young athlete. Unfortunately the young, coming from the nature of their age, does not endure the everyday performance based duplicate trainings and the stressful situations coming from the confident personality of the professional sportsmen. The outcome is: they give up the competition!

On national level, one coach has many athletes, and the problem is that he can only deal with the most successful ones with maximum attention. One of the solutions would be if more coaches could deal with the athletes in a team so more time could be spent on young talents. Unfortunately in the recent economic situation many sportsmen struggle with everyday financial problems. Despite many problems, they train conscientiously and prepare themselves for the next competition period in order to achieve their goals.
In the following, I am listing different point of views, which help us to become an exponent of the sport.

Innate conditions:
These conditions determine the possibilities of a sportsman during his career, but they can be developed. The acquired abilities can be developed greatly with trainings and these features are the most determinant in the case of the preparation of a kayak-canoe sportsman.

Characteristics of a talented sportsman:
Due to trainings, he develops faster than his mates and gets better results. He responds advantageously to the increase of training load. Due to this fact, the amount and intensity of workload can be increased sooner for him. According to the planned training work his results improve continuously. He/she requires less time for adapting the acquirements of the basic technique. He successfully accomplishes the required technical and tactical instructions. For restitution time his body regenerates faster than his teammates do and that is why he can accomplish more and more intense training work.

Technical skills:
In order to reach a perfect technique, long-run instructions are required. Actually, a kayak-canoe athlete improves his technique with the help of his coach from the beginning of his career till the very end. I try to adapt new techniques to my own sportsmen experienced during a competition but this would be only copying! It is always necessary to attempt to work out and make up such new techniques, which fit to the individual and with which we are well before the front-rank of world! Among coordination abilities the most important is balancing ability. We already start developing it in childhood. We should deliberately train our competitor for it. The perception of movement and the spatial- orientation ability considering the nature of age is developed and cultivated with trainings. We can form the good technique for our athletes with the raising to ability level of these mentioned skills.

Physiological ability:
The most important abilities of the kayak-canoe sport are the conditional and coordination abilities which can be developed with high efficiency as a consequence of trainings. Basically, canoeing is an endurance sport therefore the main objective is the appropriate development of circulation. Most time should be spent to train the aerobe ability. In the case of young athlete the main objectives are: development of long term endurance, expansion of the aerobe capacity and evolvement of the capillarization. The maximum standard endurance of competitors of 1000m should be worked out in the course of the trainings. Coordination of endurance and rhythm helps the development of an efficient movement technique. 200m was declared as an Olympic distance in 2009.
200m requires a special training plan and training work as well. For development of strength conditional abilities, maximal- and sub-maximal-strength trainings are determining. The main aspect is the development of the strength and speed endurance. Special trainings are necessary to develop speed. This takes time since all types of it can be used in short distance. Practicing of reaction, movement speed or speed up, reaching the maximum speed requires respective training work. Appropriate time should be expended on the development of movement shift speed.

Mental ability
On one hand it is a hereditary property and on the other hand it can be developed with a great efficiency. Remember the complexity of personality or character training. The professional coaches are doing a hard work as they have to work with already evolved personalities. Development of sport intelligence is important, the coaches of adult sportsmen can progress in it. In the case of training of professional sportsmen, one of the most important points is to evolve a good mental condition. Remember the problems, were caused among athletes by the changing of the shape of boat bodies and introduction of Wing-kayak paddles. Recently the main question is what type of boat and paddle should be used. This is a professional question how the athlete can live with the conflict caused by that change. The goal is always to be positive and confident with the change. There is a problem if we don't have the most up-to-date instruments. Earlier the German developed a new boat body for each Olympic by which they mentally gained advantage over their competitors even at the beginning of the competition. The better properties of their boat compared with the others' was not always proved to be true but they gained a psychical advantage over the competitors.

High level of workload toleration (trainability)

During the training of a sportsman it is always an important task to be able to supply newer and newer stimuli. Incorporation of a new stimulus is almost 3 month which equals with a macro cycle. Workload can be increased with the cycles continuously thus the competitor can adapt better to that load. A higher training-stimulus can be incorporated into the preparation of a competitor by this method. There are numerous means methods that can be used for load increasing. E.g. long term and interval trainings. Increasing the intensity, reduction and increasing the resting time, trainings with boat brake, course rowing, divided partial distance trainings, time attack rowing, etc.

Adaptiveness:
This factor is very important especially in competitions. It is necessary to be adapted to e.g. weather, wind relations, warm, cold, sunshine, rain, etc. Warm water training camps and international competitions when e.g. the time difference, the climate, different meal customs, food, imperfect recreation, tiring journey appears as a plus load. Regarding these the sportsmen have to develop their own general surviving toolkits which help them in the adaptation process. Our competitors have to be educated in a way to be certain that usually it depends on them what happens with them in the various training and competition locations. The full-fledged sportsman concentrates to the full thus there will be no negative change in his performance but characteristically performs his personal maximum level.
He has to be adapted to the new boat bodies and paddles which come out in almost every year and keep up with the professionals of the world. I know many successful competitors who became especially confused by such a change and this was the reason why his sport career was given up.

Personal characteristics:
Training plan is adapted always to the best athlete. Of course, if a coach has more than one successful competitors, trainings fit to personal needs can be solved by differentiation and setting up more trainings. In competition period many times occur that I hold trainings 8:00-12:00am till 3:00-6:30pm to the crew units C1-C2-C4. According to the new training methods large percentage of the trainings occurs in marked off courses. Without this method we wouldn't be able to be effective and successful in the international level. Cruel laws dominate in first class sport; the weak should always be adapted to the stronger. Many times this takes its toll since competitors with weaker abilities will end their sport career. However, the aim is to reduce the drop off process to a minimum level.
Goal: Our sportsman should seek the opportunities of personal development in personal characteristics.

To undertake challenges, to be engrossed with activities, to have an open mind to take up the new and to look for the change and development, these are the characteristics of first class competitors.

Lifestyle
In kayak-canoe sport many times we train 6-7 hours per day. Consequently, the right set of rate of workload and relaxing is also a main viewpoint. We have to teach the sportsmen to complete the high-level training workload he needs and also how to have an adequate relaxation as well. A certain rhythm of life should be formed from the beginning of the career. We have to teach the sportsmen to keep and create an adequate daily routine. Sleeping before midnight is the most important in point of relaxation.

Social background
Appropriate family background is important as it ensures and helps the career furthermore, the development of a sportsman. Financial background of the family is an important factor since canoeing does not belong to the cheapest sports recently. Not all families can afford to undertake the costs of competitions and purchasing the equipment. It is important to gather and control appropriate friends. Absence of good friends can be the most damaging since it is easier to give head to the temptation than accomplish hard work. The financial situation of the club

of sportsman is very important furthermore, it is not neglecting what kind of professional, social and existential background the association can provide for its competitors. It is typical for coaches and teammates as well that they are capable to reveal and utilize the latent and hidden abilities in the course of thinking together. It has a role in forming of team boats! I have seen many times that a competitor solves his own problem if he had not enough personal knowledge in a way that he organizes a team and find the solution together. These persons are committed and help the work of the coach

Adapting to social demands:
Meeting the requirements of the Sport Association, MOB and the public feeling. Efficiency pressure coming from the tradition of this sport and when somebody goes to (World Cups, European- and World Championship(s) only the first three places are acceptable. We have to prepare ourselves for the occurring failure and the coach should think of how his athlete treats it?
Financial supporting and the appreciation of his own, the coach and the club depends on the performance of the exponent of a sport as well.
Meeting the requirements of sponsors, supporters and local governments. Keeping contact with them continuously is also a big task. We speak much about the role of media. It is usually harmful in the life of an exponent of a sport. It does not always help him and his results if he is always at the fore.

I could perhaps put this viewpoint to the first place. The most important fact, that during years such relationship should be formed between the coach and the athlete, which takes for their whole life. I think it depends greatly on the personality of the coach. In these years, during training and education we should form such relationship with our competitor that he trusts his coach implicitly. He should accept and accomplish the exercises ordered by us. A positive self-estimation approach should be formed in the competitor in order to he can see clearly the continuance of his own development and the results of his self-perfection. As a result of trainings he lives his everyday life as a person who is capable of renewing and improving. He must be aware of that he can reach it only together with his coach through interactions. We always must attempt to keep the written and unwritten rules of ethic and moral. Of course, through our personal example. The so far acquired results (from the side of competitor and coach) make somebody authentic. Besides these it spreads quickly in a small group how reliable and fair somebody is. It is also important to involve the already accomplished active competitor, exponent of a sport in the creating activity. Of course, in a way that the will of the coach does not damage. I could list several viewpoints, which existence or absence can influence the preparation of a kayak-canoe world-class. The above mentioned viewpoints were assorted by my own experience. Most parts claim own chapter, I would like to elaborate them later.

APPENDIX 3
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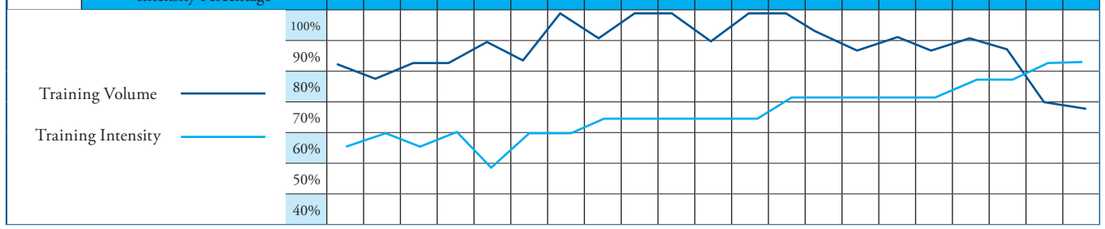
APPENDIX 4
ANNUAL TRAINING PLAN FOR 2012

ANNUAL TRAINING PLAN FOR 2012

ATHLETE'S OR GROUP'S NAME:						**COACH:**								**SPORT:**									
DATES	MONTHS	JAN.12				FEBR.12				MÁRC.12				ÁPR.12					MÁJ.12				
	WEEKS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
COMPETITION CALENDER	LEVEL, LOCATION, DATE																				WC1, Poznan, 18-20	WC2, Duisburg, 25-27	
PERIODIZATION	Mezo Cycles	1				2				3				4					5				
	TRAINING PHASE	SPECIFIC TRAINING								PRE-COMPETITION TRAINING													
	No. of Paddling	2	2	2	3	3	3	5	5	6	7	8	9	10	10	11	11	11	11	11	11	11	
	Ergometer / Pool Paddling															1	1		1		1		
	Strengh Training	5	5	5	5	5	5	5	5	5	4	4	4	4	4	4	3	3	3	3	3	3	
	Running	4	4	4	4	4	4	4	4	4	4	4	4	2	3	3	3	3	3	3	3	3	
	Swimming	4	4	4	4	4	4	4	4	3	3	2	2	2	2								
	Others (Games, Mountaineering)	2	1	2	1	2	1	2	1	2	1	2	1	1	1	1	1	1	1	1	1	1	
	Total Training Volume/W	17	16	17	17	18	17	20	19	20	19	20	20	19	20	20	19	18	19	18	19	18	
Peaking Index																							
Testing Dates																							
Medical Control Dates																							
	Intensity Percentage	55	60	55	60	50	60	60	65	65	65	65	65	70	70	70	70	70	75	75	80	85	



YEAR:							**FEDERATION:**																
JÚN.12				JÚL.12					AUG.12				SZEPT.12					OKT.12				NOV.12			
22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
WC3, Moscow, 01-03						OG, London 2012										National CH, Tehran									
6				7					8				9					10				11			
MAIN COMPETITION TRAINING																		ACTIVE REST							
10	10	10	10	10	10	10	10	10	10	10	10	10	8	10	8	10	8	10	3	4	4	5	5	6	5
3	2	2	2	3	2	3	2	3	2	2	2	2	2	1	2	1	2	2	2						
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																			1	1	1	1	1	1	1
15	14	14	14	16	15	15	15	15	14	15	14	14	11	13	11	13	11	14	8	7	7	8	8	9	8
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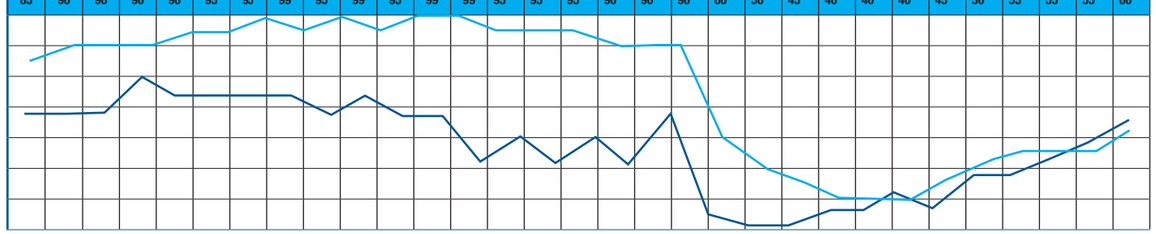

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																															4
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																			1	1	1	1	1	1	1	1	1	2	2	2	61
																															27
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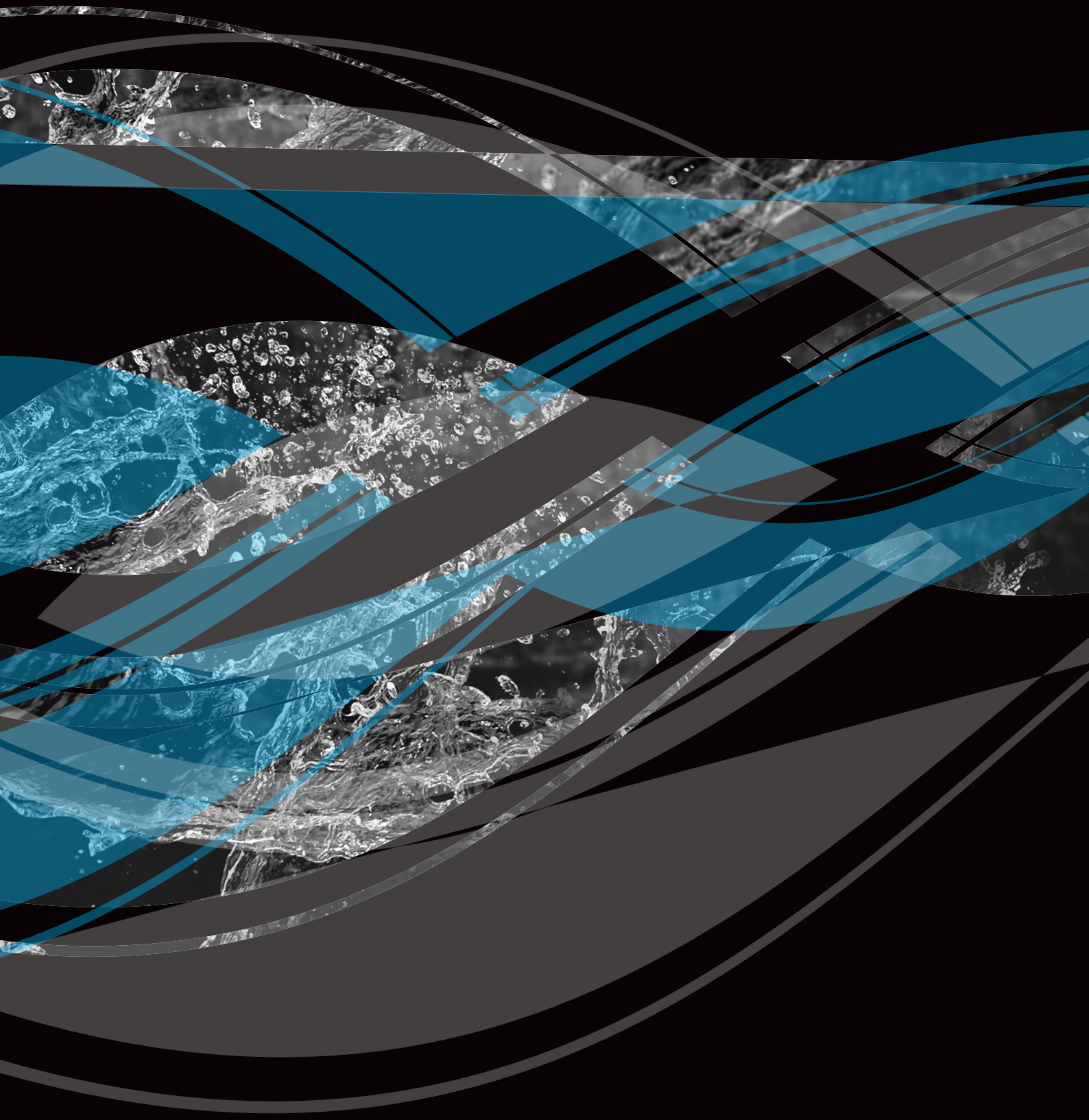

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