# Land and Water Differences

## Physical Properties of Land and Exercise Considerations:

### Body Weight & Gravity

- Gravitational force is consistently downward.
- The environment doesn't change its effect on the body without adding equipment.
- Weight of the person's body is consistent.

### Temperature

- Core body temperature increases quickly and can be regulated somewhat with clothing.

### Resistance

- Air resistance and a 3-dimensional effect is negligible.

## Physical Properties of Water and Exercise Considerations:

### Temperature

- May create lower body temperature and make thermoregulation difficult.
- May lower heart rate.
- May dramatically alter perception of exercise intensity.

### Body Weight & Buoyancy

- A submerged body weighs approximately 90% less than land weight.
- Balance and coordination need adjustment in response to buoyancy.
- Impact (the feel of gravity) is dependent on body composition and water depth.
- Buoyancy reduces stress on joints and connective tissue and provides support.

### Resistance

- Resistance is approximately 4-42 times greater in water and depends on speed and surface area moving through the liquid (average is 12-15 times air).
- Resistance is 3-dimensional which can enhance the development of muscular strength and endurance in unique range of motion. Multi-dimensional resistance encourages agonist/antagonist muscle balance and parity.

### Hydrostatic pressure

- Hydrostatic pressure is greater than air, equal on all sides and increases with water depth.
- This pressure challenges the breathing mechanisms and assists with circulation, working as an auxiliary heart pump, increasing circulation. (May account for lower heart rates especially when the lungs are submerged.)

## Water Properties Applied to Basic Training Principles:

### Muscular Conditioning

Resistance varies with *exertion/intensity* regulated mostly by the effort.

Moving in water can strengthen the *erector spinae* in the back; *leg muscles* and *abdominals*, especially for students below the norm in fitness levels. This effect can be achieved while using water's resistance with the body in a vertical, functional posture.

Just as in the weight room on the land, overload equipment needs to be added as clients become strong.

Working in a buoyant environment, with lower joint stress, may increase possibility of extending *duration* of exercise for muscular endurance objectives.

Resistance level can be individually adjusted instantly by decreasing or stopping effort.

### Cardiorespiratory Fitness

The heart functions more *efficiently*.

Decreased gravitational pull and hydrostatic pressure *increases* uphill circulation.

*Monitoring* heart rates manually is more difficult; heart rate drops quickly, water motion makes pulse more difficult to count accurately. Heart rate monitors along with RPE are the most effective method.

*Buoyancy* allows participant to workout for longer duration without increasing risk of injury.

### Flexibility

Natural water movement and warm water promotes muscle relaxation, encouraging *full range of motion* and active stretching after they are warmed up.

### Functional Fitness

People who need to maintain, or recover function of normal movement, can train in the pool for cross-over benefits during activities of daily living on the land.

### Other Factors

Increased *Hydrostatic Pressure takes lactic acid* out of the cells and delivers it to the liver more efficiently. Muscles do not feel as sore after exercise.

*Dehydration* is still a factor in performance. Clients should be encouraged to drink before, during, and after workout sessions.

*Cooler* temperatures keep the core at 98.6° more consistently, facilitating longer periods of high intensity exercise.

## General Benefits of Exercise in Water:

Aquatic therapy combines the properties of water with exercise to produce the following documented physiological changes:

- Increased circulation
- Increased heart rate
- Increased respiratory rate
- Increased metabolic rate
- Decreased blood pressure
- Redistribution of blood flow
- Decreased sensitivity of nerve endings

The positive therapeutic results can include:

- Relaxation
- Reduction of pain and muscle spasms
- Increased range of motion
- Increased strength, power and endurance
- Cardiovascular endurance
- Psychological well-being

Contraindications to water exercise:

- Individuals with diminished respiratory functions or capacity
- Bladder or vaginal infections
- Hypertension
- Severe hypotension
- Infectious diseases
- Known allergies to infectious diseases
- Post-surgery open wounds.

*Source:* Fawcett, C.W., R.N., M.Ed., ATC (1992) Principles of Aquatic Rehab: A New Look at Hydrotherapy. *Sports Medicine Update*. Vol. 7 No.2. Summer 1992.

## Buoyancy/Hydrostatic Pressure

Archimedes' Principle describes *buoyancy* as the upward thrust exerted on an immersed object at rest as a force equal to the weight of fluid which is displaced.

*Hydrostatic pressure* is defined as the thrust of the molecules of a fluid upon the entire surface area of an immersed body. Hydrostatic pressure against the body increases with depth.

**Buoyancy's Effect on the Body and Exercise Design Considerations:**

**Body Composition, Impact, and Balance**
Buoyancy acts on the body by pushing upwards; each individual responds differently depending on body composition, height, bone density and overall surface area.

The arms and legs have a different degree of buoyancy depending on body composition and lever length. Lifting an arm overhead and out of the water decreases the buoyancy of the body.

Impact will vary due to water depth, the amount of body surface area immersed in the water, body weight, and composition.

Gravitational forces are decreased with water depth changes:

- Waist depth (lungs not submerged)–50% decrease; feet are used as a base of support.
- Above xiphoid process, lungs submerged–85% decrease; feet less stable base of support.
- Neck-deep water–90% decrease; without buoyancy equipment, feet less stable base of support, suspended with buoyancy equipment feet are not a base of support.

Balance in water may be difficult to control because of the effects of buoyancy pushing upwards.

Balance and stability in a depth with lungs submerged is more difficult because the body must balance the *center of buoyancy* at the lungs with the *center of gravity* at the hips.

## Exercise Design Considerations

Teach balance skills like sculling and coordinated arm /leg patterns for balance. Webbed gloves on hands provide increased surface area to assist with balance.

A student's ability to touch the bottom of the pool is not the criteria for establishing an optimal shallow water depth (Kennedy et al, 1989). The criteria for finding optimal working depth in shallow water needs to consider body composition, stability and control of movement; and the ability to move and potential to move with speed through the water using the feet for propulsion.

Buoyancy and impact can be varied by changing depths. Deep water exercises (without the feet touching the bottom of the pool) can be mimicked in shallow water simply by lifting the feet off the bottom and working "suspended".

Design exercises to address individual buoyancy differences as will as buoyancy differences at various water depths.

## Technical Drills for the Pool

1. Jog in shallow water with hands out of the water, then with arms hanging straight down at your side (no movement), and finally with a figure-eight scull in the water. Which of these three upper body positions provided the most stability or support for the movement?

2. Work a cross country ski movement with legs and arms working in unison, then work the movement with legs and arms in opposition.

3. Jog in shallow water (navel to nipple) and gradually travel to deeper water. Feel the differences of impact, control of movements, speed of the movements.

4. Work a scissors in shallow water. Work the move in a "rebound position" (pushing forcefully off the pool floor) and then drop to the "suspended position" and mimic deep water. Feel the impact changes. How do the arms and legs need to work together for balance and stability?

## Hydrostatic Pressure and Breathing

When the lungs are submerged, the increased hydrostatic pressure makes breathing more difficult. Breathing and inflating the lungs against the pressure will help maximize lung volume and the student will adjust to the feeling of pressure against the chest.

The increase of pressure aids venous circulation and contributes to the reduction of edema, especially in the lower body. In a vertical position, the greatest pressure is at the feet.

Systolic blood pressure may increase initially upon immersion as a response to hydrostatic pressure on the body. In deep water exercise, heart rate decreased as stroke volume increased.

## Exercise Design Considerations

Cue your students to breathe, fully inflating the lungs against the pressure.Watch that students don't hold their breath.

Teach your students that their body will normally rise on inhalation and descend with exhalation.

Students with high blood pressure must adjust to deep water gradually by starting in shallow water and exiting in shallow water.

Using heart rates to estimate exercise intensity in water may not be appropriate because research shows that water depth (increased hydrostatic pressure), temperature, amount of arm work used, and the use of hand-held equipment affect heart rates. Use a combination of perceived exertion (RPE), heart rate (if monitored) and the talk test to monitor intensity.

## Technical Drills for the Pool

1. In shallow water, submerge lungs and shoulders, scull and straddle legs. Inhale and feel your feet rise off the pool floor, exhale and feel your body descend.

2. In deep water, (with buoyancy equipment), leg hanging vertically, arms outstretched horizontally, practice breathing and inflating lungs. Feel your body rise on inhalation and descend on exhalation.

## Gravity vs. Buoyancy

On land, gravity is the primary force acting against the body. In water, buoyancy (the tendency of a body to float or rise when submerged in a fluid) is the primary acting force.

On land, work is created by lifting upwards against gravity. In water, intensity increases as arms and legs move downward against buoyancy.

Buoyancy will assist upward movements and provide some resistance to downward movements (Fawcett 1992).

Buoyancy "assisted" movements will help the student float to the surface. The degree of assistance depends on individual body composition.

Buoyancy "resisted" movements pushing down against the water creating work. The amount of work will depend on the surface area and lever length body composition.

Consider these Land/Water-Gravity/Buoyancy Assisted and Resisted Muscle group differences:

| Land Exercise | | Water Exercise | |
|---|---|---|---|
| **Assisted** | **Resisted** | **Assisted** | **Resisted** |
| Triceps | Biceps | Abductors | Adductors |
| Abdominals | Erector spinae | Deltoids | Latissimus Dorsi |
| Adductors | Abductors | Biceps | Triceps |
| Latissimus Dorsi | Deltoids | | |

*Application Consideration:* The biceps are considered strong muscle groups on land. They can be assisted in water, while the weaker triceps can be resisted against buoyancy for natural overload.

## Exercise Design Considerations

Exercises can be designed to work in opposition to buoyancy to add resistance or in the same

direction for assistance of movements.

When performing exercises you need to determine the direction of buoyancy's force to create work or rest, examine the mechanics of a move and manipulate range of motion speed and surface area against buoyancy's force.

Equipment, such as a step, increases the effect of gravity and reduces buoyancy by decreasing water depth when standing on top of the platform.

The addition of buoyancy equipment to the body or limb can be evaluated for its assistive or resistive effects. Example: Holding a foam dumbbell during elbow flexion, the biceps are assisted while the triceps contract eccentrically to resist the buoyant force toward the surface. Moving the foam dumbbell with elbow extension requires the triceps to contract concentrically.

## Technical Drills for the Pool

1. Test the effects of buoyancy assisted movements by placing your hands at your sides in water and notice how your arms have a tendency to float to the surface.

2. Perform a biceps curl (elbow flexion and extension) in chest deep water and a kick in front (hip flexion and extension). Determine what part of each movement is buoyancy assisted and resisted.

## Video References

*The Introduction to the Speedo® Aquatic Fitness System*, (1994) video, Session 1, Buoyancy.
*Specificity of Training and Deep Water Program.* (1995) video, Introduction.

## Speed, Power & Force

Speed is a direct measure of the rate of covering distance or rate of motion of a moving object (Brancazio, 1984). The speed of exercise in water is considered differently, because movement of the body involves overcoming the additional force of the water working against it. Faster movement through the water results in greater drag and resistance, which increases the muscular work required for movement.

Power is the rate of doing work, where the time required to do a given amount of work is part of the equation (power = work done/time). Power is the result of exerting more force during a movement.

A force is any action that can cause an object to accelerate (Brancazio, 1984). The larger the force pushing against the water, the greater the acceleration and the resulting speed. The body will accelerate in the direction of the force acting on it. Therefore, as students exert more force (without changing any other variables), the result is an increase in resistance and intensity for the exercise.

## Speed, Power & Force: Effect on the Body

The lack of traction, an inability to overcome inertia, and floating effects of buoyancy, can prevent students from attaining the speeds necessary to produce the optimal resistance against the body.

Greater muscular work is required to maintain faster speed against the increased forces of resistance than with comparable movement on land.

Heart rates increase with the speed of movements through water.

Lower body movements performed in water result in higher oxygen uptake ($\dot{V}O_2$) than similar exercises performed on land.

Research shows that only 1/2 to 1/3 the speed achieved during land walking and jogging was necessary for the same level of energy expenditure for walking and jogging in waist-deep water.

Buoyancy can affect speed and force. Too much buoyancy can make it difficult to stabilize and apply sufficient force through the water.

## Exercise Design Considerations

Increasing the speed, power or force of a movement without compromising range of motion will increase the intensity of the movement. Students should be allowed to adjust the speed of movement at any time during the workout.

Equipment can affect a student's intensity by altering speed, power and force of the move. For example, students who wear shoes will have better traction, allowing the participant to push more forcefully through the water with greater speed, increasing resistance and exercise intensity.

Exercises that train for power, help train for activities of daily living (ADL's). (Example: Going up and down stairs, walking with greater speed). This type of training in your exercise design would include using the working position of "rebound" during both travel and stationary movements or mimicking the "bounding" movements of stair climbing.

Speed, range of motion and surface area are critical components of exercise design that each student must learn to regulate individually. Working "on the beat" of the music may compromise one or more components resulting in under or overtraining some students (Rippee and Sanders, 1994).

Make sure your students are working in the proper water depth so they can balance and apply force through water to maximize the objective of the exercises. This is especially important for travel through the water.

**Technical Drills for the Pool**

1. Find a working depth at navel depth. Jog forward without using your hands. (Shoes will help with traction). Change your force through the water. Does your speed change? Does the intensity change as you speed up or slow down?

2. Match a movement to the beat of the music working in the shallowest water possible. While maintaining the beat, move to deeper water and note any changes in the size or control of the movement.

3. Partner up in navel depth water. Turn on the music and have the partners face each other performing a jumping jack move, staying on the beat for one minute. Choose a different beat that is faster or slower and work on that beat for one minute. Check your intensity. Can the partners stay with each other and the beat the entire minute? Monitor your intensity, does it match the training objective?

4. Perform a rotator cuff movement with sliced mitts through the water. Maintaining the same size of the movement and surface area of hand, increase the speed of the movement. Feel the increase of resistance to the movement.

## Video Reference

*The Introduction to the Speedo® Aquatic Fitness System*, (1994) video, Session 1, Speed, Power & Force.

## Inertia

Inertia is the tendency of a body to remain in a state of rest or of uniform motion in a straight line until acted upon by a force to change that state.

## Inertia's Effect on the Body in Water

Once the body has overcome the inertia of still water to begin movement, currents are created that can be used to create resistance.

A body moving through water produces currents that can be used to assist movements in the same direction, or resist movements in the opposite direction.

A direction change creates opposing currents. Moving in a repeating pattern back and forth quickly in the same area will challenge balance, stability and control as the body moves against the force of the currents.

The currents are the greatest when working in the center or back of a group situation traveling in the same direction. The strong current will carry you along.

## Exercise Design Considerations

Allow time during changes of direction to overcome the currents slowly, while maintaining balance and good body alignment. When traveling the class, cue students to stop traveling, stabilize (jog in place & scull) before changing the direction of the travel. This allows the current to subside prior to changing direction.

Be aware of the placement of the students in the class. Traveling in the center or back of the group may be less work than leading, due to the strong currents. Put the stronger students on the outside of the group, but be watchful of the weaker students that may be carried along and even knocked off their feet!

Encourage balance exercises by traveling, then stopping, using the currents created by a body, limb or hand moving through the water to challenge balance. These exercises can improve core or trunk (abdominal, obliques and erector spinae) strength by creating currents with travel, then "freeze frame" to train the stabilizers against the water's movement.

Use the water's current to create work or rest for your exercise design. When repeating a traveling pattern back and forth quickly, the intensity of the work will increase as the number of repetitions and speed increases.

## Technical Drills for the Pool

1. Freeze frame: Shallow depth. Walking to jogging in a variety of directions and styles (Zig Zag, Scoot Giant steps, walk backwards) and give a 1, 2, 3, count to FREEZE or stop. Stabilize against the pushing and pulling current. Progress the challenge by standing on one leg or bringing your arms out of the water on the FREEZE.

2. Stork Stance: Partner work. One partner stationary sculling for stability as the other partner runs around her (both directions) creating a current. Progress the drill by standing on one leg and then bring arms out of the water. Feel the core stabilizers engage and help provide stability against the turbulence. Change roles.

3. Jog back and forth, changing directions without allowing the current to subside, increase the repeating pattern and increase the speed. Feel it become harder and harder to continue to push against the current. What training objective could you target by performing this drill?

4. Inertia Circle: Work a circle moving in the same direction. Feel the current carry you along. Reverse the direction and move into the current and feel the difference.

5. The Snake: Work a snake in single or double lines and feel the directional changes of the current challenge your balance and create work, as you power through the water.

## Video Reference

*The Introduction to the Speedo® Aquatic Fitness System*, (1994) Video, Session 1, Inertia.

## Resistance

Water provides resistance because of its viscosity. *Viscosity* is the tension between molecules of water. It could be thought of as the "thickness" of a liquid. When the body is submerged, resistance can be manipulated in any plane, pattern of movement or body position. Resistance can be influenced by one or more of these variables as a body moves through water: form drag, turbulence eddy resistance, speed, leverage, action/reaction and inertia.

*Form drag* relates to the *surface area* and the shape of the object moving through the water. Drag force acts to resist motion. Drag increases as an object's surface area increases. Reducing the surface area and streamlining will decrease drag. As drag increases, the intensity of work required to move an object through water increases. Limbs, the body and equipment can be dragged through the water to change the shape and change the work intensity.

*Turbulence* is moving, choppy water with multi-directional force. It is created by objects moving through the water. Faster speeds and a non-streamlined object creates greater turbulence.

*Eddy Currents* is water flowing into the area of reduced pressure behind the body as it moves forward through the water. The pressure in front of the body is an area of higher pressure. The result is water flowing into the area of reduced pressure behind the body as it moves through the water. These eddies tend to drag the body backwards thus increasing resistance to movement.

*Speed*, *leverage*, *action/reaction* and *inertia* are other variables that influence the resistance. Refer to other sections of this session.

## Resistance Effects on the Body in the Water

The resistance of movement in water is estimated to be about 12-15 times that of air, based on the average speed of movement.

Lower body movements performed in water result in higher oxygen uptake ($VO_2$) than similar exercises performed on land.

Research shows oxygen consumption to be highest when individuals travel through water at their optimal working depth at maximum speed. The lack of traction, inability to overcome inertia and floating effects of buoyancy may prevent participants from obtaining the speeds necessary to produce the frontal resistance, drag and turbulence required to develop optimal resistance against the body.

Small changes in the "resistance variables" have marked effects on the intensity.

Training studies found that the resistance of water provided enough intensity to significantly improve muscular strength and endurance, especially for the upper body.

## Exercise Design Considerations

Exercises need to address the principle of progression using speed, water's currents, form drag, to target individual fitness levels, and appropriate resistance for work against the body.

Think of the pool as a giant resistance machine, where muscular endurance can be targeted "on demand" with the initiation of movement.

"Travel sets" in the workout at sufficient speeds can be an excellent way to target cardiorespiratory training objectives during the workout. Cue proper upper body skills that assist with the leg's movement through water.

Equipment can vary the type of water flow and change the resistance to movement through the water. This equipment can change the intensity of the work, either by streamlining or unstreamlining movement. By manipulating the amount of resistance, intensity can be regulated to achieve muscular training adaptations.

## Technical Drills for the Pool

1. Turbulence–with elbows at the waist, pull your hands up toward your face changing the size and speed of the movement in order to observe the turbulent water on the surface. Watch as you pull harder, moving more water, the turbulence appears to increase at the surface.

2. Partner up and jog, one behind another. The person behind should step outside into the wake turbulence created by the leader traveling forward and then close behind the leader into the "eddy space" to get pulled along. Repeat exercise across the width of pool. Use various formations and pool patterns to increase this effect on the body.

3. Jog forward, hands clasped behind your back. Try to maintain the same speed while you wing out your elbows, then slice your hands, then open out and drag fully webbed hands. Now, jog backwards and reverse the sequence, slowly decreasing the resistance and streamlining your body. Feel the changes in intensity. Blend this drill with a "Traveling Set" during your workout and use form drag to change the move and the intensity!

## Video Reference

*The Introduction to the Speedo® Aquatic Fitness System* (1994) video, Session 1, Resistance.

## Leverage

The lever length of limbs (arms and legs) will affect the center of balance of the body and the shape of the body moving through the water. The longer the lever (such as the difference between a flexed and extended arm), the greater the surface area.

## Leverage: Effects on the Body in Water

### Resistance

The longer the lever, the greater the resistance of movement due to the increase of surface area and drag force through the water.

Specific muscle groups may be recruited and overloaded as the lever length changes.

### Center of Balance

As the lever length increases (arms and legs work extended), the center of balance moves away from the center of the body requiring greater stabilization by the trunk muscles to maintain balance.

As the lever length is shortened, the center of balance moves closer to the working joint and is closer to the center of the body. This reduces the intensity for the trunk stabilizers.

## Exercise Design Considerations

Surface area (lever length differences) and speed are two important variables that can be modified to provide appropriate resistance for changes in exercise intensity.

Cue students to change from a short lever to a longer lever slowly to protect the joint(s) and to establish proper stabilization prior to increasing resistance.

As movements are enlarged by increasing the lever length, the students should coordinate synergistic arm or leg movements to balance the movements. (Example: kicking side to side with coordinated extended arms working in opposition.)

## Technical Drills for the Pool

1. Walk forward with a bent knee. Stop. Stabilize. Walk forward extending the leg and pulling it down (lead with the heel) as you move forward. Feel the increased resistance with the increase of the lever length.

2. Short to Long Drills:

   Stationary jog, sculling for balance and stability, increase the lever and kick in front.

   Rock side to side, arms pressing out at sides, extend the lever to a kick side to side extending the arms long and working in opposition.

   Rock forward and back, sculling at sides, enlarge the move and extend the front leg, enlarge

the scull for balance.

Neutral stance, arms short lever (movement from elbow) "playing the piano" extend the arms to long lever (movement from shoulder) and continue playing. (Watch for proper alignment of the extended position. Don't lean forward!)

## Video Reference

*The Introduction to the Speedo® Aquatic Fitness System* (1994) video, Session 1, Leverage.

## Action/Reaction

Newton's third law states that for every action there is an equal and opposite reaction.

## Action/Reaction: Effect on the Body in Water

In the water, the harder you press against the water, the harder it pushes back against your body, creating variations in intensity for training.

In water, this law can be used to increase or decrease resistance, assist or resist travel, oppose movement, and create work.

Long levers will produce the greatest action/reaction response.

## Exercise Design Considerations

The direction of assistance should be determined and used to either *assist* or *resist* travel. Example: As you pull your arms backwards, the body is pushed forward. Travel is assisted forward. When the arms pull backward, the exercise can oppose forward movement by jumping or kicking backwards. The result is an increase of intensity.

The size of the movement is as important as speed when regulating the intensity. Small, quick movements may impede travel, while larger movements performed with sufficient speed will assist travel.

To increase the efficiency of travel through the water, large movements that push the water in the opposite direction will provide the greatest response by assisting travel.

## Technical Drills for the Pool

1. Action/Reaction: Sculling Drill

   Balance and stability drill: Wearing webbed gloves, scull with a flat hand, jogging in a stationary position.

   Assisting travel: Scull with fingers up, pushing the water forward, assist travel back; scull with fingers pointed down, pushing the water backwards, assist travel forward.

   Resisting travel: Scull with fingers pointed down, pushing water backwards, travel backwards; Scull with fingers up, pushing water forward, travel forward.

   Scull for lift: Suspended jog, flat hand scull for lift.

2. Wearing buoyancy equipment, kick short, fast kicks in front of your body. Now lengthen the leg levers (kick from the hip) and watch how the reaction to the move is increased. Add your arms by rowing back to front. Feel the assistance to travel.

3. In neutral position, row your arms from front to back while tucking your knees to your chest.

Feel the assistance to travel. Repeat by rowing back to front through the water. Now row front to back while you tuck jump backwards and feel the resistance to travel and the intensity change.

## Video Reference

*The Introduction to the Speedo Aquatic Fitness System* (1994) video, Session 1, Action/Reaction.

# Fundamental Skills

*Shallow water* is defined as water that is navel to nipple depth measured with the individual standing on the bottom of the pool.

## Sculling

Sculling is a skill used to increase propulsion through the water and assist balance by providing lift. The figure-eight motion of sculling, especially when students wear webbed gloves (soft lycra or stiffer neoprene type fabric), can be used to assist with good neutral posture, to resist or assist travel and direction changes and increase intensity for the upper body.

Students should move their hands with palms facing downward and a little to the side. Have them practice making a figure-eight motion with both hands at their hips, then at the surface, pretending to smooth sand. Ask them feel the resistance of water on the palms of their hands as they "lean" slightly on the supportive surface or "table top" you've created.

Buoyancy pushing upwards against the surface area of the hand or more so the webbed glove, provides support for the body by acting as "rudders" to help make correction when the body is pushed or pulled off center. As students push downward, the principle of action/reaction assists the body to stand more erect.

In transitional depth sculling, scooping-under skills help to assist with controlling descent, balancing and bringing the legs back under the body for tall landings.

In deep water, sculling is important not only for balance and postural stabilization, but also to assist travel and to change the working positions of the body from vertical to horizontal.

## Video Reference

*The Introduction to the Speedo® Aquatic Fitness System*,Video, Session 2, Fundamental Skills, Sculling.

## Recovery to a Stand and Personal Safety

Balance in water is affected by individual buoyancy, body composition and skills. It is important to teach basic recovery skills in case participants lose their footing.

The least desirable position for fearful participants is on their back or front in a horizontal position. The recovery to a stand should be taught so that participants can bring the body back to a vertical position, which is the most comfortable.

Lifeguards in real life rescue situations reported that victims prefer to be stabilized in an upright vertical orientation, rather than horizontal on the surface. For that reason, the American Red Cross has introduced "the cross chest carry" which is performed with the rescuer underwater and the victim in a comfortable vertical orientation to the surface.

The recovery to a stand empowers participants to take responsibility for their personal safety. It is also a good task to allow instructors to check each participant's water comfort level. In order to perform this skill, participants must move from a horizontal to a vertical position in the water. By having participants practice this skill, instructors can see which students feel comfortable in the pool. If a participant is afraid to lie on their back or front, it is a "red flag" to instructors that perhaps this participant is afraid of water and might panic if balance is lost. *Panic is the number one cause of drowning deaths.*

This recovery skill is particularly important when using floatation devices (especially on the ankles), since balance is more difficult. A fall to the prone position (face-down) can create an uncomfortable and undesirable hyperextension of the back.

To protect your back while in the prone position (face-down), turn your head to the side (your body will follow your head), roll over to the supine position (face-up) and recover according to the instructions illustrated on the video and cue card.

This can be a difficult skill for people with a high body fat composition, or large breasts, coupled with underdeveloped abdominal strength. Screening may be necessary for people who cannot perform this skill. The buddy system may be appropriate, but it is imperative that the skill be performed effectively prior to participation in any deep water classes.

Personal safety applies outside of the water too. Know the depths and contours of the pool along with the emergency exits and emergency plan. It is highly recommended that all participants wear shoes for safety and good traction.

After water exercise, dermatologists recommend a shower without soap, followed by lotion or Vaseline applied to wet skin to prevent drying.

Remember to stay warm and workout in a well-ventilated facility.

### Video Reference

*The Introduction to the Speedo Aquatic Fitness System Video,* Session 2, Fundamental Skills, Recovery to a Stand.

## The Athletic Stance and Proper Body Alignment

The body should be centered: head, shoulders, hips aligned, or, ears, shoulders, hips and heels lined up. This is called the energy position or water "chi", the balanced stance where all movement originates.

Hold the chin in neutral position, do not extend it. When the chin is forward of the shoulders, stress is placed on the lower back. Present a stable lumbar spine against resistance when moving backwards. Keep the chin in for the power back movement, push with the hips engaging larger back muscles, hold the upper body in slight spinal flexion (forward).

Work the muscle, not the joint. Power through moves with force to desired extension, not hyperextension.

Land rebound movements through the foot—toes, ball of the foot, heel to flexed knee. (Like running up hill.)

Press heels to the floor regularly.

When jogging, bring the knees forward in front of the shoulders. Lean slightly forward, avoid hyperextension of the back.

In deep water, balance can be maintained with knees slightly flexed and forward, ahead of the shoulders.

Keep shoulders relaxed. Adjust the body to the cool water temperature by immersing the armpits, front of the neck and sides of the chest. The adjustment may help reduce shoulder shrug. Move to keep warm and relaxed.

If a participant cannot maintain proper body position and control movements, check the water depth and move them to shallow water (reduce the effects of buoyancy to gain control). Have them move more slowly with force and control or change the exercise. It takes good abdominal strength to hold water "chi" during some exercises. It may take time to develop the basic strength.

A contraindicated exercise is any movement performed out of the "Athletic Stance". Instructors must monitor participants and make corrections or change the moves as necessary to maintain proper body alignment.

## Video Reference

*The Introduction to the Speedo® Aquatic Fitness System*, Video, Session 2, Fundamental Skills, Recovery to a Stand.

## Thermoregulation, The Big Chill is No Thrill!

Let's help keep students in the "Target Comfort Zone" by proper cueing and exercise design. Water provides an environment that is complex. It's soft and forgiving, yet hard and resistant; rough on the surface, while calm and quiet beneath. The dynamic properties of water can also create opposing responses of heat discharge or heat conservation in the human body. To establish a standard of care it's important for both the student and the instructor to understand thermalregulation.

Do your students bolt quickly to the locker room after class to warm up? Do they leave early, drop out or complain about being cold? Aquatic fitness instructors are challenged by many variables including air, wind, water, facility types, temperatures and individuals.

### Some Cool Concepts

Normal body temperature is approximately 98.6°F (37°C) and body temperatures can vary throughout the day. Additionally, women's body temperatures vary with menstrual cycles, pregnancy and menopause.

Hypothermia is defined as "a depression in core temperature sufficient to affect body functions, usually below 95°F (35°C)." Mild hypothermia symptoms include uncomfortable cold, numbness (especially in the extremities), shivering, loss of coordination, concentration and slurred speech.

To treat mild hypothermia, encourage the individual to get into a Jacuzzi or hot shower. Remove wet clothing, get him or her dressed in dry clothes, cover with a blanket and offer warm beverages. Treatment for a more critical condition is different and should be coordinated with your EMS personnel.

## Thermoregulation

The human body can maintain a constant body temperature even with environmental variations through physiological responses such as shivering or voluntary intellectual actions, such as movement and wearing clothing.

### The Body Loses Heat Four Ways:

*Convection* occurs when the body comes in contact with air or water that has a lower temperature. While in contact with the body, the air/water is warmed then carried away by streaming (movement).

*Conduction* is the transfer of heat energy away from the body by substances with which it is in direct contact. Conduction can occur in any medium–solid, liquid or gas. Water conductivity is 240 times greater than air, thus water is an excellent heat conductor.

*Evaporation* is heat lost through the evaporation of water from the skin, such as perspiration. Evaporation accounts for about 2/3 of the normal resting heat loss from the skin and respiratory

tract. (Thorton, 1990).

*Radiation* is the direct emission of heat energy to and from mostly solid objects. The body gains great heat from sources such as the sun and fire.

**Water Fitness Considerations to Balance the "Target Comfort Zone.":**
Design a program that will provide the opportunity for students to keep warm and comfortable throughout the entire workout.

Depending upon the variables, format the class to alternate less active work involving smaller muscle groups such as the biceps/triceps, with more vigorous sets involving large muscles such as the quadriceps/hamstrings.

Combine simultaneous upper and lower body movements to keep participants moving continuously. Cue students to increase the speed, size and force of movements to maintain a higher workload, which produces more heat. Although the focus muscle groups used and major work area may change, keep the entire body in motion. For example, perform upper body resistance sets while jogging lightly.

Eliminate interruptions. Record a full workout on one tape with exercise transitions cued by a quick fade in/out of the music with no breaks.

Be organized so there is no waiting to begin. Workout in the sunny area of the pool, if possible.

If indoors, close the doors and windows to reduce wind chill. Wind chill markedly increases heat loss by radiation, convection and evaporation.

Check for comfort during class. Ask the students "are you warm?" Don't even use the word "cold"!

End the workout with a light, buoyant "warm"-down incorporating large easy movements that will keep students warm for the trek to the locker room and beyond. Encourage students to go directly to the showers to chat.

**Immersion Responses:**
*Condition*: The cooling of the skin in the water causes constriction of the peripheral blood vessels and an increase in the heart rate due to temperature change which may, in turn, cause an increase in blood pressure.

*Solution*: Be aware of students with heart problems by taking health histories; urge them to work with their physicians and encourage gradual immersion.

*Condition*: Blood vessels in the skin and skeletal muscles can constrict strongly, creating an outer shell that protects the body's core against further heat loss. This cooling of muscles and nerves results in slower, weaker, poorly conditioned movements.

*Solution:* Suggest gradual immersion followed by relaxed, large muscle group movements to produce and conserve heat. Watch for shrugged shoulders and pinched faces which are signs of tension and cold.

*Condition:* The areas of highest heat loss are along the sides of the chest, front of the neck at the carotid artery, the groin area and the armpits (the warmest areas prior to immersion).

*Solution:* Splash pool water on these warm spots prior to full body immersion. Surfer undershirts that cover the neck, armpits, shoulders and chest will help reduce heat loss. Tights, unitards and "Chill Vests" may help. If it's windy, position students with their backs to the wind to decrease effects of wind chill heat loss from the face and neck areas. If you are facing the wind, make sure you protect yourself.

*Condition:* Other risk factors contributing to cooling are fatigue, hunger, dehydration, improper nutrition, immersion time and depth, medications, use of tobacco or caffeine which are vasoconstrictors, and the use of alcohol which is a vasodilator.

*Solution:* Suggest students limit their intake of caffeinated beverages. Research has concluded that iron-deficient women experienced cold sooner and were less tolerant of lower temperatures. Encourage drinking water and a high carbohydrate diet, which slows skin cooling. Check that your diet is "iron balanced".

If students become too cool during deep water workouts and the ambient air temperature is greater than the water temperature, move them to shallower water to reduce the amount of body surface directly exposed to the water, thus decreasing heat loss. Students may also be able to move with greater force, power and intensity in the shallower water, thus improving heat production.

*Condition:* Goosebumps or piloerection over the body's surface tends to increase the thickness and effectiveness of the insulating air covering the skin.

*Solution:* Goosebumps are a forerunner of shivering, watch for them and respond with heat producing and/or conservation efforts.

**Other Chilling Tidbits:**
Large individuals with a high percentage of body fat usually cool more slowly than small individuals with a low percentage of body fat. However, large individuals who lack the muscular conditioning that allows them to move at a high enough intensity through the water may actually cool more quickly than leaner people.

Keep in mind that a person's amount of body fat may not be the only critical factor for body comfort. Fat may diminish the response to cold, but muscle acts as the more critical insulator.

A study of warmth and cold showed that man is three times more sensitive to cold when the skin is already cold (Collins, 1989). So, start warm and stay warm.

## Thermal Training Applications and Recommended Water Temperatures:

Cue your students to keep their "heaters" going by moving their legs, when they begin to chill. Be sure to design exercises that encourage leg work and if necessary, add a "heater" set to the workout on demand to keep students warm.

Remind students to layer on vests and leggings to reduce heat loss and stay warm.

A general rule of thumb is to keep the air temperature approximately 3° higher than the water temperature, however, the intensity of the training (based on the level of aerobic activity and the amount of heat generated from cardiorespiratory targeted training) and the health and fitness of your students must be primarily considered. Recommended water temperatures for the comfort of your water exercise students when considering intensity are:

Competitive Athletic Training conducted at a high intensity (above 4.2 METS): 80°-83°F (26°-28°C).

Fitness Classes: The neutral temperature where most people can balance heat production with heat loss is 84° F (29° C) working at 4.2 METS (vigorous aerobics) (Cole, Craig).

Functional Water Fitness classes targeting activities of daily living: 84°-86°F (29°-30°C), for moderate intensity (below 4.2 METS) and stop and go activities. (Sanders & Maloney-Hills, 1998).

Arthritis Classes: 83°-88°F (28°-31°C), depending on training intensity, with 86°F (30°C), being the most comfortable for a wide variety of exercises performed at low to moderate intensity (YMCA, 1997).

Aquatic Therapy Sessions conducted by licensed health care providers for rehabilitation: 88°F-90°F (31°C-32°C), at low intensity (YMCA, 1997).

## Monitoring Exercise Intensity

Two methods most frequently used to monitor intensity include Target Heart Rate (THR) and Rate of Perceived Exertion (RPE). Determining heart rate during water activity presents entirely different problems from land exercise. Reference Course 2: *Specificity of Training and Deep Water Program* for more information on monitoring exercise intensity.

THR: Heart rate alone is not always a valid indicator of exercise intensity. It is not unusual for participants, especially beginners, to experience muscle fatigue long before the desired intensity can be reached. Bob Beasley, Ph.D. at the University of South Florida, writes in *Sports Medicine Digest*, (1989) exercise heart rates are affected by water temperature. When the water is cool, 70-80°F, exercise heart rate in waist to chest deep water is approximately 10-15 BPM lower than while performing similar exercises at the same metabolic rate on land. On the other hand, exercise in warm water, 86-88 degrees Fahrenheit, elicits a heart response similar to land exercise. Hydrostatic pressure in the water requires more effort from the participant to inflate the lungs, especially if the lungs are submerged as in swimming activities. These factors make it important to use a combination of methods to assess exercise intensity. The talk test is based on the premise that, while exercising, the participant should always be able to speak in two or three word phrases. The accuracy of the talk test varies within any given population and is best used in conjunction with the THR and RPE for monitoring exercise intensity.

RPE: Gunnar Borg, psychologist, developed a psychophysical scale for ratings of perceived exertion (RPE), which shows a high correlation with heart rate and other metabolic parameters, according to the American College of Sports Medicine (ACSM) guidelines. (See RPE Table.)

Experts do not agree when it comes to THR versus RPE. Unfortunately no method is ideal. Fortunately all the methods can be useful. The obvious solution is to use a combination of all three and use the one that works best for you and your students. Other cues that are helpful to check intensity include: Can talk, warm? Lick your lips! Is everyone breathing?

**Rate of Perceived Exertion**

| RPE Revised Rating | Description of Perceived Exertion |
|---|---|
| 1 | Very weak, very light |
| 2 | Weak or light |
| 3 | Moderate |
| 4 | Somewhat strong or hard |
| 5 | Strong or heavy |
| 6 | |
| 7 | Very strong or heavy |
| 8 | |
| 9 | |
| 10 | Very, very strong |
| | Maximal |

Table Source: McArdle, Katch, Katch (1991). *Exercise Physiology, Energy, Nutrition and Human Performance*, p 732, Lea & Febiger, Philadelphia/London.

## THR/RPE/TALK TEST

The Pros and Cons of using THR, RPE and TALK TEST to measure exercise intensity.

### THR–TARGET HEART RATE (using a heart rate monitor)

*Pros*

1. Indicates a definite increase in work load or heart rate (as long as linked to metabolic load, i.e. aerobic activity).
2. Is most accurate method for land exercise: 10-second pulse is accurate within six beats per minute. For water, a 6-second pulse may be more accurate due to rapid heart rate changes because of cool water temperature.
3. May work better for inexperienced exercisers.

*Cons*

1. External or factors such as temperature and buoyancy may affect heart rate.
2. Heart rate may not accurately reflect intensity. Lower rates may "push" participants to overwork.
3. Concepts may not be easily explained or understood. A heart rate chart with adjusted rates should be easily accessible for reference.

### RPE - RATE OF PERCEIVED EXERTION

*Pros*

1. Concept is easy to understand and to explain based on 0-10 scale.
2. Continuity of exercise need not be interrupted.
3. Is appropriate for experienced exercisers.
4. Provides effective means of determining anaerobic threshold.
5. Trains exercisers to become aware of how they feel while exercising.

*Cons*

1. Untrained exerciser may perceive effort at a higher rate than true heart rate would indicate.
2. Measurement is subjective.
3. Requires practice.

### TALK TEST

*Pros*

1. Can easily identify personal threshold.
2. Stimulates social interaction.
3. Puts exerciser in touch with how they feel.

*Cons*

1. Measurement is subjective.
2. Is least accurate (best when used in combination with THR and/or RPE methods.

*Source:* Chicado, E.W. (1994). Weber State University, *Water Fitness Training Manual*, Ogden, Utah, 1994.

## Regulating Exercise Intensity

As you coach your students to work progressively to increase intensity for training, it is up to them to self-check and to be able to modify according to their personal RPE. Encourage students to work at their own intensity, until they find the level that provides enough overload for work, but not too high where they feel uncomfortable. It's impossible for you to know what level is appropriate for each student. By teaching students this simple skill, they can take control of their own workout by systematically modifying to lower intensity for personal comfort and safety. If they experience any pain or limitations in range of motion, they should modify the move or replace it with a similar move. Review the 4 S's frequently and check that everyone understands how to use them.

**4 S's to lower intensity:**
**S** = make the movement **SMALLER**
**S** = **SLOW** down the move
**S** = **STABILIZE**: check the move is coordinated and stable or scull and lightly jog as you adjust your stabilizers for control
**S** = **SUBSTITUTE** with a similar move that feels more comfortable. For example, if jogging bothers your knees, march instead and/or move to deeper water to unweight.

## Video Reference

*The Golden Waves Program, Functional Water Training for Health* Video.

## Basic Equipment for Safety and Exercise Performance

It's important to consider some basic equipment that will keep your students comfortable, safe and enhance the effectiveness of the exercises.

**Webbed Gloves:** Webbed gloves increase the surface area of your hands so students can "lean" on them for effective support and balance, especially during big leg movements. This extra surface area acts as a "table top", assisting with upper body posture, as the lower body works the resistance of the water. Additionally, the surface of the gloves enhance action/reaction, so students can use their hands effectively to help change direction or adjust body positions. Finally they provide, "on demand" variable resistance for upper body muscular conditioning by changing positions as follows:

Low Intensity
↓
Level 1: Slicing hands
Level 2: Fisting hands
Level 3. Cupping hands
Level 4: Webbing hands open

High Intensity
Gloves are made in soft or stiffer fabrics, so students can choose the level of support or resistance.

**Shoes:** Should be worn for safe footing from the locker room to the pool. During class, shoes effectively provide good traction for faster travel through the water and cushion the foot for comfort. Worn in deep water, shoes can add extra drag resistance. During step work, students should be required to wear water shoes that provide good toe protection, cushioning and support.

**Fitness Apparel:** Water exercise is not swimming or sunbathing. Apparel should make students feel comfortable and allow freedom of movement. Fitness suits that provide extra support for women, or jog bras can be worn under suits. Additionally, tights can be worn to decrease heat loss, increase the visibility of the legs for the instructor so they can provide feedback and make students feel great about the walk from the locker room into the pool.

## Video Reference

*Introduction to the Speedo® Aquatic Fitness System* Video.

# Designing Exercises and Progressions

In this section we'll examine how to design water-specific exercises in shallow water.

## Basic Moves:

The Basic Moves for shallow water have their origin in dance moves. They are:

Walking
Jogging
Kicking
Rocking
Jumping
Scissors

Every movement on land can be tracked to a variation of one of these basic moves. Each basic move can be varied slightly to create progressions for exercise intensity and to change the impact against the body. Instead of complicated choreography, a simple variation using the same basic movement can create new moves that balance muscle use, adjust intensity for cardiorespiratory or muscular endurance and allows the instructor to be responsive to students needs "on the spot". Instead of memorizing "steps", you'll be able to create thousands of movements based on simple variations of basic movements, allowing you the freedom to grow your own workouts.

## The S.W.E.A.T. Formula

Each move can be manipulated through the S.W.E.A.T. formula to apply water properties in creating new moves, to change intensity, and to ensure muscle balance. This simple acronym helps you remember ways to vary the move creating a new move. Each letter relates to a specific water property and has a specific training goal.

**S.** = change Surface area and Speed. These two manipulations relate primarily to changes in intensity created by the exponential increase in resistance with an increase in lever speed and a change in resistance by changing the shape of the body moving through the water as it relates to form and wave drag, eddy resistance and frontal resistance.

**W.** = the Working positions of Rebound, Neutral and Suspended. Working depth is the most critical factor in designing workouts and movements. By changing the working positions, we can increase or eliminate the effects of gravity on the body. We can mimic the buoyant state in suspension. Each time the position is changed, the intensity is affected by changing the properties of water that are primarily affected through each position.

*Rebound.* Pressing forcefully off the bottom of the pool vertically increases the effects of gravity, speed, form drag, inertia, turbulence and impact. Intensity can be increased as you flex deeper on landing by increasing the distance traveled upwards. More power increases the speed and intensity.

*Neutral.* By lowering the body into the water, buoyancy is enhanced and the levers now move through the water, with more horizontal movement possible. The effect of gravity is decreased and hydrostatic pressure is increased. Some vertical moves will be shorter due to the limited distance between the surface and the bottom. However, with the assistance of buoyancy, long lever horizontal moves are more effective and since more of the lever is submerged in the resistive environment, intensity can increase through leverage, form drag, action/reaction and speed.

*Suspended.* This is the buoyant state in an open kinematic environment. The effects of gravity are minimal and the properties of water movement are enhanced. Buoyancy, speed, inertia, resistance, leverage and action/reaction laws are more important, especially as you balance in this state. Symmetrical lever moves, along with sculling and trunk stabilization are all important while you work mostly through the horizontal plane (while still maintaining vertical trunk orientation).

As you submerge your chest, hydrostatic pressure will increase on your chest and lungs creating a feeling of "tightness". Remember to breathe rhythmically.

**E.** = Enlarging a move using the property of buoyancy for support of the lever. Extending to a fuller range of motion increases form drag and surface area and can increase intensity as well as encourage movement around the joint for greater flexibility.

**A.** = By working Around the body or joint, muscle balance can be achieved. Changing the planes of movement around the entire body or even around a single joint encourages you to work the multi-dimensional resistance in many planes and encourages new neurological firing as you increase the number of muscle fibers recruited to perform a move. This enhanced recruitment can lead to improvements in muscular strength/endurance.

**T.** = Traveling or propelling your body through the water is shown to create the highest intensity possible. All of the properties and forces of the technical environment of water apply here and create work against the body. Travel is one of the best modes to create high intensity work, but can also be used for lower intensity exercise simply by reducing speed, force, frontal drag, inertia, etc.

By applying the six basic moves through the S.W.E.A.T. formula you can manipulate the properties of water and affect exercise intensity and provide progression, muscle balance and exercise variation. Entire workout sets can be developed by applying S.W.E.A.T. to a single move.

**Regulating Intensity, using the S.W.E.A.T. formula as your tool box.**

Let's examine how many different moves can be created by applying the S.W.E.A.T. formula "tools" to one basic move. Identify the intensity changes that result from each tool as it's applied.

**Basic Move: Scissors**
S.W.E.A.T. Tool Applied:

**S.** = Surface Area and Speed variations
Moves:
Surface Area

- Change the position of the hands, slicing to palms flat, pushing and pulling the water.
- Change the legs by rotating toes out.

Speed Variations

- Increase or decrease speed to change resistance level.

Intensity: Both surface area and speed variations will affect intensity, slower, smaller moves are easier, while larger moves performed at greater speeds are harder. Allow students to adjust speed and surface area for their own fitness.

**W** = Working Positions
Moves:
Perform the move in Rebound, maximally flexing and extending. Slow down and change to Neutral Position, lowering the body to allow buoyancy to support the body, extend the legs to a fuller range of motion forward and back.

Slow the move again and go Suspended, using the arms to help create lift, working the feet completely off the bottom, and enlarging the scissors to a comfortable range of motion. There is NO impact at this stage.

Intensity: Rebounding will create more impact and challenge the lower body muscular strength and endurance along with providing an opportunity to overload the cardiorespiratory system. Neutral position decreases impact, but increases the students ability to extend to fuller ranges of motion, which targets range of motion. When the move is performed in this large range, at sufficient speed, cardiorespiratory training can occur. Suspended, will challenge both range of motion and muscular endurance, along with cardiorespiratory work, depending on body composition. Leaner students will need to work harder to keep their heads above water, while students with high body fat may be assisted by buoyancy and not be motivated to work hard at all.

All the working positions can challenge cardiorespiratory endurance, based on the speed of the scissors and provide an effective system to change impact.

**E.** = Enlarge the move
Moves:
Begin with a small scissors, then ask students to gradually enlarge the range of motion making it as big as they feel comfortable. Then change the size, making it smaller, then change again.

Intensity: To increase the challenge for cardiorespiratory and muscular endurance, ask students to try to maintain the same speed as they enlarge the scissors move. Enlarging the move while

slowing down the speed can be used to target range of motion training.

**A.** = work Around the body
Moves:
Scissors front and back
Change the working plane to the side, working a jax
Change to diagonal plane

Intensity: As the planes of movements change, new muscle groups are engaged or the same muscles are assisted by different muscle groups, providing "fresh" muscles to the working body, so cardiorespiratory training can continue without local muscle fatigue.

**T.** = Travel
Moves:
Forward
Backwards
Sideways
Diagonal

Intensity: Both cardiorespiratory and muscular endurance intensity can be increased by traveling through water. The speed of travel will dictate resistance levels against the body.

We've just created 15 different movements and changed intensity while applying the tools of S.W.E.A.T. to the basic Scissors move. What else can we create?

**S.W.E.A.T. Combinations**
Now let's *combine* the elements of S.W.E.A.T. for more movement and intensity variations:

- Change the Speed and Surface area of the hands (speed up & web gloves), then the legs (toes out)!
- Change the working position from Rebound to Suspended and Speed up!
- Change to a Diagonal plane and travel forward, then backwards, slow down and go Suspended!

The combinations are limitless. Allow students at least six repetitions before changing each element, and be sure to cue to slow down before changing working positions, or planes around the body! Check body alignment, then gradually make the change.

## Video Reference

*Introduction to the Speedo® Aquatic Fitness System* Video, Session 5.

# Basic Shallow Water Workout Components

What are the components and objectives of a basic shallow water fitness workout?

## 1. Warm-up (3-5 minutes)

**Objectives:**
• To find a good working depth where you can overcome buoyancy and maintain control of your movements, i.e., non-buoyant people can work out in deeper water, buoyant people may need to work in shallow water.

• To adjust balance and to practice good alignment and sculling while working in Neutral and Suspended positions.

• To start warm and stay warm: Research suggests that if the body core temperature falls, the appetite center may be stimulated and exercisers may eat more after a cool swim. It was found that even with heavy exercise, water temperature had to be 29°C (84°F) to balance heat loss with heat production to create a similar training result as that on land. Craig and Dvorak (1986) found there was an initial drop in core temperature with immersion in water temperature of 32°C (90°F) which continued to decline even with light exercise.

• To rehearse, at low intensity, the movements being used in the workout.

• To elevate the heart rate slightly, warm up the muscles and joints and achieve a comfort level with the water and any attached equipment. The use of equipment should be minimized during this phase to reduce the effects of surface drag which can create too high an intensity.

**Optional Stretch for pre-workout performance (2-3 minutes).**
This set depends on water and air temperature, fitness level of the participant (body composition) and length of time for the workout. Stretching may be added if the body is warm enough to perform low intensity exercises at this stage of the workout. Working around the body and joints for muscle preparation can be accomplished when synergy or supporting movements of the body are used to maintain thermalregulation. Stretches at this point are meant to enhance the warm-up phase and should not be intended to enhance flexibility.

## 2. The Cardio Warm-up (2-3 minutes)

**Objectives:**
• To practice proper alignment for traveling moves at a lower intensity before beginning the work phase. The cardio warm-up specifically addresses the changes and safety concerns occurring with traveling moves. Buoyancy, balance and stabilization of postural alignment are affected to a greater degree by the increased resistance of travel and need to be practiced at a lower

intensity before beginning the work phase.

• To progressively increase intensity to enhance deep muscle temperature and elevate heart rate into the lower end of the training zone.

## 3. The Conditioning Phase (20-40 minutes)

**Cardiorespiratory Work:**

**Training Objectives**: Cardiorespiratory endurance, caloric expenditure.
In this case, the physiological overload would consist of moderately hard, multi-joint, large muscle activity while sustaining an exercise heart rate of 60 to 90 percent of maximum heart rate for 20-40 minutes. Either an interval (go easy/go hard) or continuous format is appropriate. Since buoyancy decreases or eliminates impact, people can increase the duration of their work phase without the risk of injury that gravity creates on land.

Travel uses many of the properties of water and research shows that it will create the highest intensity.

In water, instead of complicated choreography to increase intensity, we can achieve conditioning by manipulating a single basic move through a number of variations that change the properties of water acting on the body. These changes create an Intensity Progression.

**Cardio Training Tips:**

- Use different muscle groups and a variety of movements. This will help prevent muscular fatigue that makes it difficult to maintain the heart rate in the target zone. Arms will fatigue faster than the legs in water; in order to keep the heart rate up change the movement before the student begins to slow down and tire.
- Demonstrate movements at different intensity levels. Give verbal reminders to students to work at their own appropriate pace, based on feelings of breathlessness and heart rate.
- Encourage thermalregulation clothing to retain body warmth for peak muscular and cardiovascular efficiency.
- In water, the duration of the workout may be longer than on land, due to the decreased impact on the joints. This means that a greater number of calories may be burned overall with a longer, fun, more comfortable workout. Intensity must parallel land recommended intensity and to achieve training results, you must be working at a high enough intensity for your fitness level. Remember, it's easy to "cheat" in water if you want to. The percent of body fat, muscle and bone is of primary concern for achieving a healthy body and of interest to most water fitness participants. The average person gains one pound of fat per year after the age of 25 years. Additionally, as they age one half pound of Fat Free Weight is lost each year due to reduced physical activity.

**Muscular Conditioning Work**

**Training Objective:**
To focus on isolated muscle groups. It consists of two parts: high resistive exercises for developing muscular strength and endurance training, and stretching movements for flexibility training.

**Training Tips:**

- This is an effective way to improve the percentage of Fat Free Weight (muscle and bone) which increases resting metabolic rate. This increase in resting rate is important for weight management, because a fit person will burn more calories even at rest than an untrained person (Kosich, 1995). More muscle increases the capacity for movement allowing the person to be more active, even as they age.

- Isolate muscle groups and work them to near fatigue, then rest using a slow movement or a different move. Repeat the exercise using sufficient repetitions and sets to train the muscle groups. Add overload equipment as needed for training

- Use synergistic moves to maintain body warmth. For example, when isolating for triceps/ biceps work, keep the legs moving at an easy pace.

## 4. Optional Fun Set for Relaxation

Funky moves, sports fun moves and moves just for fun can be added here to end class on a light, playful note.

## 5. Cool Down, Stretching and Warm Down (3-6 minutes)

**Objectives:**
• Post-exercise stretching is done to improve range of motion of a specific joint. Now is the best time to stretch for improvements in flexibility. If the water is cold, keep from chilling by moving other muscles while stretching. For example, when stretching the upper body, jog lightly.

• A brief warm-down which includes easy, light, buoyant moves maybe included to insure that participants transition to land and exit the pool comfortably warm.

• Maintaining range of motion and mobility is important for efficient, effective movement.

*Note:* Targeting specific objectives are covered in detail during the next video courses: *Specificity of Training and Deep Water Program*, Video 2 and *The Aquatic Step Program*, Video 3 and *The Specificity of Training* Manual.