Safe Fun

Safe whitewater fun demands respect—respect for the river's power, your abilities, and your companions' safety. Canoeing or kayaking safely on whitewater is a matter of developing and practicing your skills and using good judgment. Have a great time and play hard, but play safe.

BSA Safety Afloat

When earning any of the aquatic merit badges, it is essential that you follow safety rules and use self-discipline and wise judgment. Tackling your first whitewater adventure will be challenging and rewarding if you understand and follow the nine points of Safety Afloat outlined below. These guidelines were developed to promote boating and boating safety and to set standards for safe unit activity afloat in flatwater or in whitewater.

1. QUALIFIED SUPERVISION

All whitewater activities must be supervised by an adult age 21 or older. All other supervisors must be at least 18 years old. In addition, there must be one supervisor for every 10 Scouts and adults, and no fewer than two supervisors for each group. These supervisors must accept responsibility for the safety of all Scouts participating in the whitewater activity.

All supervisors must be experienced in whitewater activities and familiar with the equipment commonly used in these activities, and they must have had rescue training for the type of watercraft to be used in the activities. Finally, all supervisors must complete BSA Safety Afloat and Safe Swim Defense training, and at least one supervisor must be certified in cardiopulmonary resuscitation (CPR).

2. PHYSICAL FITNESS

All paddlers must show fitness by presenting a complete health history from a physician, parent, or legal guardian. It is particularly important that the supervisors know about medical conditions, so that they can take the necessary precautions to make paddling safe.

3. SWIMMING ABILITY

All participants must have passed the BSA swimmer test. Anyone not classified as a swimmer may ride as a passenger in a canoe if one of the paddlers is an adult certified by a recognized agency as a lifeguard or lifesaver.

4. PERSONAL FLOTATION EQUIPMENT

All participants in a whitewater activity must wear U.S. Coast Guard–approved personal flotation devices (PFDs) that are properly fitted. Type III PFDs are recommended for whitewater activities.

5. BUDDY SYSTEM

Participants in every canoeing activity must use the buddy system. Every individual must have a buddy, and every craft should have a buddy boat when on the water.

6. SKILL PROFICIENCY

All participants must be trained in watercraft handling skills, safety, and emergency procedures. For whitewater activities, all participants must complete special training by a BSA Aquatics Instructor or qualified whitewater specialist approved by the local council.

7. PLANNING

Float Plan. A summary of the whitewater activity should be recorded in a float plan that documents exactly where the unit will put in and pull out, and what course will be followed. Time estimates should be generous in case of unexpected weather conditions and to avoid traveling under time pressure. Use accurate and current maps and review the plan with others who have made the trip under similar seasonal conditions.

Notification. File the float plan with parents of participants and a unit committee member. Because the activity uses boats on moving water, file a copy of the float plan with the local council service center. Appropriate authorities such as the Coast Guard, state police, or park personnel also should be notified of the activity.

Local Rules. All paddling activities must comply with state and local laws and regulations. Get written permission to use or cross private property.

Weather. Know and understand the seasonal weather patterns for the area. Check the weather forecast just before setting out and keep an alert eye on the weather.

Contingencies. Planning must anticipate likely emergencies and other circumstances that could force a change in plans. Develop appropriate alternative plans ahead of time.

8. EQUIPMENT

All equipment, including canoes, kayaks, paddles, safety equipment, and rescue equipment, must be in good repair and satisfy all state and U.S. Coast Guard requirements. When possible, carry spare equipment and appropriate repair materials.

9. DISCIPLINE

All participants should know, understand, and respect the rules and procedures for safe unit activity afloat. The rules should be presented before the outing and reviewed before the activity begins. Safety rules, plus common sense and good judgment, keep the fun from being interrupted by tragedy.

American Whitewater Safety Guidelines

For more information about whitewater safety and to view the complete American Whitewater Safety Code, visit (with your parent's permission) *http://www.AmericanWhitewater.org.*

Whitewater activities present new opportunities for adventure, but they also pose some additional risks that you should understand and take precautions to avoid. The following guidelines, adapted from the American Whitewater Safety Code, are geared especially for whitewater enthusiasts and are an excellent supplement to the Safety Afloat guidelines. Together these sets of guidelines will help ensure that your outings will be both safe and enjoyable.

1. BE A COMPETENT SWIMMER.

Being a safe whitewater boater does not require Olympian swimming skills, but you should be comfortable and competent in the water and be able to handle yourself underwater.

2. WEAR A PERSONAL FLOTATION DEVICE.

A properly fitted vest-type PFD offers back and shoulder protection as well as the flotation needed to swim safely in whitewater.

3. WEAR A SOLID, CORRECTLY FITTED HELMET.

A helmet is essential in kayaks or covered canoes and is recommended for open canoeists using thigh straps and rafters running steep drops.

4. KEEP YOUR BOAT UNDER CONTROL.

Your skills should be sufficiently developed to enable you to stop or get to shore before reaching danger. Do not enter a rapid unless you are reasonably sure that you can run it safely or swim it without injury.

5. BE AWARE OF RIVER HAZARDS.

Whitewater rivers present many hazards, such as high water or very cold water, strainers (brush or trees in the water), dams, ledges, holes, undercut rocks, or places where broaching (hitting an obstacle broadside) is likely. If you do not think you can boat around a hazard, get out and walk.

6. AVOID BOATING ALONE.

The recommended minimum party is three people in at least two craft.

7. KNOW THE LIMITS OF YOUR BOATING ABILITY.

Do not attempt rivers or rapids that require paddling skills more advanced than those you possess.

8. KNOW HOW TO SELF-RESCUE.

Learn and practice self-rescue techniques such as recovering from a capsize.

9. BE TRAINED IN RESCUE SKILLS.

Be able to perform CPR and first aid, including being able to recognize and treat hypothermia.

10. BE SUITABLY EQUIPPED AND PREPARED FOR EMERGENCIES.

- Wear shoes that will protect your feet.
- Carry a throw rope, knife, whistle, and waterproof matches.
- Tie your glasses on.
- Bring duct tape on short runs and a full repair kit on isolated rivers.
- Do not wear bulky clothing that could get waterlogged and hinder your ability to swim.

11. BE RESPONSIBLE FOR YOUR OWN SAFETY.

- Make thoughtful and responsible decisions about whether to participate in a trip.
- Choose appropriate equipment.
- Scout all rapids first and use your best judgment to decide whether to run or portage.
- Evaluate your own and your group's safety on an ongoing basis. Speak with anyone whose actions on the water are dangerous, whether the person is a part of your group or not.

Safety on the Water

Whenever you participate in whitewater activities, you should carry adequate safety equipment and be prepared to help out in a rescue or to perform first aid. You must be aware of safety considerations at all times and be completely alert. Do not go afloat if you are fatigued. Be sure also that your whitewater partner and those in your buddy boats are fully alert, sober, and responsible.

Personal Flotation Devices and Whistles

Your PFD is your most important piece of safety equipment. If you go overboard, the support from your PFD will allow you to concentrate on righting the boat and getting back under way. In an emergency situation, it might keep an unconscious paddler afloat until help arrives. In short, wearing a properly fitted PFD helps minimize risk and saves lives.

You should wear a PFD every time you paddle, whether on a peaceful lake, a slow-moving stream, or a whitewater river. Attach a loud whistle to your PFD so that you can sound it instantly, should you need help. Do not, however, tie it to the zipper where currents could catch it and inadvertently open your PFD.

Make sure your PFD fits correctly. To check the fit on dry land, put it on and tighten it until it is snug but not uncomfortable. Zip all zippers, buckle all buckles, tie all ties, and clinch up all side straps. Have a buddy stand behind you, grasp the material covering each shoulder, and try to pull it up straight. If the PFD can be pulled up to ear level, readjust it. You many need to try a different style or size for a better fit. The best test is to check the fit in calm water over your head. Enter the water and relax your body while tilting your head back. Your PFD should keep your chin well above the water. If it does not, readjust your PFD, try a different style, or use one with a higher buoyancy rating (read the label).

Check over your PFD every year. Sun, sand, water, and age all take a toll on a PFD. Look for frayed fabric, broken or missing buckles, and poorly functioning zippers. Do not attempt to repair tears or rips in the material. Replace your PFD if you have any doubt about its integrity or ability to keep you afloat.

U.S. Coast Guard–Approved PFDs

The following are brief descriptions of the five U.S. Coast Guard–approved PFDs. For recreational whitewater activities, Type III PFDs generally are worn.

The Type I PFD is an offshore life jacket that provides enough flotation in the chest, shoulders, and upper back areas to turn most unconscious victims faceup in rough, open water. Type I PFDs are not designed for recreational paddling, but they are suitable for passengers on cruising vessels on large bodies of water.

The Type II PFD is a near-shore buoyant vest that places all the flotation in the front and around the neck. Shaped like a horse collar and less bulky than Type I PFDs, Type II PFDs may help keep an unconscious victim faceup in calm, inland waters. It will not prevent an unconscious person from floating facedown. Type II PFDs are OK for short periods of recreational boating but are too uncomfortable to use for paddling trips.

Type III PFDs most often are used for water sports such as waterskiing, fishing, kayaking, and canoeing. The Type III PFD is designed to keep a conscious person floating in a vertical position. It will not prevent an unconscious person from floating facedown. Generally, Type III PFDs have a zipper or buckle closure, and they may include adjustable side straps. They are comfortable and have a similar buoyancy as Type II PFDs.

The Type IV PFD (a circular ring, ring buoy, or seat cushion with straps used for throwing) is designed to be tossed to a person in the water. A Type IV PFD should never be used in place of a wearable PFD.

The Type V PFD is for special use only. A PFD designed for commercial whitewater rafting with extra flotation and a buoyant collar is one example of a Type V PFD. Other Type V PFDs, such as a rescue vest with a quick-release harness built into it, should be used only by someone who has had special training.

Helmets

In addition to wearing a PFD, you should always wear a helmet if you are paddling a kayak or open canoe with thigh straps (see American Whitewater safety guidelines). You should also wear a helmet in a raft when attempting a Class IV rapid. The helmet will help protect your head in the event of a capsize or in case you need to swim in whitewater. Most helmets feature holes that allow water to drain out. When adjusting and checking fit, the helmet should feel snug but comfortable. You should be able to grasp your helmet with both hands and wiggle it a little but not enough to expose the parts of your head the helmet is intended to protect—your forehead, temples, ears, and the base of your skull.

Throw Ropes

Your PFD and helmet will help keep you safe should you flip, but an accurately thrown rescue rope can quickly pull you to safety. Throw ropes are soft floating lines approximately 60 to 70 feet in length and 5/16 inch or 3/8 inch in diameter. They often are made of polypropylene, a relatively inexpensive synthetic fiber that is strong enough to haul in swimmers and has the most buoyancy of any rope material.

Throw ropes come in a nylon bag with, typically, a disk of closed-cell foam in the bag's end. Because the ropes float, a swimmer can easily grab them. Avoid using nylon ropes because they sink and could become a potential entrapment hazard for other paddlers. (See "Rescue Techniques" for a discussion of how to use a throw rope to rescue swimmers.)

Throw-Rope Care. If a throw rope gets wet, hang it between two points until it is dry. Repack the rope in its bag. Store it away from heat and bright sunlight. At least once a season, inspect your throw rope inch by inch. Check that it is uncut, supple, and clean. A friend's life may depend upon it someday.

First Aid

Although there is much you can do to avoid accidents and injuries while out on the river, you should always be properly prepared to deal with them should they occur. On every river trip, carry an easily accessible waterproof first-aid kit. The longer your trip and the farther you are from civilization, the more extensive your kit should be. Always take a personal first-aid kit to cover your own needs. On group outings, a patrol first-aid kit should be sufficient. Consult the *First Aid* merit badge pamphlet or the *Fieldbook* for kit contents.

Dealing With Cold Water and Cold Weather

Hypothermia occurs when the body's core temperature falls below the normal range. Exposure to cold, or even cool, water can lower your core temperature dangerously. Early signs of heat loss include bluish lips and shivering, followed by a loss of judgment and the inability to do simple tasks. Further chilling can lead to unconsciousness and, eventually, death. Stop additional heat loss by removing the victim from the water and removing any wet clothing. Wrap warm bedding or blankets around the person and make sure to cover the head, where heat loss is the greatest. In extreme cases, keep the victim as warm as possible and call for medical aid. Before an outing, always review hypothermia treatment procedures and carry equipment for warming anyone who shows symptoms of heat loss.

Wear protective clothing (a wet or dry suit) if the water temperature is 50 degrees or less or the combined water and air temperature is less than 120 degrees.

Recognizing Heat Reactions

High temperatures can pose as much of a safety threat as low temperatures. Heat reactions, including heat exhaustion and heatstroke, result when the body cannot keep itself cool enough. A person with *heat exhaustion* will have symptoms that include feeling dizzy, faint, nauseated, or weak. The victim may develop a headache or muscle cramps or look pale and be sweating heavily. Have the person lie down in a cool, shady spot with feet raised. Loosen clothing and cool the person with a damp cloth or a fan. Have the victim sip water. If the condition worsens, get medical help. Recovery should be rapid.

Heatstroke is an extreme heat reaction in which either *dehydration* (water loss) has caused body temperature to rise and sweating to stop or the body cannot lose heat fast enough and sweating occurs. The pulse is extremely rapid, and the person will be disoriented or unconscious. Cool the victim immediately through immersion or with cold packs, and increase the body's fluid level. Treat the person for shock and seek emergency help immediately. Heatstroke is a life-threatening condition.

Dehydration can occur at any temperature if a person is sweating profusely and/or not drinking enough liquids. Avoid dehydration by drinking plenty of fluids and eating enough throughout the day. If someone in your group becomes weary, confused, or develops a headache or body aches, have the person rest in the shade and sip water until the symptoms subside.

Earning the First Aid merit badge provides an excellent start in preparing for medical emergencies on land or on the water.

Sunburn is an inflammation of the skin caused by too much exposure to the sun. When sunlight reflects off the water surface, it increases the chance of being burned, so it is especially important for paddlers to cover up, use a waterproof sunscreen, and limit exposure time.

Shoulder Dislocations

Shoulder dislocations are one of the most serious injuries associated with whitewater activities. A shoulder becomes dislocated when the ball at the end of the upper arm bone slips out of the socket at the shoulder. This can happen when a paddler attempts a maneuver such as a high brace that involves reaching overhead to gain leverage with the paddle. Any stroke or maneuver in which the arm is fully extended and then rotated rearward so the elbow is behind the shoulder puts the shoulder joint in a vulnerable position. You can reduce the likelihood of such an injury by making sure you keep a slight bend in your elbows and by keeping your grip or upper hand no higher than your forehead.

If someone in your party should suffer a shoulder dislocation, put a sling on the arm and immobilize the area above and below the joint as for a collarbone fracture. Before applying the sling, place a pad between the arm and chest. Do not move the joint or attempt to put the arm bone back in the socket. Take measures to prevent the person from going into shock. Get the victim to medical attention as quickly as possible.

Minor Injuries

Paddlers can get insect bites or stings while afloat or when preparing to launch from the shore. The best strategies for avoiding stings and bites are to use insect repellent and wear long-sleeved shirts and long pants when in buggy areas. For typical insect stings and bites, apply first aid as described in your *Boy Scout Handbook*. For severe and prolonged pain, or any severe reaction, dizziness, or respiratory distress, get medical help.

Bruises are injuries that cause bleeding under the skin. Applying an ice pack to a bruise will reduce pain and swelling. Minor wounds, such as cuts, should be washed carefully with soap and water and covered with a sterile bandage or dressing to prevent infection. Deeper cuts or puncture wounds may need stitches, antibiotics, and a tetanus shot to prevent infection. For these injuries, return to shore at once and visit a doctor.

Blisters form when skin is irritated, usually by friction or heat. A hot spot signals the beginning of a blister. Stop immediately and protect the tender area by cutting a piece of moleskin or molefoam and covering the affected area. If a blister forms, build up several layers of moleskin or molefoam, as needed, to take off the pressure. Blisters are best left unbroken. Treat a broken blister as you would a minor cut.

Cardiopulmonary Resuscitation

Cardiopulmonary resuscitation (CPR) is a procedure used on someone whose breathing and heartbeat have stopped. It is only for extreme emergencies. CPR is required only when someone has no pulse, indicating that the heart has stopped beating. Someone's heart may stop in the event of a heart attack or drowning. CPR includes both chest compressions and rescue breathing (mouth-to-mouth resuscitation). The procedure provides the blood circulation and breathing that could save the victim's life. CPR should not be performed on someone who has a pulse but is simply unconscious. A drowning victim may stop breathing but could still have a pulse. In this case, rescue breathing, not CPR, is the correct procedure to follow.

CPR courses are designed to teach rescuers how to recognize life-threatening conditions and respond appropriately. Check with the American Red Cross, the American Heart Association, and other similar organizations in your area to find out if they offer CPR and other first-aid training. Every river trip should include one or more persons trained and certified in CPR. You need to know CPR before you have to use it.

A frightened or anxious victim might breathe too heavily or too deeply, which can result in hyperventilation. Calmly encourage the person to relax and breathe slowly.

Reading a River

Before you set foot in your boat, take the time to learn as much as you can about the stretch of river you will be running. Find out about the river's unique features and hazards, identify what class of rapids you will be dealing with, and scout your route to avoid unpleasant and potentially dangerous surprises.

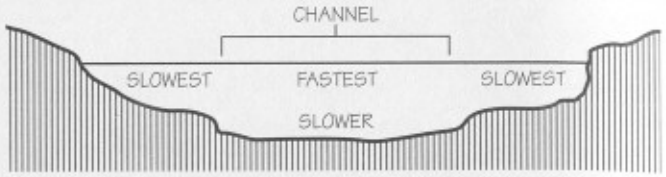
When scouting a river, be sure to wear your helmet.

River Features

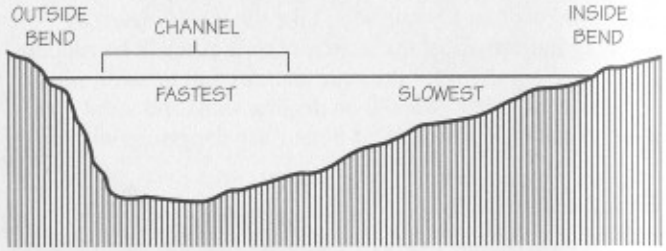
The term *whitewater* refers to a stretch of swiftly moving water that becomes white and foamy as it passes over or around obstacles. A *rapid* is a turbulent, fast-flowing stretch of river that contains obstructions above or below the water. Rapids may feature *drops* in which the water abruptly descends over a ledge.

Current describes the continuous movement of water in a certain direction. The strength of the current is affected by three things: gradient, flow, and width. The steeper the gradient (or slope of riverbed) and the higher the volume of flow, the more powerful the current.

Water in a river flows in different layers at different speeds. In straight channels, the layers just beneath the surface and in the middle of the river flow faster than the layers on the bottom or on the sides because there is less friction with air and the river bottom. As the riverbed widens and the water becomes less deep, the current slows and *shallows* (shallow areas) develop.



Speed of currents in a straight river

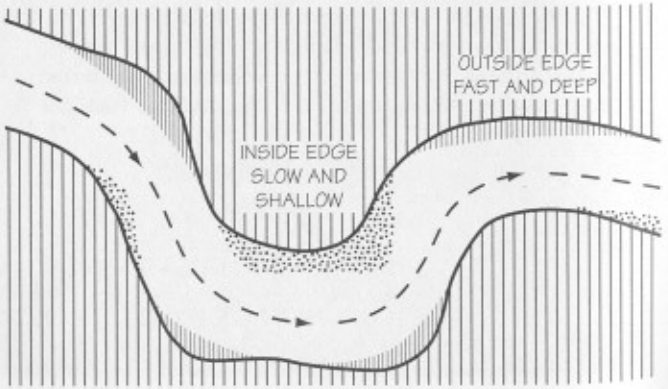


Speed of currents in a river bend

The amount of water flowing downstream changes seasonally, daily, and sometimes hourly. A river's flow is measured in cubic feet per second (CFS).

When a river turns, it forms a *bend*. The strongest, deepest, and fastest current will be found on the outside of bends. You usually will find the biggest waves on the outside of the curve, and the smallest waves, called *riffles*, running on the inside. Here the water is the slowest as it passes over sand or gravel bars.

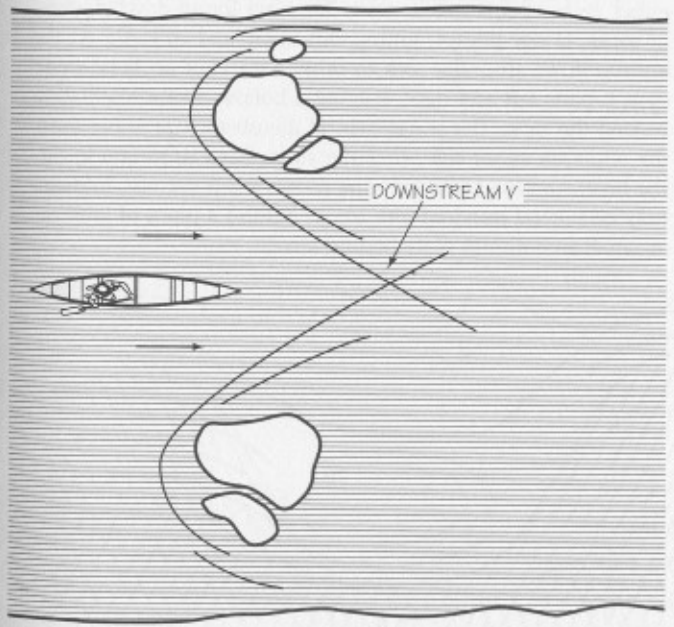
The beds of most whitewater rivers are littered with rocks, but when a paddler talks about *rocks*, he or she usually is referring to rocks jutting above the river's surface. Logs and trees just below the surface are called *sleepers*.



Ledges are rock shelves that extend from the bank into the river or are submerged. A series of ledges can form a stair-step rapid. Big ledges can create *falls*, or a drop where water free-falls at least part of the way. Ledges often warrant a look-see before running.

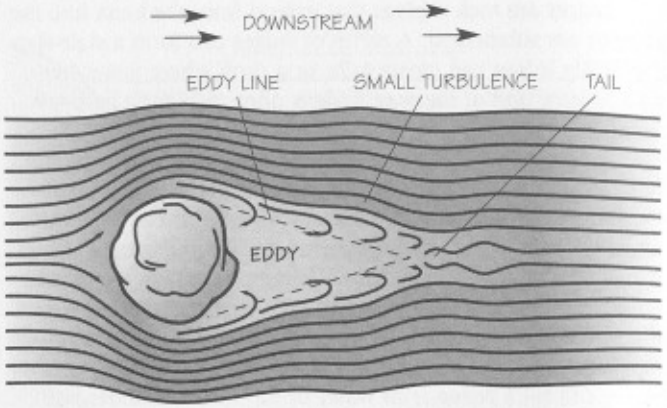
A *downstream V* forms when current flows between two obstructions, such as midstream rocks or the walls of a narrow canyon. A downstream V's wide end faces upstream and its apex, or narrow end, faces downstream. Steep diagonal waves usually define the sides of the V, forcing boaters to the middle of the V, where the fastest current and deepest water are found. Running the downstream V can be the easiest route through a rapid, but huge waves can form at the bottom of the V. These waves can fill a canoe with water or flip a boat. Canoes with lots of rocker, or curve in the hull, and flotation bags can minimize the amount of water that will enter the boat.

As you paddle downstream, you will often see a *pillow*—a layer of slack water that cushions the upstream face of a rock as the river pours over.



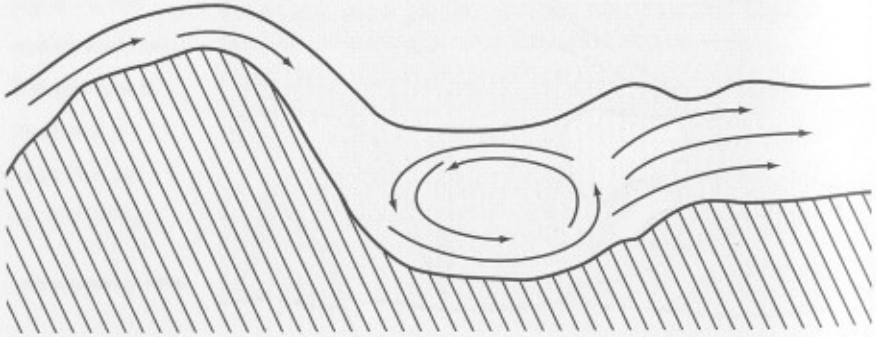
Downstream V

To tell the difference between eddies and holes, remember this: Water flows into eddies and then out again at the surface. Water flows into holes, recirculates for a while, then flows out along the river bottom.



An eddy can form on the downstream side of a boulder.

Eddies are relatively calm waters where the main current either stops or reverses its flow. They are found downstream of rocks, bridge pilings, jutting cliff faces, and so forth. As the current flows around a rock or other natural or artificial structure, it parts left and right, leaving a hollow area immediately behind the rock. The water behind the obstacle is lower than the water on either side, so water flows back upstream to fill the hole, running counter to the river's main current. Eddies may be several hundred feet across behind a point of land or as small as a dinner plate behind a rock.



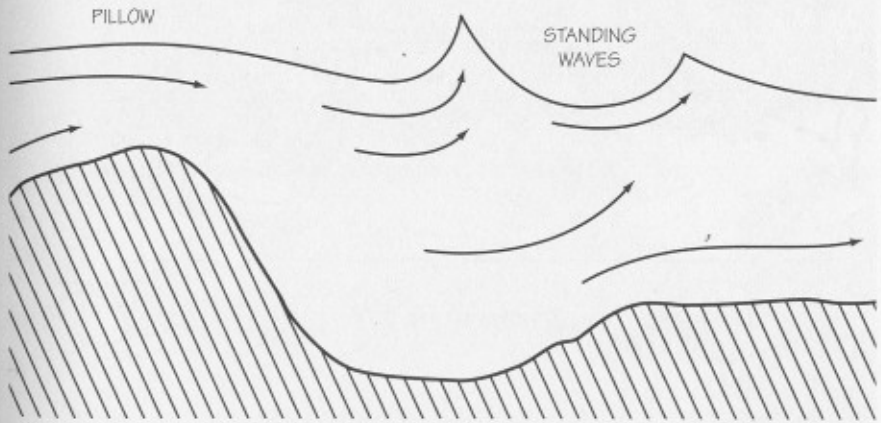
Shallow currents flow over an obstacle to create a hole on the downstream side.

Eddy lines are the often-visible lines where the downstream current rubs up against an eddy's upstream current. This forms a ridge in the water that tapers from high to low the farther downstream you move in the eddy.

Holes are areas behind obstacles where a trough forms, followed by a wave that curls back toward the hole. *Hydraulics* are extremely dangerous holes that form over an obstruction or following a sudden drop in the riverbed, with most of their water recirculating instead of flowing back into the river downstream of the obstruction. In a hydraulic, water flows in from all sides and flows out along the river bottom. Hydraulics usually feature violent, aerated water and powerful tumbling current.

Waves are moving ridges of water. Sometimes waves bunch up into *standing waves*, a series of connected waves also called a wave train. Standing waves form at the end of a rapid when the faster water from upstream piles into the slower water below it. A line of waves form, one following another, gradually decreasing in size, until the moving water dissipates its energy and the current is calm again.

Standing waves can be fun to ride. You will feel as if the river is standing still and your boat is being raised and lowered like a yo-yo. At other times, standing waves can be steep enough to overturn or fill boats.



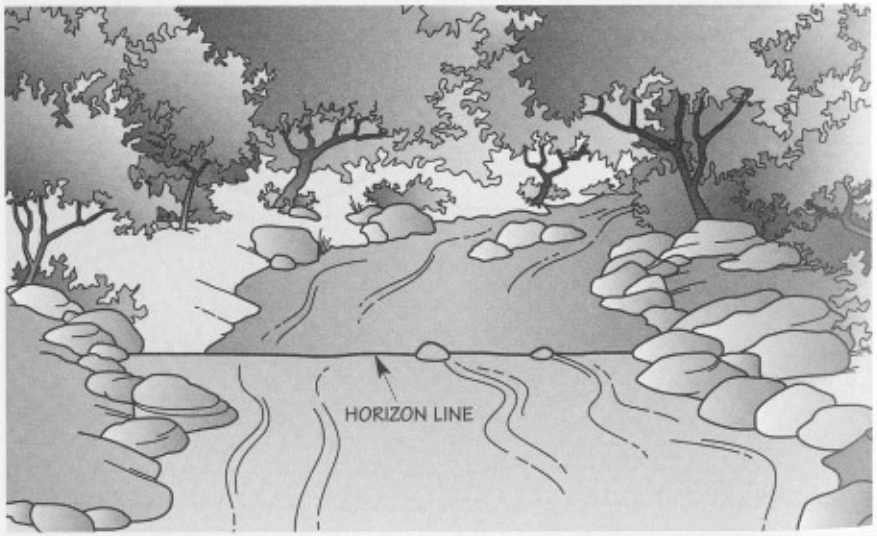
Deeper currents cover the pillow and flow over the obstacle to form standing waves farther downstream.

River Hazards

Hydraulics and riverwide waves can be created by artificial structures such as weirs or low-head dams. *Low-head dams* (usually made of concrete or rock rubble) often stretch from bank to bank, typically without a break for the current to flow through. Instead, the river falls evenly over the structure, forming an often lethal, unbroken wave.

Never run drops formed by low-head dams or weirs. They are aptly called "drowning machines." Their symmetry forms a very dangerous recirculating hydraulic with no defined downstream flow and no opportunity to escape downstream or to the side. Many times they are marked on maps. Identify each one during trip planning and make sure each can be safely portaged.

Also be on the lookout when you are out on the water for low-head dams or waterfalls that are not marked on maps. They often give themselves away by revealing an unbroken horizon line. A *horizon line* is formed when the river steepens and the rapid or falls formed by this sudden drop is below your sight line, thus marking a steep drop, a falls, or a low-head dam. Always stop and scout drops with horizon lines. Horizon lines frequently indicate a mandatory portage.



Horizon lines appear as an unbroken line, often stretching from bank to bank. You will see the river running up to this line, then disappearing, to become visible a distance downstream.

Even the most skilled paddlers sometimes find their boat going sideways down the river. If you are approaching an obstacle like a large rock in this position, try to avoid *broaching*. Broaching occurs when your boat is sideways to the current and gets pushed up against an obstacle. *Vertical pinning* occurs when the boat goes over a steep drop and the bow sticks in the river bed below, usually jammed between rocks.

Broaching

Avoid getting any part of your body between your boat and an obstacle if your boat broaches. Not only can the current's force wrap boats, but it can entrap paddlers, sometimes with fatal consequences.

If you begin to broach, lean toward the obstacle and allow the current to flow underneath and around the hull. If you lean upstream, away from the obstacle, the current will usually flip the boat upstream. If you are in a canoe, the water will fill the boat like a big tub. If you are in a kayak, water will tend to push the boat down, deeper into the water, entrapping you inside. If it looks like you are going to pin, get out of your boat—fast—and onto the obstacle.

The best way to avoid broaching is to keep the boat pointed downstream. It is better to hit a rock straight on with the bow than to try to turn in the current and end up going sideways.

Undercut rocks are rocks that have been eroded underwater. They often are invisible from the surface and can entrap boats. They are very dangerous and can be fatal. Avoid undercut rocks by boating or portaging around drops with undercut rocks.

Strainers are obstacles that come in many guises but always spell big trouble. Tree limbs (also called *sweepers*) are a common type of strainer. They comb the current—stopping boats and boaters while allowing the current to flow cleanly through. Downed trees or roots also snare unwary boaters. Artificial strainers such as fencing, old cables or pipes, and chunks of concrete and rebar form severe hazards on some rivers. Portage around any strainer that you are not confident you can safely pass.

Low-hanging tree branches often create strainers.

When in Doubt, Scout!

Before running a section of whitewater, a blind corner, or a potential drop of any sort, land your boat and scout ahead along the shore to make sure that there are no upcoming obstacles that might be beyond your ability to navigate.

When scouting a river, it is important that everyone use the same terms to describe what they see. *Downstream* describes the direction in which the current is flowing toward the mouth of the river, and *upstream* describes the direction opposite the general flow of the current. *River right* and *river left* always refer to the right side or the left side of the river as if you were facing downstream.

Scouting ahead helps you choose the safest route through rough water. Start planning your run at the downstream end and work your way back upstream. First know where you want to end up, then figure out *if* and *how* you can get there safely. Look things over to identify hazards, and discuss them with your buddies.

Note landmarks that might help you know when to begin that critical midrapid move. While walking back to your boat, stop several times to squat down and look back downstream. Try to imagine how things will look from water level. Break your run into sections. By doing so, you can break down an imposing stretch of foam and spray into a series of planned maneuvers. Identify several options to use in case your run does not go according to your original plan.

Rivers change from one day to the next. You need to know what is around the next bend or over the next drop. Normal erosion, floods, fallen trees, and new fences may transform overnight a safe route into a hazardous one. Remember that water levels rise and fall with the seasons and after rains. Sudden dam releases may lower or raise water levels drastically, dramatically changing a river's character. Don't take anything for granted.

The time of year, fallen trees, and rainfall are just several elements that can transform a normally safe route into a dangerous one. Always scout ahead, plan your run, and identify several options in case your run does not go as planned.

International Scale of River Difficulty

The International Scale of River Difficulty provides a standardized classification system for rating the difficulty and risks in running rapids. River runners use the scale as a rough but useful means of comparing the difficulty of one river with another. As a beginner, your paddling will be in Class I and Class II whitewater so that you can build skills in water where you can have fun with relatively low risk. In addition, you can develop new skills safely by practicing difficult moves in easy rapids.

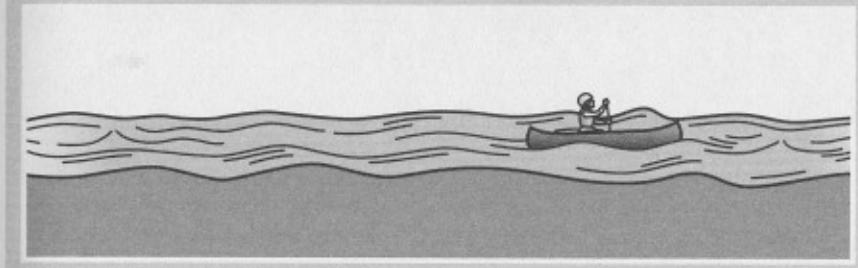
The scale (from Class I through the extreme Class VI) is useful only if you understand your own capabilities and limitations and those of your companions. Although Class I and II rapids are good choices for beginners, you may find yourself deciding to run a rapid you portaged last time or portaging a rapid you ran previously. For instance, cold or high water can raise a rapid's difficulty by one or more levels.

In addition, you should consider a river's rating to be one class higher if the sum of the temperature of the water and air totals less than 120 degrees or if the trip is on a remote river. As you gain experience, you will learn to exercise progressively sophisticated judgment about both the river and yourself. Always choose safety and common sense when in doubt.

Regardless of a rapid's classification, do not run anything you would not swim.

International Scale of River Difficulty

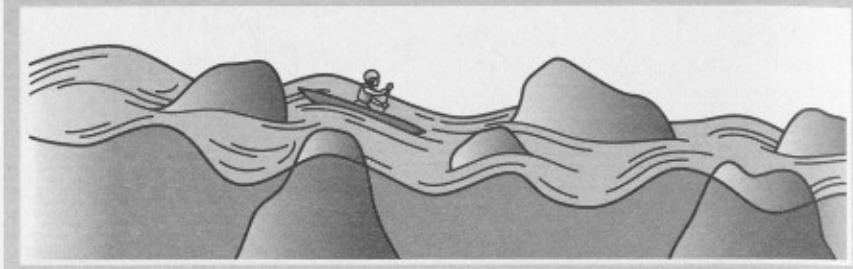
Here are the six classifications used for the International Scale of River Difficulty.



Class I: Fast-moving water with riffles and small waves. Few or no obstructions. Risk to swimmers is slight; self-rescue is easy.

Class II: Straightforward rapids with wide, clear channels. Some maneuvering may be required, but rocks and medium-size waves are easily avoided by trained paddlers. Swimmers are seldom at risk.

Class III: Rapids with moderate, irregular waves that may swamp an open canoe. Complex maneuvering is often required. Some risk to swimmers; group assistance may be necessary.



Class IV: Powerful, but predictable, rapids requiring precise boat handling in turbulent water. May feature large, unavoidable waves and holes or narrow passages demanding fast maneuvers. Risk to swimmers is moderate to high; self-rescue may be difficult and group assistance is often necessary.

Class V: Extremely long, obstructed, or very violent rapids. Drops may feature large, unavoidable waves and holes or steep, congested chutes with complex, demanding routes. Eddies may be turbulent or difficult to reach. Swims are dangerous, and rescue is often difficult, even for experts.

Class VI: These runs have almost never been attempted because they are extremely difficult, unpredictable, and dangerous. The consequences of errors are very severe and rescue may be impossible. Only teams of experts who have taken every precaution should attempt them, and only when water levels are favorable.

Boats, Paddles, and Other Equipment

Canoes and kayaks designed for whitewater are more sturdily built than those designed for flatwater. They are designed to bounce or slide off rocks, to turn quickly, and to be forgiving in turbulent water.

Boat Materials

Most whitewater canoes and kayaks are made of plastic, plastic-foam composites, or Kevlar® and carbon-fiber composites. Aluminum canoes and fiberglass canoes and kayaks were once the most popular boats for whitewater. They have been replaced by modern plastic boats but still remain very common for trips on moving water without rapids. Each material has advantages and disadvantages. When selecting a boat, you will need to consider expense, your skill level, and how well the boat material will stand up to the type of river running you will be doing.

The table here lists some common canoe and kayak materials and lists the advantages and disadvantages of each.

Whitewater Canoe and Kayak Materials

Hull Material	Advantages	Disadvantages
ABS Royalex™ (acrylonitrile butadiene styrene), cross-linked vinyl, ABS plastic, and ABS closed-cell foam sandwiched together	Strong; flexes instead of breaks; quiet, repairable, moderately priced; the most common material used to build whitewater canoes	Heavy; dents and scratches easily; sometimes too flexible; cannot be shaped into fine bows and sterns; repairs can be difficult; heavier than fiberglass or Kevlar®
Polyethylene (plastic or plastic and foam, injected or molded in a form)	Flexes instead of breaks; quiet; least expensive; the most common material used to build kayaks	Very difficult to outfit and repair; sometimes too flexible; often very heavy
Aluminum	Strong and weatherproof; less expensive than some materials	Noisy; "sticks" to rocks; not lightweight; cannot be shaped into fine bows and sterns; external keel ill-suited for whitewater; more difficult to outfit; heavier than fiberglass
Fiberglass	Strong; lighter than ABS; can be formed into sophisticated shapes; stiff; easier to outfit and repair; moderately priced	Less durable than ABS; heavier than Kevlar®; few whitewater-specific canoes and kayaks are made of fiberglass
Kevlar®/carbon fiber	Very strong for its weight; can be formed into sophisticated shapes; very stiff; relatively easy to outfit and repair; often used for competition and elite whitewater canoes and kayaks	Most expensive; less tolerant of abuse than ABS

Decked Canoes

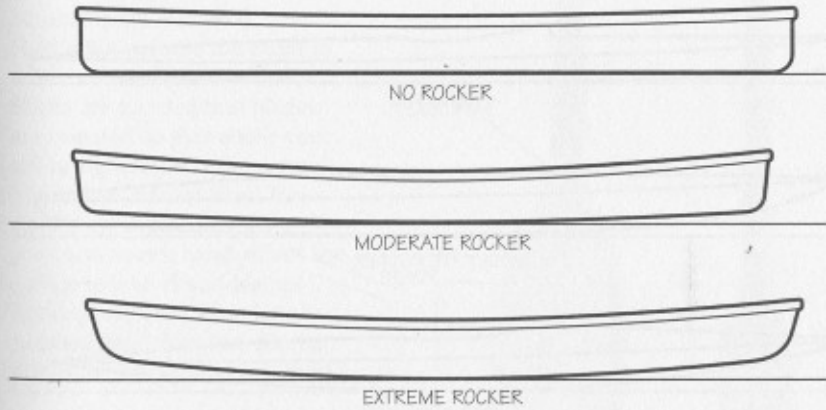
Solo and tandem covered canoes, called C-1s and C-2s, are a treat to watch as they run heavy white water or slip through slalom gates. Like kayaks, paddlers in C-boats are decked, so paddlers wear spray skirts that allow them to stay dry in big waves and to play in holes. C-boat paddlers kneel on a pedestal rather than sit in a seat, and they use a single paddle.

Differences in Whitewater and Flatwater Canoe Design

Whitewater solo canoes vary from 11 to 14 feet in length, and are usually less than 30 inches wide. Tandem whitewater canoes are 14 to 16 feet long and 32 to 36 inches wide. The average whitewater canoe's bow and stern are fuller than those designed for flatwater or ocean touring. This aids buoyancy and reduces the chance that the ends of the boat will get buried in a wave.

Whitewater canoes are built with more rocker than flatwater boats. *Rocker* is the term used to describe a boat's end-to-end profile. The bottom of the boat curves up, like a banana, toward the front and back of the boat. This shape helps whitewater canoes turn quickly. Flatwater boats have much less rocker, which helps them track in a straight line.

Another way whitewater canoes differ from flatwater canoes is that they often have higher sides to help keep out waves. Some whitewater canoes are designed with *tumblehome*, an inward curving of the upper section of the side of the canoe. On well-designed whitewater boats, tumblehome does not adversely affect the boat's stability and makes it considerably easier to paddle because the hand on the paddle shaft can be kept closer to the boat.

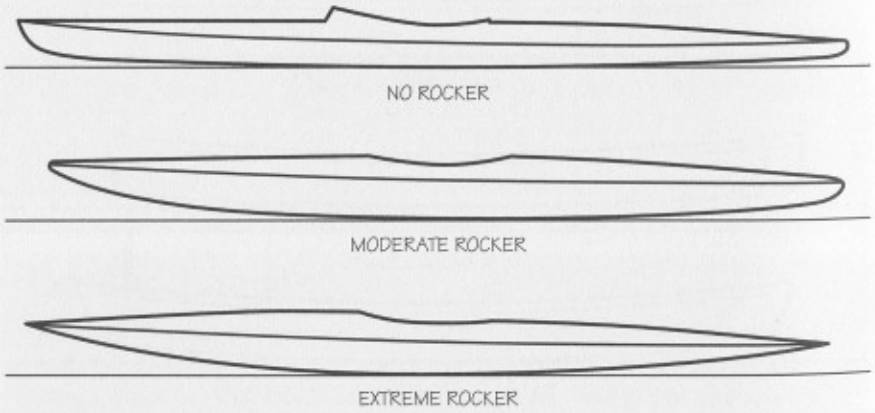


Canoe rocker

Types of Kayaks

Most modern kayaks are made of rigid plastics such as polyethylene, fiberglass, or Kevlar®. Kayak designs vary according to usage and construction. For example, a flatwater racer differs from a whitewater racer. Recreational kayaks are multipurpose craft suitable for a variety of water conditions. Touring kayaks are larger and have storage capacity for camping gear. They are also known as sea kayaks, due to their use around ocean shorelines. These kayaks are built long—up to 20 feet—to aid in tracking, and they often have a rudder, or *skeg*. Sit-on-top kayaks do away with the traditional cockpit and deck in favor of a recessed well that is self-bailing. Inflatable kayaks are made of the same materials as whitewater rafts and are very stable. Inflatables are open, like rafts, with the paddler sitting on the floor of the boat.

Special play boats, also called *rodeo kayaks*, are used in heavy whitewater. Some play boat designs are adapted for surfing. They are only 6 to 9 feet long and 2 feet wide, with low decks and hard chines (where the floor meets the sides). Short boats are slow boats, but what they sacrifice in speed they gain in maneuverability. Low decks make it easier to play in holes; flat bottoms make it easier to spin; and hard chines make carving turns and steering easier.



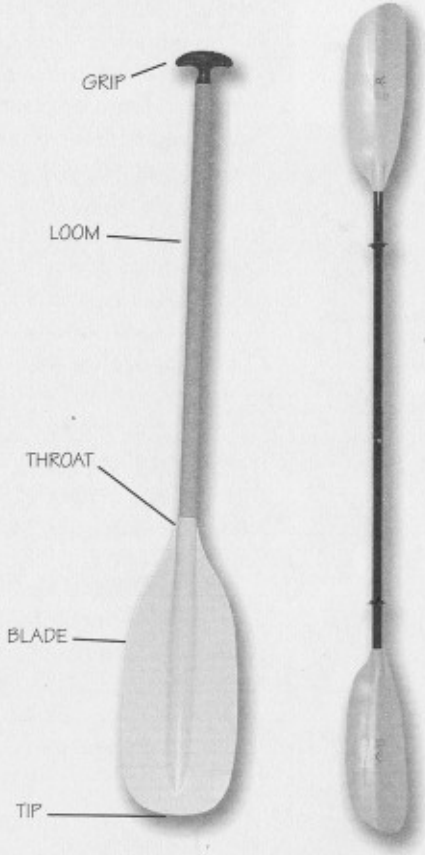
Kayak rocker

Paddles

On every trip, you will lift your paddle thousands of times, making a lightweight but sturdy paddle worth its weight in gold. The best paddle shafts are *indexed*, or oval, not round. An indexed shaft helps you control the boat and is easy on your hands. Paddle blade shape is important as well. The best whitewater paddles combine lightweight strength with shapes that "stick" in the water, then move cleanly through the water.

Whitewater canoe paddles are made of wood, aluminum, plastic, and composite materials, such as fiberglass, Kevlar®, and carbon fiber. Most whitewater canoe paddles feature a T-grip for better feedback and control. Blades vary in size, but most have a medium-size blade that is steady and predictable in the water. The tip of the blade is often constructed with an insert of a durable material such as aluminum or polyurethane.

Kayak paddles have blades at both ends. Usually the blades are set at an angle to each other from 45 to 90 degrees. The offset angle allows the paddle blade out of the water to be automatically feathered. Feathering reduces the effect of wind and wave on the blade. Shafts are indexed and blades are oriented so that either your left or right hand is the control hand. Your control hand constantly grips the shaft while your noncontrol hand allows the paddle to swivel and feather between strokes. Some kayak paddles break into two shorter pieces for storage and transport.



Every kayaking party should have at least one spare paddle; every canoe should have one, too. Canoeists' spare paddles should be securely fastened to their boats, out of the way, but readily at hand in case they are needed.

Kayak blades in profile can be either flat or curved and either a simple oval or a complex curved shape. Kayak paddle faces can be flat or hollowed. Whitewater kayak paddles are shorter and generally more symmetrical than touring kayak paddles.

Outfitting

Most whitewater canoes and kayaks feature special outfitting to hold paddlers securely in their boats. Foot braces, for example, help both kayakers and canoeists hold themselves in their boats with their legs and knees. Releasable thigh straps keep canoeists from falling out when the boat is tipped or upside down.

In addition, most whitewater canoes are outfitted with rigid foam or plastic pedestals (or "saddles") on which paddlers kneel astride. Pedestals offer much better control over a canoe and, by virtue of being easier to tumble off of than bench seats, are safer in the event of a capsize. Knee pads glued into a canoe keep paddlers from sliding around and ease the discomfort of kneeling.

Kayakers pad their boat's cockpit so that it will fit like a glove for the purpose of control while on moving water. Most whitewater kayaks include pillars or bulkheads made of foam to keep their decks from collapsing should they broach. Pillars, usually placed fore and aft, brace the floor and deck between kayakers' legs or in front of their feet and behind their boat's seat.

All canoe and kayak outfitting must be installed with safety in mind. Most outfitting is glued into boats with adhesives specifically designed for the task. Many are toxic. Have an experienced whitewater paddler help you make sure your outfitting is functional, properly installed, and safe to use.

Whitewater Rafts

Rafts are inflated watercraft that come in a variety of shapes and sizes. Paddle rafts are paddled by a crew of paddlers, while oar rafts are rowed by a single oarsperson. Most rafts are 10 to 16 feet long and oval. The hulls are made of inflatable tubes about 14 to 20 inches in diameter. These tubes are made of sturdy synthetic rubber or vinyl. Oared rafts are coupled to an aluminum frame that holds gear, seats, and rowlocks. Most modern whitewater rafts are self-bailing, that is, they feature an inflated floor with drain holes that allow water to flow out of the boat.

The size and weight of a whitewater raft make it a stable and forgiving craft that is ideal for carrying gear. Because whitewater rafts are big and heavy, they are slower and less agile than are canoes or kayaks when it comes to catching eddies, surfing, and playing in rapids.

Install extra flotation (air bags or plastic foam) in your whitewater boat to ensure your boat will ride high in the water if you flip.

Rafting Safety

Whitewater safety precautions for canoeing and kayaking apply to rafting, too. If you are in a paddle raft, always wear a PFD and follow the other BSA Safety Afloat guidelines.

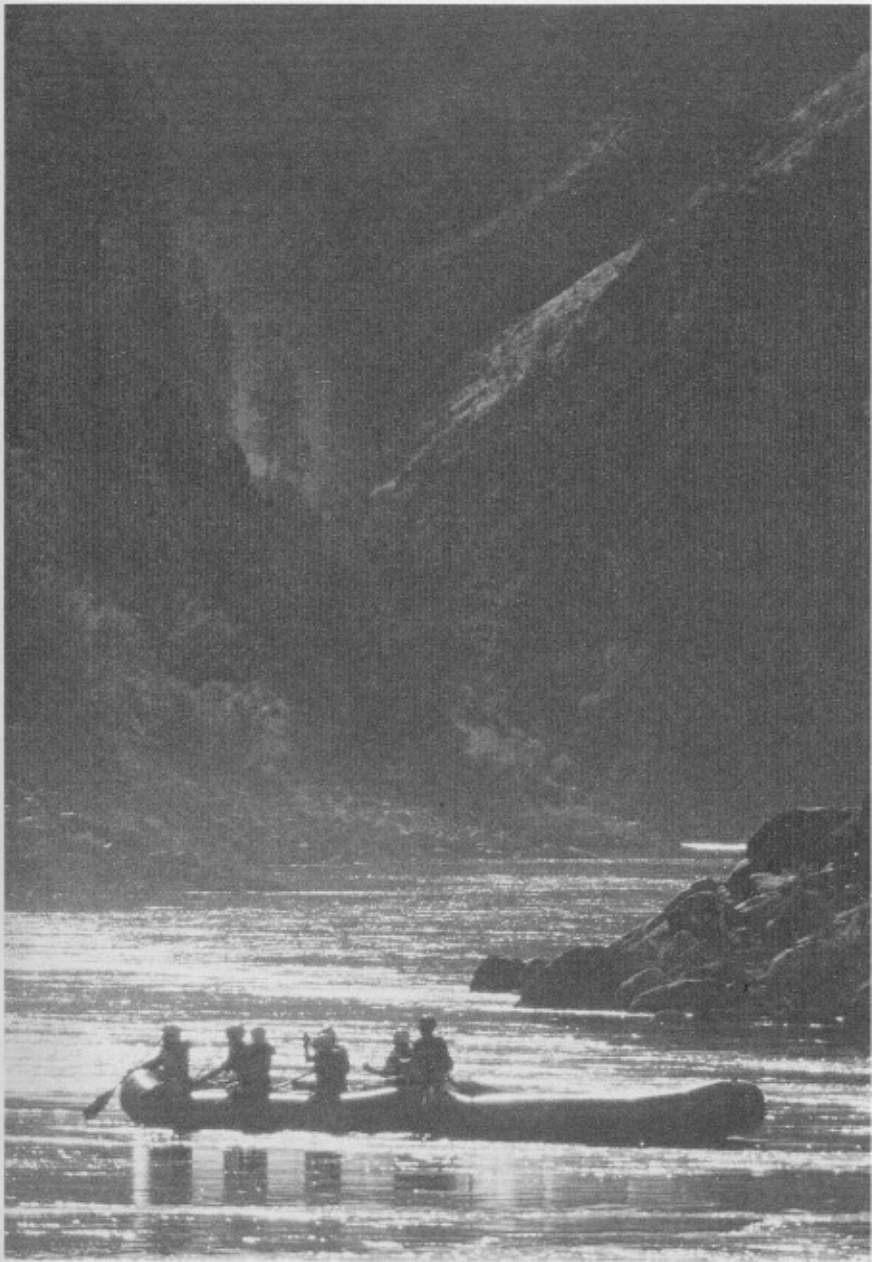
Rafting injuries are frequently caused by paddle contact. Remember that you are riding beside another paddler, and there is another person paddling close behind or in front of you. Keep the blade on the outside of the craft, and grip the paddle low and close to your own body. If you capsize or fall overboard while rafting, reach out to the side, grasp the grab line, pull yourself out from under the raft, and move to the upstream end.

Do not overlook the safety of others on the river. A six-person raft plowing through the rapids can run over a kayak like a bus running over a bicycle. Look ahead and be sure the rapids are clear when you begin your run.

Tubing

Tubing should never be done on whitewater. Inner tubes are difficult to steer, which means it is difficult to avoid hydraulics, rocks, and other dangers. They offer almost no protection in a collision. In addition, their inflation valves and stems tend to cut and scratch their riders. When tied together, they become a significant entrapment hazard.

Only go tubing on slow-moving water with no rapids. You must wear shoes and your PFD. Take a buddy, and make sure you follow the BSA Safety Afloat guidelines.



Basic Whitewater Skills

If you are itching to become a great paddler, you need to practice to perfect basic strokes and form so that you will have the confidence and skill to meet the challenges of whitewater paddling.

Body Mechanics and Position

It is important to be mindful of body mechanics and form whether you are on flatwater or whitewater. Proper form will keep you safer and ensure that you get the most out of the effort you expend.

Always grip your paddle with your hands a little more than shoulder-width apart and your paddle shaft perpendicular to the water. Canoeists should keep one hand on their paddle's grip. When performing strokes like the cross draw, avoid letting your upper paddle hand rise above your head—if your paddle is yanked backward in strong current or if it strikes a rock, you are vulnerable to dislocating your shoulder.

When paddling in a solo canoe or kayak, you are, of course, solely responsible for powering and steering. Keep your eyes on your target and make lots of small corrections. Little corrections are easy and keep you moving along; big corrections are harder and slow you down.

Tandem canoeists paddle on opposite sides. This helps move the canoe in a straight line and provides tremendous stability. The bow paddler provides power, initiates many maneuvers, and provides stability. The stern paddler steers the canoe with a combination of power and steering strokes.

On flatwater, the bow paddler follows the instructions of the stern paddler. On whitewater, however, the bow paddler has a clearer view of the river and its hazards than the stern paddler and so decides the direction of the boat.

Most of your paddling power comes from your torso—from coiling and uncoiling the large muscles of your back, stomach, and shoulders.

In a tandem canoe, the stern paddler's forward strokes will have more effect on the canoe's direction than will those of the bow paddler, and will usually cause the boat to turn away from the stern paddler's selected paddling side. The same is true when paddling solo: The forward stroke commonly turns the canoe to the paddler's offside. Efficient stern and solo paddling include a steering component at the end of each stroke. There are many different steering strokes (J-stroke, C-stroke, Canadian stroke), but to begin with, canoeists should focus on developing a dependable J-stroke.

Canoe paddling positions are termed *onside* and *offside*. For solo canoeists, the side on which the paddler performs the forward stroke is the onside position. The opposite side becomes the offside. In tandem canoes, the side on which the bow paddler does the forward stroke becomes the onside.

Recall that all strokes can be divided into the following three phases:

- **Catch**—In this position, the paddle blade has entered the water and the paddle shaft is perpendicular. The force of the blade applied by the paddler against the water is now equal to the water's resistance. The paddler feels the paddle "grab" the water.
- **Power**—The torso uncoils, delivering the power of the muscles of the upper body to the blade through the shaft.
- **Recovery**—The stroke has ended and now the blade is lifted out of the water, and set up for another stroke in the catch position.

Scout Gate Test

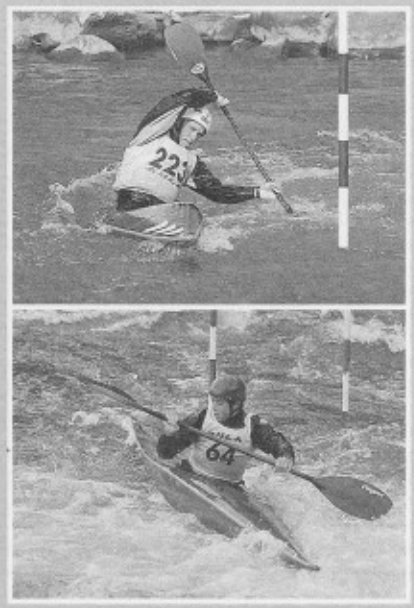
To make sure you have mastered the basic canoeing and kayaking skills you learned while earning your Canoeing merit badge or Kayaking BSA Award, you need to complete the Scout gate test within 160 seconds. To prepare for the test, you may want to review and practice strokes such as the forward stroke, backstroke, draw stroke, pushaway stroke, forward sweep, reverse sweep, and J-stroke.

The Scout gate test is a variation of a classic canoe and kayak training drill used by slalom paddlers to build strength, speed, and technique. The test is conducted on flatwater using floats, floats supporting upright poles, or poles hanging above the water. If you use floats, anchor each float separately and use a 4-foot spreader about 20 inches under the water to keep the floats apart. If the poles are suspended above the water, position them 4 feet apart and about 2 inches above the surface.

Your ready position for the first pass should be in front of the gate, with your bow just outside the gate.

The five gate passes for the Scout gate test are as follows:

1. On the "go" signal, paddle through the gate; pivot right 180 degrees after the boat's stern has cleared the gate.
2. Return through the gate paddling forward; now pivot left 180 degrees.
3. Return a third time through the gate, paddling forward.
4. Back up outside of the right pole (or float) and go forward through the gate.
5. Back up outside of the left pole, and go forward through the gate for your fifth and final time. Your time ends when the stern of your boat clears the gate.



Hints:

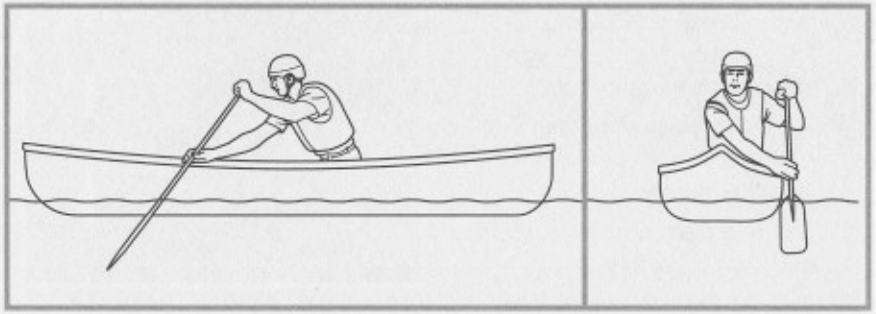
- Stay close to the gates while turning and reversing direction.
- Practice by paddling slowly, but smoothly, through the gates. Build speed over time.
- Try different stroke combinations and determine which ones work best for you.
- Avoid touching the gates. Each time you touch the gate pole or float with your boat, paddle, or body, 5 penalty seconds are added to your time.

Whitewater Paddle Strokes

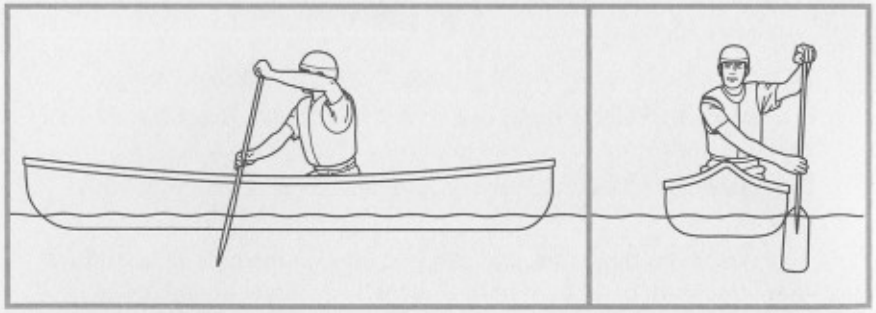
Practice whitewater paddle strokes and maneuvers on flatwater or on a slow-moving river. Practice slowly, working first toward precision and later adding power and speed.

The Cross Forward—Canoe

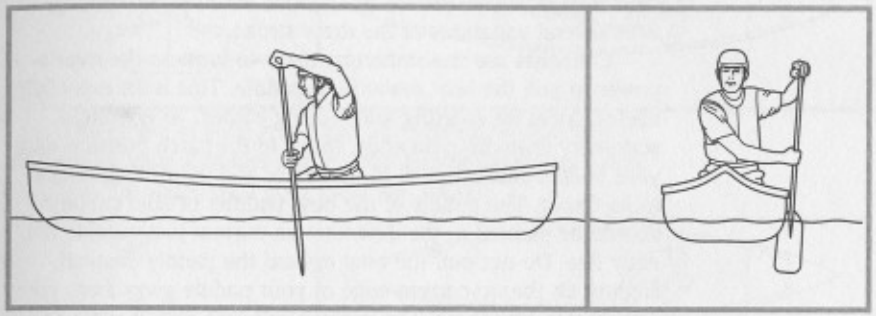
A cross stroke is any stroke performed on the paddler's offside without switching hands. The *cross forward stroke* is a forward stroke done on the offside. It is frequently used by solo canoeists to keep the boat moving forward while correcting the tendency of the bow to go to the offside. The cross forward brings the bow back to the onside.



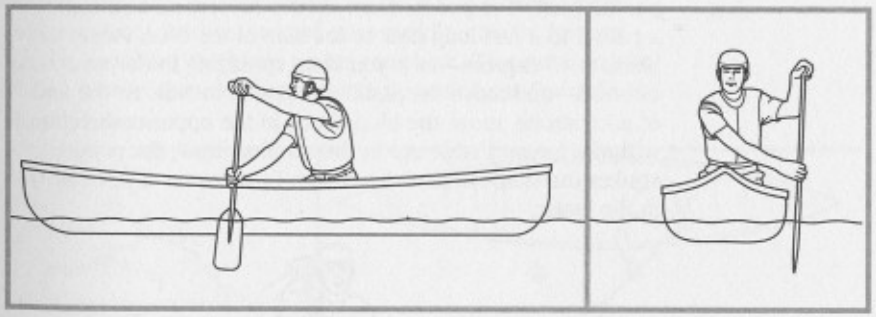
- **Catch**—Without switching hands, swing your paddle across your boat. Twist your upper body, rotating your shaft-hand shoulder forward and your grip-hand shoulder backward. Lean forward about 45 degrees, and place your blade (buried to its throat) at the ready in the water. Your grip-hand elbow will be behind your head (at about ear level), and your arms should be extended out in front of you.



- **Power**—Forcefully bring your torso to an upright, vertical position while pulling your hips toward your paddle. Your paddle should stay perpendicular to the water.



- **Recovery**—When your blade reaches your hips, rotate your grip-hand thumb forward so that your paddle's leading edge is parallel to your boat. Slice your paddle through the water back to the catch position. Rotate the blade so that it is ready for your next stroke.



Draws

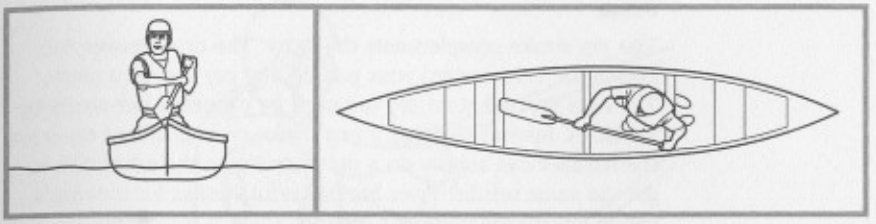
When you earned the Canoeing merit badge or the Kayaking BSA Award, you learned to do the basic *draw stroke* to move your boat sideways toward the paddle. Whitewater boating uses several variations of the draw stroke.

Canoeists use the *stationary draw* to harness the river's power to pull the boat toward the paddle. This is an especially useful stroke for entering and leaving eddies. To execute a stationary draw from an eddy, move to the catch position with your paddle shaft vertical in the water and your blade buried to its throat. The paddle of the bow paddler or solo canoeist should be planted in the downstream current just outside the eddy line. Do not pull the boat toward the paddle. Instead, slightly tilt the up-current edge of your paddle away from your boat and hold it there. The current will grab your paddle and "fly" it; all you have to do is hang on.

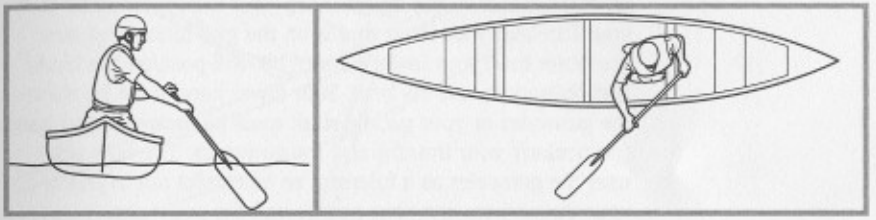
Both canoeists and kayakers can use the *sculling draw* to pull the boat sideways or initiate a turn. Hold the paddle with your upper or grip hand no higher than your forehead and your other hand positioned about a shoulder-width lower on the paddle shaft. The paddle shaft should be vertical and move in a path 2 to 3 feet long next to the side of the boat. Angle the blade at 45 degrees—as if you were spreading butter on a slice of bread—and move the paddle from side to side. At the end of each stroke, move the blade back in the opposite direction with the forward edge up. In the sculling draw, the paddle strokes the shape of an infinity sign (a sideways figure eight) in the water.

Sculling draw

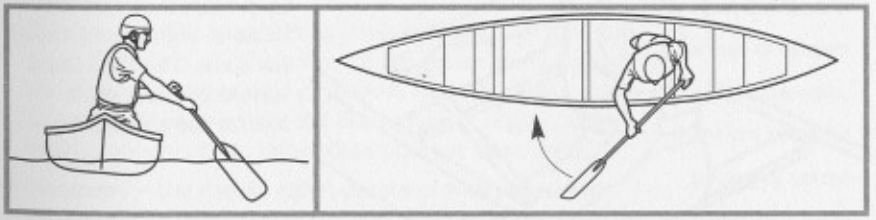
The bow paddler or solo canoe paddler also uses a *cross draw* to move the boat sideways or initiate a turn. Without switching hands, set up a cross draw by rotating your torso perpendicular to the keel line of the canoe.



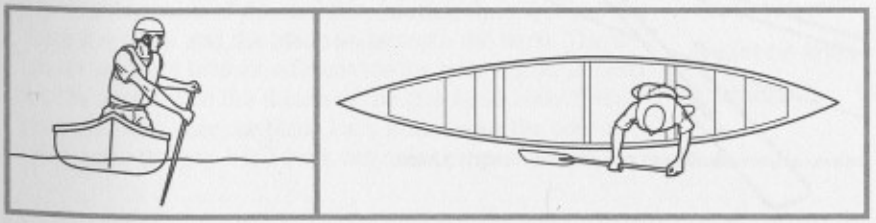
The elbow of your grip-hand arm should be well below the level of your shoulder and rotated behind you. Your blade goes into the water with your torso still coiled.



The power phase is simple—just leave your arms and hands pretty much where they are, and unwind your upper body, drawing the boat toward your paddle's blade. Be sure you do not allow the blade under your boat. The cross draw is such a powerful stroke that you can tip your boat if you do not stop in time.



Recover by dropping your grip hand. Re-rotate and twist your torso, place the paddle back in the water, and repeat.

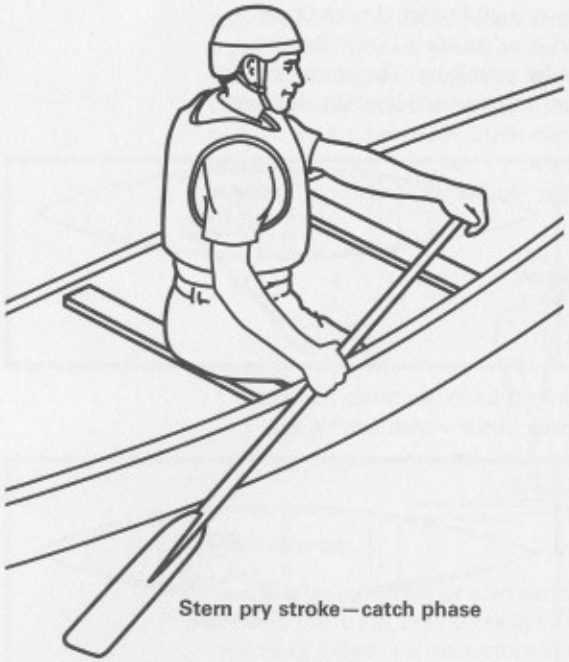


Pries

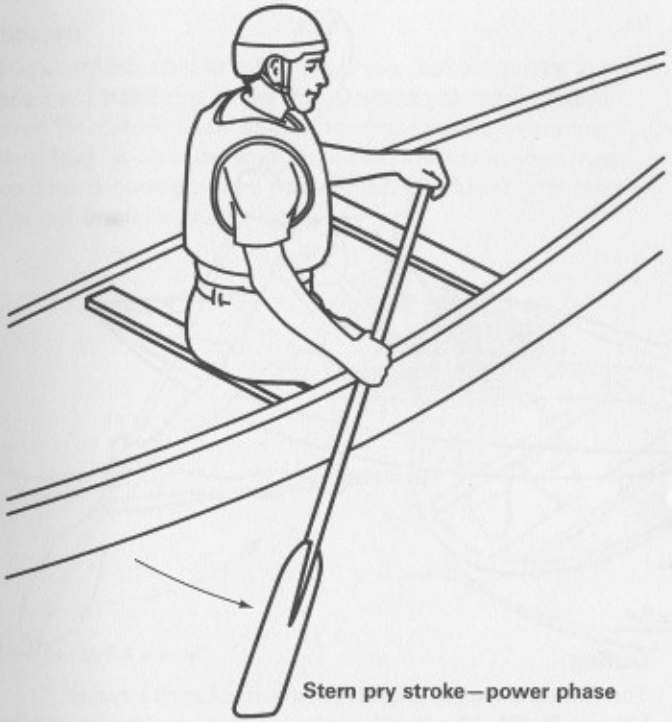
The *pry* stroke complements the draw. The draw moves the end of the boat toward your paddle; the pry moves it away. The *bow pry* and *stern pry* are used by canoeists but rarely by kayakers. Instead of doing a pry stroke on one side of the boat, the kayaker can simply do a draw stroke on the other side to get the same results. Pries are powerful strokes for moving a canoe toward the paddler's offside.

- **Catch**—For the bow pry, hold your paddle perpendicular to the canoe's keel line, then place your paddle in the water with its blade buried to the throat. Keep your forearm in front of your face and your hand that is on the grip farther out over the water than your lower hand. This will position the blade slightly underneath the bow. Your lower hand must be above the gunwales or your paddle shaft must be between your hand (particularly your thumb) and the gunwales. The bow pry uses the gunwales as a fulcrum, so be careful not to pinch your thumb between your paddle and the gunwales.

For the stern pry, hold the paddle shaft parallel to the side of the boat and place the grip end of your paddle out over the water. Put the blade in the water to the throat so that the blade is slightly underneath the stern. The shaft hand should hold the shaft against the gunwales.



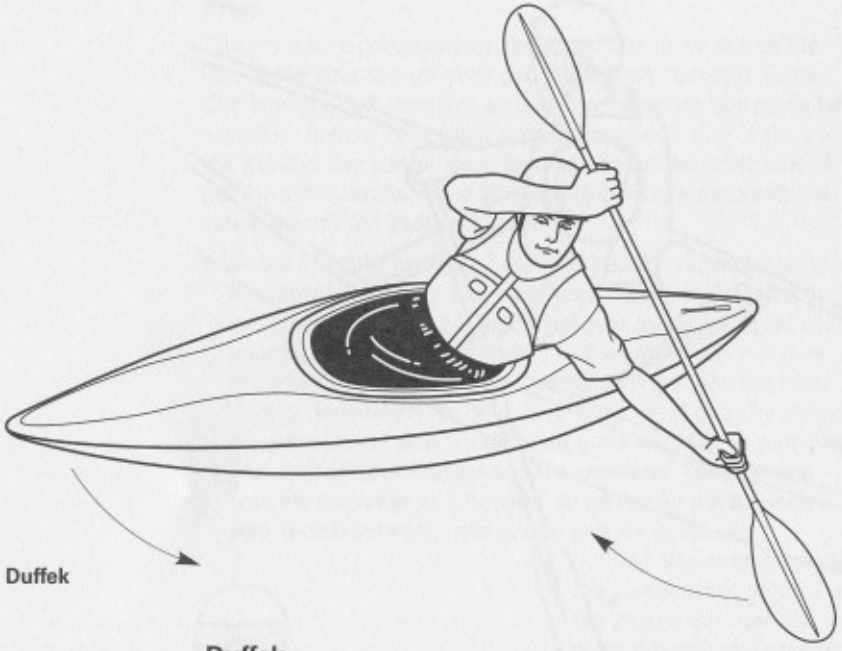
Stern pry stroke—catch phase



Stern pry stroke—power phase

- **Power**—Use the gunwales as a fulcrum and pull your grip hand into the boat. The power of the stroke increases with the speed you move your grip hand. Keep the stroke short—about a foot or so—since the blade quickly begins pulling your gunwales down, rather than pushing them away.
- **Recovery**—You can do either an out-of-water or in-water recovery. The out-of-water recovery is more efficient for the stern pry and requires that you drop your grip hand down toward your lap, slicing the blade out of the water. Return to the starting point of the stroke by moving the grip hand out over the water and the blade underneath the stern. The in-water recovery is more efficient for the bow pry. At the end of the stroke, turn the thumb of the grip hand away from you and then slice the blade back underneath the bow as you move the grip hand back out over the water.

From the stern of a solo or tandem canoe, the stern pry is a powerful turning or correction stroke. Keep the pry stroke short and fast. Repeat the stroke if necessary.



Duffek

Duffek

The Duffek is named after the innovative Czech kayaker Milovan Duffek. The Duffek stroke is a static stroke. The paddler plants the paddle near the bow and lets the momentum of the boat or current push the other end of the canoe or kayak around it. When the paddle is placed in the water, the thumb of the grip hand points in toward the boat. This turns the forward edge of the blade away from the boat, causing the paddle to act as a pivot point with the boat swinging around it.

Some people refer to a certain combination of strokes as the Duffek, but a more appropriate name is the Duffek maneuver. This maneuver combines a Duffek stroke with a draw to the bow, followed by a forward stroke. The cross Duffek maneuver begins with a cross Duffek (a Duffek done on the offside without switching hands) followed by a cross draw to the bow and ending with a cross forward stroke. The Duffek and Duffek maneuver are primarily used to enter and leave eddies. Practice the Duffek in flatwater using a buoy and a little forward speed.

Braces

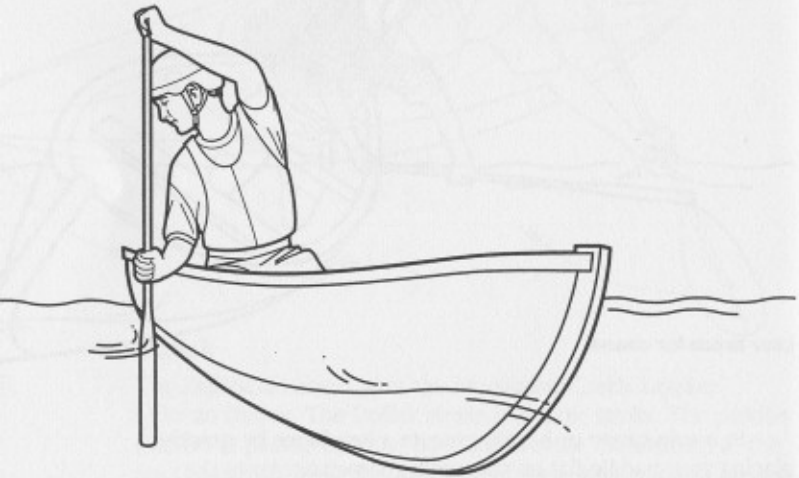
Braces are intended to catch you if you start to tip. The *low brace* is a stabilizing stroke that prevents you from tipping over. You can do a low brace upstream or downstream from your boat. In a canoe, you execute the low brace when your boat starts tipping toward your onside. In a kayak, you can use the low brace for either side.

Low brace for canoe

In a solo canoe or kayak, execute a low brace by quickly placing your paddle flat on the water (perpendicular to the length of your boat). Press the paddle firmly down on the water and use your knees and torso to flatten out your boat. The low brace is the preferred stroke to prevent onside capsizing.

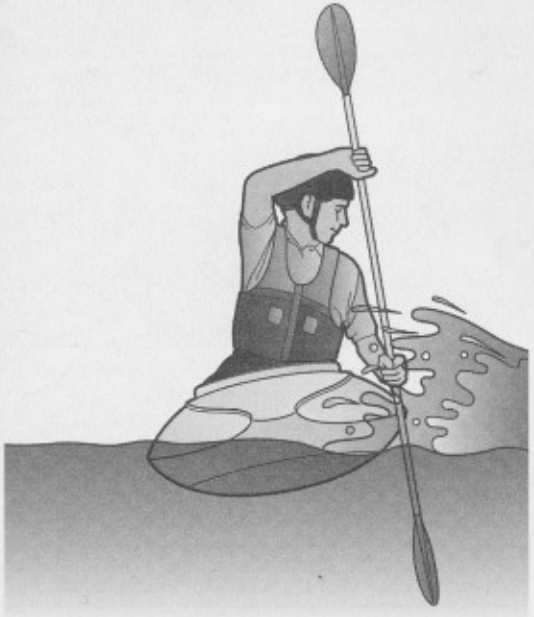
Low brace for kayak

The pry stroke will move your canoe away from the paddling side. Holding the paddle as you would for a draw stroke, slip the blade back into the water next to the canoe and pry it away. Though it can be hard on the paddle loom, you can brace the loom against the canoe, using the gunwale as a fulcrum or pivot for leveraging the stern away from the blade of the paddle.



Pry stroke for canoe

A *high brace* is a stroke that is used to prevent tipping to the paddler's offside. As the boat tips away from the paddler's onside, the paddler reaches out and does a quick draw stroke to right the boat. This stroke is usually less effective than the low brace, but in solo canoes, it is often considered the only possible stroke to do if your boat is tipping away from the side you are paddling on.



High brace for kayak

Paddlers in tandem canoes must learn to do a combination of braces to prevent the boat from tipping over. If the boat tips to the onside (the bow paddler's paddling side), the bow paddler would do a low brace while the stern paddler would do a high brace. If the boat tips to the offside, the bow paddler would do a high brace while the stern paddler would do a low brace.

Whitewater Maneuvers

Savvy boaters use the river's power to take them where they want to go. Technique, not strength, is what you need to control your boat on the river.

Launching and Landing

You are as likely to upset your boat launching and landing as you are when on moving water. If you are using a canoe, enter and exit only when your boat is completely in the water. Launch and land with your canoe parallel to the shore so that the boat is fully afloat and you can step in or out without clambering over your load.

As you step into or climb out of your canoe, keep three points of contact with the boat. Step into the center of your boat, keeping both hands on the gunwales. Stay low as you move about. In tandem canoes, one paddler should steady the canoe while the other paddler climbs in. Then, the first aboard should steady the canoe for the other paddler. In swift water, the paddler down current enters first and exits last; this makes it easier for the up-current paddler, while on land, to hold the canoe and keep it from swinging out into the stream short one paddler.

Many whitewater kayakers "seal launch," that is, they climb in on shore and push themselves and their boats into the water. This is not recommended, because it can damage the kayak as well as the fragile margins of rivers.

Before you enter a kayak, put on your spray skirt. To steady yourself as you slip into your craft, place your paddle shaft against the *coaming* at the back of your boat's cockpit so that one blade is touching ground. Grasp the center of the paddle shaft and the cockpit coaming with one hand and ease yourself into the boat. Attach the spray skirt to the cockpit rim and you're ready to paddle off. Reverse this process to climb out.

Coaming is the raised edging around the cockpit for keeping water out.

Paddling Forward in a Straight Line

In a solo canoe, the J-stroke allows for a smooth, continuous forward stroke that keeps the boat on course with minimum effort. Apply only as much "J" to the stroke as is needed to keep the canoe going straight. Too much will turn the canoe. If necessary, review and practice the J-stroke solo in flatwater by picking a distant target and paddling to it in a straight line. In a tandem canoe, the bow paddler should do a forward stroke while the stern paddler does a J-stroke to keep the boat on course.

In a kayak, forward motion is achieved with the basic forward stroke. Stroke first on one side and then on the other. Review and practice the forward stroke on flatwater if necessary.

The J-stroke is an advanced stroke that takes a lot of practice.

Backpaddling

Canoeists and kayakers use backstrokes to backpaddle, that is, to slow or reverse the forward motion of the boat. You may need to backpaddle to

- Run a set of waves slowly, giving your boat's bow a chance to rise above a wave so that it will stay dry.
- Give yourself more time to turn or move your boat sideways.
- Keep control in swift water, allowing more time to move left or right or to stop.
- Slow your boat in anticipation of shallow water, rocks, or sleepers.
- Stop your boat so you can scout or take a break.
- Back ferry (or "set") is to move your craft left or right in the current while still facing downstream.

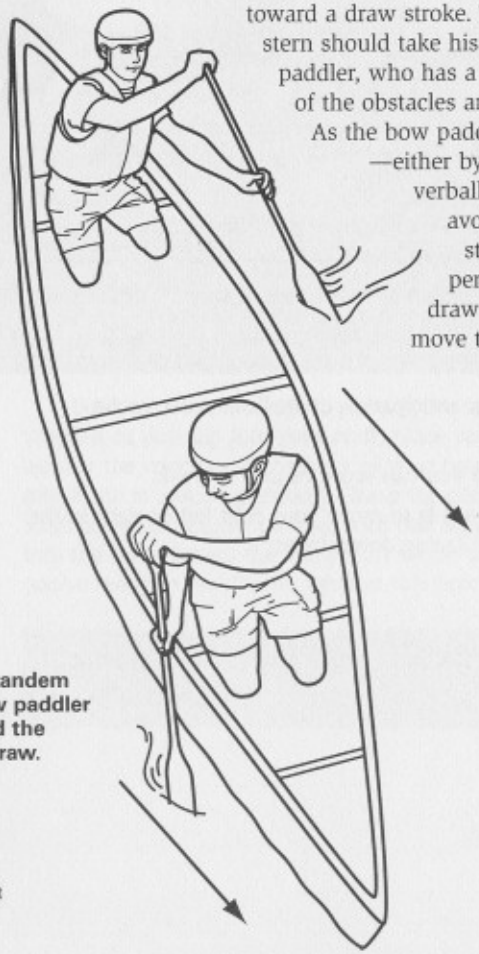
Sideslips

Sideslips are very useful on shallow rivers. Practice them in quiet water by paddling forward and then executing a stationary draw *or* pry (solo) or draw *and* pry (tandem).

Sideslipping on a river means moving your boat to one side or another far enough to miss a rock or other obstacle and then continue paddling on downstream. Draws and pries are the two strokes you will need to do a good sideslip.

Suppose you are moving faster than the current going downstream. A rock becomes visible directly downstream and you want to dodge it on its river left. If you are in a solo canoe or kayak, execute a draw or pry until your heading is clear of the rock. Once your path is clear of the rock, continue paddling downstream.

In a tandem canoe, one paddler draws and the other pries. The boat will move away from a pry and toward a draw stroke. The paddler in the stern should take his cues from the bow paddler, who has a much better view of the obstacles and hazards ahead. As the bow paddler communicates—either by his strokes or verbally—the need to avoid an object, the stern paddler should perform a matching draw or pry stroke to move the boat sideways.



Sideslipping to a tandem boat's offside. Bow paddler executes a pry and the stern executes a draw.

Eddy Turns

As you paddle downstream, you will want to stop in an eddy to rest or to scout a rapid below. The maneuver to enter an eddy while heading downstream is called an eddy turn. Later you will learn how to exit an eddy using a peel out. When you have learned how to move in and out of eddies with confidence and ease, you will have passed a major whitewater skills milestone.

Entering an eddy while moving downstream in a boat can be challenging, especially if the current is fast. Here are the basic steps to doing an eddy turn.

Step 1—Start well upstream and begin angling your boat so that when it reaches the top of the eddy, the boat will cross the eddy line at about a 45-degree angle.

Step 2—Aim the bow so it crosses the eddy line as close as possible to the top of the eddy. Avoid hitting the obstacle that is creating the eddy.

Step 3—As soon as possible after the bow crosses the eddy line, plant the paddle in the upstream current of the eddy so that the rest of the boat will swing around the paddle as the pivot point.

Step 4—Just before and as the boat enters the eddy, the paddler or paddlers must lean the boat (not themselves) into the turn by using the lower body and shifting more weight onto one knee in a canoe or one hip in a kayak. The upper body moves very little.

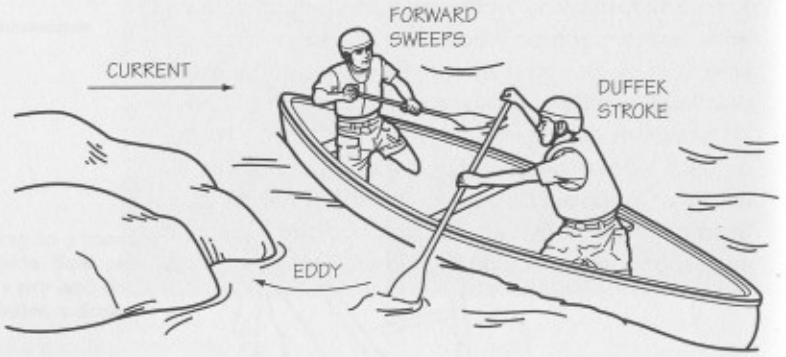
The strokes used by whitewater paddlers to do an eddy turn depend on whether the maneuver is done solo or in tandem and whether it is done in the onside or offside position. Technically, kayakers do not have an onside or offside since they have a paddle blade on each side of the boat. For the purposes of this section, the kayaker's onside position will refer to the side of the body with the dominant arm and will correspond to the onside position for solo canoeists.

Tandem canoes dance from eddy to eddy by virtue of technique and communication. Bow and stern paddlers must talk to one another about where they are going and how they are going to get there. Pause at the top of a rapid and have a chat about the strokes you will need to use.

For kayakers and solo canoeists, an onside eddy turn uses the forward stroke to build up enough momentum for the boat to cross the eddy line at a 45-degree angle. As the bow and then the paddler's body enter the eddy, a Duffek stroke is performed followed by a Duffek maneuver (a draw to the bow and then a forward stroke). For tandem canoeists, the bow paddler does a Duffek after his body has crossed the eddy line while the stern paddler does a quick draw stroke followed by a series of forward sweeps. Once the stern has entered the eddy, the bow paddler does the Duffek maneuver and the stern paddler does a forward stroke to move up to the head of the eddy.

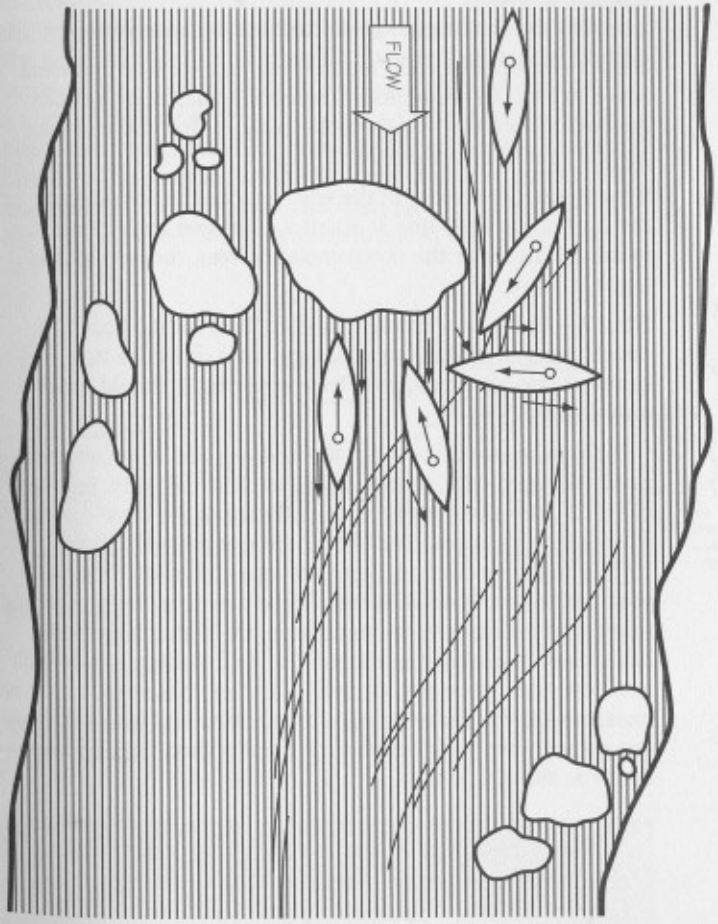
An offside eddy turn is more difficult than an onside turn. For kayakers, the offside turn is performed like the onside turn except with the other blade. Solo canoeists perform the same steps as for the onside turn, but they must use a cross Duffek followed by a cross Duffek maneuver (cross draw to the bow and then a cross forward).

Tandem paddlers in a canoe use the same approach to the eddy—including the angle and lean of the boat—as for the onside eddy turn. However, instead of a Duffek, the bow paddler does a cross Duffek. The stern paddler does a quick pry before the boat crosses the eddy line, followed by a reverse sweep, which is sometimes combined with a low brace. When the stern has entered the eddy, the bow paddler does a cross Duffek maneuver. Once in the eddy, the stern paddler performs a forward stroke or J-stroke.



Onside eddy turn

Kayakers and solo canoeists accomplish eddy turns using a variety of strokes. A forward stroke, usually a J-stroke, combined with a forward sweep, draw or cross-bow draw, should push you in and then turn you in an eddy. Take one more stroke than you think you need to cross that eddy line. A Duffek stroke often will work as well or better. As in tandem canoeing, a solo boat should enter the eddy at right angles, tilt into the turn, and have the right amount of speed to complete the maneuver.



Eddy turn—entering and exiting an eddy

Peel Outs

The peel out maneuver is used to exit an eddy and reenter the main current of the river. Peel outs are easier than eddy turns since you don't have to worry about maneuvering in a fast-moving downstream current. On the other hand, you will not have the speed that comes from the current because you have to cross the eddy line to exit. When done correctly with the right combination of speed, angle, and lean, any paddler can do a smart-looking turn into the current without a set of complicated strokes.

Here are the basic steps to safely doing a peel out:

Step 1—Exiting the eddy requires the boat to have sufficient speed to clear the eddy line. Position the boat near the eddy line and toward the bottom of the eddy so that you can take several strokes before exiting.

Step 2—Exit at the top of the eddy as close as possible to the start of the eddy line at about a 45-degree angle. Keep in mind: The faster the downstream current, the smaller the angle of entry.

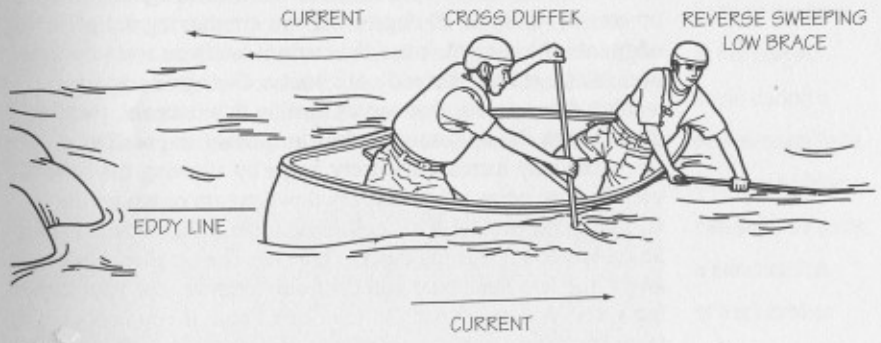
Step 3—As the bow crosses the eddy line, tilt the boat downstream by shifting more weight onto one knee in a canoe or one hip in a kayak. Your upper body should move only slightly.

To do an onside peel out for kayakers and solo canoeists, paddle forward with enough speed to clear the eddy. Solo canoeists may need to use a combination of the cross forward stroke, forward stroke, and J-stroke to exit the eddy at the correct angle. As the bow begins to cross the eddy line, shift your weight to the downstream side of the boat. Keep paddling forward to maintain your momentum. Only *after* your body has crossed the eddy line should you do a turning stroke such as a bow draw, stern pry, Duffek, or Duffek maneuver. In many instances—if you have the right momentum and lean—the current will turn your bow downstream without any turning stroke at all.

With two paddlers in the boat, it is important to coordinate the downstream lean so both are leaning the boat in the same direction at the same time.

Tandem canoeists doing an onside peel out follow the same steps as solo canoeists, but have the advantage of two paddlers to build up speed to exit the eddy. Once across the eddy line, the bow paddler does a turning stroke such as a Duffek while the stern paddler continues to power the boat out of the eddy with forward or J-strokes. As the bow of the boat begins to turn downstream, the stern paddler can do forward sweeps if there is enough speed and momentum to carry the boat out of the eddy.

An offside peel out incorporates all the same features of the onside peel out except that the turning strokes are different. For kayakers, the opposite paddle blade is used for the turning stroke. After crossing the eddy line, solo canoeists can use a variety of turning strokes, including a forward sweep, cross bow draw, cross Duffek, or cross Duffek maneuver. Tandem canoeists use a combination of a cross Duffek or cross Duffek maneuver in the bow while the stern paddler does a low bracing reverse sweep or simply powers ahead with a forward or J-stroke.



Offside peel out

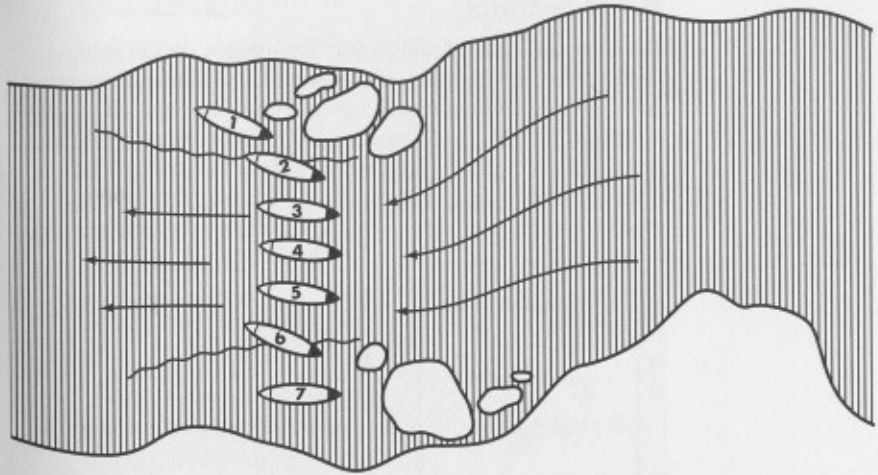
Ferrying Upstream and Downstream

Upstream (forward) ferries and downstream (back) ferries move you sideways across the current. In an upstream ferry, you face upstream and paddle forward with your bow at an angle to the current. You move across the current in the direction your bow is pointing. To perform a downstream ferry, you face downstream and backpaddle with your stern pointed upstream at an angle to the current. You move across the current in the direction your stern is facing.

Kayakers and solo canoeists use the forward stroke with an occasional stern draw or pry stroke to keep them angled into the current. In a tandem canoe, the bow paddler does forward strokes while the stern paddler does combinations of strokes to keep the boat at the desired angle to the current.

To perform a successful upstream ferry, begin by turning your boat until it faces upstream. As you start paddling, adjust the ferry angle—the angle of the boat compared to the upstream—to about 10 degrees. If you are moving out of an eddy into the current, enter the current as if you were doing a peel out by exiting the eddy at about a 45-degree angle and leaning downstream. Instead of turning downstream, paddle directly into the upstream current as quickly as possible.

Gradually increase the ferry angle by allowing the bow of your boat to point a few degrees downstream of where the current is flowing. Use a small ferry angle if the current is fast and a larger angle if the current is slow. The smaller the ferry angle, the less your boat will drift downstream, but your crossing speed will be slower. On the other hand, if you use a large ferry angle, you will get across the river faster, but you will end up farther downstream. Your paddling counters the river's tendency to pull you downstream, and your boat's angle off the current allows the river to nudge you toward the far bank. This can be tricky, so practice by ferrying across an easy current with the goal of reducing the number of strokes needed to cross the stream.



Upstream ferry across river to avoid obstacles.

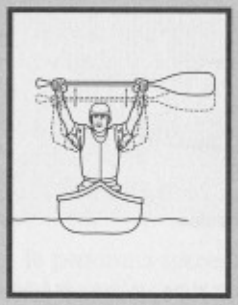
Downstream ferries are more difficult than upstream ferries. To perform a successful downstream ferry, point the stern of your boat almost directly upstream and exit into the current. Kayakers and canoeists use backstrokes and control their angle to the current with draws and pries. Tandem canoe paddlers use the backstroke while doing a downstream ferry, but the bow paddler—not the stern paddler—is responsible for steering the boat.

Remember: It is the angle of your boat to the current, not to the shore, that determines your ferry angle. Over time you will become skillful in reading currents and upstream and downstream ferries will become second nature.

To keep the boat at the correct angle during a downstream ferry, the bow paddler can steer by using a combination of backstrokes with bow draws and prys.

River Signals

Running rapids takes teamwork. Teammates should discuss their run on an ongoing basis and make adjustments to any plan as needed. Sometimes, however, talk is impossible. Even a small riffle can muffle words, and roaring rapids often drown out speech altogether. For emergencies or times when talk is difficult, river runners make use of whistles and paddle signals to communicate. Review river signals before the beginning of every trip.

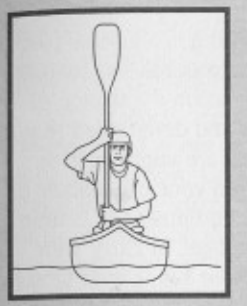


Here are important emergency and directional signals.

- **"Stop!"**
  Raise and lower a paddle horizontally over your head or hold both arms out at right angles to your body and wave them up and down.

- **"Help!"**
  Give three long blasts of your whistle. Or wave your paddle, your helmet, or PFD back and forth over your head.

- **"Are you OK?"**
  Raise one arm over your head, bend your elbow outward, and tap your helmet with your fingertips. To respond that you are OK to someone signaling you, return the same signal.

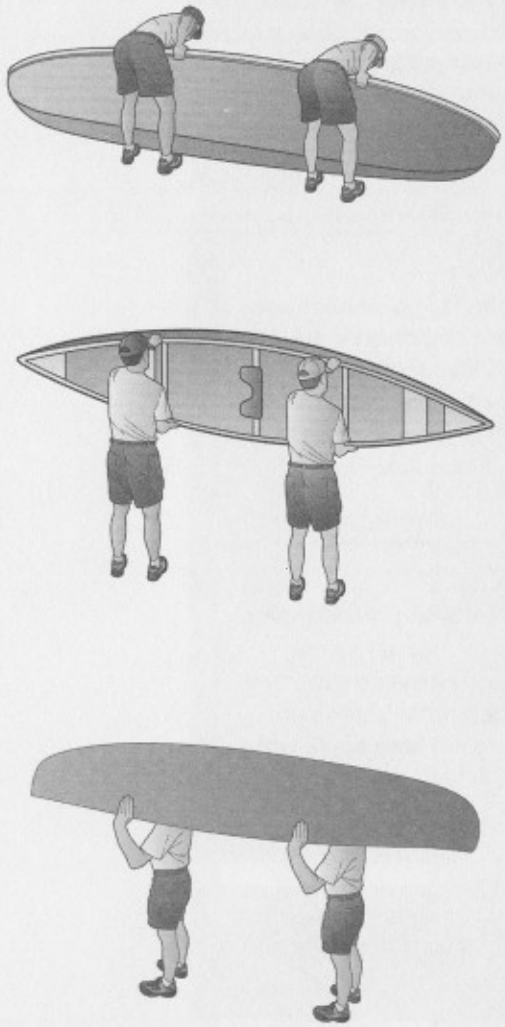


- **"Run down the center" or "Come ahead" or "All clear"**
  Hold your paddle blade in a vertical position above your head with the blade flat for maximum visibility.

- **"Run left"**
  When facing downstream, this directional signal indicates river left. Point your paddle to the left at a 45-degree angle with the blade flat.

- **"Run right"**
  When facing downstream, this directional signal indicates river right. Point your paddle to the right at a 45-degree angle with the blade flat.

Important: Always use directional paddle signals to indicate where the safe route through a drop lies. *Never point toward hazards.*



Portaging

Portaging

Portaging is a normal part of running rivers. When you have scouted a stretch of river and determined that the rapids are impassable or beyond your capabilities or your equipment, it is time to portage, or carry your canoe or kayak over land to a safer place on the river. Always portage around low-head dams and weirs or any sheer drop or strainer that cannot safely be avoided. Shallows may also require a portage. When assessing a rough stretch of river, a good rule is, "When in doubt, walk around."

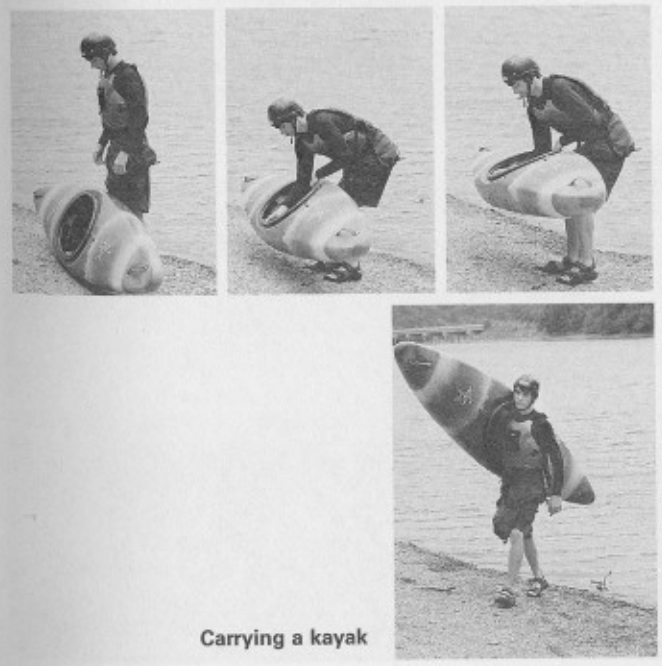
To portage a canoe with a yoke, position yourself near the bow of the canoe and your buddy near the stern. Reach across the canoe and grasp the gunwales, then in unison lift the canoe and flip it over your heads, turning yourselves forward as you do. As your partner stabilizes the canoe, walk your hands backward along the gunwales until you can tuck your shoulders against the yoke. Your partner is free to duck out from under the canoe, and you are ready to begin a portage. Your partner leads the way as you walk, alerting you to obstacles or turns.

If there is no portage yoke, the canoe can be transported using a two-man carry.

With practice, one canoeist can lift a canoe for portaging. To begin, stand at one side of the upright canoe, near the stern and facing the bow. Grasp the gunwales, one in each hand, a few feet from the stern. Turn the canoe over and lift it over your head, allowing the bow to remain on the ground. Holding the gunwales, begin "walking" toward the bow. As you reach the center of the canoe, its weight will balance over your shoulders and the bow will lift off the ground. Ease the yoke onto your shoulders to carry the canoe.

Many kayaks have toggles installed at the bow and stern, positioned for two people to lift and carry a craft. For a solo carry, reach across the cockpit, lift the kayak, and flip it onto your shoulder. (If the kayak is heavy, allow the stern to stay on the ground as you lift and position it.) Shift the cockpit on your shoulder to reach the kayak's balance point, and you should be ready for a relatively easy tote to your destination.

There's an old saying that no one ever drowned on a portage.



Carrying a kayak

Rescue Techniques

Every kayaker and canoeist capsizes from time to time. Whenever you take a spill, make the safety of the people involved your top priority. Equipment and gear can be replaced, people cannot. Practice to become adept at recovering from a capsize and learn to use a throw rope to rescue other paddlers.

Self-Rescue

When you capsize, follow these steps:

Step 1—If you can, stay in your righted boat, even if it is flooded. The hull can protect you from banging into obstacles. You may be able to climb back in (assisted or unassisted by other boats) and then paddle to shore. If you are in a kayak with or without a spray skirt or in a solo whitewater canoe with thigh straps, exit the boat as quickly as possible. You may have to pop the skirt or loosen the straps to free yourself from the boat. As you become more experienced, you can learn to right yourself using an Eskimo roll. Intermediate kayakers and advanced canoeists learn how to do the Eskimo roll so that if they turn over while in their boats, they can flip back up again without having to do a wet exit.

Step 2—If you have been tossed into the water, hold on to your boat. It will stay afloat, and it will be easy for rescuers to spot. Stay upstream of your boat so you do not get caught between your fast-moving boat and a hard obstacle like a boulder.

Step 3—In the following situations, swim aggressively for shore.

a. You have been thrown clear of your boat.

b. The water is very cold.

c. You are approaching worsening rapids.

d. No rescue is forthcoming.

Step 4—If you must ride out a rapid before swimming to safety or catching a rescue line, stay on your back in fast water, keeping your feet and legs downstream so they can act as shock absorbers to fend off rocks. Use a backstroke to maneuver past obstacles and keep an eye out for an eddy that might offer protection.

Step 5—Do not stand up in swift-moving water above your knees. If your feet were to become entrapped under rocks, the current could knock you over—either backward or forward—and then force your head under the water.

Step 6—If you find yourself being swept toward a strainer, change from a feetfirst position to an active headfirst swimming position with your head out of the water. Try to swim up on top of the strainer and pull yourself onto it instead of getting sucked underneath.

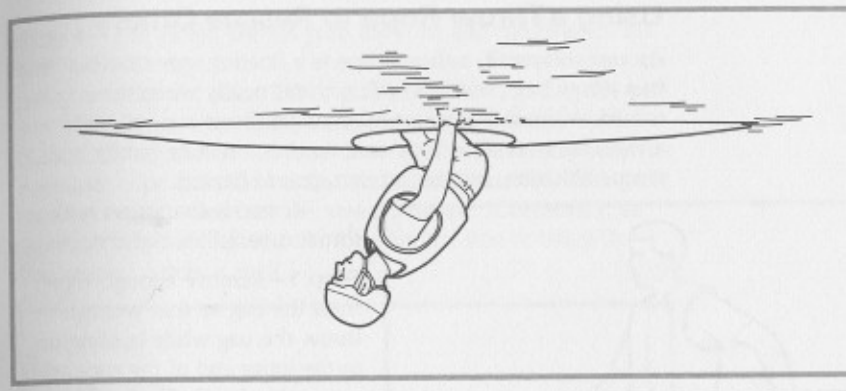
Step 7—When rescuers are trying to assist you, do all you can to help them help you.

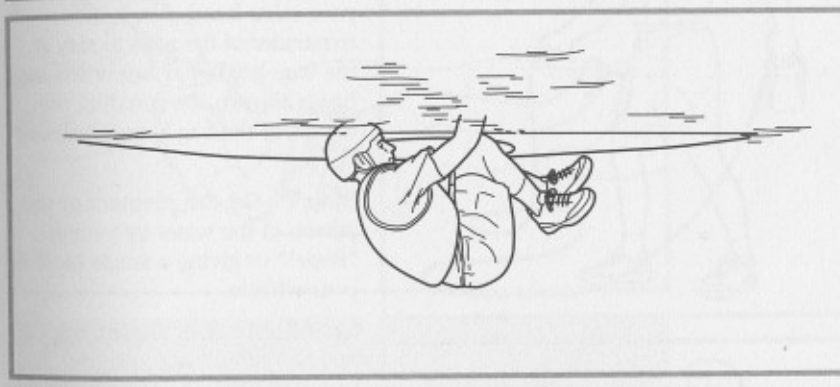
Capsize Drills

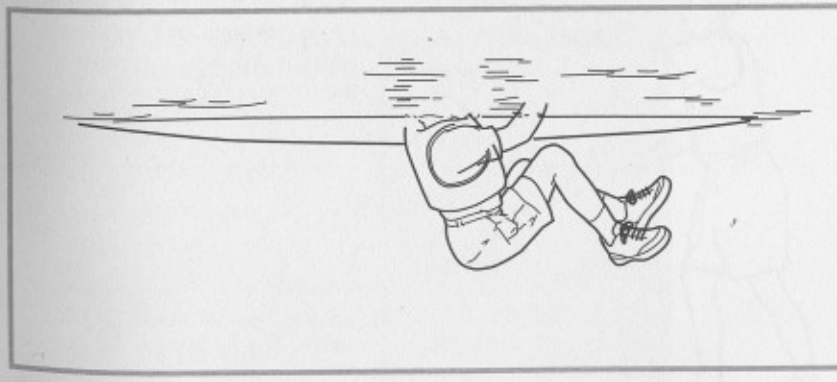
Intentionally capsize your craft in calm water and practice recovering from the spills until your reactions become automatic.

To safely capsize a canoe, sit next to your paddling partner in the bottom of the canoe facing the same side. Let your legs hang over the gunwale. Put your hand nearest your partner on the gunwale behind you. Put your other hand on the gunwale in front of you. Rock forward and backward until the gunwale in front of you goes below the water level and the canoe begins to fill with water.

To practice a "wet exit" from a kayak, lean your body out over the water to cause your boat to capsize. Release the spray skirt from the coaming then lean forward with your forehead near the deck and push on the sides of the coaming with your hands. This will push you out of the kayak. When your legs and feet are clear, let them drop toward the bottom. Keep your grip on the coaming throughout the maneuver. When you are in the feet-down position in the water, bring your head up on one side of the capsized kayak. After completing the wet exit, turn the kayak so you can grab an end loop. Push or pull the kayak to shallow water, keeping it upside down so that the air trapped in the cockpit will keep the boat afloat.







Using a Throw Rope to Rescue Others

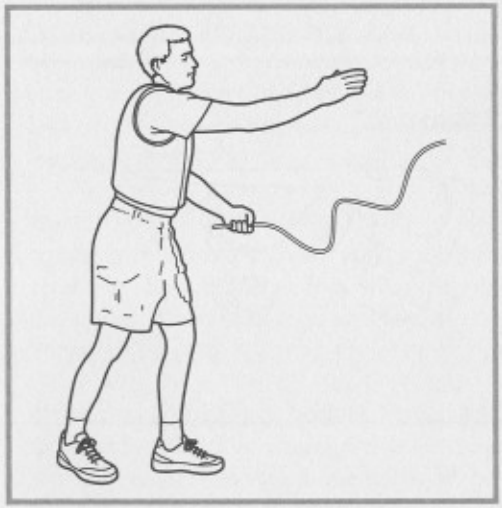
As you will recall, a throw rope is a floating rope that is stored in a throw bag. The rope will pay out neatly when the bag is tossed. A throw bag or a neatly coiled throw rope should always be secured in your craft so that it will be handy in a rescue situation, but not an entrapment hazard.

To rescue swimmers with a throw rope follow these steps:

Step 1—Remove enough rope from the bag so that you can throw the bag while holding on to the loose end of the rope with your other hand. Allow the remainder of the rope to stay in the bag. It will pay out when the bag is thrown. Be sure that the mouth of the bag is only halfway open.

Step 2—Get the attention of the person in the water by yelling, "Rope!" or giving a single blast of your whistle.

Step 3—Grasp or step on the free end of the rope and toss the bag at the swimmer. Aim at, or slightly beyond, the swimmer's head. If you miss, quickly restuff the bag or make arm-length coils of rope and try again.



Step 4—The victim should grab the rope and roll over on his back with the rope held in the middle of the chest and the rope going over the shoulder. Either pull in the line to bring the person to safety, or allow the person to swing on the line to the bank. Walking the end of the line along the shore may help the swimmer cope with the current and avoid obstacles. Take great care not to be pulled into the water yourself. If necessary, sit down to help hold against the force on the line or belay the line around a tree or rock.

Practice Using the Throw Rope

Using a throw rope effectively takes practice. If you cannot practice in a controlled setting in a river, practice on land with a buddy by doing the following exercises.

1. Have your buddy pretend to be a slow-moving victim about 30 to 45 feet away. Toss the throw bag to him as he moves slowly by you.
2. Practice what you would do if you missed the throw the first time. Retrieve the rope by making long coils. Divide the coils between your hands and throw the rope again to your buddy. Practice both short and long throws and at different speeds as your buddy pretends to be in slow and fast moving currents.

Trip Planning

Before you head out to demonstrate your whitewater skills, work with your merit badge counselor or another qualified adult to select the river course and choose group participants. Consult with your counselor to make sure that the course is within the capabilities of all participants and that the equipment you will be using is appropriate for the activity.

Research and prepare a float plan that specifies your route. Be sure to include put in and take out points. Set up a schedule in which you determine how much time you will need to safely float the stretch of river you selected. Double check your equipment and review safety precautions and emergency procedures. Identify your options in the event of a problem with equipment, a sudden change in weather, or a medical emergency. A review of the BSA Safety Afloat principles and the American Whitewater safety guidelines will help you with these tasks.

Obtaining Necessary Permissions

The use of many rivers is governed by special rules and permits. Stay on the right side of the law, and get permission to float before you go. You will often find that a state or federal agency holds jurisdiction over the stretch of river you want to run. If you will be crossing private property, always get permission from the landowner. Local boating shops, river guidebooks, maps, and government-agency Web sites can provide information about whom you need to contact.

Personal and Group Equipment

Before you head out on the river, always double-check that you have both personal and group essentials necessary for a safe whitewater outing. This checklist provides some guidelines, but you may need to adapt it to reflect your specific needs and the purpose of your trip.

Personal Essentials

- ☐ PFD with whistle
- ☐ Helmet
- ☐ Pocketknife
- ☐ Spare clothing
- ☐ Rain gear
- ☐ Unbreakable water bottles filled with water
- ☐ Lunch and/or snacks
- ☐ Sun protection (including sunscreen, brimmed hat, and sunglasses with a strap)
- ☐ Map and compass
- ☐ Spare glasses (if you wear them)
- ☐ First-aid kit

Place everything that must stay dry in waterproof containers such as dry bags, boxes, buckets, or barrels. Items that need to stay dry include food, spare clothing, first-aid kits, maps, sleeping bags, tents, and other camping equipment.

Use cam straps, bungee cords, and pieces of rope to secure items and equipment so they will not fall out past the gunwales if you capsize. Dry bags are often lashed in gunwale to gunwale. All loose rope should be stowed out of the way. It is vital that your lashing does not pose an entrapment hazard.

Packing for a whitewater trip

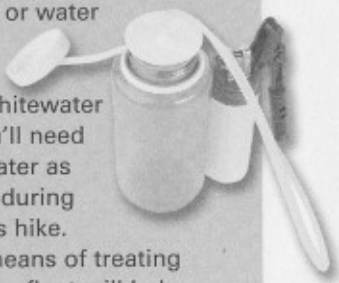
Essential Group Equipment

Group equipment should be evenly distributed among all the boats. Here is a general list of equipment. Adjust your own list to suit the length of time you will be out and the number of people participating.

- ☐ Spare paddle (at least one per party, preferably one per boat)
- ☐ Flotation (air bags or foam) in each boat to keep the boat afloat if you capsize
- ☐ For canoes: A bailer made of a cut-out gallon plastic jug, attached to the floor of your boat with a very short length of line or webbing and a plastic fastener

- ☐ Large absorbent sponge to soak up splashes and clean up sand and mud

- ☐ For open canoes: Bow and stern lines (painters) securely attached. Use ropes at least 5 feet longer than your boat, 5/16 inch or 3/8 inch in diameter. Secure them to the canoe so that they are readily available but will not entangle feet and legs in case of a spill.
- ☐ Water filter or water treatment tablets. During a whitewater outing, you'll need as much water as you would during a strenuous hike. Having a means of treating water while afloat will help avoid dehydration.



- ☐ Throw rope in a bag
- ☐ First-aid kit
- ☐ Waterproof matches, lighter, candle, or fire starter
- ☐ Duct tape and a repair kit
- ☐ Handheld bilge pump
- ☐ Camping equipment (for overnight trips)

River Etiquette

River etiquette is simply showing courtesy and respect for people you encounter on the river including other boaters, fishers, and swimmers. Here are some common guidelines for being a good ambassador for whitewater paddling.

- Yield the right of way to crafts with less maneuverability such as rafts and boats running straight through a rapid.
- When running down a river, try to pick a path that will not interfere with another paddler playing in a hole or surfing a wave.
- Do not tailgate through a rapid. Leave plenty of space between boats.
- If an eddy is already full of boats, wait upstream until there is room or find another one downstream.
- Pass other boats with care. Do not try to pass in a rapid.
- Allow faster boats to pass.
- Stay out of other boaters' way. Pass fishers quietly and give them as much space as possible.
- Share play spots with other boaters and wait your turn.
- Do not crowd boating classes or novice boaters.

Bear in mind that river recreation often concentrates a lot of traffic into a narrow corridor. Many of our rivers are in danger of being loved to death. Take care of stream banks when you launch and land your boat, and walk gently on the land. Practice Leave No Trace principles. Respect the river so that future generations will be able to enjoy the thrill, mystery, and beauty of whitewater paddling.