HOW TO FREE A WRAPPED RAFT

Audience: Whitewater guides and private boaters with a basic understanding of river hydraulics and technical rope work. Knowledge of technical rope systems including the figure eight family of knots, prussics, and Z drag is assumed.

Objective: Understand how to analyze the problem and retrieve a raft that has wrapped around a midriver obstruction, using simple or mechanical advantage systems.

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Overview

Sooner or later, any rafter who spends time on a river will encounter a rescue situation known as a “wrap”. A wrap occurs when a raft broaches on a midstream obstacle such as a rock or bridge abutment. As the raft contacts the obstacle and stops, the pillow formed by the current against the obstacle transfers to the upstream tube of the raft. If the crew fails to highside by transferring all weight to the downstream tube, the current will drive the upstream tube under. The pressure of the water against the submerged tube and the floor of the boat will then wrap the boat around the obstacle. When this happens, the crew will be spilled into the river, and sometimes may even be trapped under the boat. *It is imperative in this situation to immediately account for all personnel.* If there is the slightest possibility that one or more crew may be trapped under the raft, don’t hesitate; cut the floor out. The cost of the equipment is negligible next to the possibility of loss of life.

This procedure focuses on recovery of the raft, after personnel have been rescued. You will learn how to assess the situation, and use various methods including mechanical advantage (ma) rope systems to pull the raft free.

River Safety

The first concern in any rescue scenario is safety. No boat or equipment is worth risking life or limb in the attempt to retrieve it.

Safety priority is to provide for your own safety first, followed by the safety of your teammates. If you put yourself at unnecessary risk, you may become a victim and put your teammates at higher risk by escalating the situation.

- **Personal Safety**

The first and most important requirements for personal safety are awareness and knowledge. Awareness is a state of mind; dangerous decisions can be made when the mind is dulled by hypothermia, or reacting to adrenaline in the excitement of the moment. Technical rescues can take hours to plan and implement, and should only begin after the excitement is over and the situation has been assessed. Knowledge is gained by prior experience, study, and practice.

The proper personal equipment is an important aspect of protecting yourself. The minimum basic equipment is shown in Table 1.

TABLE 1 Personal Equipment

Personal Floatation Device (PFD).	A U.S. Coast Guard approved type III or V, or type III/V PFD is recommended. This type of PFD has a minimum of 15 ½ lb of floatation. In addition, the PFD should be designed for river or rescue use.
Helmet	A helmet with ventilating holes and foam padding is preferred. Fixed brims should be avoided; current working against the brims may cause problems and injury.
Wetsuit or Drysuit	River rescue may involve considerable time in the water. A wetsuit provides some protection against hypothermia in the water; in addition, the neoprene foam rubber can offer some physical protection from rocks. A drysuit provides excellent thermal protection both in and out of the water.
Footwear	Bare feet or sandals do not provide secure footing on a river bottom. Heavy boots such as fishing waders, or firemans' boots are a liability when forced to swim. Tennis shoes with neoprene socks, or thick soled 'Okispor' neoprene booties are a better choice.
Gloves	Neoprene gloves will provide both warmth and protection for the hands. Precurved gloves are more comfortable and will not fatigue the hand as rapidly as straight cut gloves.
Whistle	A loud whistle is used for communication. Choose a whistle that does not have a cork ball in it. The ball often swells when soaked in water, and can reduce the effectiveness of the whistle.
Knife	A knife that locks into it's sheath is essential for river rescue. It is usually mounted near the shoulder on the PFD, and should be easily accessed and released from it's sheath. Some rescuers now carry disposable surgical shears, of the type with the blunted tip. This can cut through ½ inch kernmantle rope or a raft as effectively as a knife.

Team Safety

Next to providing for your own safety, is providing for the safety of your teammates. While operating in current, at least one member of the team should be waiting downstream with a throw bag to rescue any swimmer caught by the current. In addition, a spotter should be upstream, ready to warn other boaters coming down river. It wouldn't do to have another boat pile up into a tensioned rope stretched from shore to the wrapped boat in midstream!

In publicly accessible areas, this type of operation can attract attention from the general public. Some may even offer to help. *It is doubtful that any of the general public have the skills or knowledge to keep from inadvertently endangering either themselves or others.* In this situation, crowd control may become a priority. A highly tensioned rope that suddenly releases can cause serious injury. Keep all nonessential personnel away from any rigging, or the path that a rope may follow.

Basic Rescue Equipment

There is no list of equipment that will apply to all scenarios. The following list of equipment is sufficient for the techniques discussed here:

TABLE 2 Rescue Equipment

200 ft	3/8" braided poly and kernmantle rope, rated for 4300 lb static load
2	2" rescue pulleys
6	locking "D" carabiners
3	5 mm prussic
2	15' x 1" tubular nylon web

Situation Analysis

Before rigging a complex system of ropes and pulleys to in an attempt to pull the wrapped raft free, analyze the situation. A mechanical advantage system pulling at the wrong angle may not work at all. The simplest approach is always the best.

The raft is pinned by the force of the current pushing it against the obstacle. Where is the pressure of the water the greatest? Which way will the boat go once it is freed? How close is the nearest bank? Is the boat symmetrically wrapped on the rock? If more of one side of the boat is off the obstacle than the other side of the boat, that is the direction to concentrate your effort.

Simple Methods

If the raft is not pinned too severely, it may be possible to release it simply by jumping up and down on it, to “bounce” it free. An oar or paddle may be used to apply leverage between the raft and the rock it is pinned against to help break it loose. If the floor is one of the laced in type, some of the lacings can be cut to allow the water to pass through the boat, reducing the pressure keeping it pinned. The floor may be softened slightly by releasing a small amount of air.

Ropes can be used to pull on portions of the raft for greater effect. If the lower tube can be lifted slightly, water will begin to flow under the raft, reducing the pressure pinning it to the rock. A rope is attached to the lower tube of the raft and wrapped around the handle of an oar which is used as a fulcrum to apply leverage. (See Figure 1.)

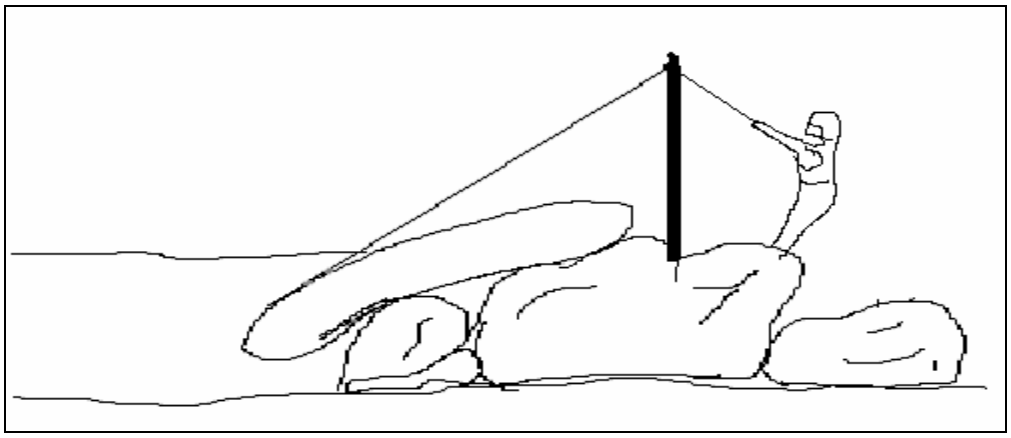

Figure 1 Using an oar as a fulcrum

Another simple method to spill water from the raft is to use a simple Z drag to fold the boat, spilling water. (See Figure 2.)

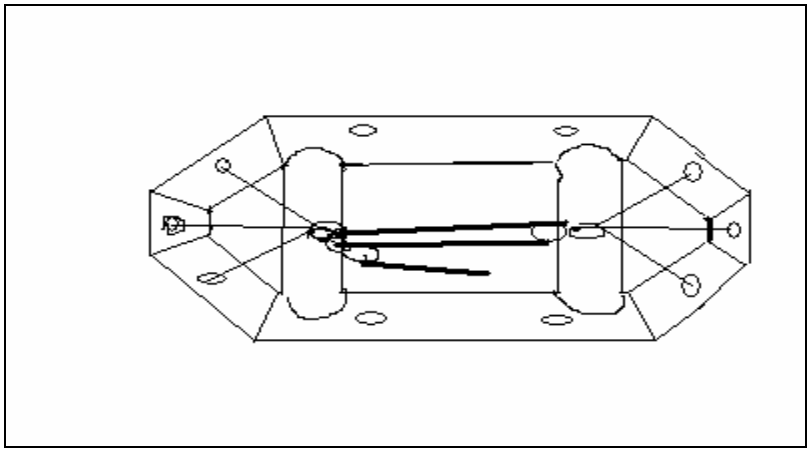

Figure 2 Using a simple Z to spill water

When attaching systems with mechanical advantage to the boat, be wary of attaching to a single D ring. It is unlikely that a D ring would hold more than 500 lbs load; a poorly bonded D ring may release under considerably less strain. Use a load distributing anchor system to multiple D rings, or secure the anchor web through the floor and around the tube.

Shore Based Systems

When the simplest methods will not work, pulling with a rope from the shore may be required. The first pull should be across the boat, in the direction the river is pushing the boat. Direct force can be tried initially; remember, three people pulling on a rope exert as much force as one person pulling on a 3:1 Z drag. Try changing the angle of the pull. If there is high bank or a tree that a pulley can be rigged to for a change of direction, try pulling up on the raft. It may be possible to spill enough water this way to free it. When a raft is seriously wrapped, mechanical advantage will have to be used.

Vector pull

Again, always use the simplest method. The vector pull shown in Figure 3 is quite simple to implement. No special equipment is required, other than rope.

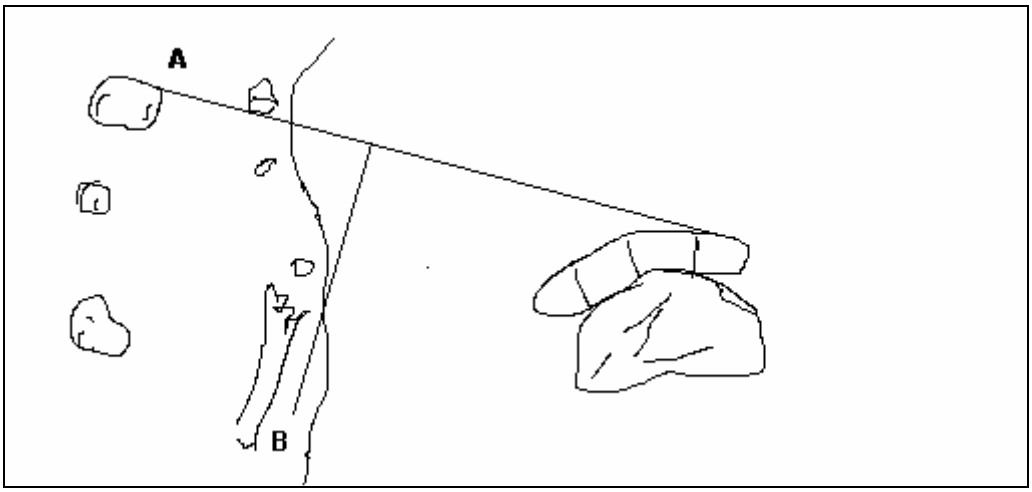

Figure 3 Vector pull

Anchor a rope between the raft and a fixed object on the shore, such as a sturdy tree or large boulder (A). Use a second rope to pull at right angles to the first rope (B). The vector forces generated by this method greatly amplify the force exerted between the raft and shore anchor. At 10 degrees of deflection, 100 lb of pull translates to about 500 lbs on the raft.

The problem with this system is that the multiplying effect of the vector is not constant; it is inversely proportional to the sine of the angle. As the raft begins to move, the vector angles change, and the effective force is reduced. This requires retensioning the first rope each time the raft moves. The main advantage to this system is the simplicity; the only equipment needed are two ropes.

Z Drag

The Z drag is perhaps the most complicated to set up; it requires more gear, but offers the ability to apply mechanical advantage in a system which can easily be reset to take in more rope as the raft begins to move off the rocks.

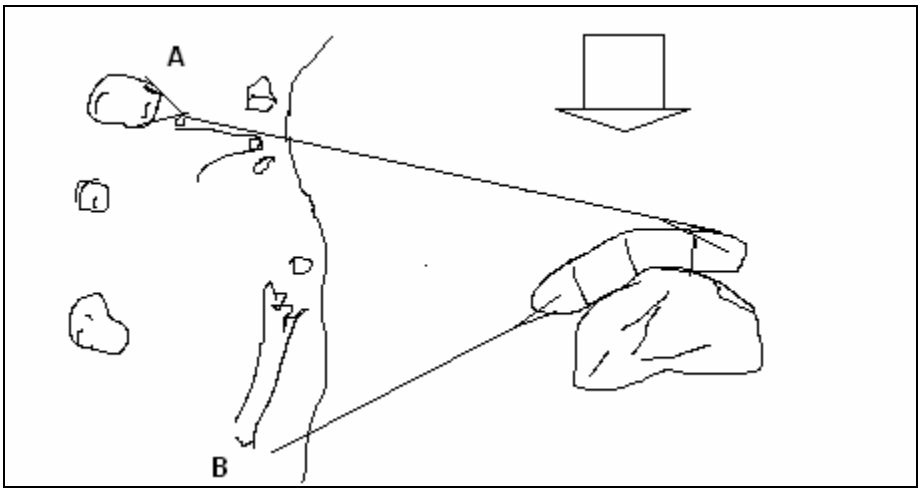

Figure 4 Using a Z drag to pull on the raft

In Figure 4, an anchor is set up around the boulder at A using 1" tubular web. Unlike the vector pull, the 3:1 mechanical advantage remains constant as the raft moves and the rope gets shorter. When all the slack in the pulley system is used up, simply reset the working prussic for another pull.

Add a second rope from the raft to the shore at a downstream angle to help drag the raft around and off the rock. As more of the boat moves in this direction, the current will add to the forces pushing the boat downstream and off the rock.