Rafting Course

and Instructor's Materials

Forward

The contents of this manual reflects the rafting course taught in the Adventure Sports program at Garrett College. The materials contained in this manual follow closely the content of the course and represents the evolution of the course over the years. The materials in this manual represent over twenty-five years of instruction.

The manual is designed to complement the American Canoe Association (ACA) Level 4 Rafting (Paddle) instructor's course. An objective in creating this manual was to provide materials that will encourage the teaching of the ACA course. The ACA outline has been synthesized into seven chapters (eight including the teaching materials). An effort has been made to include most of the topic on the outline. The manual is presented on the author's website for instructors who want to augment their courses with the materials.

Figure 0.1: Powerful Popper – Running R-1, the author is running Power Pop-up on the Upper Youghiogheny in Western Maryland in his Shredder. Source: Limbaugh – [file: \cc4283_56b.jpg]

An effort has been made to represent both east and west rafting. There are some differences. Also, rowing oar rigs is included in the strokes and maneuver sections. This helps to expand the usability of the manual.

Representing the east/west divide and the paddle versus oar rig are Figure 0.1 and Figure 0.2. Representing eastern rivers and paddle craft is the author running in his Power Popper on the Upper Youghiogheny River in Western Maryland in his R-1 Shredder. Representing western rivers and oar rigs is the author entering Zoom Flume in Browns Canyon on the Arkansas River in Colorado.

Figure 0.2: Typical Oar Rig – The typical center mount oar rig of the author entering Zoom Flume on the Arkansas River in Colorado. Source: Commercial Photographer – [file: \BrownsCanyon3157720.jpg].

In its seven chapters, the manual contains over 90 graphics developed by the author. Many of these are new and developed specifically for this manual. Others, like the graphics on river dynamics have evolved over the years and form the basis for the discussion of river dynamics for other publications including the Swiftwater Manual and the Human Kinetic series on Canoeing and Kayaking. The graphics are available on the author's website.

Organizationally, I believe the materials presented in the manual have a good flow. The progression of the manual is as follows. The first chapter involves getting started, including the ACA Course outline. Chapter 2 discusses equipment including rafts and personal equipment. Chapter 3 focuses on river dynamics. Building on this chapter, Chapter 4 introduces strokes and maneuvers for both paddle and oar craft. Safety and Rescue are split. Chapter 5 covers general safety topics. Chapter 6 covers "self-rescue" and "rescue by others in your group" type rescues. Chapter 7 focuses on trip leadership including guiding and trip behavior. Chapter 8 includes teaching materials for the IDW (Instructor's Development Workshop).

As with any publication, it involves other people. I would like to thank Mike Logsdon, Terry Peterson and Mike Malfaro who have co-taught the course and who have provided considerable input into the materials developed including the basic structure of the course. Also, I would like to thank Mike Logsdon who has provided support for the course over the years. Also, we have worked with countless co-instructors and students on an interim basis.

Robert B. Kauffman, Ph.D.

Rafting Course Manual
(Instructor's Materials)

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    5. **Conceptual topics**
        a. Hypothermia
        b. Hyperthermia (e.g. wetsuits)
        c. LNT in a rafting environment
        d. Backpackers count ounces, canoe campers count pounds, and rafters count tons. Consider this in terms of trip planning for a multiple day trip.
        e. Creating a "roller coaster" experience. Should raft guides have imaginary tracks going down the river?

Appendix A: Examination

Chapter 1:
Getting Started

ACA
AMERICAN CANOE ASSOCIATION
Kayak & Canoe Recreation

Level 4: Whitewater Rafting - Paddle

Instructor Criteria

Overview: Fundamentally, it is expected that participants should possess the paddling skills, technical knowledge, rescue ability, teaching ability, group management, and interpersonal skills commensurate with this level of certification prior to presenting themselves for evaluation as Instructor Candidates at an Instructor Certification Exam (ICE).

Essential Eligibility Criteria:

In order to participate in an Instructor Development Workshop (IDW), an Instructor Candidate must satisfy the following essential eligibility criteria:

Be 18 years or older
Be a current ACA member in good standing
Be able to independently participate in all skills, activities and rescues listed in the appropriate ACA Certification Course Outline and Instructor Criteria documents
Be able to effectively communicate with the Instructor Trainer and other course participants
Be able to manage all personal care and mobility independently

In order to participate in an Instructor Certification Exam (ICE), an Instructor Candidate must satisfy the following essential eligibility criteria:

Be 18 years or older
Be a current ACA member in good standing
Be able to independently complete all skills, activities and rescues listed in the appropriate ACA Certification Course Outline and Instructor Criteria documents
Be able to effectively communicate, including effective verbal communication
Be able to manage all personal care and mobility independently

Course Prerequisites: Completion of the appropriate level assessment course, or equivalent skills.

Course Duration: Combined IDW & ICE - 4 Day Minimum

Course Location / Venue: This class is taught on moving water in Class I–III

Class Ratio: 6 Candidates: 1 Trainer 12:2 with a qualified assisting ACA Instructor

Succeeding Levels of Certification:
None.

Complementary Levels of Certifications:
Level 4: Whitewater Rafting - Oar

The following is a list of the criteria used to evaluate Instructor Candidates. The content covered and sequence of evaluation should be adjusted to best fit the participant's needs, class location and time allowance.

General Requirements for all Instructor Certifications:

- Be at least 18 years old
- Meet the appropriate essential eligibility criteria
- Successfully complete an Instructor Development Workshop (IDW)
- Be a full ACA member & Upon successful completion, register with the Safety Education & Instruction Council
- Have and maintain First Aid and age appropriate CPR
- Demonstrate a general knowledge of paddle sports and the ACA
- Demonstrate the ability to appropriately perform and teach all of the following material unassisted in the appropriate venue

- Demonstrate knowledge and ability to efficiently/effectively plan and implement appropriate instructional sessions and assessments for a different learning styles and ability levels, to include:
  - Differentiation of instruction based on the individual learner (student centered)
  - Use of an appropriate skills progression when teaching complex skill sets
  - Selects of appropriate teaching venue based on ability and desired outcomes
  - Focus on core principals rather than specific technique
  - Provides appropriate, specific and meaningful feedback

Maintenance Requirements:
- Teach at least two courses that meet ACA standards within the four-year certification period and report the results to the National Office
- Complete an Instructor Update, at the highest level of certification, during the four-year certification period
- Maintain ACA membership and SEIC registration annually
- Maintain First Aid and CPR Requirements

Level 4: Whitewater Rafting-Paddling Instructor Requirements:
Fundamentally, we expect that Instructor Candidates should have basic paddling skills, before presenting themselves for evaluation as instructor candidates as below:

1) Demonstrate a knowledge of ACA Paperwork:
   How to register & report a course (with and without insurance)
   An understanding of the ACA Waiver & Release of Liability
   Have a Clear understanding of the ACA website and tools that exist therein

2) Demonstrate a knowledge of:
   Teaching theory
   Learning theory
   Effective methods of providing feedback

3) Demonstrate the following:
   Positive interpersonal skills
   Appropriate group management skills (including leadership and judgment)
   Ability to choose an appropriate venue / class site

4) Demonstrate the knowledge and ability to teach the following topics and skills:

RAFT HISTORY
History of the sport
Rafting terminology

RAFT & EQUIPMENT
Parts of a Raft: Types, materials
Paddle design, types and parts
Multi thwart raft
Cooler Frame to Boat interface,
Proper paddler spacing
Life Jacket (PFD): types, material, fit
Helmets
Clothing and Footwear suitable for immersion and appropriate to the conditions

Raft outfitting: bow & stern lines, flip lines, chicken/life lines

Proper Inflation
Securing equipment
Care of equipment
Raft , frame and paddle repair and improvisation

RIVER DYNAMICS (and how each item below changes with river levels)

Tongues
Bends
Eddies
Waves
Holes
Rocks
Hazards
How each of these features effect a paddle raft and why

RESPONSIBITIES OF CAPTAIN (guide):

Distribution of Paddlers
Group Communication
Commands
Boat Loading and Trim
Reading the River
Special Equipment: (Coolers, Dry Bags, etc…)

5) Demonstrate the ability to teach and appropriately model these strokes and maneuvers:

LIFTING ~ CARRYING:

Carries overhead
Carries underhand

LAUNCHING:

Lifting
Stacking
Shoreline
Launching and Landing

IN THE RAFT:

Seating and proper paddling position
- Back and shoulder protection

Foot and knee lock in positions for paddlers and captain
Movements in the raft: high side, down
Personal protection from loss of paddle, entrapment, safety of passengers

PADDLE:

How to hold paddle
Efficient paddle position (Use of Core Muscles)
Foot and knee position
Positions in the raft based on number of paddlers
How to balance each paddlers ability

STROKES:

On all below Paddling related Categories: Candidate must be comfortable captaining raft with two or more paddlers

- Focus on hand position and using core muscles
- Captain focus on Draw and Pry strokes
- The rafting J-Stroke
- Sweep stroke

MANEUVERS: (calm water) as the paddle captain with at least two paddlers, lead the following

- FORWARD: Slowly paddle in a straight line
- FORWARD: With speed, paddle 200 yards row in a straight line (using corrective strokes as needed)
- BACKWARD: 200 yards row in a straight line starting slow and working up speed (using corrective strokes as needed)
- SPIN: Pivot the raft – left & right and stop
- TURN FORWARD/BACKWARD: Broad arcing turn
- FORWARD LEFT/RIGHT TURN: Make Square with 10 yard sides, 4 left turns, then spin and repeat in opposite direction.
- FORWARD LEFT/RIGHT TURN: Figure 8's in both directions
- BACKWARD LEFT/RIGHT TURN: Make Square with 10 yard sides, 4 left turns, then spin and repeat in opposite direction.
- BACKWARD LEFT/RIGHT TURN: Figure 8's in both directions
- STOPPING: Stop the raft from a good speed (within ½ boat length)
- REVERSE STOPPING: Stop the raft from a good speed (within ½ boat length)

MANEUVERS (moving water – class III)

- PROPER RAFT ANGLE: Entering a Rapid/Tongue
- ANGLE ADJUSTMENT: While in Rapid
- PROPER USE: Forward stroke
- FERRIES: Front, Back
- EDDY TURNS: shallow, wide
- PEEL OUTS: shallow, wide
- SPIN: Pivot the raft – left & right and stop spin
- MICRO EDDY USE: While running Rapids, Boast Scouting and Safety Positions

6) Demonstrate the ability to teach and appropriately model these rescue techniques:

- ALL CANDIDATES: Must have taken a ACA or Rescue III Swift Water Rescue class
- RESPONSIBILITY: Group, Individual, Rescuer, Victim
- RESCUE Priorities: People, Boats & Gear
- SIGNALS: Whistle, Paddle, Hand
- RESCUE SEQUENCE: (RETHROG)
- BOAT FLIP & RECOVERY: Self, assisted (Considerations- Frame, load, flip safety, shore based flips for heavy boats)
- REENTRY: Self, assisted
- SWIMMING IN CURRENT: defensive and aggressive, down river position
- THROW ROPE / BAG: use and practice
- BASIC WADING
- ENTRAPMENTS: show stabilization line

BOAT PIN/WRAP: strong arm, rope use (Boy scout pull, vector pull, mechanical advantage systems, anchors, safety considerations)
BUMPING
TOWING ANOTHER RAFT
RESCUE EQUIPMENT: Unique to rafting due to force of water and raft load ability. Safety consideration while rescue equipment is under load

7) Demonstrate knowledge of, and the ability to teach, the following:

RIVER ETIQUETTE: River rules of the road, safety in multi-use areas where others may be present.
4 W's- WIND, WAVES, WATER AND WEATHER as it relates to paddlers
REGULATIONS – USCG / State / Local safety requirements
SAFETY: Understand the risks of rafting and hazard avoidance
HYPOTHERMIA ~ HYPERTHERMIA: Recognition and treatment HELP/HUDDLE
ENVIRONMENTAL ISSUES: Leave No Trace, ecology, Camp Etiquette ext.…
TRIP PLANNING: Comfortable in preparing for a day or multi day trip
GROUP AWARENESS: Familiar with whistle and paddle signals
GENERAL: Familiar with the different disciplines of paddle sport, Oars Boat-man-ship
SECURING RAFTS TO VEHICLE/TRAILER: Attach raft to rack or trailer using flat cam-straps or rope and suitable knots
PERSONAL PREPARATION: Planning, clothing, food and water
RAFT: types, parts, materials, maintenance, care and repair
OARS: Types, parts, materials, fit
CONCEPTS OF ROWING: in river environment
TRIP PLANNING: 6P's – prior proper planning prevents poor performance. Familiar with how to prepare for a day and up to 3 day trips
KNOTS: Figure 8 family, bowline, truckers hitch, and clove hitch. Munter-Mule for rescue purposes, and proper application of all knots and hitches.
RESCUE EQUIPMENT: A clear understanding of all rescue gear that needs to be carried on any raft trip. This includes but is not limited to harnesses, carabineers, anchor systems, etc…

GROUP MANAGEMENT

Planning a trip
Put-in Briefing
Group Management (1 Boat or Team, Lead /Sweep, Safety, Spacing)
Demonstrate leadership, group management skills, experience and judgment necessary to be a safe, effective instructor
Understand group dynamics

Primer on Waivers[1]

by

Dr. Robert B. Kauffman

1. The purpose of a waiver is to ***transfer*** the cost of the injury, damage, or loss to the participant. It does nothing to ***reduce*** the likelihood of an accident occurring.

    Definition – *A **waiver** is a voluntary relinquishment or abandonment – express or implied – of a legal right or advantage.*

    a. **<u>Assumption of Risk</u>** – Under this doctrine, the participant assumes all the risk associated with the danger of the activity. The following paragraph in a waiver is typical.

        "*I hereby assume all of the risks of participating in this activity or event, including by way of example and not limitation, any risks that may arise from negligence or carelessness on the part of the persons or entities being released, from dangerous or defective equipment or property owned, maintained, or controlled by them, or because of their possible liability without fault.*"

    b. **<u>Indemnity and Hold Harmless Clause</u>** – A contractual provision in which one party agrees to answer for any specified or unspecified liability or harm that the other party might incur. The following paragraph in a waiver is typical.

        "*I indemnify, hold harmless, and promise not to sue the entities or persons mentioned in this paragraph from any and all liabilities or claims made as a result of participation in this activity or event, whether caused by negligence of release or otherwise.*"

2. **<u>Do They Work</u>** – In eight states, the courts have outlawed or not upheld waivers. It is state by state issue regarding their validity. The following are some considerations.

    a. **<u>Gross Negligence Trumps Ordinary Negligence</u>** – In general, gross negligence negates any waiver. When asked what the difference between gross and ordinary negligence is, most lawyers respond that gross negligence is worse than ordinary negligence. It may be difficult to define and often the court will let the jury decide if it is gross negligence and whether the waiver will or will not be upheld. Hence, it is often a "road bump" on the way to trial or settlement. Take it seriously because it can be a significant roadbump.

    b. **<u>Voluntary</u>** – Since the waiver is a contract, it needs to be entered into voluntary. The response that "*We can't reimburse your payment because there is no one to take your place on the trip*." might be considered as coercive and not voluntary.

    c. **<u>Minor</u>** – Minors cannot enter into contracts. Parents signing for minors waive the parent's right to sue on behalf of the child, not the child's right. The child can sue for injury, damage, or loss when reaching majority age.

3. **<u>Epitaph</u>** – Waiver are important tools in protecting yourself. Do not deceive yourself by thinking that your "bullet proof" waiver will protect you from being sued. Gross negligence trumps any waiver. Your best strategy is to run a safe trip or event and prevent the injury, damage, or loss from occurring before it happens.

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[1] Source: Kauffman R., and Moiseichik, M., (2013). *Integrated Risk Management for Leisure Services*. Champaign, Illinois: Human Kinetics, 42-46.

AMERICAN CANOE ASSOCIATION MEMBERSHIP FORM

All participants in ACA-insured activities must be ACA members in one of the following categories (choose one):

I am currently an ACA member. My member number appears below. (Check here if renewing with this form ☐) ☐	I would like a one-year ACA Paddle America Club Membership for: (check & circle one) Individual $30 | Family (2 adults + minors) $40 ☐	I would like a one-year ACA Membership for: (check & circle one) Individual $40 | Family (2 adults + minors) $60 ☐
I would like a one-year Student Membership for $25 (under 18, or under 23 with copy of student ID) ☐	I would like an ACA Introductory Membership for $15 (Six month full membership with benefits, including *Paddler* Magazine) ☐	I would like an ACA Event Membership for $5 (one activity membership, no member benefits) ☐

AMERICAN CANOE ASSOCIATION ADULT WAIVER & RELEASE OF LIABILITY

READ BEFORE SIGNING

IN CONSIDERATION of being permitted to participate in any way in the American Canoe Association, Inc. sports and recreation program and related activities ("Activities") I, for myself, my personal representatives, assigns, heirs, and next of kin:

1. ACKNOWLEDGE, agree, and represent that I understand the nature of paddlesports and related activities and that I am qualified, in good health, in proper physical condition to participate in such activity and willingly agree to comply with the stated and customary terms and conditions of participation. I further agree and warrant that if at any time I believe conditions to be unsafe, I will immediately discontinue further participation in the Activity. If I decide to leave early and not complete the trip as planned, I assume all risks inherent in my decision to leave.

2. FULLY UNDERSTAND that: (a) Paddlesports and related ACTIVITIES INVOLVE RISKS AND DANGERS OF DAMAGE TO PERSONAL PROPERTY AND SERIOUS BODILY INJURY, INCLUDING PERMANENT DISABILITY, PARALYSIS, AND DEATH ("RISKS"); (b) these Risks and dangers may be caused by my own actions or inactions, the actions or inactions of others participating in the Activity, the condition in which the Activity takes place, or THE NEGLIGENCE OF THE "RELEASEES" NAMED BELOW; (c) there may be OTHER RISKS AND SOCIAL AND ECONOMIC LOSSES either not known to me or not readily foreseeable at this time; and I FULLY ACCEPT AND ASSUME ALL SUCH RISKS AND ALL RESPONSIBILITY FOR LOSSES, COSTS, AND DAMAGES I incur as a result of my participation or that of the minor in the Activity.

3. HEREBY RELEASE, DISCHARGE, AND COVENANT NOT TO SUE the American Canoe Association, Inc., its Paddle America Clubs, affiliated clubs and organizational affiliates, their respective ACA certified instructors, certified instructor trainers, and certified instructor trainer educators, administrators, directors, agents, officers, members, volunteers, and employees, other participants, any sponsors, advertisers, and, if applicable, owners and lessors of premises on which the Activity takes place, (each considered one of the "RELEASEES" herein) FROM ALL LIABILITY, CLAIMS, DEMANDS, LOSSES, INJURIES, DAMAGE TO PROPERTY, OR OTHER DAMAGES ON MY ACCOUNT CAUSED OR ALLEGED TO BE CAUSED IN WHOLE OR IN PART BY THE NEGLIGENCE OF THE "RELEASEES" OR OTHERWISE, INCLUDING NEGLIGENT RESCUE OPERATIONS; AND I FURTHER AGREE that if, despite this RELEASE AND WAIVER OF LIABILITY, ASSUMPTION OF RISK, AND INDEMNITY AGREEMENT I, or anyone on my behalf, makes a claim against any of the Releasees, I WILL INDEMNIFY, SAVE, AND HOLD HARMLESS EACH OF THE RELEASEES from any litigation expenses, attorney fees, loss, liability, damage, or cost which any may incur as the result of such claim.

I HAVE READ THIS AGREEMENT, FULLY UNDERSTAND ITS TERMS, UNDERSTAND THAT I HAVE GIVEN UP SUBSTANTIAL RIGHTS BY SIGNING IT AND HAVE SIGNED IT FREELY AND WITHOUT ANY INDUCEMENT OR ASSURANCE OF ANY NATURE AND INTEND IT TO BE A COMPLETE AND UNCONDITIONAL RELEASE OF ALL LIABILITY TO THE GREATEST EXTENT ALLOWED BY LAW AND AGREE THAT IF ANY PORTION OF THIS AGREEMENT IS HELD TO BE INVALID THE BALANCE, NOTWITHSTANDING, SHALL CONTINUE IN FULL FORCE AND EFFECT.

Name (print) ______________________ Date of Birth ____________ ACA # (if any) ____________

Street Address ____

City ______________________ State ____________ Zip ____________

Email ______________________ Phone ____________

Date ______________________ Adult Signature ______________________

Name / Description of Activity or Event ____

Sponsoring Club / Organization ______________________ Activity Date ____________

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3. HEREBY RELEASE, DISCHARGE, AND COVENANT NOT TO SUE the American Canoe Association, Inc., its Paddle America Clubs, affiliated clubs and organizational affiliates, their respective ACA certified instructors, certified instructor trainers, and certified instructor trainer educators, administrators, directors, agents, officers, members, volunteers, and employees, other participants, any sponsors, advertisers, and, if applicable, owners and lessors of premises on which the Activity takes place, (each considered one of the "RELEASEES" herein) FROM ALL LIABILITY, CLAIMS, DEMANDS, LOSSES, INJURIES, DAMAGE TO PROPERTY, OR OTHER DAMAGES ON MY ACCOUNT CAUSED OR ALLEGED TO BE CAUSED IN WHOLE OR IN PART BY THE NEGLIGENCE OF THE "RELEASEES" OR OTHERWISE, INCLUDING NEGLIGENT RESCUE OPERATIONS; AND I FURTHER AGREE that if, despite this RELEASE AND WAIVER OF LIABILITY, ASSUMPTION OF RISK, AND INDEMNITY AGREEMENT I, or anyone on my behalf, makes a claim against any of the Releasees, I WILL INDEMNIFY, SAVE, AND HOLD HARMLESS EACH OF THE RELEASEES from any litigation expenses, attorney fees, loss, liability, damage, or cost which any may incur as the result of such claim.

I HAVE READ THIS AGREEMENT, FULLY UNDERSTAND ITS TERMS, UNDERSTAND THAT I HAVE GIVEN UP SUBSTANTIAL RIGHTS BY SIGNING IT AND HAVE SIGNED IT FREELY AND WITHOUT ANY INDUCEMENT OR ASSURANCE OF ANY NATURE AND INTEND IT TO BE A COMPLETE AND UNCONDITIONAL RELEASE OF ALL LIABILITY TO THE GREATEST EXTENT ALLOWED BY LAW AND AGREE THAT IF ANY PORTION OF THIS AGREEMENT IS HELD TO BE INVALID THE BALANCE, NOTWITHSTANDING, SHALL CONTINUE IN FULL FORCE AND EFFECT.

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Street Address ____

City ______________________ State ____________ Zip ____________

Email ______________________ Phone ____________

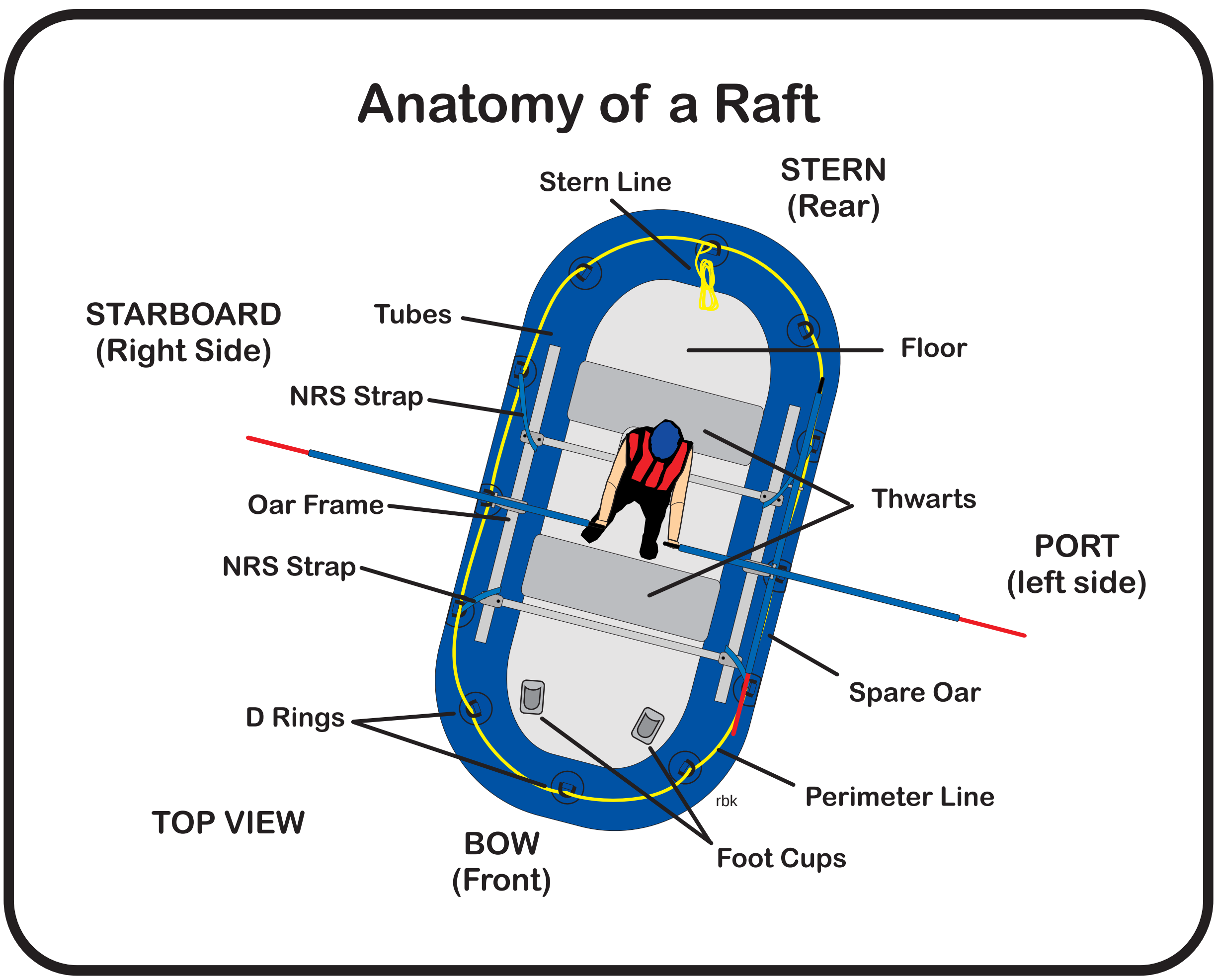
Date ______________ Adult Signature ______________________

Name / Description of Activity or Event ______________________

Sponsoring Club / Organization ______________________ Activity Date ____________

ACA Certification Information – Rafting Spring 2015	
Item	**Student Information**
ACA#:	
Last Name:	
First Name:	
Address:	
City:	
State:	
Zip:	
Phone:	
email:	
Date of Birth:	
Certification Level: (We fill this out)	

Chapter 2: Equipment and Repairs



Chapter 2.0:
Equipment and Repairs [1]

The focus of this chapter is on rafts and personal equipment. In terms of the ACA materials, it combines the repairs section with the equipment. The major sections in this chapter include types of rafts, anatomy of a raft, cams and knots, proper inflation, valves, personal equipment, and care of equipment.

Types of Rafts

Rafts are not homogenous. There is considerable diversity in term of size and use of the rafts. There is definitely and eastern and western bias regarding rafting and the types of rafts used on rivers. It is neither good nor bad, just a difference in approach. The following topics provide an overview of the different types of rafting. The grouping is by no means complete but it is a sampling. For example, the author paddles a shredder which is a non-traditional raft (see Forward).

Figure 2.1: Eastern Paddle Raft – Commercial rafting on the Lehigh River in Northeast Pennsylvania. Source: Author – [file:\lehigh0016.jpg]

<b>**<u>Paddle Raft</u>** (Figure 2.1) – The raft pictured in Figure 2.1 typifies commercial rafts used on eastern rivers. The raft is a commercial raft on the Lehigh River in Pennsylvania. The raft pictured is an unguided paddle raft that carries four to six people.

<b>**<u>Oar Rig</u>** (Figure 2.2 and Figure 2.3) – Most paddle rafts can easily be converted to an oar rig. The scene in Figure 2.2 depicts three different paddle craft on a commercial trip on the Middle Fork of the Salmon River. In the foreground are two rubber duckies. They are a one or two person craft paddled with a kayak paddle. Rubber duckies are extremely stable and easy to paddle.

Figure 2.2: Oar Rigs – In addition to the typical oar rigs used on the Middle Fork of the Salmon is the gear boat and rubber duckies. Source: Author – [file:\DSC_0008.jpg]

In the middle ground are pictured a typical oar rig. The NRS cam straps used to fasten the oar frame the raft are clearly visible. Also, the general outfitting of the raft is visible with the cooler serving as a seat.

[1] This section was written by Robert B. Kauffman who is solely responsible for its content. This section is copyrighted © Robert B. Kauffman, 2018.

In the background is the gear raft. A large raft, it utilizes a very different oar system. There is a large oar on the bow and one on the stern. The one on the bow is clearly visible. The raft drifts in the water and the oars are used to steer the raft.

Figure 2.3 shows a typical configuration with the rower and two passengers in the bow of the raft. Also, clearly pictured is the perimeter line that is stretched through the D-rings around the perimeter of the raft.

<b>**<u>Cataraft</u>** (Figure 2.4) – Catarafts are popular on western rivers. The two tubes are connected together with a aluminum frame. For transportation, the tubes can be detached from the frame if needed or the entire unit can be trailered behind a vehicle. Also, note the extensive use of NRS cam straps to fasten boxes and bags to the raft.

<b>**<u>Motorize Rafts</u>** (Figure 2.5) – A large motorized raft on the Colorado River is shown in Figure 2.5. The stern of the raft is shown for two reasons. It shows the outboard motor used to propel the raft. Second, close inspection reveals that the raft is constructed from a raft in the middle with two tubes lashed to the main raft on the outside. The rule is that bigger rafts make big water less big.

Figure 2.3: Passengers – The oar rig is set up to transport two passengers in the front of the river on the Middle Fork of the Salmon. Source: Author – [file:\DSC_0063.jpg]

Figure 2.4: Cataraft – With their two tubes and frame in between, catarafts are similar to catamarans. Middle Fork of the Salmon. Source: Author – [file:\DSC_0007.jpg]

Figure 2.5: Motorized Raft on the Colorado – Large motorized commercial raft on the Colorado River. Source: Author – [file:\DSC_0343.jpg]

Anatomy of a Raft

<b>**<u>Side View</u>** (Figure 2.6) – The ***tube height*** is the distance from the bottom of the tube to the top of the tube. The ***waterline*** is where the surface of the water make a horizontal line on the raft. The waterline indicates the amount of water displaced by the weight of the raft, its occupants and its cargo. The distance from the waterline to the top of the tube at its lowest point is the **freeboard**. **Rocker** indicates the amount of rise of the bow and stern from the bottom of the haul. More rocker aids in turning the raft more easily and in going over waves. The raft pictured is symmetrical from front to back and other than how it is outfitted

(e.g. foot cups), it paddles backwards just as easily as forward.

<b>**Orientation** (Figure 2.7) – Facing forward, ***starboard*** is the right side of the raft. ***Port*** is the left side. A way to remember port is that both port and left are four letter words. The ***bow*** is the front of the raft and the ***stern*** is the rear of the raft. As with the side view, the raft pictured is symmetrical from side to side as well as front to back and will go backwards as easily as forwards. The bow and stern are determined by outfitting including the foot cups and oar frame. The motorized rate pictured in Figure 2.5 is not symmetrical front to back.

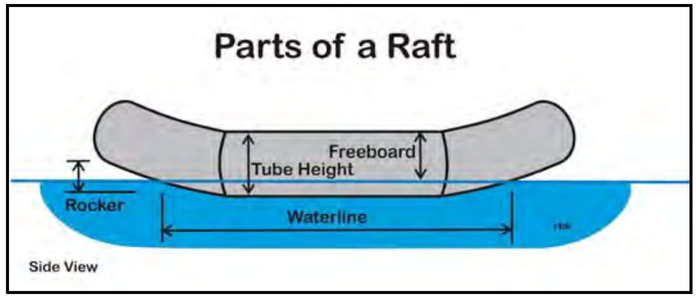


Figure 2.6: Parts of a Raft – Side View. Source: Author – [file:\Raft-answer01.jpg]

<b>**Oar Frame** (Figure 2.7 and Figure 2.8) – The oar frame is constructed out of aluminum tubing. The frame is fastened to the raft with four NRS straps that connect the corners to D-rings on the raft. The frame has two cross members or thwarts. Both are adjustable fore and aft. The seat is attached to the rear cross-member. The forward aluminum member is usually adjusted so that the rower can place his/her feet on it and push against it when needed. This allows transferring the rowing energy directly to the raft. Placing one's feet on the tubes is okay, but the tube has a lot of flex and give.

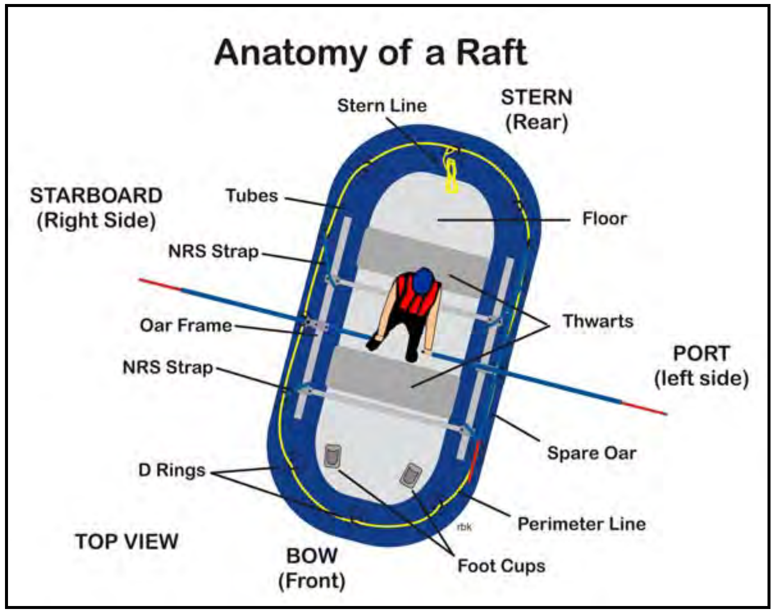


Figure 2.7: Parts of a Raft – Oar Rig – Top View. Source: Author – [file:\RaftAnatomy.jpg]

The oar mounts are fastened to the frame and the bolts tightened (Figure 2.8). The oar mounts should be placed roughly one-third of the reach of the arms on a forward and reverse stroke. Normally, the the mounts and oars are located in center of the raft, fore to aft. Also, the grips should not hit each other when taking a stroke.

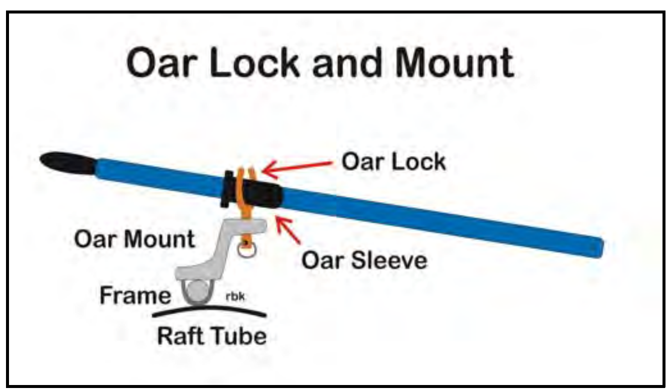


Figure 2.8: Oar Mounts – Source: Author – [file:\EQUIP_OarLock.jpg]

<b>**Parts of a Raft** (Figure 2.7) – Many of the parts of a raft have been identified with the oar frame and orientation sections. Additional parts of the raft are listed below. It should be noted that the raft in Figure 2.7 is outfitted for an oar rig. Remove the oar rig and the raft is usable as a paddle craft.

<c>***Tubes*** (Figure 2.7) – Most rafts have a minimum of three main tubes. Generally, there are two types of tube construction. The first is where the tube itself is the air tight baffle. This is the typical construction. The second approach is to use an inflatable baffle within the tube. The outside tube protects the baffle. Either system works well. As a footnote, when filling the tubes with air, fill **all** the tubes before topping them off. This reduces the remote possibility that the sidewall between tubes is blown out by the air pressure.

<c>***Thwarts*** (Figure 2.7) – Depending on the size of the raft, it will have one or more thwarts or cross-tubes. The tube provides a fourth tube to rafts with three main tubes. The thwarts provide seats for paddlers and lateral stability between the two side tubes.

<c>***Floor*** (Figure 2.7) – Most modern rafts are self-bailing rafts. The slight increase in weight more than offsets the advantages of not having to bail the raft. The floor in a self-bailing raft is actually a horizontal or flat tube that forms a floor. The river water enters and exits the raft where the floor is connected to the side tubes.

<c>***Perimeter Line*** (Figure 2.7) – The perimeter line is fastened to and extended through the D-rings on the side of the raft. The main purpose of the line is to provide a grab line for swimmers during rescue. It is recommended that when fastening things to the raft, use the D-ring rather than the perimeter line. This author would fasten his Shredder to one of the larger rafts overnight or when beached during the day. This would keep the tubes in the water and disperse any heat buildup to the water. Also, it reduces any abrasive action of the sandy beach abrading the bottom of the tubes. As a general rule, the perimeter line of either raft was avoided and the D-ring or its equivalent on the Shredder was used. A three foot NRS strap worked exceeding well.

<c>***Spare Oar*** (Figure 2.7) – The spare oar should be carried on one of the side tubes. A popular approach is to use a Fastex ® fastener to clip the oar to the frame and the grip end is slipped through the an O-ring which is cinched to the frame. The Fastex keeps the oar from slipping out of the O-ring. If carrying a spare oar, the rafter should be cautious that the blade of the spare oar does catch the water and impede the progress of the raft. Also, be sure that it doesn’t catch any objects and impale the raft on the spare oar either.

<c>***Foot Cups*** (Figure 2.7) – Most paddlers like to be physically connected to the raft. Many rafts are outfitted with foot cups in the bow of the raft. The foot coups enable the paddlers to put one of their feet in the cups.

<c>***D-Rings*** (Figure 2.7) – A series of D-Rings are placed strategically around the raft on the main tubes. The D-Rings are designed for maximum loading. The oar frame is connected to them. So is the perimeter line. If a haul line is connected to a pinned raft, the D-Rings are used.

<c>***Stern Line*** (Figure 2.7) – The stern line is a twenty to twenty-foot length of coiled rope tied to the rear D-Ring. Its primary purpose is to secure the raft when beached. The line can be connected to either end or both. However, only one line is generally needed for beaching purposes.

Cams Straps and Knots

For a large part, the cam strap has replaced ropes and knot tying on rivers. Two knots are include. The first is the bowline. It is an all-around useful knot that is strong and easy to tie and untie. The second knot is the specialized directional figure-8 follow-through. A truly self-equalizing anchor, it is a specialized knot that is useful in extricating a pinned raft.

<b>**NRS ® and Cam Straps** (Figure 2.9 and Figure 2.10) – NRS straps ® or cam straps are a staple of rafting. They are used to fasten everything to the raft in both paddle craft and oar rigs. In paddle craft a strap can be stretched around one of the cross tubes. Objects such water bottles and dry bags can be carabinered to the strap. A two foot strap can be used as an extension of an end loop on the raft. Again, it allows items to be fastened to the extension with carabiners. In an oar rig, the oar frame is fastened to the raft with cam straps. On extended trips on western rivers, virtually everything that is stored on the raft is fastened to the raft using cam straps (Figure 2.10). This ranges from ammo boxes to bed rolls. It is not an understatement to state that cam straps have replaced ropes in all aspects other than the bow line used to anchor the raft when it is beached.

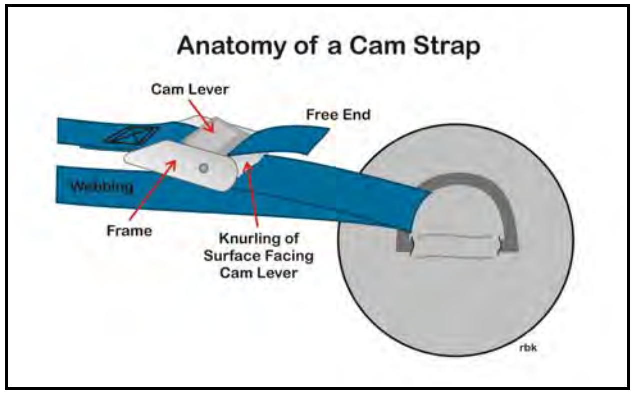


Figure 2.9: Anatomy of a Cam Strap – The NRS ® straps or generic cam straps are a stable on the river used to fasten everything to the raft. Source: Author – [file:\.EQUIP_NRSstrap.cdr]

Figure 2.10: Cam Straps – In preparation for a Grand Canyon trip, a guide is fastening dry bags to the raft with NRS ® straps. Source: Author – [file:\.DSC_0267.jpg]

Cam straps are easy to use and relatively foolproof (Figure 2.9). Thread the strap into the cam. Pull it taught. The cam is designed to lock down on the strap. To release, simply press the button on the back of the cam. The traditional cam trap is a 1" polypropylene strap with a tensile strength of roughly 1,500 lbs.

<b>**Storing Cam Straps** (Figure 2.11 and Figure 2.12) – Three methods of storing cam straps are discussed. Perhaps the easiest and most convenient method is to store them loose in a container (not shown). Access is quick and the length of the strap is not a problem getting in the way. Since most

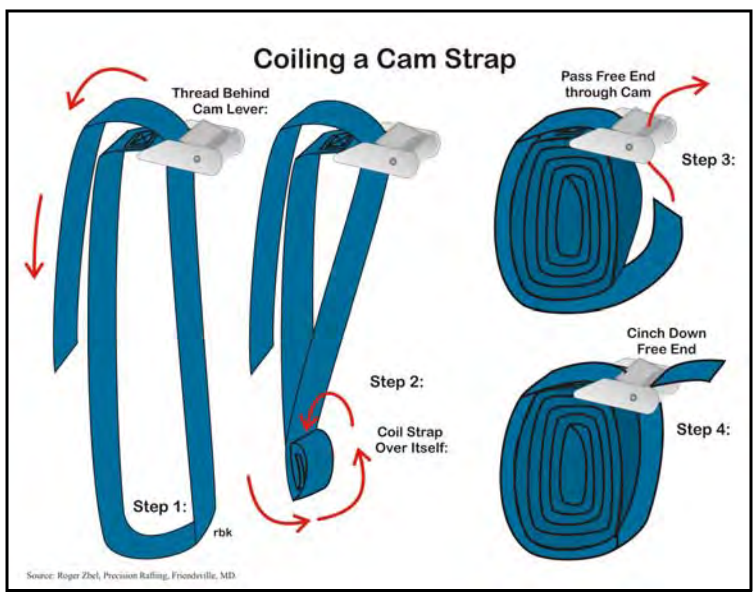


Figure 2.11: Coiling a Cam Strap – Source: Author

straps have the length of the strap marked on the strap, it is easy to identify the length needed and pick the strap needed from pile of straps.

The second method of storing straps is shown in Figure 2.11. New straps sold from the store are normally packed using this method. That in and of itself says something. The advantage of coiling the straps is that they store easily and compactly with other gear. There are no loose ends. It is easy to uncoil the coiled straps. They can be easily tossed to someone who needs a strap. The big disadvantage is that it takes time to coil the straps.

Figure 2.12: Stringer of Cam Straps – Source: Author.

Coiling a Strap (Figure 2.11) – Coiling the straps is not initially intuitive. Two tips to the method include the following. First, thread the webbing behind the cam lever and where the other end of the webbing is attached to the frame (Step 1, see Figure 2.10 for parts). Second, allow sufficient length of the free end so that it can be cinched down later. This may require some trial and error. Next, the strap should hang down (Step 2). Coil the webbing back on itself upward. Coil it toward the cinch lever in the frame. When coiled, wrap the free end around the coil and through the cam (Step 3). Cinch it down until it is snug. Store it in the gear bag (Step 4). It is ready for use.

Stringers of Cam Straps (Figure 2.12) – Similar to placing caught fish on a stringer, cam straps are strung one after another on another cam strap. The method provides a convenient way to store the cam straps, particularly if there are a lot of equal length. The method can be cumbersome if different lengths are stored together. Also, it works better with shorter straps. Long straps (e.g. 15' or 20') can become somewhat unmanageable. As a footnote, this author finds this method less than satisfactory and uses either the coiled method or loose storage in a container.

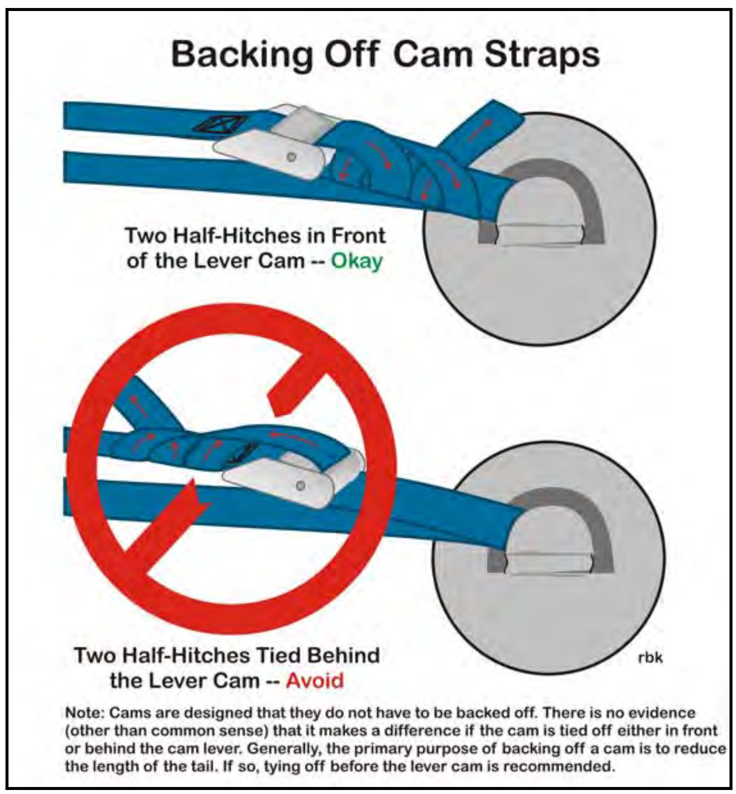


Figure 2.13: Backing off Cam Straps – Source: Author.

<b>**<u>Backing Off Cam Straps</u>** (Figure 2.13) – As designed, it is not a requirement to back off cam straps. Generally, backing off a cam strap is done to reduce the extra length of the free end. A ten foot long cam strap is used when a five foot long strap would suffice. The question is what to do with the extra five feet. It can hang loose, daisy chained or backed off. If it is

backed off, the simplest approach is to tie two or more half-hitches. Normally, the half-hitches should be tied back on the end passing through the cam (i.e. not the frame end), away from the cam lever. In theory, this prevents the hitches from accidently loosening the cam lever. It should be noted that this author is not aware of any incidents where the cam lever has accidently been loosened by the tie off passing over the cam lever. Regardless, it is a prudent to tie off on the end passing through the cam.

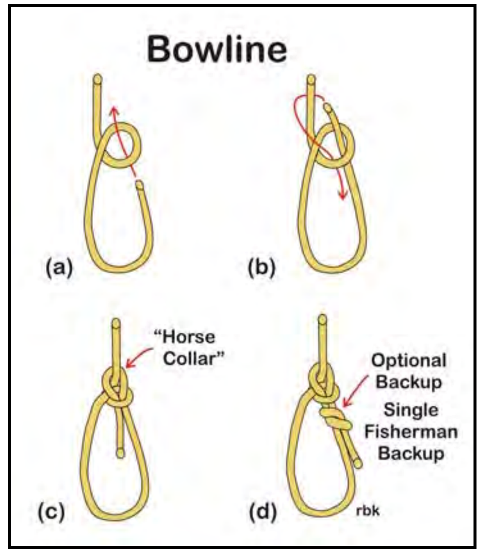


Figure 2.14: Bowline – The bowline is a useful knot on the river. It is an easy knot to tie, to tie a rope around a tree or other object, and to untie. If needed it can be backed up. Source: Author – [file:\.RS-Bowline.cdr]

<b>**<u>Bowline</u>** (Figure 2.14) – The bowline is used to tie a loop in the end of a rope. The advantage of using the bowline is that it can be tied quickly and easily. Also, it consumes less rope to tie than a figure eight follow-through. The knot maintains its integrity under tension. However, it can loosen when placed under continuous tension and compression situations. In the climbing community the bowline has fallen into disfavor for this reason. When a climber falls, they tend to bounce which can loosen the knot. If there is any doubt that the bowline could be placed in a tension and compression situation, back it up using half a single fisherman (shown), double fisherman (preferred), or even two half hitches (okay) (see Figure 2.14d).

<b>**<u>Directional Figure Eight Follow-through</u>** (Figure 2.15) – The system has been used in river rescue and to a lesser extent in climbing. The system can be hooked to multiple D-rings on a raft to extricate it from a pinning. Or it could be used to anchor a hauling line to multiple trees used as anchors where no one tree would serve as a suitable anchor. Actually, it should be used more in climbing since it is truly self-equalizing, particularly when used with carabiners.

The running end of the in-line figure eight is worked back through the loop and then retraced the knot as diagramed. The setup is a self-equalizing anchor system where the pull on each anchor is the same. The system can easily incorporate multiple anchor points with the addition of another loop. If there is an abundance of carabiners, they can be used to clip the loops around the anchors to the loop at the bottom of the figure eight.

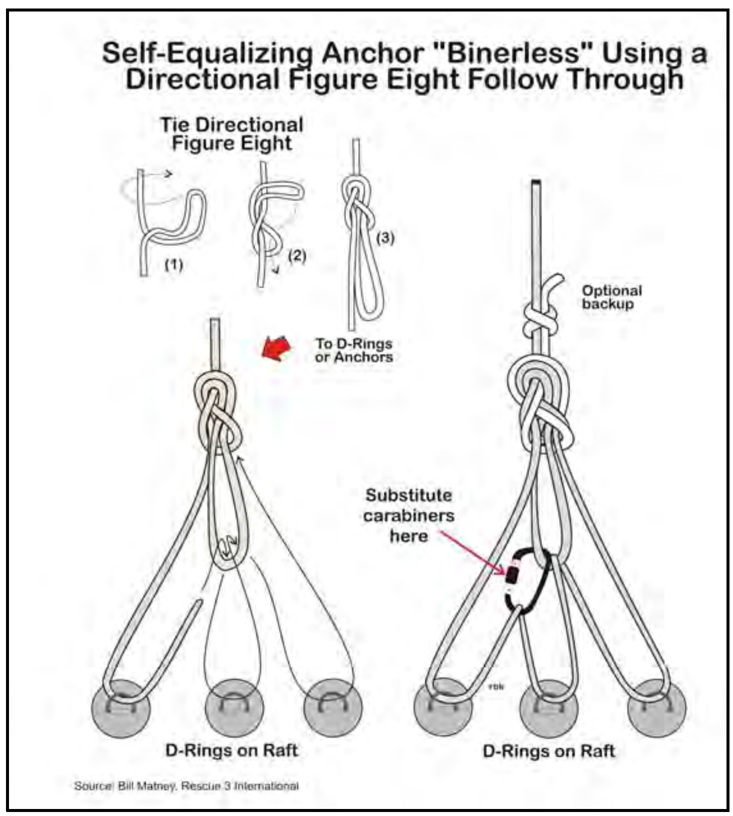


Figure 2.15: Self-equalizing Anchor – The Directional Figure-8 Follow-through can be used to extricate a raft from a pinning. It is a true self-equalizing system and will distribute equal force to each of the D-rings. Source: Author – [file:\.RS-DirectionalFigure8.cdr]

Proper Inflation

A raft obtains it structural integrity from being inflated. Until it is inflated, it is a limp pile of neoprene or similar material lying on the ground. As air is pumped into the raft, it comes to life and becomes a rigid structure. If the tubes are soft, the raft will bend and flex in the waves. A rigid raft is a more responsive and better performing raft. This requires good "pressure" management.

<b>**Pumping Up the Raft** – Using a hand pump to inflate a raft is okay for an occasional rafter. However, most rafters who pump rafts on a regular basis use a two step process. First, they use an electric pump to inflate the raft. Most of the electric pumps will inflate rafts in the range of 7.5 psi. Inflate the main tubes first followed by the thwarts and floor last. The tubes can be inflated fully without fear of popping a tube. Unless the tube is already defective, 7.5 psi should not be sufficient to pop a tube.

The easiest way to determine when the tube is full is by the sound of the motor in the pump. As the pump reaches the limit of its pumping capacity, its pitch changes. This is due to the air in the tubes pushing back on the pump. When the pitch increases and it begins to whine, you are done.

<b>**Topping Off the Raft** (Figure 2.16) – The second step is topping off the raft. This takes the raft from being hard to really hard. A hand pump is used to increase the pressure another two to three psi. Rafting companies usually have a 6" Carlson pump on hand (Figure 2.16). It is efficient and it is quick. On extended trips, outfitters pack these big hand pumps on the gear raft. They are quick and efficient topping off the rafts in the morning. Other pumps work equally well. The author uses a K-Pump (K-40) which works quite well. However, if the 6" Carlson is available, it is the pump of first choice.

Figure 2.16: Carlson Pump – The 6" Carlson pump or its equivalent is a staple of the rafting industry. Source: NRS Catalog – [file:\.CarlsonPump.jpg]

As with the electric pump, there is the issue of when has the appropriate pressure been obtained. There are several ways to determine the appropriate pressure. First, buy a gauge and measure the pressure. It is something else to lose on a trip. Second is the thumb depression method. Press the thumb against the main tube of the raft. When pressed, if the finger nail cannot be depressed below the tube, there is sufficient air in the raft. Second, there is push back on the air pump and the person pumping. When pumping, the air in the tube pushes back making it more difficult to pump air. The person pumping the air can sense this resistance. Third is the sound method. The author bounces the shaft of the paddle against the tube. Its pitch and the height of the bounce indicate the pressure in the tubes. The thumb, pump resistance and bounce methods are all used by this author. They complement each other.

<b>**Boyles Law** – Now that the raft is exceptionally hard, a word of caution. This discussion involves the implications of Boyle's Law. Boyle's Law states that if the volume is held constant, the pressure will vary

directly with temperature. The raft tubes determine the volume. They remain constant. Therefore, pressure and temperature vary together. For rafters, there are two specific situations affected by Boyle's Law. In the first situation, the raft is pumped up to the desired pressure. The air temperature is 75ºF. The raft is set in the river with a water temperature of 65ºF. The temperature drops ten degrees and so does the pressure in the tubes. The simple solution is that the raft can be topped off again. Usually, the raft is sufficiently over pressurized initially knowing that it will deflate slightly on the water.

The other situation is that the raft cooks in the sun's rays. The temperature in the raft tubes rise and so does the pressure in the tubes. It is not unheard of popping a tube due to the excessive pressure created by the temperature, particularly if the raft was inflated hard in the first place and then left to bake in the sun. There are several things that can be done. Place the raft in the shade and out of the direct sunlight or keep the raft in the water. The water will help dissipate the heat buildup from the sun to the water. Be careful at lunch stops where it is easy to pull the raft out of the water and onto the beach. This author keeps his raft afloat in the water by either attaching it to an adjacent raft or to the shore by a line.

Last, let air out of the tubes. This requires monitoring the pressure in the tubes, particularly if the rafter is running with hard tubes. Use the thumb approach. Bounce the paddle off the tubes and listen to the sound. If there is any doubt, press the valve and release some air pressure.

Valves

Two types of valves are discussed. These are the military valves and quick release valves.

<b>**Military Valves** (Not shown) – The military valve utilizes an O-ring to create the seal. Although they are simple to use, they have for the most part been replaced by the even easier to use quick release valves. There are a couple of tricks to using these valves. When filling the raft with air, unscrew the valve one or two turns to open it. It doesn't need to be fully opened to fill the raft with air. This makes closing the valve easier since only one or two turns are required to seal the valve.

One word of caution when using these valves. When the valve is seated on the O-ring, it is sealed (period). There is a tendency to over tighten the valve and continue to tighten the screw. This tends to smash the O-ring and shorten its life. Simply tighten the valve until it is sealed. Don't over tighten.

<b>**Quick Release Valves** (Figure 2.17) – Because they are durable, reliable and easy to use the quick release valves have gained wide acceptance. Name brands include Leafield and Haley-Roberts. The Leafield C7 valve is pictured in Figure 2.17.

They are simple to use. To open the valve and deflate the raft, push the plunger in and rotate it counter clockwise. To fill the raft with air, the valve needs to be in the closed mode. To close the valve, rotate the plunger clockwise. The spring will seat the rubber seal on the

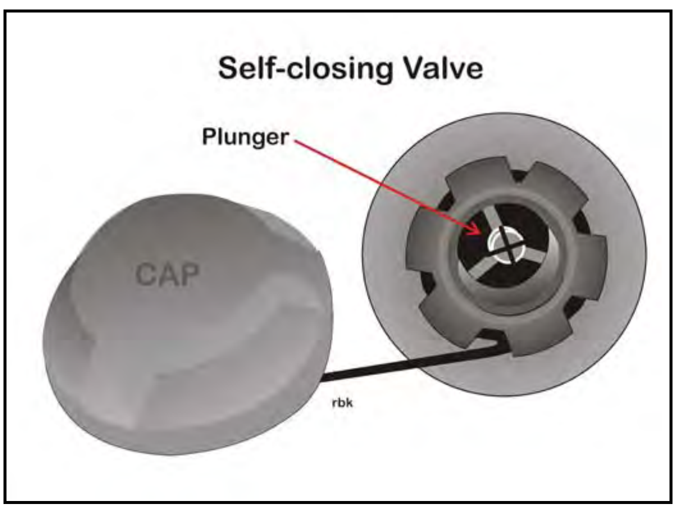


Figure 2.17: Quick Release Valve – Source: author – [file:\EQUIP_Valves.cdr]

inside of the valve and the air pressure inside the raft's tube maintains an effective seal. The pressure of the air being pumped into the raft opens the seal on the inside of the valve and automatically reseals the valve when pumping stops. Visual examination can easily determine if the valve is in the open or closed mode. If the plunger is depressed inward, the valve is open. If it is extended outward, the valve is in the closed mode.

Personal Equipment

This section includes life jackets, helmets, knives and carabiners. Clothing such as paddling jackets, wetsuits, and drysuits are discussed in Chapter 5 on Safety as part of the section on physiology.

<b>**Life Jackets** (Figure 2.18) – The U.S. Coast Guard classifies life jackets in the five categories of PFDs (Personal Flotation Device). Underwriter's Laboratories performs the testing of life jackets for the Coast Guard. The average head weights roughly 12 pounds. The objective of a life jacket is to keep the head out of the water. This means that in order for the life jacket to work, it needs to be submerged and displace roughly 12+ pounds of water. In their tests, Underwriter's Laboratories defines the head as floating if the chin and ear lob are both out of the water. The tests are performed in still water. Remember, whitewater is white because it contains air. Therefore, it has less buoyancy. The corollary is that in whitewater more flotation is better.

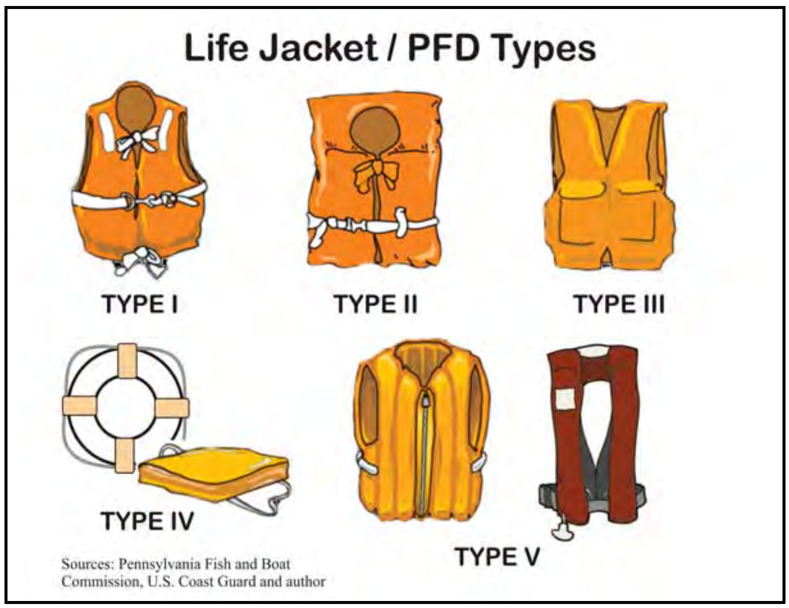


Figure 2.18: Life Jacket / PFD Types – Source: author – [file:\SA_Lifejacket02.cdr]

The ***Type I*** life jacket contains at least 20 pounds of flotation. It is the traditional "May West" and is literally designed for use by passengers when the ship is sinking. ***Type II*** life jackets are defined a near-shore vests with a minimum of 15.5 pounds of flotation and they are designed to turn an unconscious victim upright. The ***Type III*** life jacket has a minimum of 15.5 pounds of flotation and is not required to turn an unconscious victim upright. Most boaters will use a Type III life jacket. They are comfortable and designed to be worn. ***Type IV*** are throwable aids. They include ring buoys and seat cushions. They no longer meet the carriage requirements for having an approved life jacket in the boat.

Type V life jackets is a special use category. Essentially, it is the other category. Over time is has grown in the types of life jackets included in it. A critical requirement is that in order to meet the carriage requirements, they must be worn. Today there are generally three types of Type V life jackets. The first includes Type III life jackets that don't meet the test of being put on correctly by lay people. Essentially, the manufacturer has two choices. Redesign the life jacket so that it is uncomfortable if put on backwards or label it as a Type V life jacket. The other two categories are inflatables and work vests. Inflatables are designed to inflate manually or when the life jacket become immersed in the water.

Life jackets are sized by weight. Adult weighing less than 90 pounds in weight should use a child's life jacket. Conversely, children over 90 pounds should use adult life jackets. Normally, the lower strap is what keeps the life jacket on the body. It prevents the life jacket from riding up past the rib cage. As nylon degrades from sunlight, the fabric turns whiter. Use this visual inspection and retire the life jacket when it begins to fade.

<b>**Helmet** (Figure 2.19) – The use of helmets is a function of personal preferences, common practices on the river, the rapid classification, and the size of the raft. Choose a helmet that proves protection of the temple area. A visor is always a good consideration. In cold weather situations, a closed design may offer some thermal protection.

Figure 7.16: Helmets – The use of helmets depends on the river, common practices, and size of the raft used. Source: author – [file:\Helmets.jpg]

Demonstrating ***personal preference***, this author paddles a Shredder. Having evolved from hard boating, wearing a helmet is part of the normal attire. Running both eastern and western rivers where one can easily swim, this author generally wears a helmet. It is based on history and habit.

For commercial outfitters, the ***common practice*** on the river determines whether helmets are worn. This may or may not dovetail with ***rapid classification***. In writing his report on a near-drowning on the Deerfield River during a throw bag drill, Charlie Walbridge summarizes the practices of wearing helmets on several eastern rivers for commercial rafters. He was making the point that helmets are not required.

> "....Although helmets are required for commercial rafting on the Fife Brook section of the Deerfield, this exceeds the usual standard of care in the rafting industry. This section of the river is rated class I-II with one drop of class III. Helmets are not used on the Natahala in North Carolina (Class II-III) or the Lehigh in Eastern Pennsylvania (Class I-II+) or the Youghiogheny in Western Pennsylvania (Class II-III+). This latter run is significantly harder than the Fife Brook section of the Deerfield." (Walbridge, 1998, p.14)

Charlie left out the Shennadoah River nears Harpers Ferry, West Virginia. A Class II river, they wear helmets. On the New River, commercial rafters are required to wear helmets on rapids greater than a Class III classification. The same is true on the Arkansas River in Colorado. The conclusion is two fold. Wearing helmets on commercial trips is determined by the common practice on the river and is not necessarily related to the practices on other rivers.

As the ***size of the raft*** increases, there is less chance of flipping in the water and less incentive to wear a helmet. Also, on western rivers there is more need for protection from the sun and a broad rim hat is more in order. On the Colorado and Salmon Rivers, guides don't wear helmets. They wear broad rim hats.

In conclusion, know what the common practices are on the river being rafted and follow them. Obviously, it makes a difference whether it is a commercial or private trip.

<b>**<u>River Knives</u>** (Not shown) – There is a tendency toward a diminished need for carrying a river knife. In creating safety literature and posters, the issue of whether a knife should be depicted has been a topic of conversation. Let me cut to the chase. If you are working around ropes (e.g. throw bags), you should have a river knife.

A while back, this author was questioning the need for carrying a knife. I had never needed a knife on the river other than to cut bread and spread peanut butter. I was moving into the camp of not needing a river knife. This was until I received a call from a lawyer. It seems as if a passenger wrapped the line from the raft to the shore around her leg. As the rope cinched down on her leg, she received permanent damage. The guide was supposed to have a knife, but didn't because he didn't have sufficient money to purchase the knife. The company didn't provide him with a knife either. Had he had a knife, he could have cut the line and reduced the damage. It changed my mind. The corollary is that if you are working around ropes, have a knife.

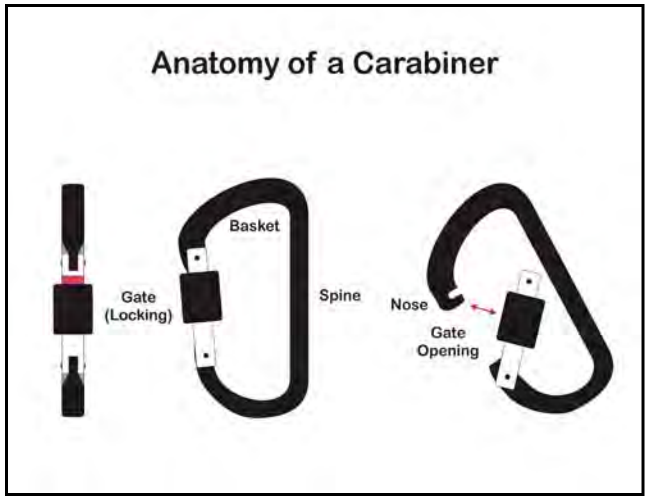


Figure 2.20: Anatomy of a Carabiner – Source: author – [file:\ROPE_CarabinerAnatomy.cdr]

<b>**<u>Carabiners</u>** (Figure 2.20 and Figure 2.21) – Carabiners find many uses on the river. They are used to fasten Nalgene bottles to the raft. They are used in hauling systems. They are used to tie rafts together although the three foot NRS strap does a good job regarding this function.

A couple of quick comments on carabiners. First is the issue of locking versus non-locking carabiners. This author prefers locking carabiners for two reasons. Coming from smaller boats where weight and versatility are an issue, locking carabiners find double duty in mechanical advantage systems. Second, two non-carabiners or a non-locking carabiner fastened to a D-Ring can easily come undone from the current moving the item about (Figure 2.21). In addition, this author has never had trouble with sand or other debris clogging the locking mechanism.

Next, boaters have a tendency of hooking one or two carabiners into the shoulder strap of their life jacket. It looks sexy. However, consider carrying the carabiners internally within a pouch in the life jacket. The carabiners fastened to the shoulder strap are a potential snag that can entrap the boater.

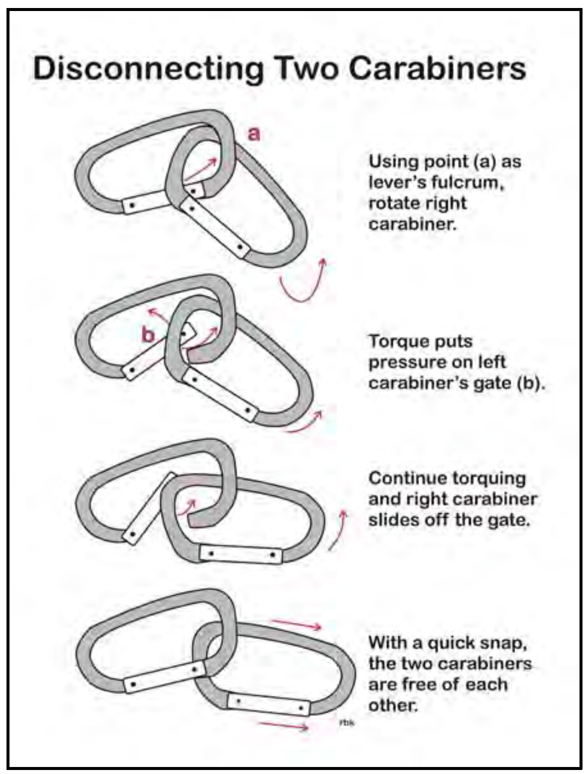


Figure 2.21: Disconnecting Two Carabiners – The water action against a carabiner hooked into a D-Ring can easily result in it becoming unhooked. Source: author – [file:\ROPE_CarabinerAnatomy.cdr]

Care of Equipment

Every outfitter has procedures for taking care of their equipment. There are procedures for cleaning and storing the rafts, storing paddles, and hanging up life jackets. Wetsuit booties and wetsuits may be disinfected and hung to dry.

Winter storage is important. The Shredder is stored in a plastic storage container to prevent little critters from burrowing in and making a home in the raft. Unfortunately, they will gnaw there way there. The use of a storage contain pretty much eliminates this possibility.

Summary

The focus of this chapter is on equipment and to a lesser extent, repairs. It presents several types of raft representing both east and west usage. It discusses fastening devices including cams and knots. Other than the bowline, everything is connected to everything else using NRS ® cam straps. In discussing rafts, proper inflation is covered and how to determine it empirically. It is an art as much as a reading a gauge. Techniques to monitor proper inflation are noted. From there, the chapter includes a discussion of personal equipment including life jackets, helmets, river knives and carabiners.

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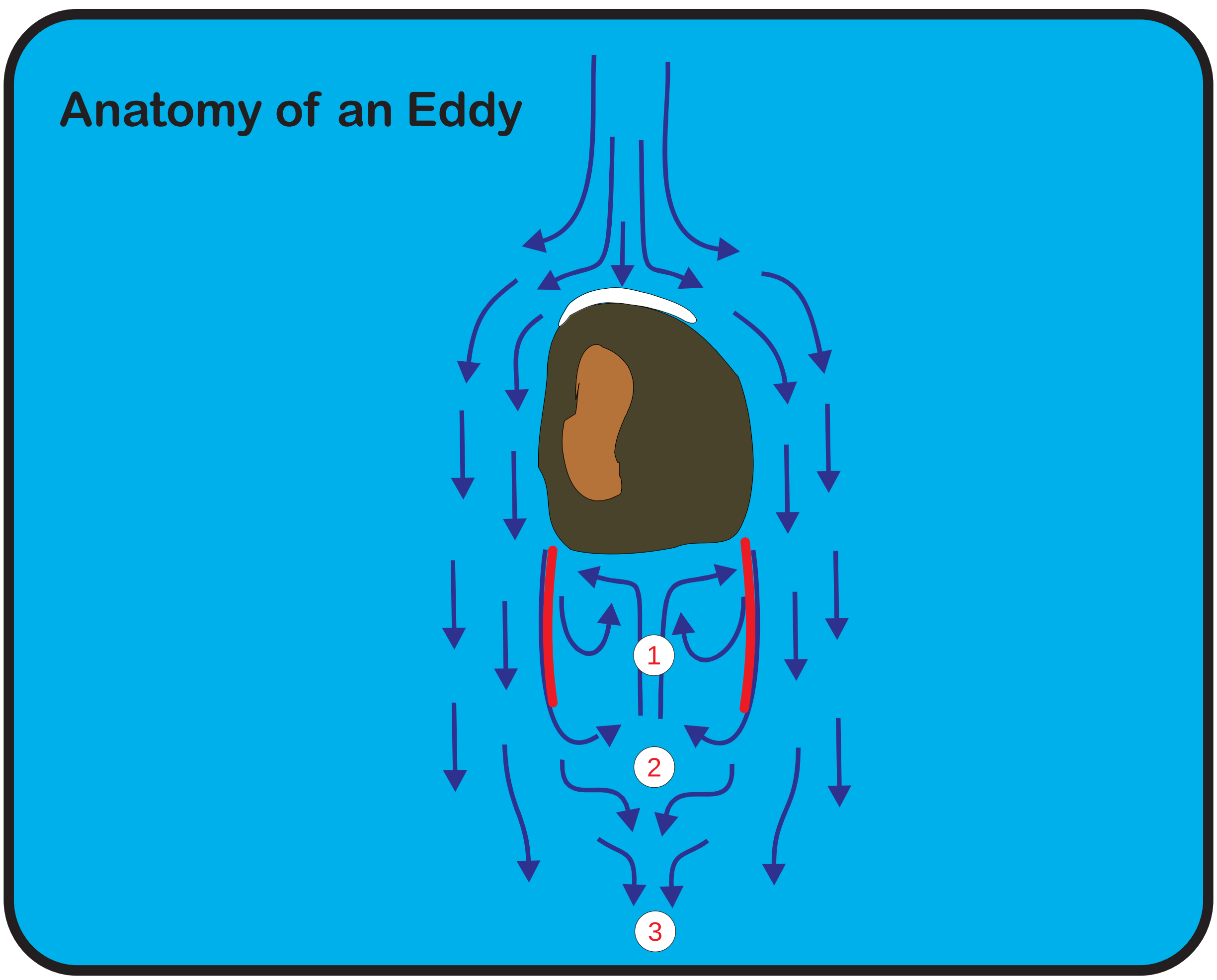
Chapter 3:
River Dynamics



Section 3:
River Dynamics [1]

Moving water has power. A swiftwater rescuer needs to understand moving water. This section covers river dynamics which provide the foundation for river reading. The dynamics of moving water covered in this section includes river currents, river obstacles, and river hazards.

River Currents

<b> **River Right and River Left** – River right and river left are an orientation used by river users. The orientation is noted on many of the diagrams. Looking downstream, river right is the right shore and river left is the left shore. Looking upstream, river right is the left shore (if looking downstream), and river left is the right shore (if looking downstream). Looking upstream, what is on the right is really on the left, and what is on the left is really on the right.

<b> **Primary Current** (Figure 3.1) – The primary current refers to the general direction in which the river is flowing. It is the current found in an unobstructed main channel. In Figure 3.1, the primary flow is represented by the laminar flow. The slowest moving water is next to the bottom and each successive layer of water toward the surface flows faster than the layer below it. The fastest moving water is found just below the surface. This is because the air next to the surface creates friction which slows the surface water slightly.

A way to conceptualize this principle is to imagine sheets of plywood stacked on the floor with wooden dowels between each of the sheets of plywood. Push the stack of plywood. The next higher sheet of plywood on the stack will travel at the speed of the lower sheet plus its own speed. Hence, the higher the stack of plywood, the greater the speed that the plywood. The last sheet of plywood representing the surface of the water travels slightly slower than the sheet below it because of friction with the air above it.

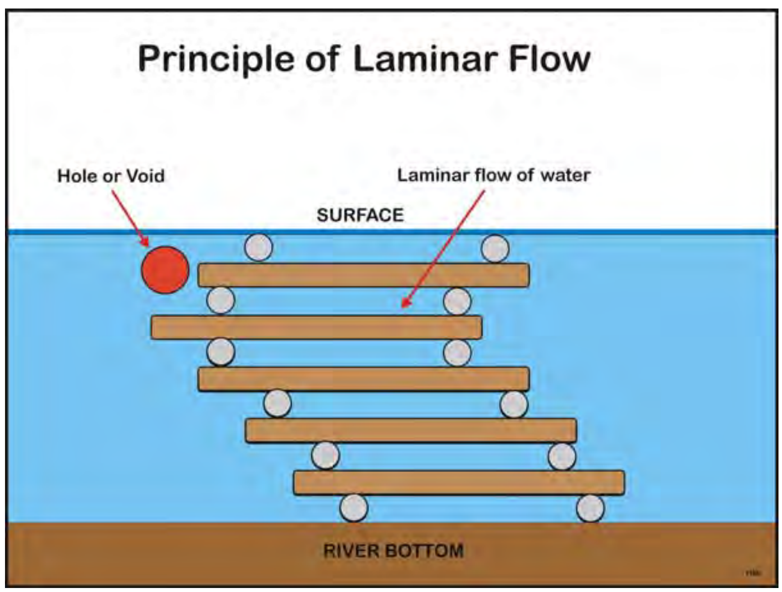


Figure 3.01: Laminar Flow – Laminar flow is like a series of sheets of plywood where each layer travels at the speed of the sheet below it plus its own speed. Source: author – [file:\RIDY-LaminarFlow.cdr]

The major implication of this principle for a rescue swimmer is when swimming in the defensive swimming mode. Often, it is difficult to keep the

[1] This section was written by Robert B. Kauffman who is solely responsible for its content. The source material for this section was adapted from a draft of Building Your Canoe Basics (Chapter 6) in *Outdoor Adventures: Canoeing*. American Canoe Association (eds), Human Kinetics, March , 2008. This section is copyrighted © Robert B. Kauffman, 2016.

feet on the surface of the water since the slower current below the surface tends to pull the feet downward.

The laminar flow is a function of the depth of the river. Since the channel is normally deeper in the middle and decreases in depth to the shore, the current in the center or deepest part of the channel is faster than current close to the shore. The difference in the speed of the current on the surface of an unobstructed channel is represented in Figure 3.2. Again, this represents a normal river channel which gets shallower toward the shore. As a footnote, canals, bridge abutments, and similar walled channels are similar to taking the center out of the channel all the way to the canal wall, bridge abutment, or similar walled channel. In these situations, there is little current differentiation from the center of the river to the channel wall. Rocks and other obstructions can affect this flow. Submerged rocks in deep channels can force vertical currents that reach the surface as boils.

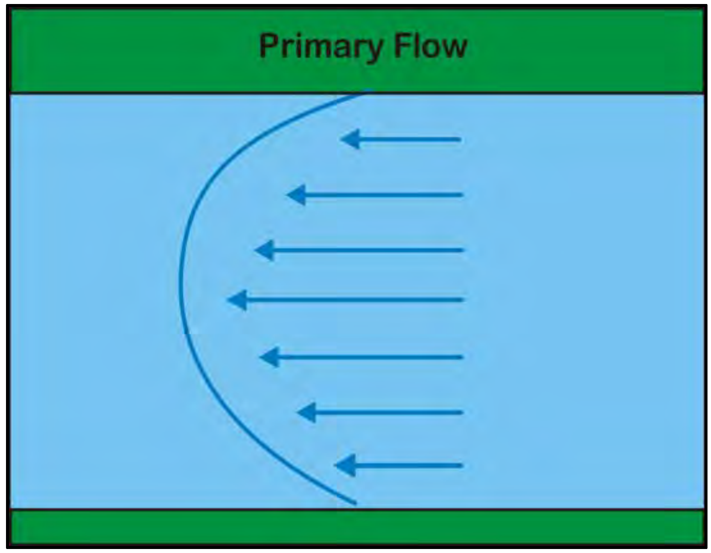


Figure 3.2: Primary Flow – The shores are shallow and the center of the river is deeper. This normal contour results in faster current in the center of the river and slower currents toward the shore. Source: author – [file:\RIDY-PrimaryFlow.cdr]

<b> **<u>Downstream and Upstream "Vs"</u>** (Figure 3.3 and Figure 3.4) – Two rocks or other objects can create a restriction in the water where the water flows between the rocks to form a small chute. The rocks form an upstream V and the chute between the rocks forms a downstream V. There is a difference in vertical height between the upstream and downstream Vs. The water piles up against the rock creating an increase in the vertical height of the water. Also, it creates a cushion of water against the rock. Conversely, the water drops off quickly in between the two rocks forming a chute and a downstream V. Also, it is lower in elevation. Boaters and swimmers look for this difference in height as they look for downstream Vs and avoid upstream Vs. Figure 3.3 shows a typical stretch of river with its upstream and downstream Vs. Figure 3.4 provides a view from a swimmer's perspective of the

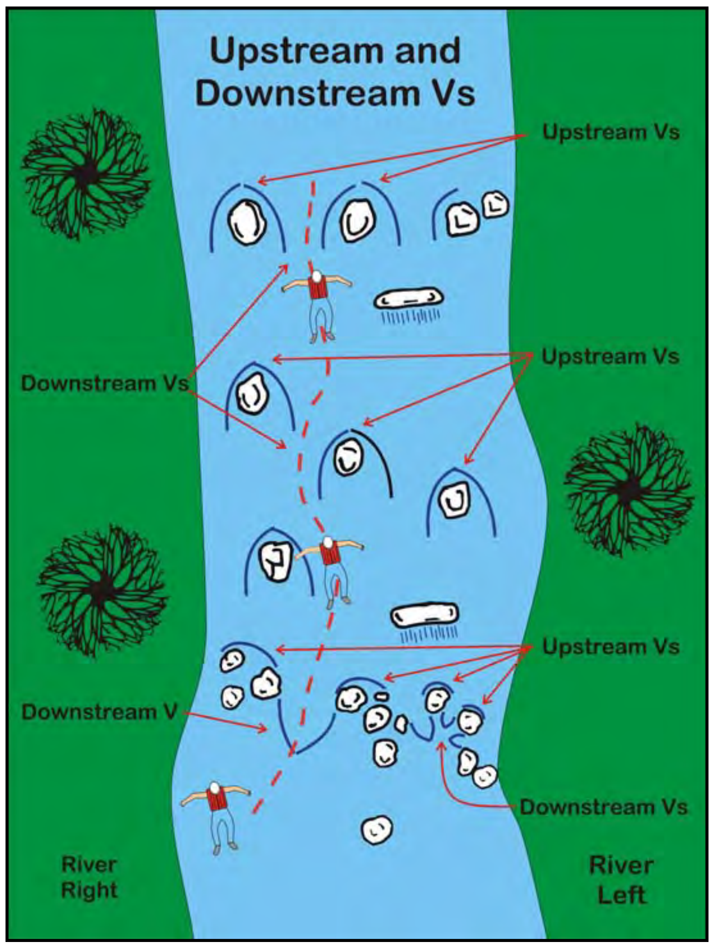


Figure 3.3: Upstream and Downstream Vs – This scene is a typical stretch of river where the swimmer looks for the downstream Vs and to avoid the upstream Vs. Source: author – [file:\RIDY-Vs.cdr]

change in elevation and the upstream and downstream Vs. The height differential may be slightly exaggerated for emphasis. This is the view the swimmer would have running the stretch of river in Figure 3.3.

<b> **<u>Bends</u>** (Figure 3.5) – Rivers tend to meander. When the river bends, inertia forces the main current toward the outside of the bend. As the deeper, faster and the more powerful current reaches the outside of the bend, it turns downward and creates a spiraling effect off the bottom of the river that leaves more room for surface water on the outside of the bend. The force of the water tends to erode the outside of the bend where trees and other debris fall into the river where they can form strainers. In contrast, the slower, shallower and less powerful current is usually found on the inside of the bend.

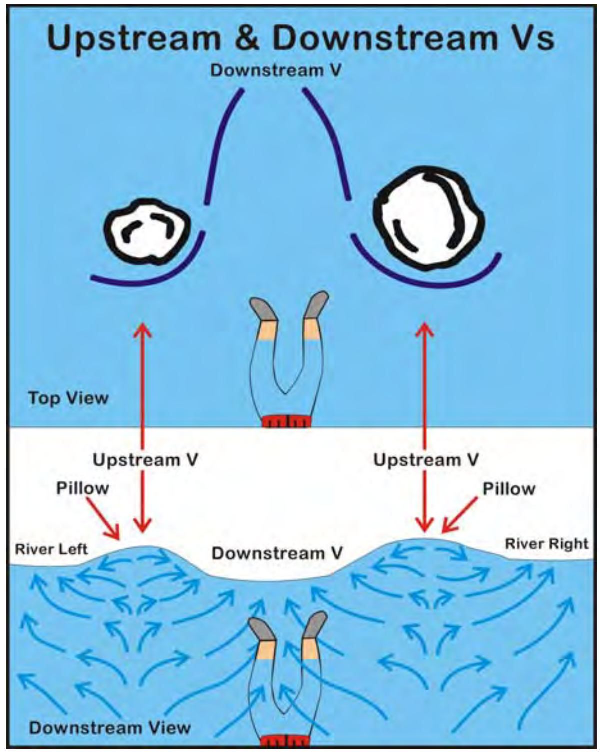


Figure 3.4: Upstream and Downstream Vs – This is the view from the swimmer's perspective. Note the subtlety in height between the upstream Vs (high) and downstream Vs (low). Source: author – [file:\RIDY-Vs&Tongues.cdr]

When swimming around a bend, the swimmer normally hugs the inside of the bend where the current is slower. Moving to the outside of the bend, the swimmer encounters the faster water which tends to push the swimmer into the outside bank where the swimmer is likely to encounter a strainer or other obstruction. Second, when swimming a bend, the swimmer sets a slight ferry angle with the head pointing toward the inside of the bend. Since the current is going faster on the outside of the bend, if the swimmer remains parallel with the current, she will be turned around by the current. This is because the head and shoulders are moving faster than the feet.

<b> **<u>Chutes and Waves</u>** (Figure 3.6) – A narrow constriction in the water forces the water to increase its speed through the constriction. This water usually forms a smooth tongue of water. After the

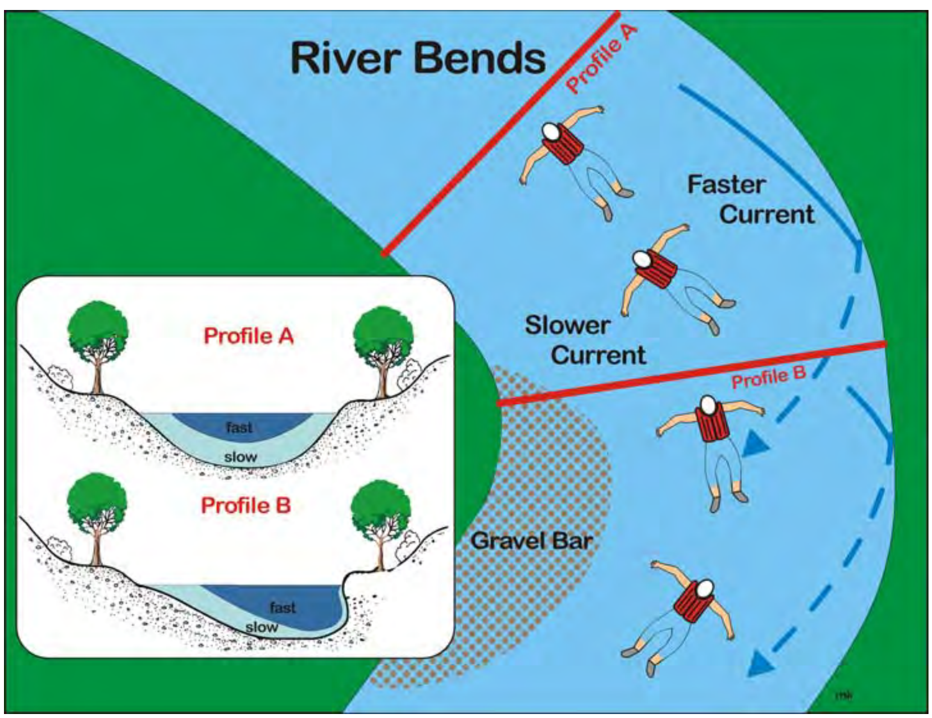


Figure 3.

water passes through the constriction, its deceleration into a deeper and slower water results in a series of uniformly spaced scalloped shaped standing waves. The constriction can vary several feet in width to a river wide constriction. The former creates a simple drop with small waves. The latter river wide constriction can create large standing waves several feet in height from the trough to top of the wave. An important consideration for the swimmer is to coordinate her breathing so that she breaths in between the waves and not as she goes through the wave.

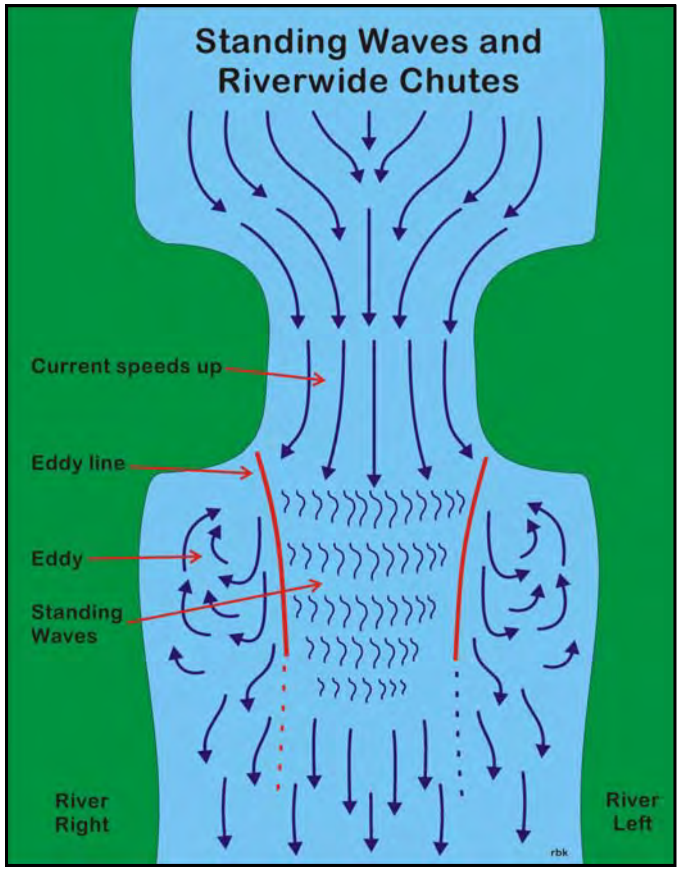


Figure 3.6: Chutes and Waves – Water speeds up in a constriction of the channel and then it is dissipated as it drops. This creates a series of standing waves. Source: author – [file:\RIDY-Chutes.cdr]

River Features

Rocks are the main obstacles found in a river. The depth of the rock in the water and its size are key factors in determining the effect of the rock on river dynamics. Pillows, holes and eddies are closely related. A totally submerged rock may have little or no effect on the surface current. As the rock gets closer to the surface, it will force the water passing over it upward to the surface creating a small wave or *pillow* downstream of the rock. As the rock or obstruction widens, water from the side cannot fill in behind the rock. This results in a depression or void behind the rock. Now the water flowing over the rock attempts to fill the void creating a *hole* or *hydraulic* behind the rock. As the rock becomes exposed, the water can no longer flow over the rock and can only fill the void behind the rock from the sides. *Eddies* are created by the water filling in the void from the sides behind an exposed rock.

<b> **Eddies** (Figure 3.7) – Eddies are formed behind rocks or other obstructions in the river. Water flows past the obstruction creating a void behind the object which the water attempts to fill. There are three distinct parts of an eddy which are created by the water attempting to fill the void.

The first part of the eddy is where the water in the main current rushes by the rock so fast that in order to fill the void the water has to flow back upstream (see #1 in Figure 3.7). This creates a very strong current differential between the main current and the current in the eddy. The interface between the downstream current and the upstream current creates an eddy line or even an eddy wall. As the current increases dramatically, the eddy line becomes an eddy wall. An eddy wall is the vertical height difference between the downstream current and the current in the eddy attempting to fill the void behind the rock. If there is an eddy wall, there is a noticeable downhill current inside the eddy also. For a rescue swimmer, this powerful of an eddy can be problematic and the rescue swimmer can find the eddy unfriendly. However, most eddies will have an eddy line where there is little or no vertical difference between the main current and the upstream current in the eddy.

The third part of an eddy is where the water in the main current enters the void behind the rock so far downstream that it continues on downstream but at a slower rate then the main current (see #3 in Figure 3.7). This area of an eddy can be problematic for rescue swimmers because rescue swimmers may think that they are in the upstream current in the eddy when they are really moving downstream, and quickly falling out of the eddy (see Figure 3.7). In addition, since the current is moving downstream in the eddy, there is no real eddy line present in this portion of the eddy. Many beginning rescue swimmers will prefer entering an eddy in this area because there is no current differential and there is less risk of having to cross the eddy line. This is okay but remember to swim upstream into the eddy.

The second part of the eddy is the interface between the current moving upstream and downstream in the eddy. The current here is neutral. In a strong eddy, this is often the ideal location for a rescue swimmer to remain stationary. They aren't being plastered against the backside of the rock by the upstream current where it is difficult to exit the eddy, and they aren't falling downstream either.

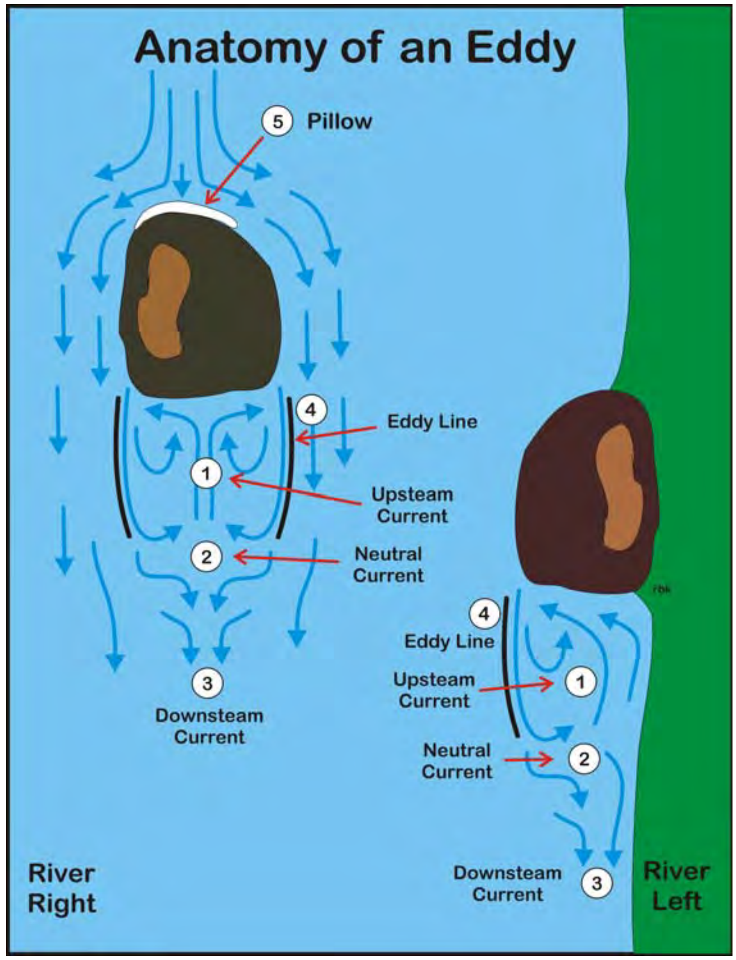


Figure 3.7: Anatomy of an Eddy – In the anatomy of an eddy, there are three parts. There is the water moving back upstream. The eddy line occurs in this section. There is a neutral area, and there is a downstream moving area. Source: author – [file:\RIDY-EddyAnatomy.cdr]

Conceptually, the three parts of an eddy have many of the same characteristics as a hole or hydraulic. Both are caused by the river attempting to fill a void. In a sense, an eddy is a hole rotated on its side. Most eddies are friendly and rescue swimmers will use them extensively as they eddy hop down a river. However, remember that some eddies can be violent and very unfriendly also.

<b> **Hydraulics and Holes** (Figure 3.8) – A hole occurs in the river when a rock or other obstruction of sufficient width to prevent the water from filling in the obstruction from the side forces the water flowing over the rock to fill the void or depression behind the rock. As the water flows over the rock, it plunges down to the bottom of the river and races downstream. As it races downstream, the water shoots back up to the surface where it moves in one of three directions. A portion of the water re-circulates back upstream to fill the void behind the rock (1). Further downstream, some of the water comes up to the surface and continues on downstream (3). This water travels at a slower rate than the general flow of the river and quickly picks up speed as it moves downriver. In between or at the interface of the upstream and downstream flow, the flow is neutral in that it is not really flowing downstream or upstream (2). This neutral area is called the "boil."

The shape of the hole affects how friendly it is. In a *smiling hole* the center of the hole is further upstream than the sides. This creates the impression that the hole is smiling when looking at the hole from the upstream side. It tends to be more friendly to a swimmer or paddler since they will find it easier to maneuver to the side of the hole where they can exit the hole.

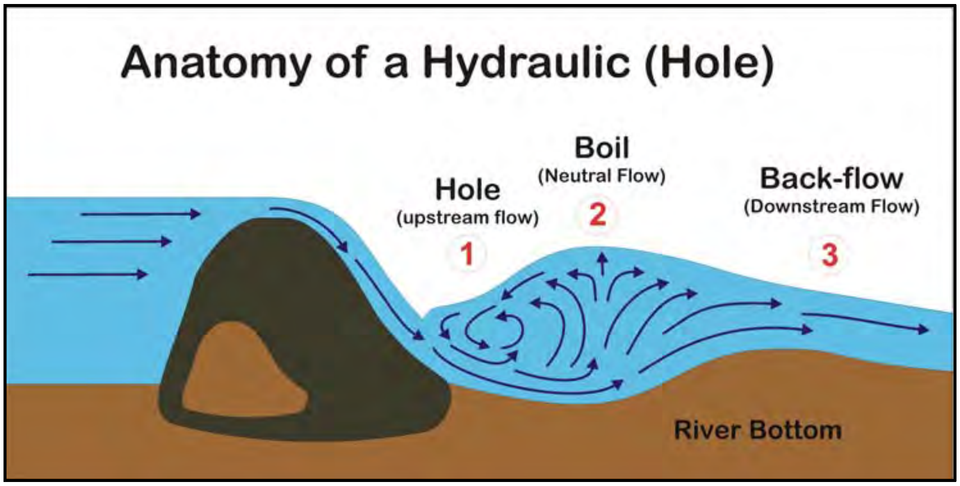


Figure 3.8: Anatomy of a Hydraulic – In the anatomy of an eddy, there are three parts. There is the water moving back upstream attempting to fill the hole. There is the neutral area or boil, and the downstream flow. Source: author – [file:\RIDY-HydraulicTypical.cdr]

In contrast, in a *frowning hole,* the middle of the hole is downstream of the sides. From the upstream side of the hole, it looks like it is frowning. Since the middle of the hole is downstream, the force of the hole tends to move the swimmer or paddler to the center of the hole where it is strongest and most powerful. These holes are often called *keepers* because they keep a person stuck in the hole. They are difficult to exit because the swimmer or paddler has to literally paddle uphill to reach the side of the hole where they can extricate themselves from the hole.

If you are paddling a canoe or kayak you can easily feel where you are in the hole. If you are on the upstream side of the boil, you can feel the pull of the current pulling the canoe upstream and into the hole. Conversely, if you are on the downstream side of the boil, you can feel the boat slipping downstream and dropping out of the hole. If you are sitting on the shore and watching the paddler you can play a little mental game where you look closely at the attitude of the canoe and tell where the canoe is in the hole. Look at the trim of the boat. If the stern is lower than the bow, then the canoe is in the downstream portion. Unless they paddle hard, they are out of the hole, and they might as well ferry to the shore and try again. If the bow is lower than the stern, the canoe will move upstream and into the hole.

Understanding these currents on an experiential level can be of benefit to the swiftwater rescuer. The rescuer can approach the victim in the downstream current behind a low head dam or keeper hole and throw a rope to the victim trapped in the hole. This area is perfectly safe for the rescuer, but the rescuer needs to know exactly where they are in terms of these three currents. Once the rescuer crosses the boil, it is all downhill and they too can become a victim. This is not an uncommon situation. This author has reviewed more than one case where the rescuer crossed the boil and died. It is important to know where you are in terms of the currents pictured in Figure 3.8.

<b> **Pillows** (Figure 3.9 and Figure 3.10) – As the rock approaches the surface, it will force the water passing over it upward to the surface creating a small rounded wave or pillow downstream of the rock. The further underneath the water that the rock is in the water, the further downstream the pillow. And, as the rock moves closer to the surface, the pillow moves closer to the rock until it is directly over it. It takes experience for a swiftwater rescuer to recognize which pillows are close to the surface and need to be avoided and which ones are deep enough not to pose a problem.

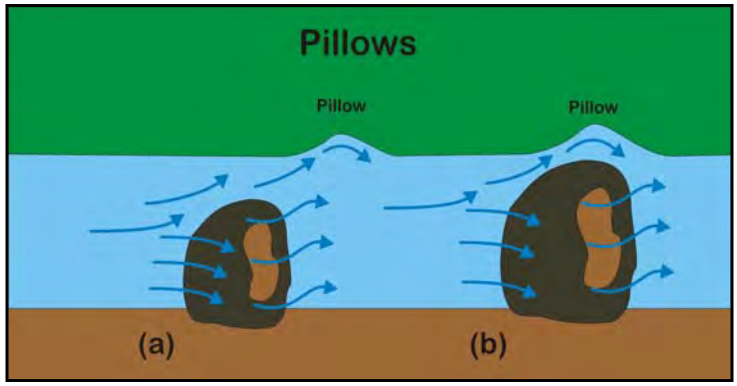


Figure 3.9: Pillows – The water hits the top of the rock forcing it to the surface creating a downstream bubble or pillow on the surface. Source: author – [file:\RIDY-Pillows.cdr]

When the rock finally emerges out of the water, the pillow becomes a cushion of water that flows up against the rock forming a *cushion*. A boater floating up on a well developed cushion can use the cushion to avoid broach on the rock. Regardless, it requires quick thinking and a quick reaction to avoid broaching. In addition, if the current is powerful enough, the rock may actually form a series of compression waves upstream of the obstacle (Figure 3.10).

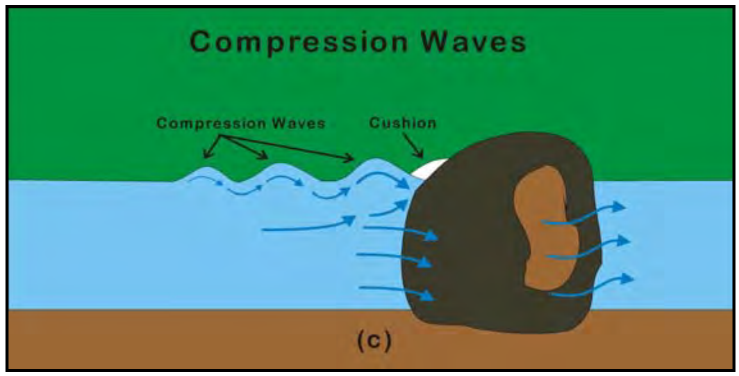


Figure 3.10: Compression Waves – The water hits the front of an exposed rock and creates a cushion because it has no where to go. Source: author – [file:\RIDY-CompressionWaves.cdr]

River Hazards

<b> **Strainers** (Figure 3.11) – Strainers are formed when water flows through an obstacle. Much like spaghetti in a colander, water flows through the strainer leaving the victim trapped helplessly. Stainers are most commonly formed by trees and rocks. STRAINERS ARE KILLERS. They are extremely dangerous and river users should always avoid them.

Trees are the most commonly encountered form of strainers found on a river. As a river continues to carve out a bend in the river, trees along the bend will fall into the river channel as the river current undermines the foundation underneath the tree. Also, a strainer on the bend of a river is particularly dangerous since the current is faster there and the rescue swimmer who is flowing with the current is more likely to be swept into the strainer.

Rocks can also cause strainers. Usually, the rocks are positioned on the bottom in such a way that water will flow thru them to create a strainer. Often, these strainers are referred to as undercut rocks. Water boiling up from the bottom in an eddy or an eddy without an eddy line is often a good indication of an undercut rock.

The strainer drill helps to prepare students for handling strainers. Again, avoidance is the primary strategy. If there is no avoiding the strainer, swim aggressively toward it and try to get as high up onto it to avoid drowning.

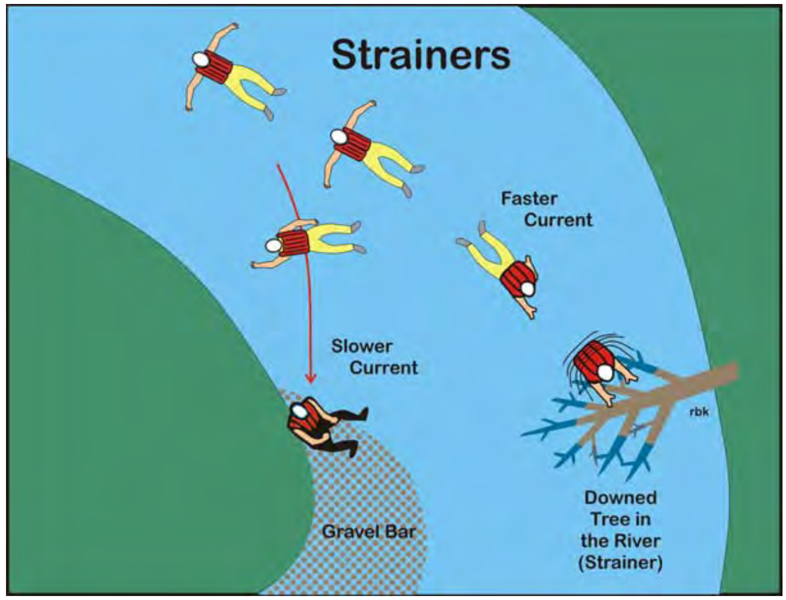


Figure 3.11: Strainers – A strainer allows the water to pass through but holds the swimmer. They are killers and should be avoided. Source: author – [file:\RIDY-Strainers.cdr]

<b> **Undercut rocks** – Most undercut rocks are a form of strainers. The main attribute of an undercut rock is that the water flows underneath rather than around the rock. Depending on its size, the current can sweep a victim underneath the rock and impale the victim in the orifice of the undercut rock (strainer).

For most boaters, a good indication of an undercut rock is that normal river features like an eddy don't behave as they normally do. They seem weird or different and they act weird because the currents are different. The eddy pictured in Figure 3.12 is modeled after and uncut rock on the Lower Youghiogheny River.

Typically, there are several symptoms or characteristics to help spot an undercut rock. First, the pillow or cushion on the upstream side of the rock is missing. This is because the current is flowing through and not piling up against the rock. Second, the current flowing through the orifice creates a boil with its outflow. The boil and outflow significantly changes the river feature. The eddy pictured does not behave as an eddy normally behaves (see Figure 3.7). Next, there

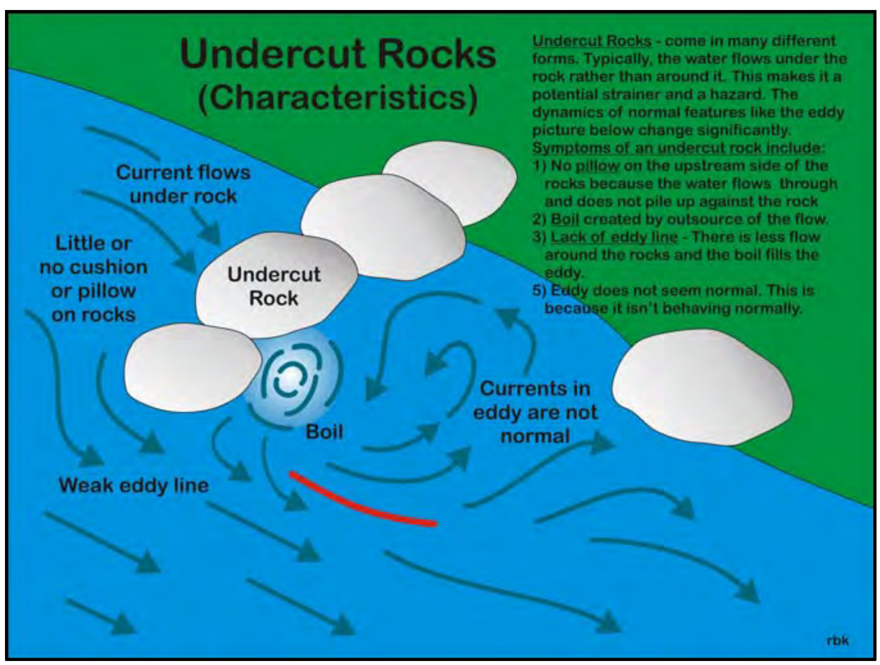


Figure 3.12: Anatomy of on Undercut Rock – To the trained eye, the undercut rock seems very different than a normal river feature. Source: author – [file: \RIDY-UndercutRocks.cdr]

is less current flowing around the rock. The eddy line may be weak or missing. The outflow current may reduce the current differential and eddy line. A boater entering this eddy would immediately experience the lack of an eddy line to cross and the force of the outflow current. Last, because of the outflow and boil, the current in the eddy is different than normal.

<b> **Low-head Dams** (Figure 3.13) – A low-head dam and a hydraulic are essentially the same with some important differences (see Figure 3.8). Examination of Figure 3.8 and Figure 3.13 suggests that they are essentially the same diagrams. However, there are some important differences. The hydraulic behind a low-head dam is a “perfect” hydraulic. It goes from one river abutment to the other. The only exit may be to dive down and catch the water moving downstream. In contrast, naturally formed hydraulics are imperfectly formed and can usually be escaped. A low-head dam is designed to disperse the kinetic energy of the falling water upward rendering it harmless. Unfortunately, hydraulic is perfectly formed and extends from one abutment to the other abutment. This is why they are called the drowning machine.

A *horizon line* is the usual indicator of a river wide obstacle like a waterfall or low-head dam. Actually, this is a variation of the differential heights created by upstream and downstream Vs (see Figure 3.3), except there is no height differential. Hence, the horizon line. As you look downstream, there will often be a section of calm or smooth-looking water followed by a line across the river where the water drops out of sight. Trees on your side of the horizon line will look normal. However, the trees just downstream from the horizon line often look as if someone cut a section out of their trunks. If the horizon line is formed by a low-head dam there are usually abutments on each side of the dam which are a clear indication of the dam.

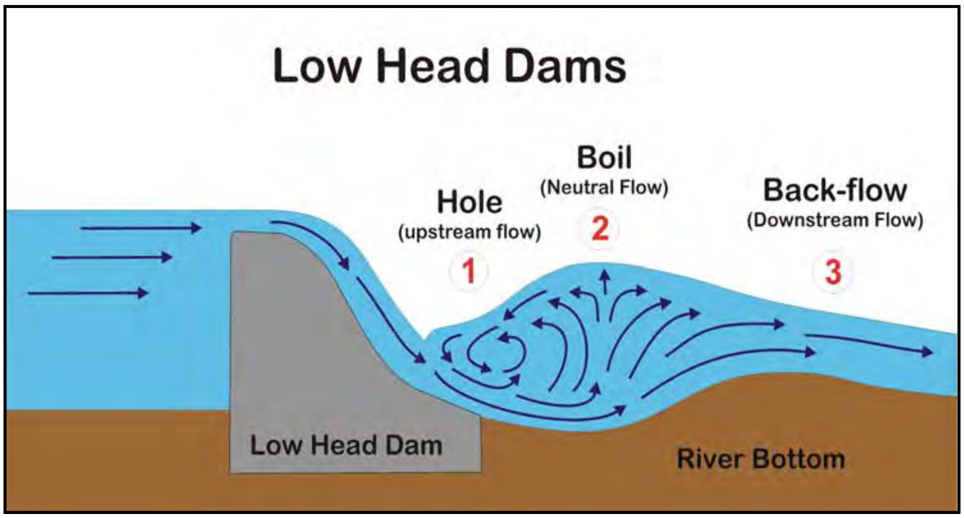


Figure 3.12: Low Head Dams – Low head dams are perfect hydraulics from abutment to abutment. They are killers and should be avoided. Source: author – [file:\RIDY-HydraulicLowHeadDam.cdr]

There are several approaches to rescuing a victim caught in the hydraulic of a low head dam. Several of these are in the province of the rescue squad and their specialized equipment. The first rule for any rescue attempt is to understand that the hydraulic behind a low head dam is a drowning machine. This applies to rescuers also. An untethered rescuer trapped in the hydraulic becomes another victim. There are cases where a bystander with full knowledge of the dangers of low head dams attempted a rescue and drowned in his rescue attempt to rescue two victims. One victim recycled out of the hydraulic and survived. The other victim along with the rescuer drowned.

The following are some rescue methods. The first requires the specialized equipment of a rescue squad. A fire hose is capped with a special cap and inflated with air. The hose is extended to victim trapped in the hydraulic. It works but requires the specialized caps. A Tefler lower can be used. This requires considerable setup time. Third, a power boat can maneuver in the slowly moving downstream current behind the hydraulic and throw a throw bag to the victim. A grappling hook can be used in place of the throwbag. A tethered victim can enter the hydraulic and effect a rescue. However, this can endanger the rescuer and should be used as a last resort, if at all. Maneuvering in the slackwater behind a hydraulic by rescuers requires an empirical understanding of the parts of hydraulic. This point cannot be emphasized enough.

<b> **Old Man-made Structures** (no figure) – Most rivers contain man-made structures such as old dams or bridge abutments that have fallen in disuse. Sometimes these structures are potentially a fun place to play with a canoe or kayak. Always use caution around these structures. Rip-rap may contain large spikes. Old dams and bridge abutments may contain reinforcing rods or sharp rocks that can create nasty injuries. Check the site at low water for hazards and if there is any doubt, find another place to play.

<b> **Drowning Trap Flows** (Figure 3.14, Figure 3.15, and Figure 3.16) – Any water level on the river can be hazardous. Ask people when the river is dangerous. Most people associate flood-like conditions with danger like muddy water, water flowing over the banks, water in the trees, floating debris and big waves. Floods and high water are dangerous and most people recognize the danger and stay off the river (Figure 3.14).

On many rivers, recreational fatalities tend to occur at moderate water levels when the river is well within its banks and the river looks perfectly normal (i.e. It is not flooding). The normal cycle of flows for rivers is that during the summer when most people visit the river, the water level drops to where the moving water is no longer a contributing factor in the fatalities. However, if the water level rises, the river can become very dangerous (Figure 3.15).

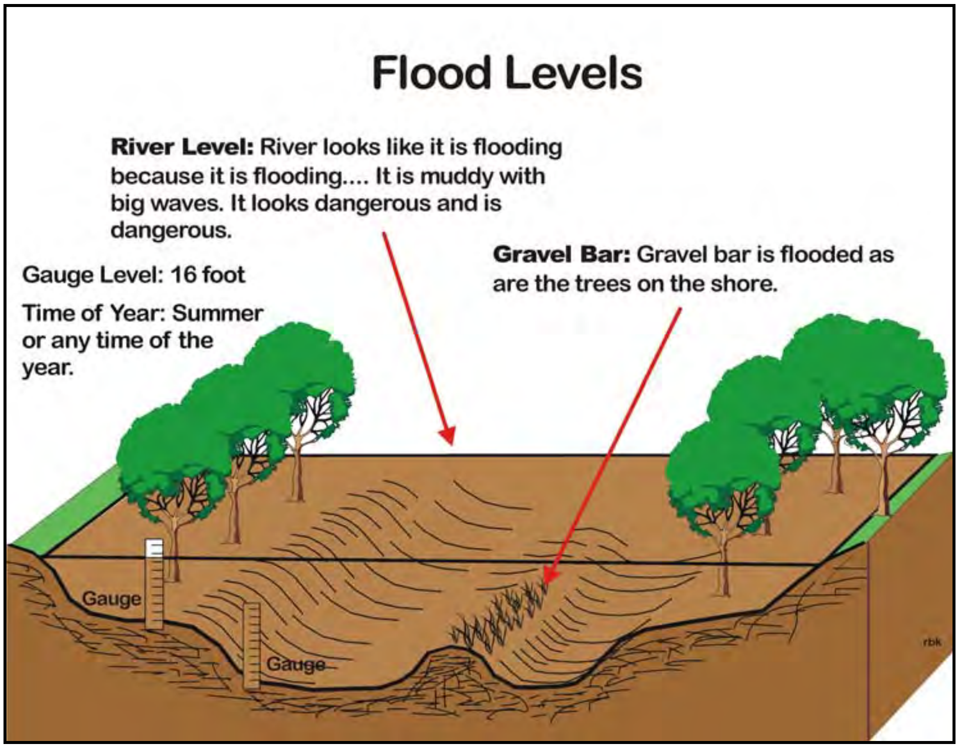


Figure 3.14: Flood Levels – Intuitively, most people recognize rivers flooding and the dangers associated with them. They avoid flooding rivers. Source: author – [file:\RIDY-DrowningTrapFlood.cdr]

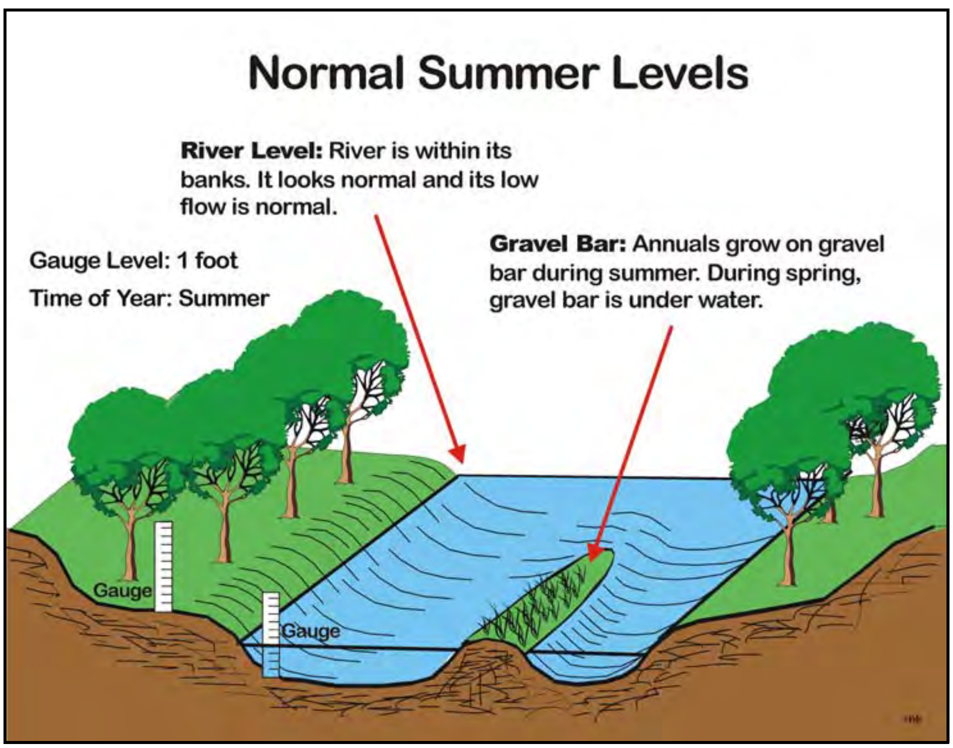


Figure 3.15: Normal Summer Flows – In the summer when most people visit rivers, the river is at low flow where it tends to lose its power as a contributing factor in accidents. Source: author – [file:\RIDY-DrowningTrapNormal.cdr]

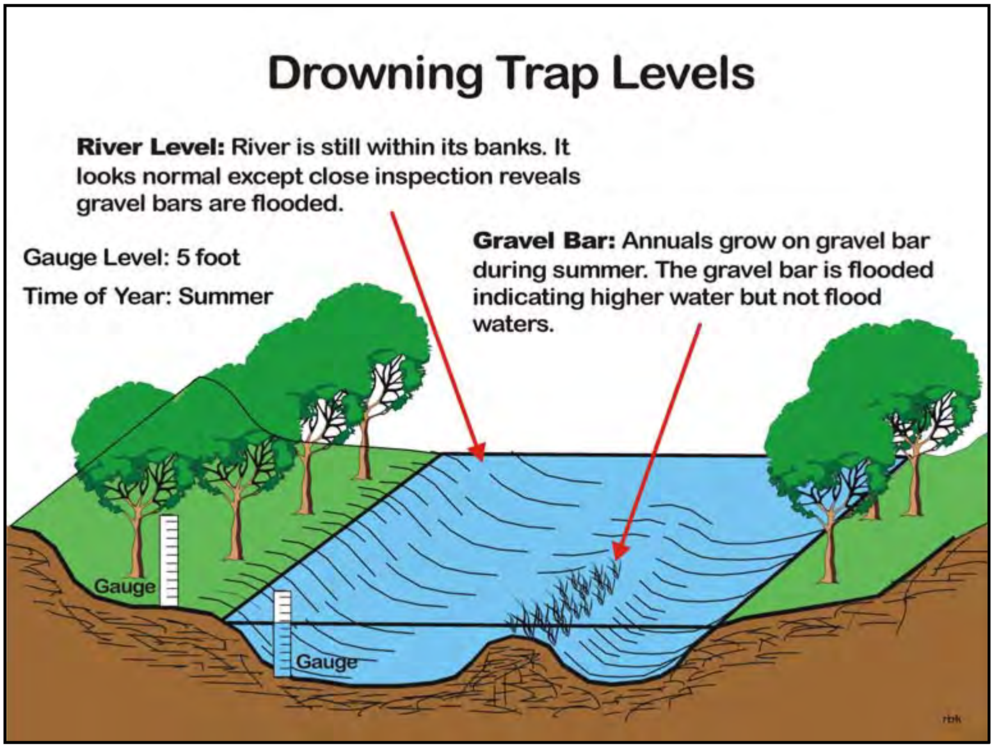


Figure 3.16: Drowning Trap Flows – When high flows occur during summer, the river current has the power to become a contributing factor in drownings. Since the river is within its banks, people don't perceive it being dangerous because there aren't flood conditions. Source: author – [file:\RIDY-DrowningTrapNormal.cdr]

Depth, velocity and deceptiveness define the drowning trap (Figure 3.16). At these moderate flows the river has the power (depth and velocity) to drown, yet it is deceptive since people tend to associate flood conditions with danger rather than moderate flows. The cross-sectional profile of a typical eastern river illustrates the relationship between moderate drowning trap flows, summer low flows and flood levels which people normally perceive as being dangerous.

The depth of the water is a key determinant of its velocity and its power. Imagine standing in moving water about waist deep. With some deliberate care you can brace yourself against the current and stand in the water. Add another foot of water so that the water is above your waist. Now the river current can easily move you. Perhaps it may knock you off your feet and sweep you downstream. When the river's speed reaches that of person walking fast, it begins to have the power to move you, knock you over and depending on circumstances, drown you.

A good indicator of drowning trap levels is when annual vegetation on gravel bars are inundated during the summer months. Look for those areas which were under water during the spring runoff. When this vegetation becomes either partially of fully under water, the river is higher than normal and may be in the drowning trap flows.

The third component of the drowning trap is deceptiveness. When asked, most people correctly associate flood-like conditions as being dangerous. And they are dangerous. However, in the Drowning Trap flows the river is well within its banks and to the casual visitor, the river looks perfectly normal. A study on the

Potomac River in Maryland found that three fourths of the river visitors visited two or less times to the river. Hence, most visitors have no reference point to determine what is the normal summer flow of the river. The river is not flooding and it looks normal because it is well within its banks. However, it has the depth and velocity to contribute to an accident. In this way it is deceptive because people don't readily recognize the danger for what it really is.

Summary

Having an understanding of river dynamics is important for the rescue swimmers. First, it helps the rescue swimmer not to become a second victim. This was evident in rescues behind a low head dam. Second, understanding and having familiarity with river dynamics is important as the rescuer moves in the river. It helps to facilitate a rescue, and again, it helps the rescuer in not becoming a second victim during the rescue. Third, understanding river dynamics goes hand-in-hand with river rescue. Last, wading and swimming rapids helps the rescuer to become familiar with the medium with which they are working. This familiarity is always a good thing.

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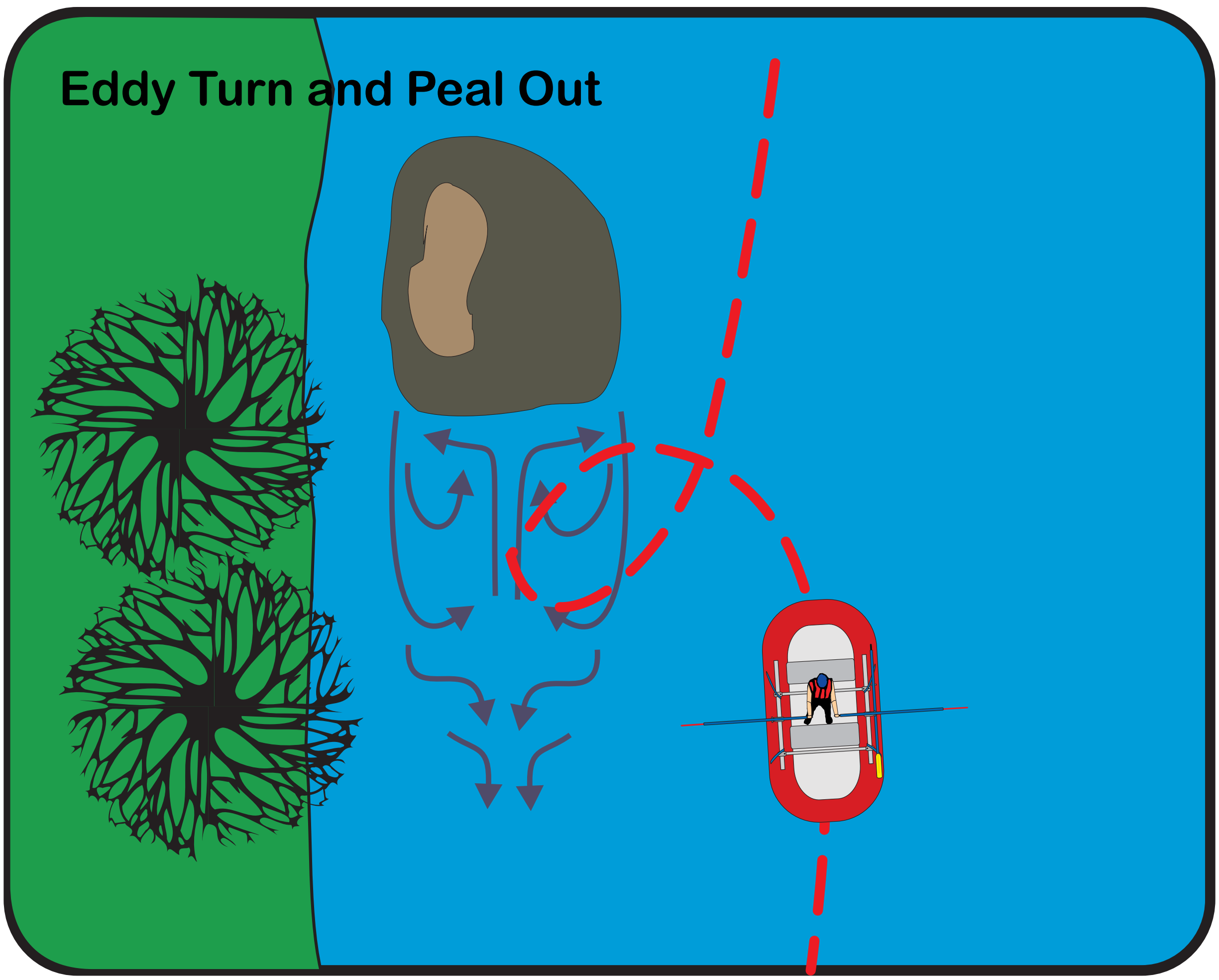
Chapter 4: Strokes and Maneuvers



Chapter 4.0:
Strokes and Maneuvers

The focus of this chapter is on paddle and rowing strokes for rafts, and on river maneuvers for rafts. Essentially, the strokes in the stroke section are independent of river features. In contrast, maneuvers are specific reactions to river features. An eddy turn describes how to maneuver the raft into an eddy. A ferry describes how to move the raft laterally in the water. Setting the raft describes how to maneuver the raft around a bend in the river. The strokes described in the previous chapter are used by guides and the crew to accomplish these maneuvers.

In terms of strokes, they are kept fairly simple. First, there were two strokes presented for passengers: the forward and reverse/back strokes. For guides, five strokes were presented. These were the forward, reverse/back stoke, draw and pry.

Second, stroke mechanics can become quite sophisticated. This author wrote the stroke section for the ACA book on Canoeing and Kayaking published by Human Kinetic (Dillon and Oyen, 2009). The stokes in this chapter are "***pure strokes***" (e.g. forward, reverse, draw and pry strokes). "***Compound strokes***" are stokes pure stokes are combined together to form new strokes (e.g. J-stroke or inside pivot turn). They are not discussed nor are they necessary strokes for a rafter. Nor are "***complex strokes***" discussed. In complex strokes the blade moves through the water at an angle rather than at right angles to the paddler and boat. The stationary draw and sculling are examples of this concept. Although these advanced strokes are nice to know and useful in rafting, there are many good raft guides who know how to use only the pure strokes to maneuver their raft very successfully. And passengers don't need to know them either.

Concepts and Principles

This section provides the setup or fundamentals needed for strokes and maneuvers. It includes the parts of a paddle and oar, the paddle or oar as a lever, blade placement in the waves, and the turning circle.

Parts of a Paddle/Oar (Figure 4.1) – The parts of a paddle are listed in Figure 4.1. For passengers, the critical paddle components are the grip, shaft and throat. These components are important because paddlers need to hold onto the grip and throat of the paddle. As noted later, there is a tendency for paddlers to hold the paddle too high on the shaft. Guides need to familiarize paddlers with these parts in order to orient them on how they should hold the paddle.

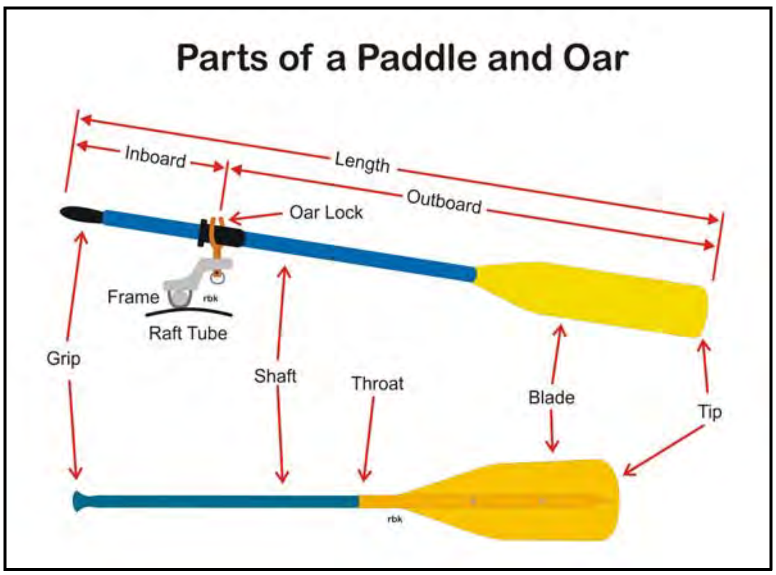


Figure 4.1: Parts of a Paddle/Oar – Source: author – [file: \EQ_PaddleOars.cdr]

Since guides are doing the rowing, they should be familiar with all the parts of an oar, if only for informational purposes (see Figure 4.1). For consideration, the overall length of the oar should be sufficient to provide a good bite in the water. Also, the inboard length should be sufficient to help offset the weight of the outboard length of the paddle.

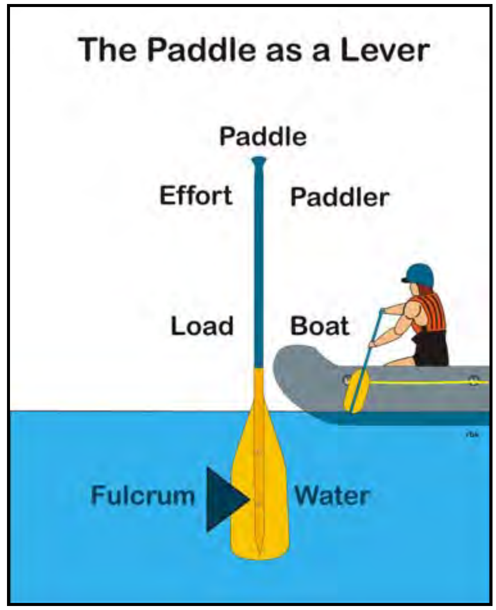


Figure 4.2: The Paddle/Oar as a Lever – Although it is not intuitive, the water is the fulcrum and not the load. Source: author – [file: \ST_LeverPaddler.cdr]

The Lever (Figure 4.2) – The paddle is a lever. There are three components in a lever. These are the fulcrum, the load and the effort. The paddler is the effort. This leaves determining the load and the fulcrum with the water and the raft. Is the fulcrum the water or raft? Is the load the water or the raft? Intuitively, many will answer that the water is the load because in practice the blade is moving though the water. This is particularly true with oar rigs because the oar lock looks like a perfect fulcrum. However, the water is the fulcrum, if only an imperfect fulcrum at best.

Think of it this way. The paddler is moving the boat past the paddle. The lighter the boat, the more this principle will become apparent to the paddler. The bigger and heavier the boat the less likely this principle will be evident. Although technically not correct, for most rafters and crew (i.e. passengers), the paddle moves through the water with the water feeling as if were the load. Practically, this is okay. From a guiding perspective where it is important to get the crew trained quickly, it is perfectly okay to teach the passengers to move the paddle through the water. In a full raft, it will feel this way anyway.

The guide should examine how the passengers hold the paddle. Often, they will have one hand on the grip and the other hand about a foot or 18 inches down the shaft. In terms of leverage, these paddlers are applying little if any power with their stroke. Because of the position of their hands on the paddle, they can’t. They have no leverage. Examination of world class C-1 paddlers reveals that their hand grips the throat of the paddle just above the blade. This allows them to apply maximum power and leverage. Passengers won’t have their grip hand this low. However, guides can monitor the hand position on the shaft to help obtain more power from the paddle strokes.

Blade Placement (Figure 4.3) – In whitewater, the paddler and for that matter, rower, wants to place the blade in the water to obtain the maximum bite. Figure 4.3 shows a typical wave configuration. Essentially, catching the backside of the wave (B) gives the most support to the stroke taken. Catching the front side or face of the wave (A) will

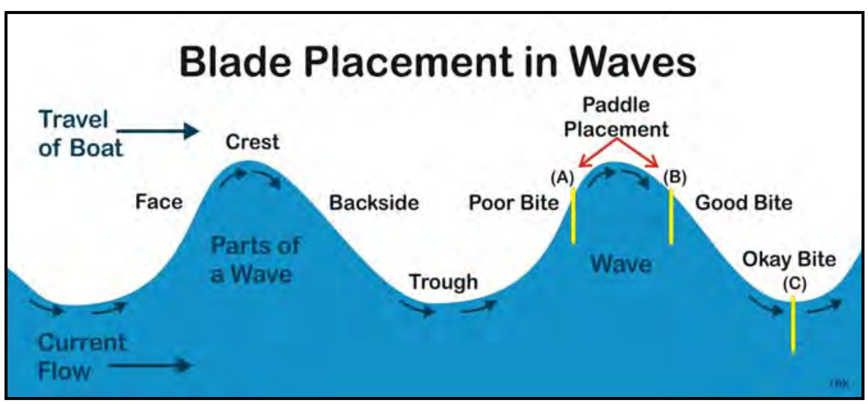


Figure 4.3: Blade/Oar Placement in a Wave – Place the blade on the backside of a wave for best effect. Source: author – [file: \ST_LeverPaddler.cdr]

generally result in catching air. Usually, there is an insufficient amount of water to support taking a power stroke. The problem catching the trough (C) is that the rafter may have to reach down to get a good bite of water. Other than this, there is sufficient support in the water to take a stroke.

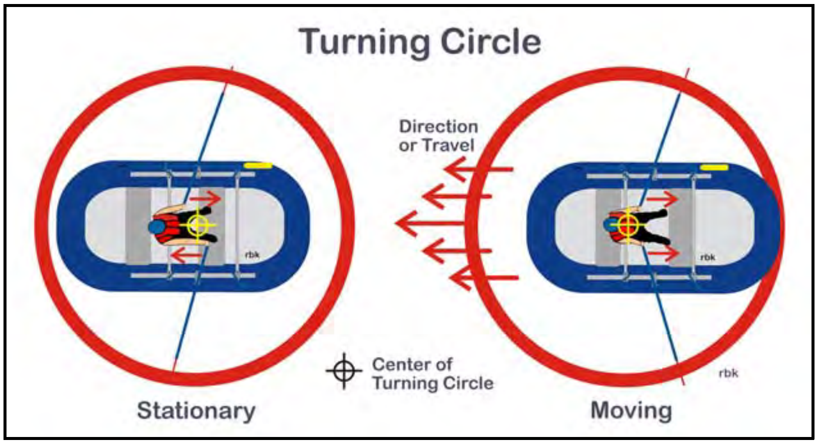


Figure 4.4: The Turning Circle – Imaging a horizontal wheel. Any stroke applied along the wheel will maximize the turning force on the boat. Source: author – [file: \ST_TurningCircle.cdr]

<u>Turning Circle</u> (Figure 4.4) – Imagine a bicycle wheel placed on its side. Any stroke applied along the wheel (turning circle) will rotate the boat on axis. For a stationary boat, the axis is in the center of the boat. The further away from the axis that the power is applied, the greater the turning effect on the boat. (e.g. the oars provide this distance).

As a raft moves forward, the turning circle and its axis move forward also. The greater the speed, the further forward the turning circle tends to move. This means that turning strokes applied in the stern of a raft will turn the raft more easily than strokes applied in the bow. Intuitively, C-2 canoeists have long known this principle by placing the better boater in the stern where they can easily steer the canoe. As a practical matter, rafts tend to move relatively slowly and the turning circle doesn't change appreciably with speed. Regardless, the turning circle explains why raft guides sit in the rear of the raft and not in the bow. Sitting in the rear provides guides with greater maneuverability.

Strokes – Paddle

In general, passengers in a raft need to know two strokes: the forward and reverse strokes. In addition, guides need to know the pry or push away and possibly the draw strokes. Working together with the commands of the guide and the corrections provided by the guide, the raft can be successfully maneuvered with these "pure strokes." Maneuvers involve river features or situations. All maneuvers can be created by using different combinations of these strokes. Guide commands for using theses strokes are covered in Chapter 7, Trip Leadership.

<u>Three Phases of a Stroke</u> (see Figure 4.5) – Typically, a stroke has three phases. These are the catch, power phase and recover phase. The ***catch*** occurs when the paddle enters the water. Most of the forward power is provided initially with the catch. This is followed by the ***power stroke*** or phrase where the paddle moves past the paddler. Technically, the boater and raft are moving the boat past the paddle (Note: *See lever discussion*). However, given the weight of the raft and the inefficiency of the water as a fulcrum, it more likely appears that the paddle is moving through the water past the paddler. The last phase is the ***recovery phase***. Normally, the blade is feathered, but in most rafting situations the paddler simply lift their paddle out of the water and return it for the catch phase of the next stroke.

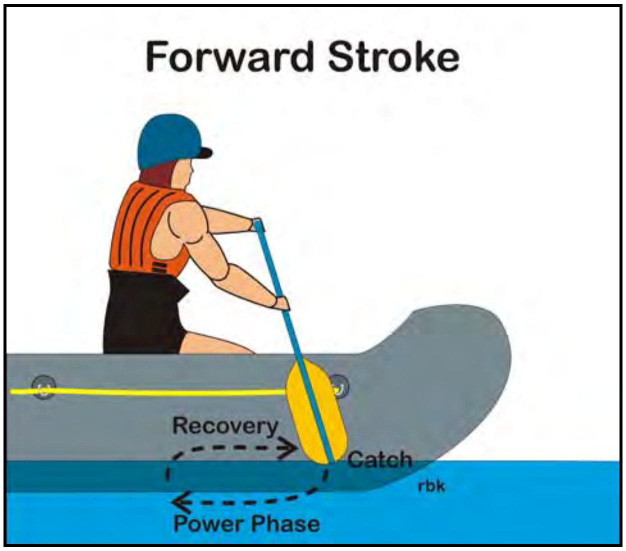


Figure 4.5: Forward Stroke –The forward stroke propels the raft forward. Source: author – [file: \ST_StrokeForward.cdr]

Forward Stroke (Figure 4.5) – The forward stroke is one of two strokes used by passengers to propel the raft forward. Keep it simple. Reach forward with the paddle, catch the blade in the water and pull the blade back to the hips. Lift the blade out of the water (i.e. recovery phase) and reach forward to take another stroke. Forget torso rotation and other important nuances involved with more advanced versions of the stroke. Again, keep it simple.

Most guides will emphasize stroke coordination to get paddlers to take their strokes in unison. Technically, if one member of a crew of five takes a stroke early without the help of others, the paddler is pulling the entire weight of the raft. This is a lot of work. If all five paddlers catch the water together and take their strokes in unison, they are only pulling one fifth of the weight of the raft. This is easier on the body and much more efficient.

One of the commands used by this author when guiding is to call out the strokes. It is reminiscent of the old Roman galleys where the Roman in the galley of boat pounds out the beat and rhythm of the strokes. All the oars are catching the water together and all strokes occur in unison. The raft command is simply a loud “stroke,” “stroke,” “stroke.” With each “stroke,” the group catches the water together in unison. It works exceedingly well in clutch situations when power needs to be applied and the raft needs to move more quickly. Also, the passengers can tell the gravity of the situation by the inflection of the guide’s commands. So be forewarned. Regardless, the cadence set by the stroke, stroke, stroke command is useful in non-clutch situations for guides. The emphasis is on the coordination of passenger’s strokes with the commands of the guide rather than developing perfection of stroke technique.

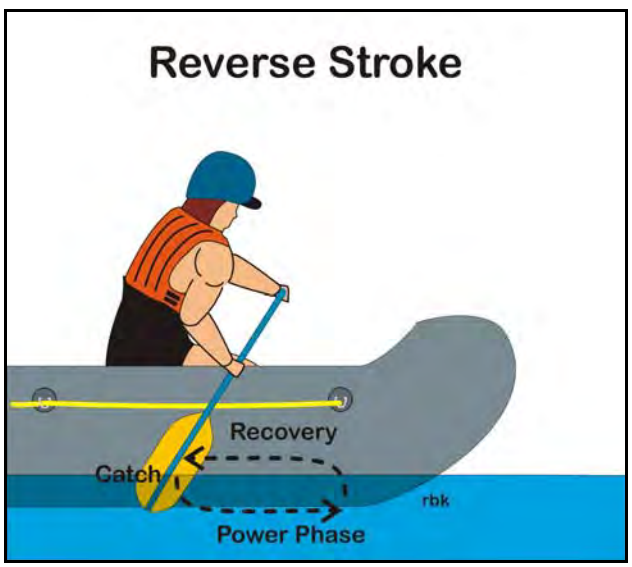


Figure 4.6: Reverse Stroke – The reverse or back stroke is used to propel the raft backwards. Source: author – [file: \ST_StrokeReverse.cdr]

Reverse/Back Stroke (Figure 4.6) – As its name suggests, the reverse stroke propels the raft backwards. Sometimes it is referred to as the back stroke. Either term is acceptable. The passengers may lean forward, reach back with the blade and catch the water just behind the hip. They push with the lower arm and pull with the upper hand. Using their back, they may end the stroke leaning backwards. When the paddle is in front of them, they remove the paddle from the water and take another stoke if needed. In the recovery phase, they can feather the blade where the blade is horizontal to the water or they can simply move the unfeathered paddle forward for another stroke. Most guides will find that the unfeathered paddle recovery works well and is more than adequate. Many paddlers will find it convenient to place the blade on the hips and use it as a wedge. Technically, it is not the most efficient stroke, but it works well and is a perfectly acceptable alternative.

Pry/Rudder/Reverse Half-Sweep (Not shown) – The pry and rudder are guide strokes. The pry and rudder can be used to move the stern of the raft away from the paddle stroke. The pry is useful in a R4 configuration where the guide can literally pry off the side tube. The paddle is turned sideways, the shaft of the paddle placed against the tube, and the stern of the raft literally pried.

When sitting on the stern of the raft the guide will often find the ***reverse half-sweep*** a more efficient stroke. It can be a powerful turning stroke. Conceptually, it is a half-sweep because the sweeping action is on the turning circle. A half-sweep maximizes the turning effect. If a full sweep is done, the second half of the sweep stroke is off the turning circle and is counter productive.

The guide will also find the rudder useful. It is most useful when the guide is on the stern of the raft. Place the shaft of the paddle on the tube of the raft with the blade in a feathering position (i.e. perpendicular to the water). Simply use the paddle as a rudder. A rudder only works when the raft is moving faster than the current. For a rudder to work the water moves at an angle against the blade. If the raft and current are moving at the same speed, there is no force against the blade and hence, the rudder doesn't rudder. As a general rule, the rudder is a convenient stroke without a lot of power. In practice, most guides will merge a rudder into a pry for more effect.

Draw Stroke (Not shown) – The draw stoke is another guide stroke. In its simplest form, a draw stroke is really a forward stroke at a right angle to the boat. From there it comes into its own with an underwater recovery. The draw stroke is a counter stroke to the pry, rudder, or reverse half-sweep. If they are used by a right-handed paddler to move the stern toward the left, the draw is used to move the stern to the right.

In a raft, the draw stroke is considered a weak stroke and in some cases a half-back stroke on the opposite side accomplishes the same thing. However, as a former C-1 (canoe) paddler, this author finds the draw stroke a useful stroke in his repertoire.

Strokes – Oar

Most oar rigs are configured with the guide and oars located in the center of the raft responsible for providing motive power. The passengers are along for the ride. To be a successful rower, there are three things the rower needs to be able to do. First, the rower needs to know how to row a rowboat. Surprisingly, the mechanics are the same. Second, the rower needs to know how to back ferry. The back ferry covers for a multitude of sins. Some western rowers may disagree with this because the back ferry slows down the speed of travel. Regardless, the back ferry slows down everything and allows for increased maneuverability. The back ferry is covered in the maneuver section of this chapter. Third, the rower needs to have river reading skills. This topic is covered in the previous chapter.

Phases of Stroke: Oar (Figure 4.7) – As with paddling, there are three phases to a stroke with oars. These are the catch, power phase and recovery. The catch is when the oar enters or catches the water. The power phase is applying power to the stoke. Recovery is feathering the blade back for the next catch and stroke.

"*Oar rights*" are a popular device today that keep the blade of the oar perpendicular or at right angle to the water. Unfortunately, they prevent feathering the blade during the recovery phase. It is easy to hit the top of a wave with the blade during the recovery phase. An advantage of the oar right is that during a crux move when the blade is inserted for the catch, it catches the water. Without a blade right, the oar may skip and miss the stroke. Although the author prefers not using oar rights, he has messed up a crux move on occassion because of the blade placement. Oar rights would have prevented the mess up.

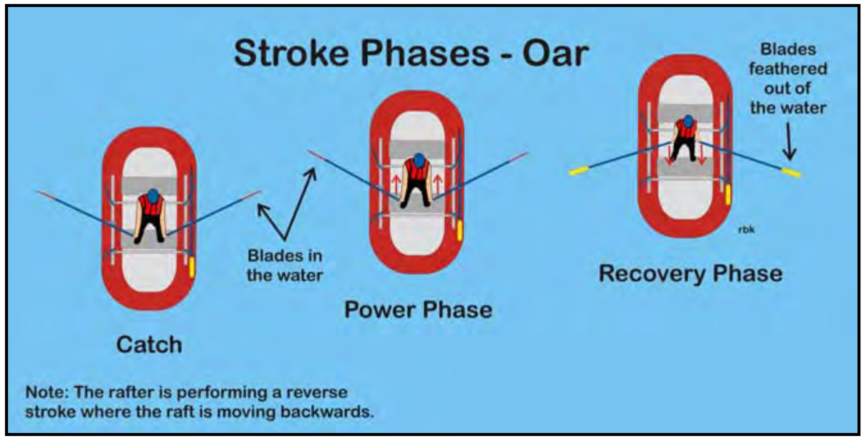


Figure 4.7: Three Phases of an Oar Stroke – Caption: The three phases are the catch, power phase and recovery. Source: author – [file: \MA_StrokePhases.cdr]

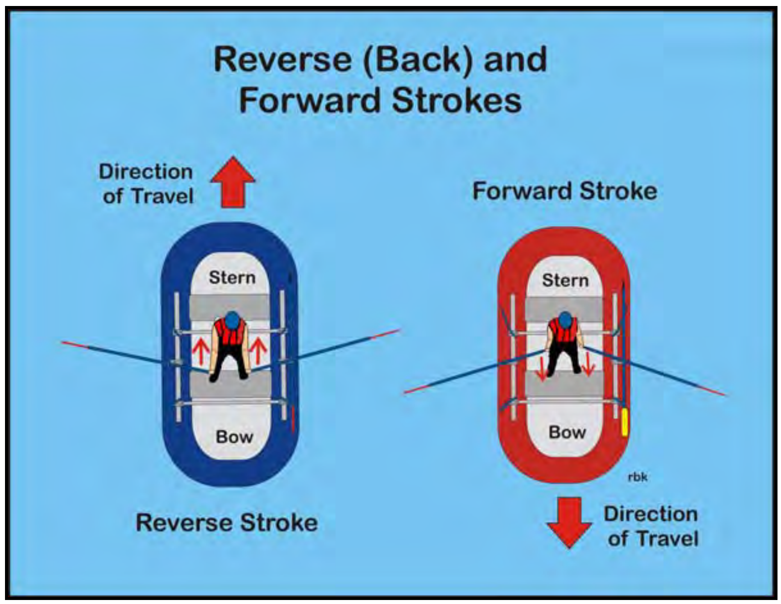


Figure 4.8: Forward Stroke The forward stroke propels the raft forward with the rafter facing forward toward the bow. Source: author – [ST_ForwardBackStroke.cdr]

Forward Stroke (Figure 4.8) – In its pure form, the forward stroke moves the bow forward in the water with the rafter facing toward the bow. The stroke starts with the grips close to the chest. The arms extend forward completing the power phase of the stroke. Physiologically, the stroke is similar to doing a series of bench presses with considerable emphasis on the use of the triceps. Although this seems to tax some of the weaker muscle groups, western rowers seem to row all day walking the raft with alternate forward strokes. For the recovery phase, the blade is lifted out of the water and returned close to the chest for the next stroke.

Walking the Raft (Figure 4.9)– "Walking the raft" is a technique of moving the raft through the water where the rafter is facing forward toward the bow and toward the direction of travel. It is a popular technique on western rivers that tend to be continuous drop and where they are using a "follow-the-leader" approach through the rapids (see Chapter 7). It is called walking the raft because the forward stroke alternate like a person walking. When walking, the legs alternate with one foot going forward while the other foot remains stationary. It is strictly a rowing technique and not applicable to paddling situations.

There are two advantages of the method. First, the rafter is facing forward through the rapids. Second, every stroke is used to propel the raft down the river. When covering twenty miles a day, this is not unimportant. Philosophically, it is similar to the slalom racer where any stroke other than a forward stroke is slowing their time.

There is one disadvantage of the method. There are times when things need to be slowed down in order to make the maneuver. The back ferry method of running the river slows things down and makes for easier negotiation of a rapids. However, it is energy not being used to move the raft down the river. For some, it is considered wasted energy.

In Figure 4.9, walking the raft is a technique where the guide facing forward takes alternating forward strokes with the raft. A forward stroke is taken with the left oar (catch and power stroke phases). The stroke drives the raft forward and the bow toward the right. Simultaneously, the right oar is being repositioned for the next stroke (recovery phase). It is lifted out of the water and the blade is feathered toward the bow of the raft. (Note: If oar rights are used, the blades cannot be feathered. Next, a forward stoke is taken with the right oar and the left oar is repositioned for the next stroke (recovery phase). The process is repeated.

Reverse Stroke (see Figure 4.8) – In an oar rig, the reverse stroke tends to be a more powerful stroke than the forward stroke because the rafter can get his back into the stroke. The major disadvantage of the reverse stroke is that when facing downstream, the rafter has obstructed visibility. Another advantage of the reverse stroke is that if the rafter is walking the raft, the rafter can easily execute a reverse stroke at an angle to the current and back ferry. This slows the raft in the current and moves it laterally.

Right Turn (Figure 4.10) – In its pure form, a right turn moves the bow to the right and the stern left. As pictured, the raft will pivot on an axis in the center of the raft (see turning circle Figure 4.4). As pictured, the handle of the left blade is positioned close to the rafter. The handle of the right blade is extended outward. Both blades catch the water together. In the power phase, the left arm extends forward and the right arm draws in toward the body. The raft rotates on the center point of the raft to the rafter's right. For the recovery phase, both blades are lifted out of the water, feathered (blades are horizontal to water) and positioned again for the next catch phase. (Note: If blade rights are used, the blades cannot be feathered.)

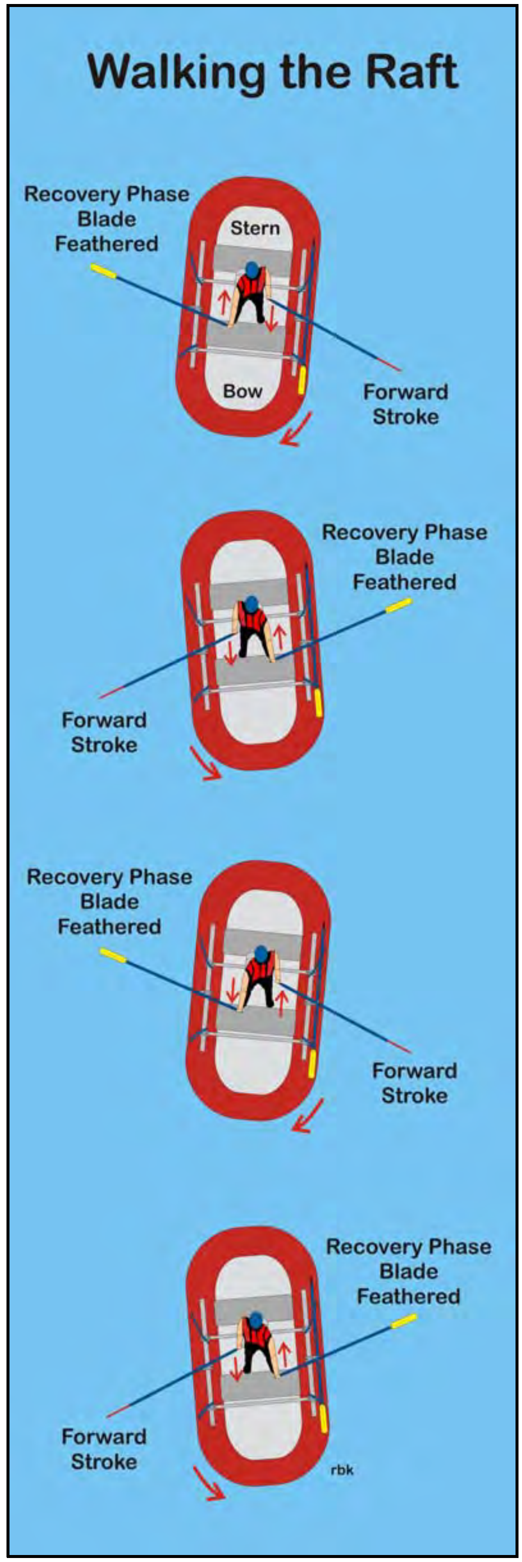


Figure 4.9: Walking the Raft – Caption: Alternating forward strokes walking the raft mimics walking. Source: author – [file: \MA_WalkingRaft.cdr]

Left Turn (Figure 4.11) – Performing a left turn is the direct opposite of a right turn. The handle of the right blade is positioned close to the rafter. The handle of the left blade is extended outward. Power Phase. Both blades catch the water together. During the power phase of the stroke, the right arm extends forward and the left arm draws in toward the body. The raft rotates on the center point of the raft to the rafter's left. In the recovery phase both blades are lifted out of the water, feathered (blades are horizontal to water) and positioned again for the catch phase.

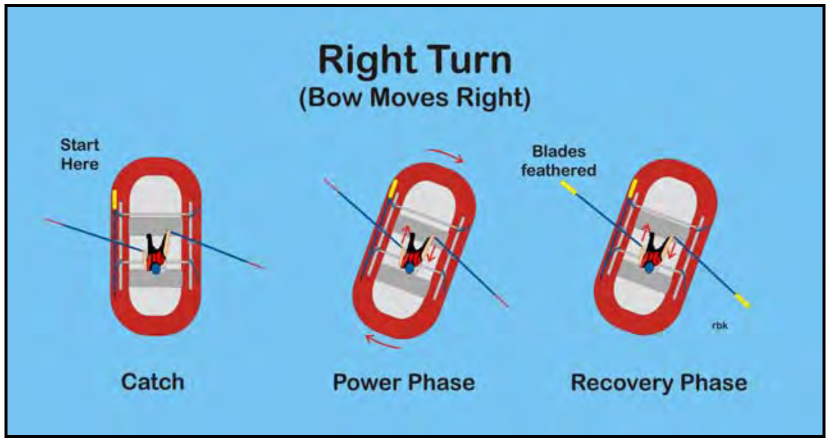


Figure 4.10: Turn Right: Pushing forward on the left oar and pulling back on the right oar turns the bow of the raft to the right. Source: author – [ST_TurnRight.cdr]

River Maneuvers - Paddle

River maneuvers include ferrying, eddy turns, peal outs, and setting a raft around a bend. These are the standard river maneuvers. These maneuvers build upon the strokes described above. Oar rig maneuvers are included in the next section.

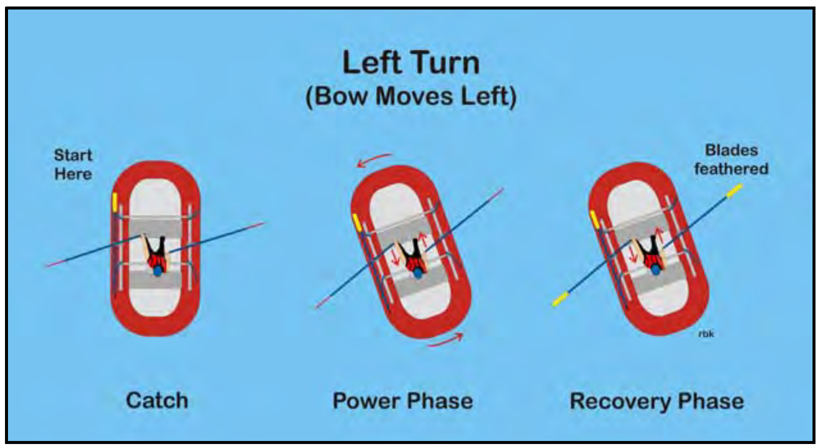


Figure 4.11: Left Turn: Pushing forward on the right oar and pulling back on the left oar turns the bow of the raft to the left. Source: author – [ST_TurnRight.cdr]

Forward and Back Ferry (Figure 4.12) – In Figure 4.12, the forward ferry is shown moving the raft from one eddy to another eddy. In a paddle raft the forward ferry has more power and is more practical than the back ferry. For this reason, the back ferry is not shown. In the figure, the raft is moving from an eddy on river right to an eddy on river left. Also, the guide is in the stern of the raft on the right side.

Exiting the eddy, the raft leaves the eddy somewhere between the upstream current and the neutral current. The closer to the rock the more powerful the current and the more the turning effect of the current differential as the raft exits the eddy. As the raft crosses the eddy line of a big powerful eddy, it may be necessary for passengers on the upstream side to lean inward to prevent falling out of the raft. In most cases the raft is comparatively large and there is little tendency to catch the upstream side and lose passengers.

As the raft crosses the eddy line (Scene A), the current differential will want to turn the bow of the raft downstream and execute a peel out rather than a ferry. To counter this, the raft guide can do one of three moves. First, the guide can do a hefty draw stroke in the stern and pull the stern out laterally into the main current. This tends to negate the turning action and maintain the correct ferry angle. The second alternative is to have those on the left side cease paddling and those on the right take several strokes. This will help to maintain forward momentum and counteract the downstream force of the current. Potentially, it has the same effect as a good hefty draw in the stern. The third approach is to do a left turn where the paddlers on the left to a reverse stroke and those on the right do a forward stroke. The disadvantage of this approach is that it reduce forward momentum and the raft will drift downstream.

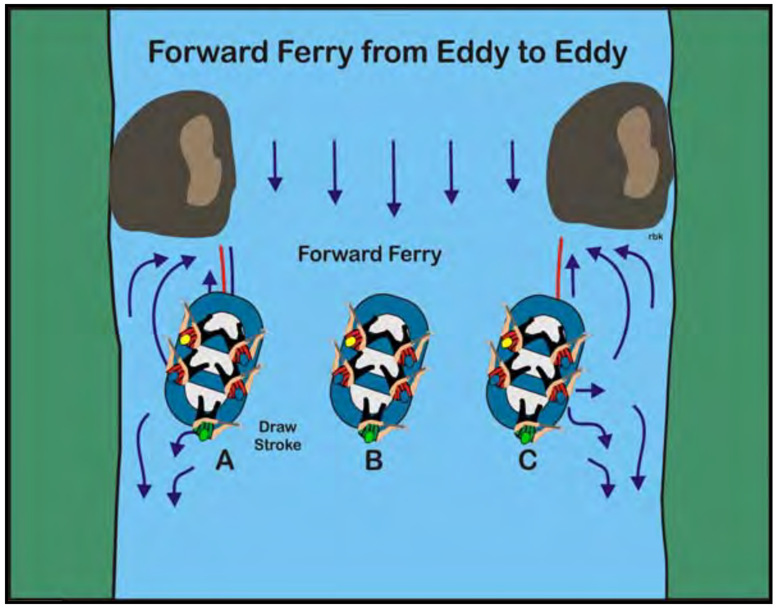


Figure 4.12: Forward and Back Ferry: In the forward ferry, the bow of the raft is pointing upstream at an angle to the current. The current hits the hull at an angle and ferries the raft in the direction the bow is pointing. Source: author – [RR_FerryEddy.cdr]

Once in the main current (Scene B), the guide maintains a good ferry angle with sufficient forward momentum from the forward strokes of the passengers to ferry across the river to the eddy on the other side. The force of the current hits the boat at an angle and propels it to the far shore. If a correction in the angle is needed, the guide can use a pry or draw stroke.

Entering the eddy (Scene C) is the opposite of leaving the eddy. As the bow crosses over the eddy line it may be necessary to apply power with one or more forward strokes on the left side to insure the raft crosses over the eddy line an into the eddy. Once the bow is into the eddy, the guide may use a draw stroke to straighten the raft within the eddy. Usually, this draw doesn't need to be hefty.

Consider a couple of variations to the above scenario from moving from eddy to eddy. The first is that the forward ferry can be performed without the eddies. Common use of this maneuver is when the raft is turned around and the guide needs to ferry the raft away from the obstruction.

Second is the back ferry. In a paddle craft it is a very useful maneuver for minor corrections in the main current or when the raft is about to plow head on into a rock or other obstruction. It slows down the raft in the current which makes maneuvering easier. The guide simply changes the angle of the raft by applying a draw or pry off the stern. Point the stern in the direction of travel. Then command both sides to back or reverse paddle. The force of the current on the hull of the raft at an angle will move it laterally. As a footnote, the backferry is a staple with an oar rig.

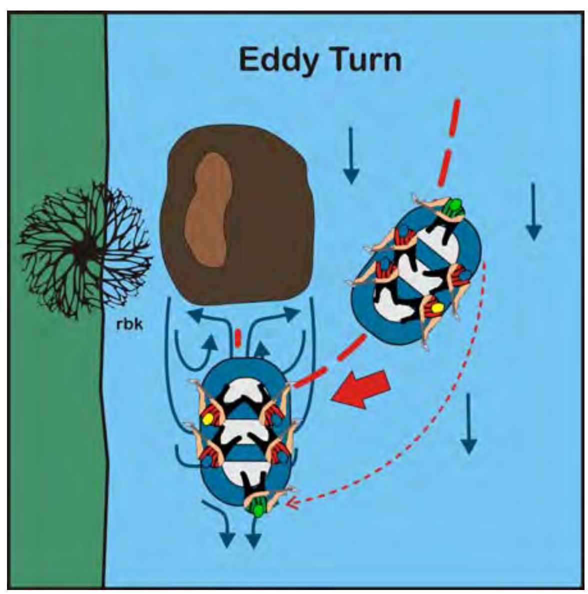


Figure 4.13: Eddy Turn: The raft needs to have speed an angle to enter the eddy. Source: author – [RR_EddyTurn01.cdr]

<u>Eddy Turns</u> (Figure 4.13) – To make an eddy turn, the guide needs forward momentum and an angle to drive the raft into the eddy. Examine the three parts of an eddy (see Figure 3.7). Where the raft enters the eddy will influence what the guide does. Cutting across the eddy line (1) and into the upstream current behind the rock, the raft will tend to be turned by the current differential so the bow is pointing upstream. Depending on the strength of the eddy, the guide may need to augment the turn. Again, the guide can use a half-back right and a half-forward left command. Also, as the raft crosses the eddy line with a strong current differential, the downstream paddlers may need to lean inward to avoid the tendency of the current catching the tube and throwing the rafters into the water.

If the raft enters the neutral current in the eddy (2) or the downstream portion (3) in the eddy, the guide will need to help facilitate the turn. Again the same commands will work.

The rafter turns the raft and drives it into the eddy (Zone #2). This is a conservative and safe entry point. After entering the eddy, the rafter orients the raft parallel with the shore or eddy current (not shown).

<u>Peel Out</u> (Figure 4.14) – There are three distinct eddy zones: (1) the water flows back upstream, (2) the water is neutral and doesn't flow upstream or downstream, and (c) the water flows downstream but at a slower rate than the main current. Rafts are big and unless the eddy is very big, a guide can usually exit from any one of the three zones without having to worry about edge control. If there are any doubts, the safe exit point is the neutral waters found in Zone #2 (see diagram). Also, it may be necessary to have passengers lean inwardly to stay in the raft when crossing the eddy line (Zone #1).

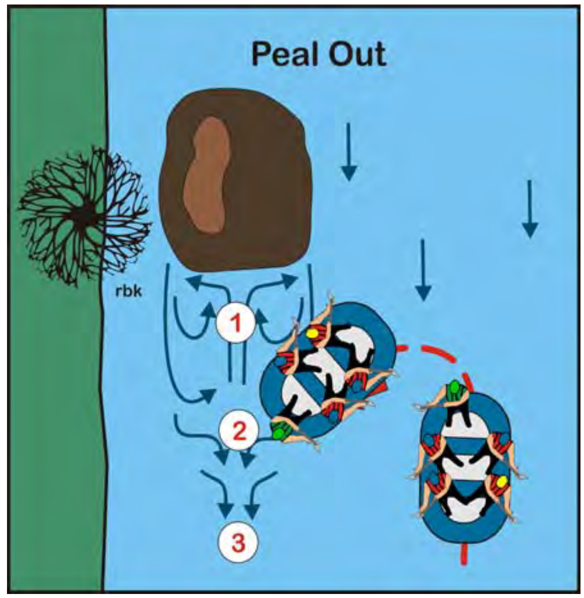


Figure 4.14: Peel Out: Rafts need to have speed an angle to enter the eddy. Source: author – [RR_PeerOut01.cdr]

The rafter powers the raft out of the eddy, in this example between Zone #1 and Zone #2. This reduces the differential effect of the eddy line. It is conservative and a relatively safe exit point. As the raft exits, the main current swings the bow downstream. If needed, the guide may augment the turn or the guide can increase the arch with a forward ferry that extends the peel out further out into the current. The rafter continues on downstream. If the current differential is exceeding strong, it may be necessary to caution the paddlers on the upstream side (i.e. left side) to lean inward.

If the guide pulls out of the eddy in zone #2 or #3 (i.e. neutral or slightly downstream current), the peal out will require more assistance by the guide. There is less current differential because the raft is leaving the eddy in the neutral area or in the current that is moving downstream but more slowly than the main current. The guide can execute a simple right turn with one back stroke on the right side and one forward stroke on the left side. This will line the raft up facing downstream.

<u>Setting the Raft Around a Bend</u> (Figure 4.15) – As the current goes around a bend, the current on the outside of the bend is moving faster than the current on the inside of the bend. A raft that is pointing straight downstream will have its bow in the slower moving water and its stern in the faster moving water. The result is that the current differential will tend to turn the raft around in the current so that the bow is pointing upstream.

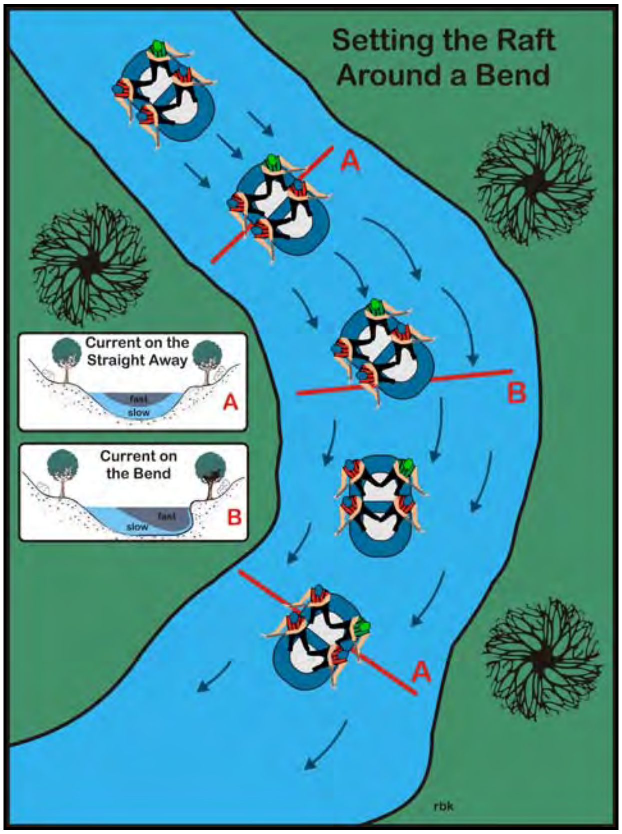


Figure 4.15: Setting the Raft Around the Bend – The stern of the raft is turned inward so that both the bow and stern of the raft are going at the same speed. Source: author – [RR_Setting02.cdr]

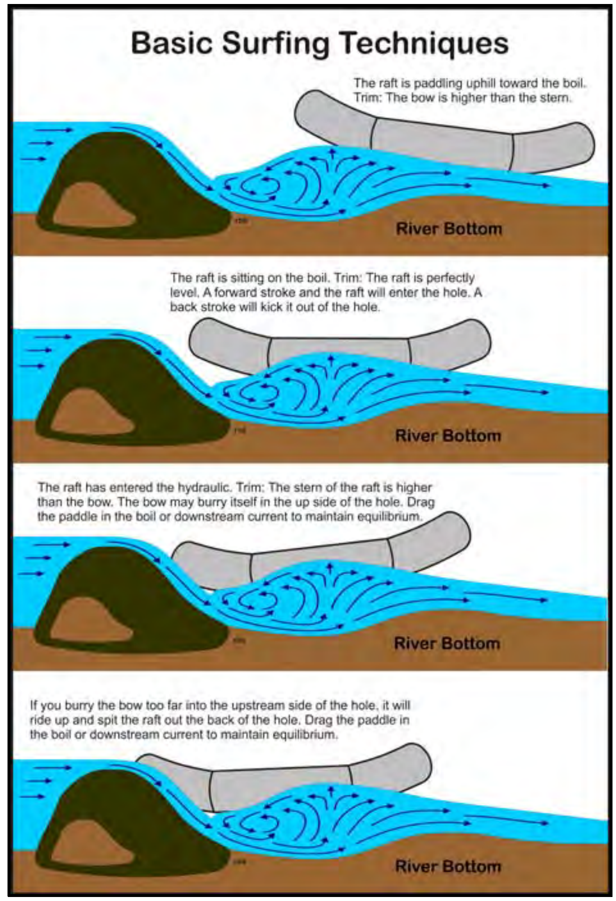


Figure 4.16: Surfing: Rafts need to have speed an angle to enter the eddy. Source: author – [HH_HydraulicSurfing.cdr]

To set the raft, the guide moves the stern of the raft inward on the rapids so that both the bow and stern are moving at the same speed in the current. A simple back ferry will help prevent the raft from being swept to the outside of the bend.

Surfing (Figure 4.16) – Generally, surfing is either a result of a fun activity or a screw up. Surfing a hole can be precarious or fun. As a fun activity, the guide will surf a hydraulic and provide the crew with a fun ride. In contrast, a raft is thrust into a hole where the hole plays with the raft rather than the raft playing with the hole can result in flipping the raft or dumping passengers into the water.

Figure 4.16 depicts the concept of the boat angle in the water. When teaching canoeing, the author would sit on the shore of the Nantahala River and watch boaters surf a wave. For the author, it was a game of determining when the boat fell off the wave. It was nothing more than watching the angle of the hull of the boat as depicted in Figure 4.16. If the bow was leaning downhill, the boat was still surfing the wave. If the hull was level, the boater could go either way and usually the boater needed to act quickly or they would fall off the back of the wave. If the hull was lower in the stern, the boater was off the wave. It was interesting to note when the boater realized they were off the wave and couldn't get back onto it. We would sit on the shore analyzing their situation. We would conclude that the boater was off the wave. They didn't know it. Now they do, but it is too late. For the instructor, the point is to be able to determine the attitude of the boat and make conclusions about it.

River Maneuvers – Oar

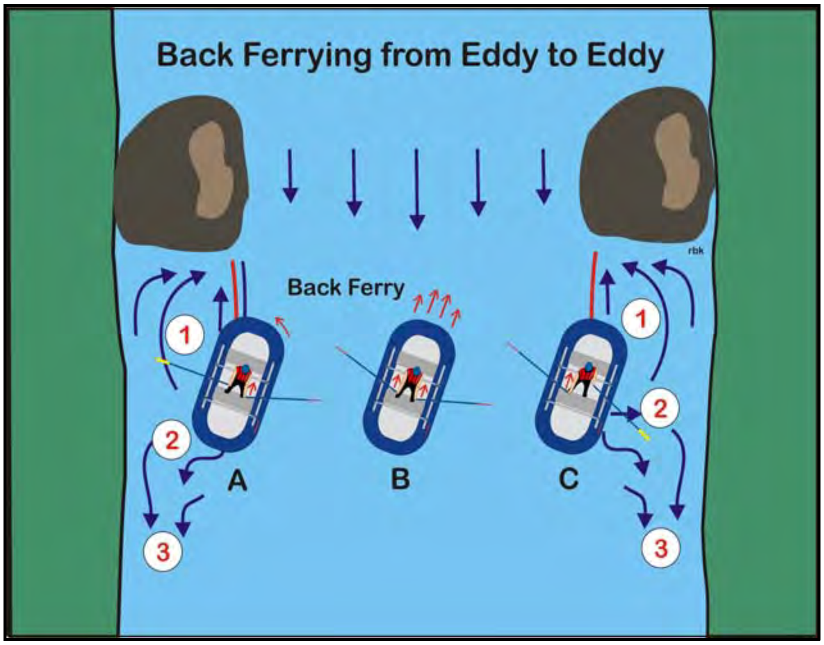


Figure 4.17: Forward and Back Ferry: In the back ferry, the stern of the raft is pointing upstream at an angle to the current. The current hits the hull at an angle and ferries the raft in the direction the stern is pointing. Source: author – [RR_FerryFerrying01.cdr]

Compared with paddle craft, some things stay the same and some thing change drastically with oar rigs. With paddle rigs, the forward ferry will find greater utility than the back ferry. With an oar rig the back ferry and its variations are a staple.

__Back Ferry from Eddy to Eddy__ (Figure 4.17) – Leaving the eddy with a back ferry is a fundamental maneuver. The back stroke is a more powerful stroke than the forward stroke. It can be more effective moving the raft across the eddy line (1) and into the main current. Figure 4.17 shows a back ferry from eddy to eddy. However, back ferrying out of the eddy positions the guide facing downstream. The guide can simply drop down with the current (see next section).

When exiting the eddy (Scene A), the rafter is using a reverse stroke on the left side only. This helps counter the turning effect of the current differential. This is a difficult stoke since the blade is in the main current. However, it maintains the raft's forward momentum and counters the turning effect of the current as the raft leaves the eddy. If the rafter uses the right oar, the raft will turn but it will have a tendency to drop further down river.

The rafter maintains the ferry angle and stokes hard enough with reverse strokes to move the raft laterally across the river. If the rafter needs to change the ferry angle, the rafter can take strokes with one oar or drag one of the paddles in the water. Dragging the paddle in the water works well but the raft will quickly drop downstream and should be avoided, unless of course, dropping downstream doesn't matter.

Entering the eddy, the rafter will need to counter the current differential (Scene C). The rafter may need to take a reverse stroke or two with the right oar to drive the bow into the eddy. The left oar is feathered and held out of the water. Taking a stroke with the left oar may tend to force the bow of the raft back out into the main current.

The back ferry can be used in the main current. The guide simply takes a turning stoke with the stern pointing toward the direction of travel. Then she takes some reverse strokes and ferries the raft.

There is some difference in use of the back ferry between eastern and western rafters. Western rivers tend to be more open and rafters tend to walk their raft with alternating forward strokes. Eastern rivers tend to be tighter in term of eddies and obstructions. Slowing things down with the back ferry is often a good thing.

Peal Out Using a Back Ferry (Figure 4.18) – Pealing out using a back ferry is a sweet move. It utilizes the power of the backstroke. The rafter can ferry out as far into the current as desired, turn and is facing downstream. The rafter can walk the raft down the river.

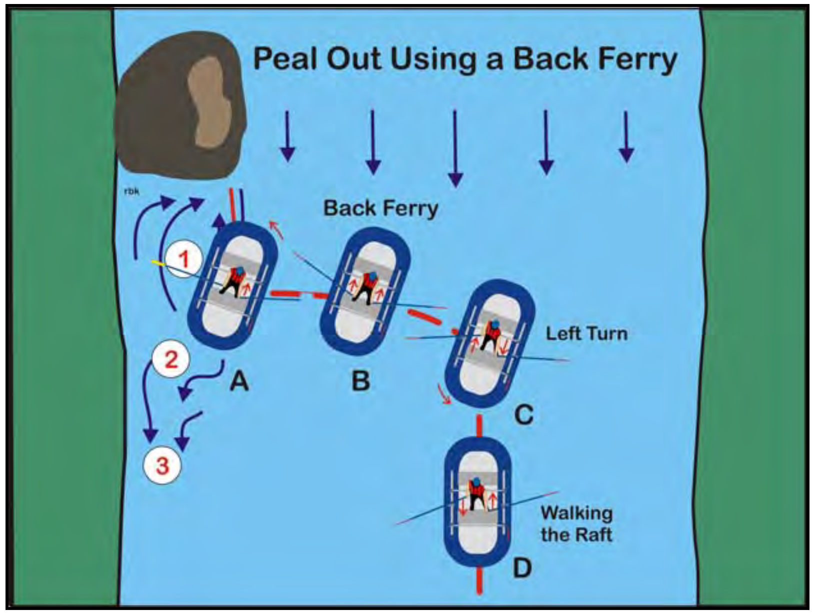


Figure 4.18: Peal Out Using a Back Ferry Ferry – A sweet move, the maneuver combines the power of the reverse stroke to exit the eddy, the back ferry to position the raft in the current and the rafter and bow of the raft both pointing downstream. Source: author – [RR_PealOutFerryOar.cdr]

Leaving the eddy and setting up the ferry is the same as in ferrying from eddy to eddy (Scenes A, B). Generally, it is okay if the raft drops down in the current since the raft is going to drop down in the current anyway. The rafter executes a left turn (Scene C) which removes the ferry angle. Normally, making the turn itself will move the raft downstream in the current. The rafter is facing downstream (D). The rafter proceeds down the river.

Eddy Turn (Figure 4.19) – When performing an eddy turn, either a bow or stern entry can be used. The bow entry is depicted in Figure 4.19. As a general rule, if more power and speed is need to pierce the eddy line, use a stern entry with a series of strong reverse strokes.

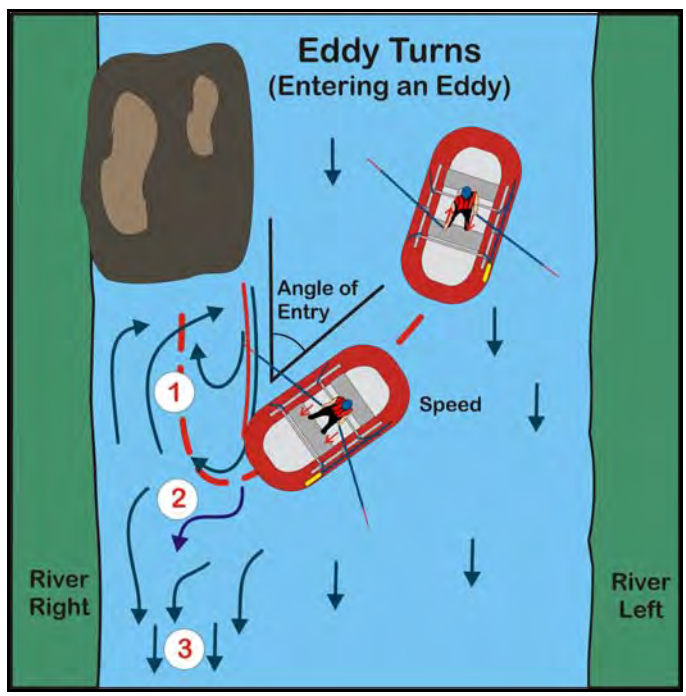


Figure 4.19: Eddy Turn: The raft needs to have speed an angle to enter the eddy. The oar rafter can enter facing either forward or backwards. Source: author – [RR_EddyTurns.cdr]**Figure 4.19: Eddy Turn:** The raft needs to have speed an angle to enter the eddy. The oar rafter can enter facing either forward or backwards. Source: author – [RR_EddyTurns.cdr]

When entering an eddy there are three considerations: speed, angle of entry, and size of the eddy. The raft needs sufficient speed and sufficient angle of entry to pierce the eddy, enter it, and remain in the eddy. The angle of entry is to turn the raft more broadside to the current. This maximizes the forward momentum driving the raft into the eddy. If there is insufficient speed or too narrow of an entry (i.e. raft is parallel with eddy line), the raft will tend to be flushed downstream and miss the eddy.

The size and attitude of the eddy will determine where to enter it. Rafts tend to be big and stable. In general they can enter any one of the three zones. If the raft enters zone (1) of a strong eddy, it may be necessary to warn passengers to lean inside to avoid falling out. The safe zone to enter is zone (2) where there is no eddy line and no current differentially. The guide may need to add a turning stroke to align the raft in the eddy. Entering in zone (3), the guide may need to turn the raft and add a stroke or two to remain in the eddy.

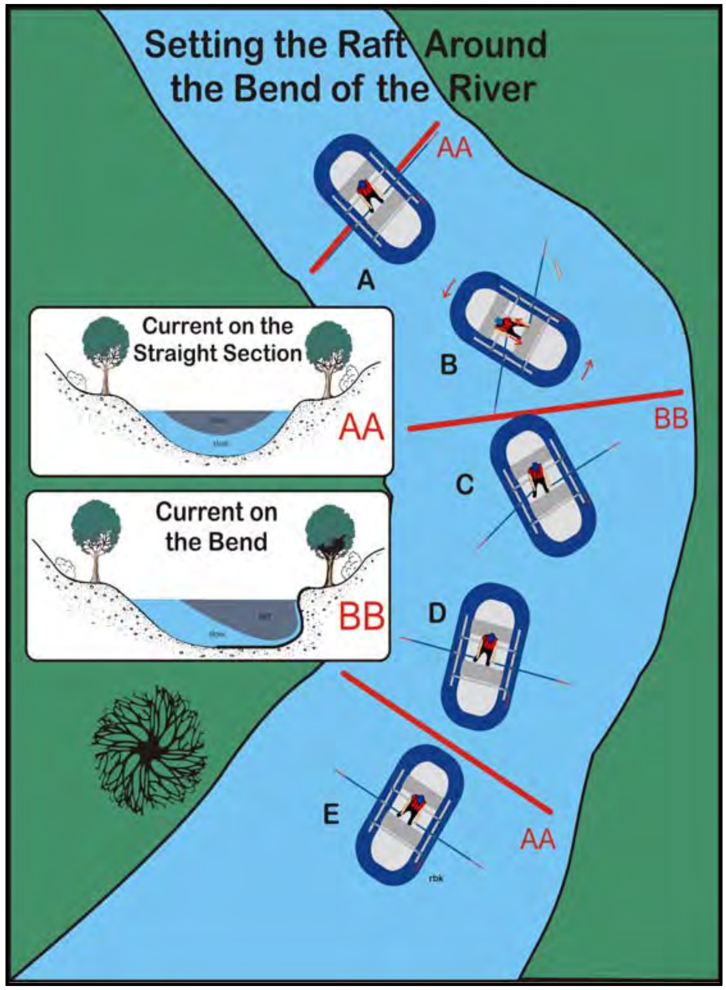


Figure 4.20: Setting the Raft Around the Bend – The stern of the raft is turned inward so that both the bow and stern of the raft are going at the same speed. Source: author – [RR_Setting01.cdr]

<u>Setting the Raft Around a Bend</u> (Figure 4.20) – Conceptually, setting an oar raft around a bend is similar to a paddle craft. As the current goes around a bend, the current on the outside of the bend is moving faster than the current on the inside of the bend (BB). The current in the normal channel is shown in the (AA) profile. As the raft goes around the bend, a raft that is pointing straight downstream will have its bow in the slower moving water and its stern in the faster moving water. The result is that the current differential will tend to turn the raft around in the current so that the bow is pointing upstream.

To set the raft, the guide moves the stern of the raft inward on the rapids so that both the bow and stern are moving at the same speed in the current. Figure 4.20 shows the rafter turning the raft so that the stern is pointing toward the inside of the bend (Scene B). In addition, a simple back ferry (Scene C) will help prevent the raft from being swept to the outside of the bend.

Summary

This chapter presents the basic strokes and maneuvers used by rafters. Both paddle craft and oar rigs are discussed. There are some significant differences. In a paddle craft, the guide needs to work with the passengers to maneuver the raft. In an oar rig, the guide propels the raft and the passengers are along for the ride. The strokes were kept simple. In a paddle craft, passengers need to know the forward and reverse strokes. The guide needs to know these strokes also along with the pry and rudder and perhaps the draw stroke. Using these strokes, the guide can eddy out, peel out of an eddy, ferry the raft, and set the raft around the bend and preform virtually every maneuver needed on the river.

For the oar rig, the forward and reverse strokes were introduced. Turns become variations of these strokes. By using the strokes in opposition to each other, the rafter can turn the raft by pulling on one oar and pushing on the other oar. In addition, the western technique of walking the raft was introduced. Using these strokes, the rafter can pretty much negotiate the same maneuvers as a paddle craft.

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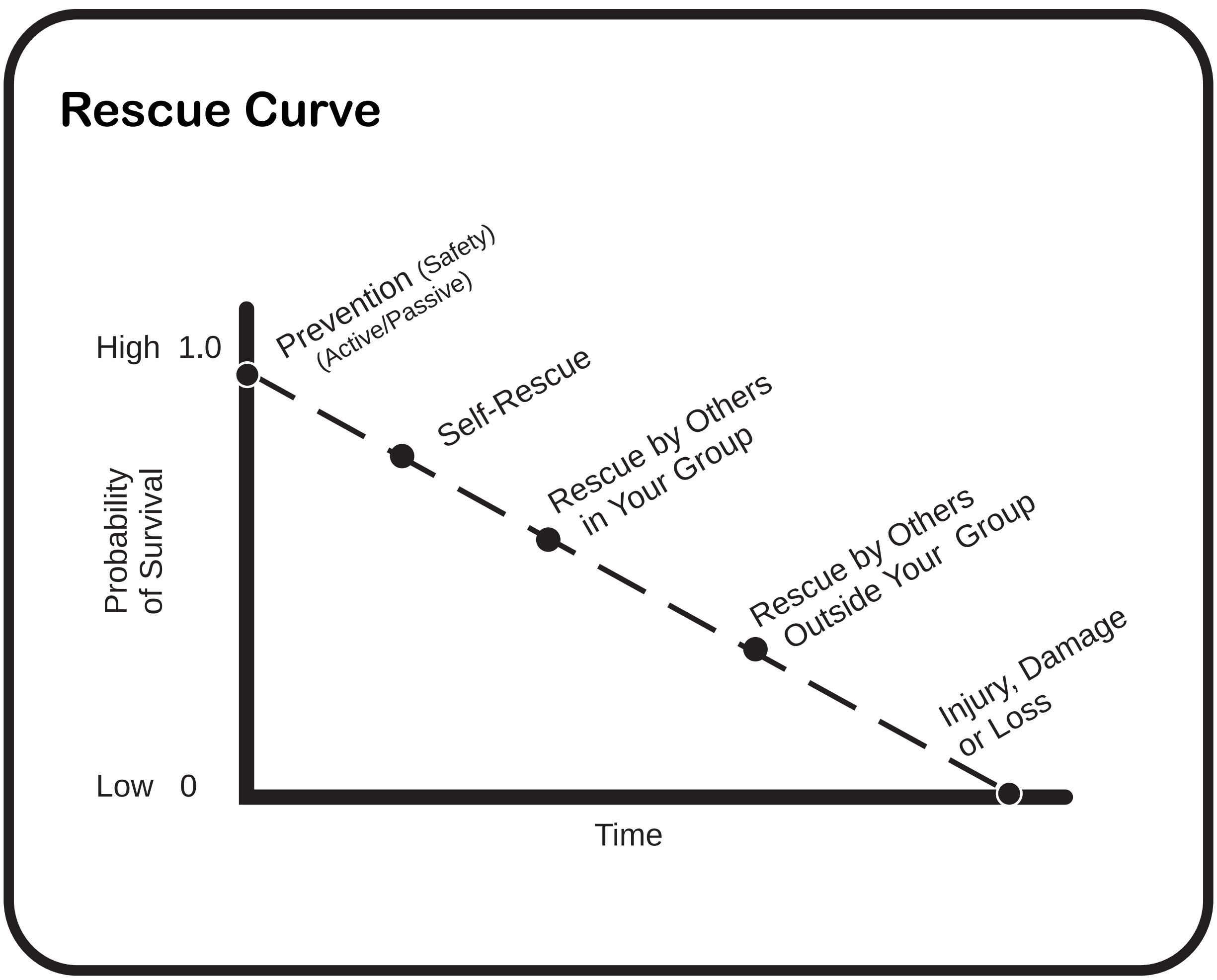
Chapter 5: Safety



Chapter 5.0:

Raft Safety [1]

The ACA materials combine safety with rescue. This chapter breaks out safety and the next chapter focuses on rescue. This chapter focuses on general safety principles that affect rafting but are not rafting specific. These principles include the rescue curve, physiology, hypothermia, hyperthermia, clothing, and signaling. The next chapter focuses on rescue techniques specifically associated with rafting. Group management and feeling comfortable in the water was moved to the trip leadership chapter.

Rescue Curve

The rescue curve describes rescue in terms of who does what when and what will happen if those attempts fail. The rescue curve states that once an incident occurs, "***without intervention, the probability of survival or avoiding injury, damage, or loss increase with time***." The rescue curve has been refined several times since it was first developed by Kauffman and Carlson (1992) (Figure 5.1). Although the model was originally developed in the context of outdoor activities, it has been generalized to non-outdoor activities (Kauffman, 2003).

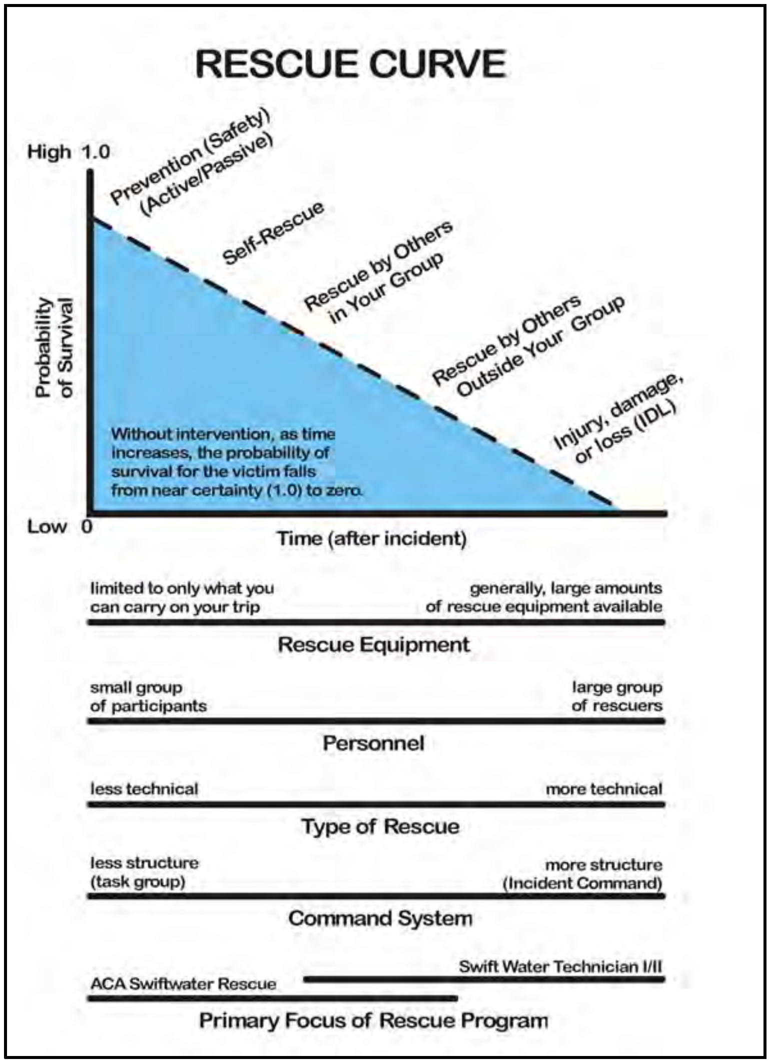


Figure 5.1: The Rescue Curve – The rescue curve suggests that once an incident occurs, without intervention the probability of survival decreases as time increases. The four stages of the rescue curve are prevention and safety, self-rescue, rescue by others in the group, and rescue by others outside the group. The differences in rescue equipment, personnel, type of rescue, and command structure are addressed with the curve. Source: Kauffman and Carlson, 1992, Kauffman 2003.

<b>**Phases of the Rescue Curve** – The rescue curve has five phases (Figure 5.1). These are safety and prevention, self rescue, rescue by other in your group, rescue by others outside your group including rescue squads and injury, damage or loss.

<c>***Safety and Prevention*** – According to the rescue curve, the first line of defense is safety and prevention. These include the active

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and passive measures that the participant should take to avoid a rescue situation or, if a rescue situation occurs, to better help survive the situation**. *Active measures*** are measures a participant takes to help prevent an incident from occurring. Boaters use their knowledge, skills, and abilities to avoid a situation in which a rescue is necessary. Their ability to know routes, avoid hazards, and maneuver the raft to avoid them are examples of active safety measures. ***Passive measures*** are measures that normally do not help prevent the initial incident from occurring but help during the rescue phase. Wearing a life jacket is the classic example. Wearing a wetsuit or drysuit are examples also. They don't prevent the incident from occurring, but help once an incident occurs.

<c>***Self-rescue*** – The first level of defense after an incident occurs is self-rescue, or what the victim can do to rescue himself. A passenger falls out of the raft. They swim to the raft and climb into the raft. Or, they swim to shore where they are picked up by a raft.

<c>***Rescue by Others in Your Group*** – The third line of defense is rescue by others in the victim's group is the next line of defense. The guide throws a line to the victim and hauls them into the raft. The raft pins and the group extricates it.

<c>***Rescue by Others Outside the Victim's Group*** – The next line of defense, rescue by others outside the victim's group, includes the rescue efforts of people passing by or the rescue squad. The company or rescue squad extricates the pinned raft. Another rafting group assists in the rescue of a foot entrapment.

<c>***Injury, Damage, or Loss*** – If no one rescues the victim, additional injury, damage, or loss usually occurs. Even if the climber is not injured by the initial fall, he will experience additional injury or even death without intervention. The paddler who is not rescued may eventually flush through the rapids and naturally wash up on the shore.

<b>**Available Resources and the Rescue Curve** (see Figure 5.1) – The rescue curve is useful in helping to explain the resources available to or influencing the rescuers. The rescue squad is in the business of performing rescues. As a general rule, the rescue squad has lots of personnel and equipment at their disposal to perform a rescue. In addition, they have trained extensively in rescue procedures. In contrast, people participating in the recreational activity are interested in performing the activity. Rescue is what happens when something goes wrong performing the activity. It is not that they are interested in rescue. They are. However, they are more interested in performing the activity. Often they think in terms of how they can adapt the equipment used in performing the activity to a rescue situation, or they will bring along with them simple devices as long as these items don't interfere with the performance of doing their activity. In terms of personnel, they are limited by who is in their group unless, of course, they are doing the activity alone. In that case, they bypass this phase for the next phase. The following example illustrate the differences in resources between participants in the activity interested in rescue, and the rescue squad who is prepared to rescue others. In a paddling group of 5 people, 4 people must conduct the rescue assuming that one person in the group is the victim; this is a small group for a whitewater rescue. In contrast, a rescue squad could have 20 to 30 trained rescuers available to them for a rescue.

Regarding equipment, climbers usually do not bring rescue pulleys and a Stokes litter with them; the rescue squad does. The paddler group might have two carabiners per person and several rescue bags. This makes any rescue involving a lot of carabiners or several hundred feet of rope difficult. In contrast, the rescue squad usually arrives with large amounts of specialized rescue equipment.

<b>**911 Syndrome** (Figure 5.2) – The 911 syndrome focuses on the difference between inexperienced and experienced participants. More experienced, specialized participants tend to begin their rescue efforts with safety and prevention. They focus on their equipment and on developing their skills and rescue techniques. They know that if a potential incident occurs, their first line of defense is self-rescue. If self-rescue does not occur, they can move very quickly through the stages of the rescue curve and run out of options. Experienced participants tend to front-load their activity with safety and prevention because they know their survival depends on it.

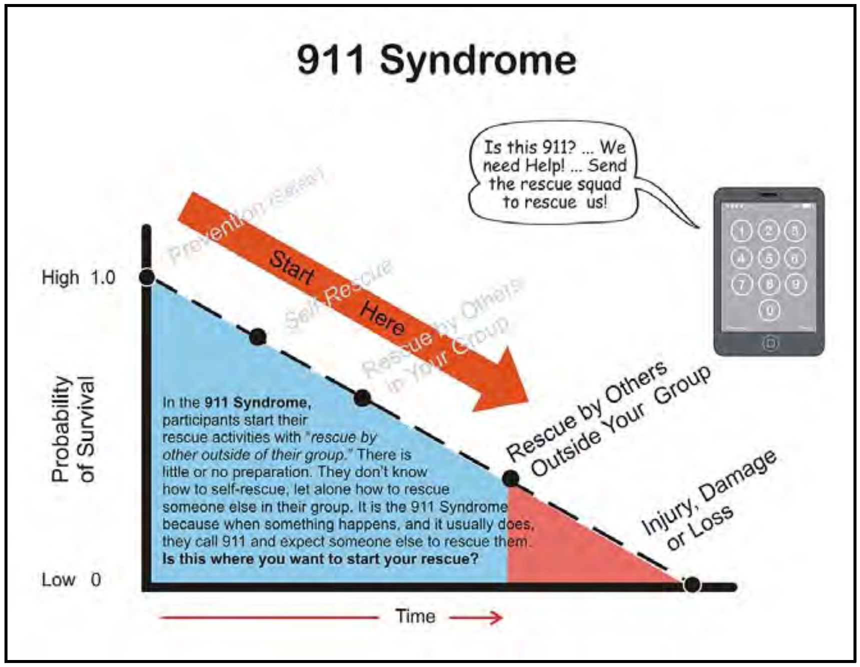

Figure 5.2: 911 Syndrome – In the 911 syndrome, participants begin their rescue efforts by calling the rescue squad (i.e. rescue by others outside your group). Source: Author – [file: \RK-911Syndrome.cdr].

In contrast, inexperienced or “activity for a day” participants usually do not have the necessary skill, knowledge, or training to perform a rescue, and they most likely do not possess or know how to use rescue equipment. They tend to quickly skip over the first three phases of rescue (i.e., safety and prevention, self-rescue, and rescue by others in the group) and immediately go to the fourth phase—rescue by others outside the group. They call 911 and hope that someone comes to rescue them. Usually, they believe that it is the responsibility of someone else to rescue them (Kauffman, 1992; Kauffman et al., 1991), and rely almost completely on the resource manager or the rescue squad for their survival.

Physiology Considerations

Man is a tropical animal. This means that in order to survive in temperate or polar environments (i.e. non-tropical) environments, man needs protection or insulation. Stated another way, the human body is designed to run within a narrow temperature range. Specifically, the body seeks to maintain the heart, lungs and brain (body core) at 98.6^{o}F mean temperature.

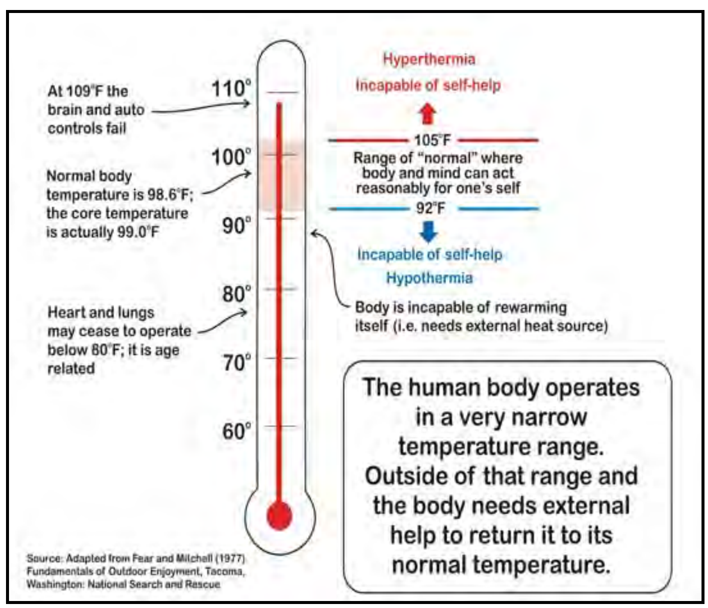

Figure 5.3: Narrow Operating Range – The body has a narrow operating range between roughly 92^{o}F to 105^{o}F. Source: Author – [file: \PH-TempRange.cdr].

Mean temperature means that some people operate at a slightly higher temperature and some people operate at a slightly lower temperature. On average, the operating temperature of the core is 98.6^{o}F (Figure 5.3).

There are three ways the body maintains core temperature and to heat the body: 1) generate heat through muscle contraction (e.g. shivering), 2) use an external source of heat (e.g. sitting in front of a car heater), and 3) insulate which reduces heat loss (e.g. wear a wetsuit). Conversely, there are three ways to cool the body: 1) sweat which cools the body through evaporation, 2) remove an external source of heat, and 3) remove insulation and allow for greater heat loss. Consciously and unconsciously, people use a combination of all three methods to maintain core temperature.

<b>**Methods of Heat Gain/Loss** – There are four ways the body gains or loses heat (Figure 5.4). These are conduction, convection, radiation, and evaporation.

<c>***Conduction*** is the transfer of thermal energy though a solid or between two solids in contact with each other. Touching a radiator in Figure 5.4 transfers the heat in the radiator directly to the fingers touching it. Sitting on a rock at ground temperature (55^{o}F), the person's buttocks will get cold. Actually, the body heat is lost through conduction to the rock or the buttocks is heating the rock.

<c>***Convection*** is the transfer of heat by the circulation of a fluid (e.g. water or air). The purpose of a convection current is to equalize the temperature differential between the hot and cold areas. The greater the differential between the hot and cold areas, the greater the potential for the creation of a convection current and the stronger the current.

In a cold water setting, the differential between 50^{o}F or 60^{o}F water and the human body can set up a strong convection transfer of energy. Insulation is the primary defense. The primary method of insulation is to created dead air spaces that are sufficiently small, that they prevent the creation of convection currents.

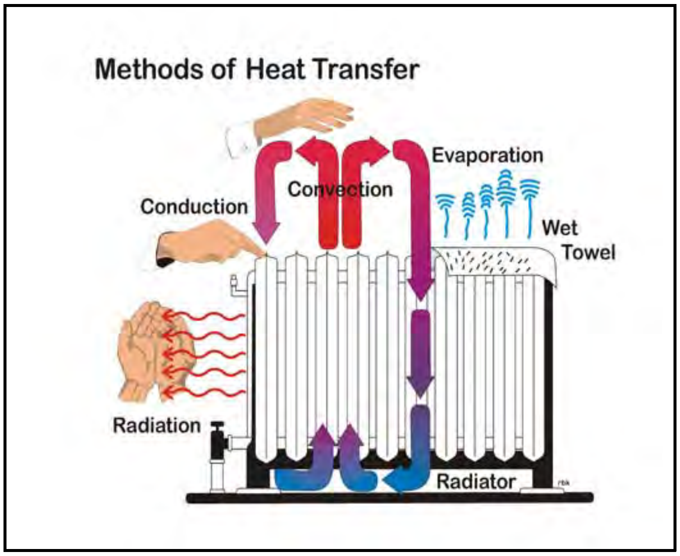

Figure 5.4: How the body gains and loses heat.

Essentially, wetsuits (see Figure 5.10) and drysuits (see Figure 5.9) use different approaches to insulate against convection losses. Both create a micro-climate surrounding the body. Neoprene is a closed cell foam. The cells in the foam are sufficiently small to retard heat loss. The water and sweat trapped next to the skin creates a micro-environment protected by the neoprene wetsuit. In contrast, a drysuit creates a waterproof barrier that enables the garments worn underneath to create the dead air spaces.

<c>***Radiation*** is energy that is transferred through waves radiating from the emitting substance. The radiator in Figure 5.4 is the emitter. The waves cause the molecules in the object being heated to vibrate. The friction from their vibration generates heat in the object being heated. Microwaves cook food using this method. People sitting around a campfire are heated by the heat radiating from the campfire. Dead air spaces or even a vacuum has no effect on stopping or retarding radiating heat. The radiating energy passes through a dead air space or vacuum. The usual method to handle radiation losses is to

reflect them inward with a reflective surface. Addressing radiation losses in cold water environments has not had a major focus.

<c>***Evaporation*** is the conversion of a liquid to a gas. In order to do so, the liquid needs to absorb energy to convert it to a gaseous state. The energy is absorbed from the environment which results in cooling the environment. Evaporation of sweat is the method used by the body to cool itself and keep it within its proper operating temperature. Evaporation plays an important role in how the body cools itself which is discussed in the next section.

<b>**The Sweating Process** – Under normal situations, the sweating process is the primary method the body uses to cool itself. It should be noted that the body can lose heat through other functions including respiration, urination, and defecation. Of these, respiration can often become a significant contributor of heat loss.

The sweating process works as follows (Figure 5.5). Heat is produced by the body. It needs to be dissipated. The warm blood is shunned to the skin for cooling. The skin secretes water through the sweat glands. The water evaporates. In order to evaporate, the water absorbs energy. The energy is absorbed from the skin cooling the skin and cooling the blood in the capillaries. The cooled blood is transported back to the body's core or muscles where it becomes reheated. The process is repeated.

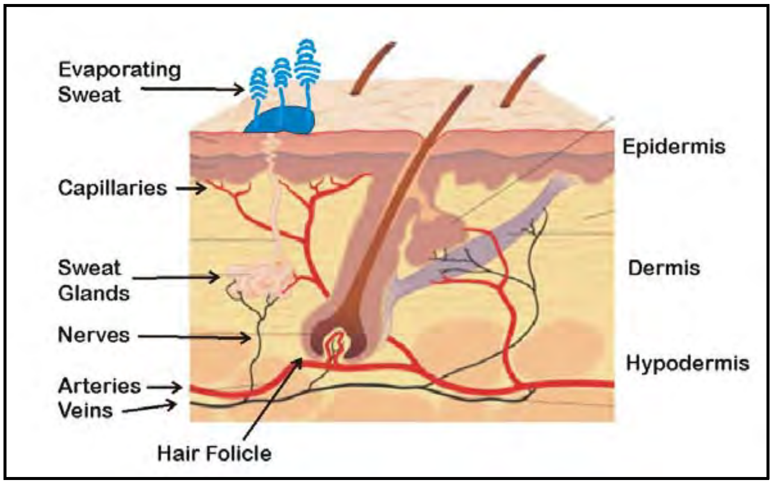

Figure 5.5: The skin sweating.

<b>**Compensatory and Decompensatory** – The thermoregulatory process described so far is a compensative process. *Compensatory* is when the body seeks to compensate and readjust to the stresses placed on the body, in this case the thermal stresses of hot and cold. As noted, it does this by increasing its heat production, by increasing or reducing energy received from outside sources, and/or by adding or subtracting insulation. Technically, the body seeks *homeostatus*. "Homeo" means "like" and "status" mean "state." The process just described is a process by which the body readjusts to changes in temperature and reaches homeostatus.

The body seeks to compensate. When the body is no longer able to compensate and maintain homeostatus, it shuts down. The shutting down process is *decompensatory*. In terms of thermoregulation, heat exhaustion and shivering are compensatory processes. Heat stroke and hypothermia are decompensatory. These processes are described in the sections on *Hypothermia* and *Hyperthermia*.

<b>**Seeking Homeostatus** – Thermoregulation is the body's process of attempting to maintain its operating temperature at a mean temperature of 98.6°F. Normally, it is a compensatory process where the body seeks homeostatus. The body gains and loses heat through conduction, convection, radiation and evaporation. Using these process, the body uses one or all three methods to maintain its optimum operating temperature. It can increase heat production. Exercise and shivering are examples of heat production. It can gain or lose heat due to external sources. Sitting in front of a campfire is a method of

gaining an external source of heat. Or the body can change the amount of insulation surrounding the body. This can be as simple as putting on or removing a hat or sweater as needed.

Hypothermia

Hypothermia results when the core temperature of the body (heart, lungs and brain) drops below 95ºF. "Hypo" means "low" and "thermia" refers to temperature. Hence hypothermia refers to low body temperature. It should not be confused with hyperthermia which is a high temperature or overheating of the body. Physiologically, the body is designed to handle cold stress and it results in a systematic shutdown of the body to maintain the core temperature of the body for as long as possible. If untreated hypothermia can cause death. Hypothermia is a secondary cause of death in that the actual or primary cause of death is usually something else such as heart failure or drowning. The key to preventing hypothermia is to spot it early and take appropriate action. This may seem simpler than it seems, but prevention is key because in the field there are often few options once hypothermia becomes advanced.

<b>**Types of Hypothermia** – Generally, there are two types of hypothermia. The first is *"chronic hypothermia*." Chronic hypothermia occurs over a long period of time. Typically, it is found in backpackers and the elderly. For the backpacker, the onset may occur over a period of a day or more and for the elderly, its onset may occur over several days or even weeks. The critical difference between chronic and immersion hypothermia is that with chronic hypothermia, the body undergoes physiological changes that result in chemical unbalances.

"*Immersion hypothermia*" results from a rapid onset of hypothermia. Perhaps a better title is "rapid onset hypothermia," but since most cases involve cold water immersion, it is referred to immersion hypothermia. Typically, the ship goes down. The passenger jumps into the fridge water. Within several minutes, the passenger becomes hypothermic and if untreated is dead within twenty or thirty minutes. Because of its rapid onset, the chemical balance of the body doesn't become significantly upset.

For boaters and water related activities, often, the participant initially experiences chronic or long-term hypothermia. Usually, its effects such as impaired coordination lead to immersion in the water and immersion hypothermia. Hence, the hypothermia is a combination of both types of hypothermia. It has some of the elements of chronic hypothermia, but it is eventually overshadowed by immersion hypothermia.

<b>**Symptoms** – The symptoms of hypothermia are listed in Figure 5.6. As a practical matter, the best symptom of the beginning stages of hypothermia is shivering. Shivering is the body's reaction to cold stress. Shivering is the involuntary contraction of the muscles. It is like running a marathon without going anywhere. The purpose of shivering is to produce heat and the heat produced is used to heat the body. The problem is that shivering consumes large amounts of energy. It is a temporary fix because if unabated, the body will quickly run out of energy to fuel the shivering process. This is why it is important to recognize the onset of hypothermia quickly and to take action to treat it.

Figure 5.6: Core Temperatures versus Symptoms of Hypothermia [1,2]	
Core Temperature	**Symptom/Comment**
98.6ºF to 96ºF	**Intense shivering at rest –** In terms of the hypothermic progression, the importance of this symptom cannot be over emphasized. Also, it is usually a good sign. The victim is capable of rewarming themself and hypothermia can easily be abated. At rest is added because activity creates surplus heat that can mask shivering.
95ºF to 91ºF	**Violent shivering, slurred speech and slurred thinking** (e.g. The victim claims that "I'm not hypothermic" when the symptoms indicate otherwise.)
90ºF to 86ºF	**Shivering stops or diminishes; with this there is a loss of muscular coordination and thinking.** – If rewarming efforts have not occurred, diminished shivering is not a good sign.
85ºF to 81º F	**Irrational, muscle rigidity, slowed respiration and pulse –** In the field, these symptoms are hard to assess. Usually, the symptoms manifest themself in lack of coordination, stumbling and not being able to perform simple functions like zippering a zipper.
80ºF to 78ºF	**Unconsciousness, failing reflexes, erratic heartbeat –** In the field, the victim becomes lethargic. They want to stop and rest, etc.
Below 78ºF	**Death –** Usually the heart stops, but at this point most internal functions have shut down. It is which cause is selected as the cause of death.

[1] Source: Adapted from Fear and Mitchell (1977). Fundamentals of Outdoor Enjoyment, Tacoma, Washington: National Search and Rescue.
[2] The key to the treatment and prevention of hypothermia is to identify the primary symptom of shivering early and taking action.

Shivering is a good symptom because if the proper steps are taken, the body will rewarm itself. Treatment is three-fold. First, increase the victim's insulation. Remove wet clothes and put on dry clothes. Insulate the head with a cap. Place them in a sleeping bag. Second, replenish the fuel in the human engine. Provide the victim with warm sugary food and liquids. Note that feeding the victim is not recommended in the later stages of hypothermia since the body shuts down the digestive tract in its attempt to conserve energy. Third, provide the victim with external heat. A campfire or car heater are examples of external sources of heat.

"At rest" is added for the following reason. As previously noted, physical activity produces heat that can temporarily mask the onset of shivering. Simply the body doesn't need to shiver because the heat produced as a by-product of activity heats the body. If working with groups, sit everyone down for a brief break and check to see if anyone begins to shiver. If they do, it is time to take action.

Physiologically, the body reacts to cold stress with a systematic shutdown of the body. First, it shuns cold blood to the extremities in an effort to keep the core warm. This can lead to "after shock" which will be discussed later. Coordination is adversely affected. Zippering a zipper may become a difficult task. Second, in its effort to conserve energy and keep the core warm, the body will begin to shut down bodily functions. The body will restrict blood flow to the digestive system and digestion will cease. Consumed food and water may simply sit in the digestive tract. Mentally, cold stress initially affects the higher levels of cognitive thought. The result is poor judgement and impaired rational thought. All of these events can easily lead to accidents and mishaps in and of themselves.

As the victim's core body temperature continues to lower, shivering will diminish and eventually stop. Essentially, the body runs out of fuel to feed the human engine used to create the heat for shivering. The brain is now cold and not functioning properly. High cognitive levels of rational thought are affected the most. Hence, the victim has bad judgement and makes poor decisions which can often result in additional harm. The more primitive autonomic nervous system is still functioning and slower in shutting down. At this point in the hypothermic process, the body is not able to rewarm itself and needs external assistance.

As the hypothermic process continues, the body continues its systematic shutdown. The victim becomes unconscious and eventually death results. Usually death is due to heart failure.

<b>**Treatment in the Field** – Treatment of hypothermia in the field differs from treatment in a clinical setting. In both settings, the patient is rewarmed. The difference is how this rewarming is performed. In a clinical setting, there are techniques available that can warm the core of the body more directly and reduce after-shock.

In the field, the best treatment of hypothermia is early detection. The best symptom is to look for shivering at while at rest. Shivering is the body's first line of defense. In addition, shivering is a good indicator that the body can rewarm itself. There are three strategies to aid in this rewarming. First, is to increase insulation of the body with warm dry clothes. Don't forget the head. Second, stoke the fuel tank to feed the human engine. Sugary foods and fluids are a good source for this energy. Third, provide an external source of heat such as a campfire or car heater.

Rewarm the hypothermic victim until they begin to sweat. Sweating is an indication of the body cooling a slightly overheated body. Small beads of sweat on the forehead are an indication that the victim is no longer hypothermic and that the person has been completely rewarmed. Technically, there are three key indicators of rewarming: return of subcutaneous blood flow, a bump in heart rate and beads of sweat. In the field, the first two indicators are difficult at best to determine. In addition, the rewarming person will often feel a flush feeling of warmth. This is a sign that rewarming is approaching conclusion, but not quite there yet. Continue to rewarm until beads of sweat appear on the forehead.

<b>**After-shock** – "After-shock" results when the body begins to rewarm. As a defense to protect the core, the body shuns cool blood into the extremities. As rewarming occurs, this cold blood is reintroduced and re-circulated back into the core of the body. The result is that the hypothermic victim's core temperature decreases further before it increases. After-shock refers to this effect where rewarming the victim actually results in a lower body temperature. In cases of severe hypothermia, it can result in death. In mild hypothermia, it should not present a problem. Again, in the field, it doesn't change the treatment which is to rewarm the victim.

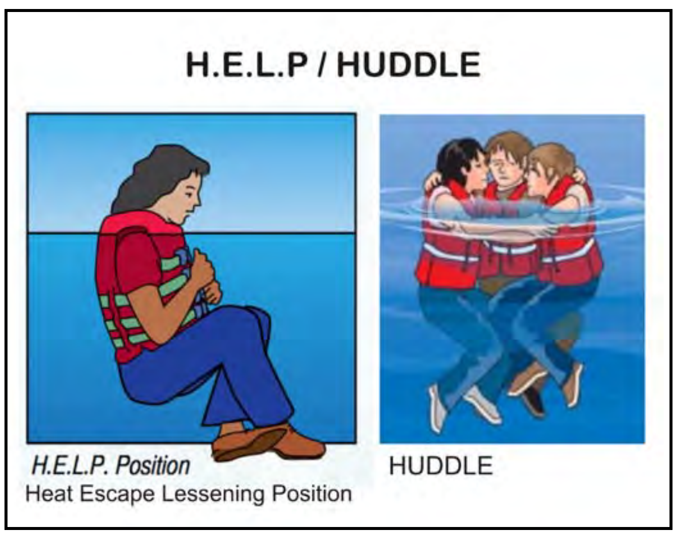

Figure 5.7: H.E.L.P and Huddle. Source USCG [file: \HELP_HUDDLE.jpg]

The more hypothermic the victim the greater the risks from after-shock and the more likely that death can result. In the field, there is little that can be done to prevent after-shock. This underlines the need for early detection and treatment of hypothermia. After-shock is also the reason for the differences in treatment in a clinical setting and in the field. Rewarming techniques in a clinical setting are specifically designed to reduce after-shock.

<b>**Alcohol and Hypothermia** – Alcohol dilates the capillaries. In the early stages of hypothermia, it increases blood flow to the extremities and accelerates the onset of hypothermia. Conversely, alcohol should not be given as part of the treatment. Again, it dilates the vessels which can enhance after-shock. In addition, it has no nutritional value.

<b>**Gag Reflex** – Quick immersion into cold water can cause a "gag reflex" which is an involuntary shutting down of the larynx and breathing. If the person is temporarily underwater, it can cause a dry drowning. A drysuit, wetsuit, paddling jacket with polypro garments and other thermal protection in the back area is the best protection against the gag reflex.

<b>**H.E.L.P/Huddle** (Figure 5.7) – For rafters, most rescue situations will involve pickup by a raft or swimming to shore. H.E.L.P and Huddle are open water techniques designed to reduce heat loss. H.E.L.P stand for Heat Escape Lessening Position. Essentially, the person balls up to reduce heat loss. Since the water transfers heat up to 25 times faster than air, the life jacket helps to conserve heat by keeping the head out of the water. As its name suggests, people huddle together in the water to reduce heat loss with Huddle. Again, these are open water techniques more so than swiftwater techniques.

Hyperthermia

Hyperthermia results when the core temperature of the body (heart, lungs and brain) elevates above 99.5ºF. "Hyper" means "elevated" and "thermia" refers to temperature. Hence hyperthermia refers to an elevated body temperature. It should not be confused with hypothermia which is a low temperature of the body. Physiologically, the body is designed to handle heat stress and it results in a systematic shutdown of the body to maintain the core temperature of the body for as long as possible. If untreated hyperthermia can cause death. Hyperthermia is divided into two phases: heat exhaustion and heat stroke. Heat stroke is life threatening and people who have survived heat stroke, often have permanent thermoregulatory damage.

<b>**Heat Exhaustion** (Figure 7.8)– Heat exhaustion is "compensative" meaning that the body attempts to compensate for the stress and return the body to normal operating temperature. Generally, heat exhaustion results when the body is above 99.5ºF and below 105.1ºF. Heat Exhaustion is caused by the body overheating. Usually, it is sun related.

Heat exhaustion and dehydration are closely related. They have similar symptoms: Prolonged and profuse sweating, muscle cramps, clammy skin, nausea and disorientation. The difference is that with heat exhaustion, the body is no longer able to control its temperature. Water losses are significant. The body in a "hot environment" can easily lose 3.5 quarts of water a day, mostly through sweating. Add exercise and water losses can easily exceed a gallon of water a day. In its attempt to cool the body, it is easy to see how the body can easily become dehydrated.

Figure 7.8: Core Temperatures versus Symptoms of Hyperthermia (i.e. Heat Exhaustion and Heat Stroke) [1]

Core Temperature	Symptom/Comment
105.1ºF	**Heat Stroke:** (Note: Heat stroke is life threatening) 1) Sweating stops 2) Victim’s skin turns pink or red
99.5ºF to 105.1ºF	**Heat Exhaustion:** (Note: similar symptoms to dehydration) 1) Prolonged and profuse sweating 2) Muscle cramps 3) Clammy skin 4) Nausea 5) Disorientation

Source: Fear, G., and Mitchell, J., (1977). Fundamentals of Outdoor Enjoyment, Tacoma, Washington: National Search and Rescue.

Treatment for heat exhaustion is two-fold. First, remove the victim from the source of the overheating. Usually, this is the sun. This means moving the victim to the shade. Second, replenish water and electrolytes. As noted, water losses can be significant and need to be replenished.

A fever and heat exhaustion have overlapping temperature ranges. Heat exhaustion is caused by environmental factors, external to the body. Other than for the heat stress, the body is operating normally. In contrast, a fever is purposely caused by the body to kill pathogens. Normally, a fever is the result of an illness.

<b>**Heat Stroke** – Heat stroke usually occurs when the temperature of the body rises above 105.1ºF. Heat stroke is “decompensatory” where the body can no longer compensate and literally shuts down. In simple terms, it is crashing and crashing quickly. Heat stroke is life threatening and death can easily result. People who have experienced heat stroke and recovered often have permanent thermoregulatory damage.

The differences in symptoms between heat stroke and heat exhaustion are readily evident (Figure 7.8). With heat exhaustion, the victim is sweating profusely. Their skin is clammy. With heat stroke, sweating stops. The sweating mechanism has stopped. The victim’s skin turns pink or red. This is due to the body shunning the hot blood to the extremities in an attempt to keep the core temperature cooler. Physiologically, it is a process similar to hypothermia. The victim is in a life threatening situation. They must be cooled down immediately with water, ice or whatever is available. Move them to shade and out of the sun. Since long-term damage can occur, seek medical assistance.

Clothing

As noted in the physiological section, one of the methods of regulating body temperature is by adding or subtracting insulation. Clothing provides this insulation. For boaters there is specialized clothing with wetsuits and drysuits. In addition, there is an issue whether to dress for the water or air temperature. Enter the 120 Degree Rule.

<b>**<u>120 Degree Rule</u>** – There is an issue whether to dress for the air or water temperature. As the spread between the two increases, the choice becomes more difficult. If the air and water temperature are the same, dressing for one is essentially dressing for the other. However, if the water temperature is 55^{o}F and the air temperature is 80^{o}F, the choice becomes more difficult. Does the boater dress for the air temperature and assume that he/she won't get wet? Or, does the boater dress for the water and sweat profusely in the 80^{o}F temperature? Consider a third element or the probability of getting into the water. For kayakers, the Eskimo roll and getting wet, is just another stroke and a way to cool off. In contrast, most rafters, don't expect to get wet and dressing for the air temperature is not uncommon. Or, one strategy is to dress *toward* the air temperature.

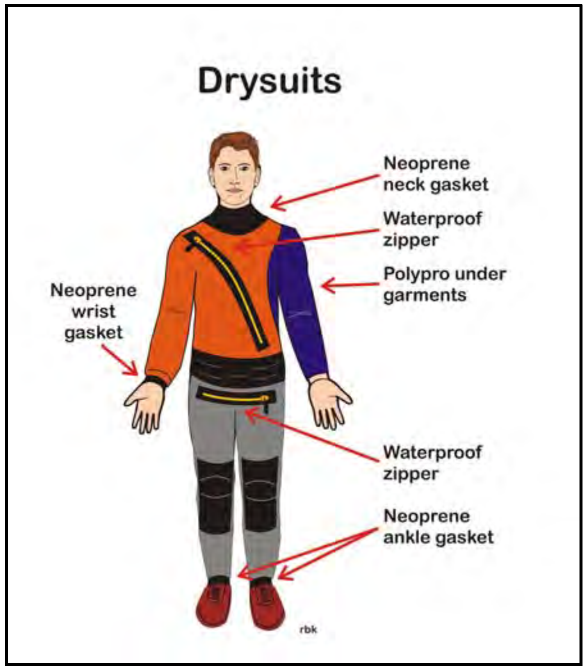

Figure 5.9: Drysuits –With neoprene gaskets around the wrists, ankles, and neck, drysuits allow wearing normal clothes in the water. Source: author – [file:\SH-Drysuit.cdr]

Within the context of the previous discussion, the 120 degree rule states that if the sum of water and air temperature is 120^{o}F, use a wetsuit, drysuit or similar form of protection. As noted this is not an absolute, but is subject to the probability of getting wet. As a historical footnote, the 120 degree rule originated as the 100 degree rule. The 120 degree rule is a little more conservative and has superceded the 100 degree rule although the 100 degree rule is still noted in the literature.

<b>**<u>Drysuits</u>** (Figure 5.9) – The use of drysuits and wetsuits are two common methods of protecting the body from cold water losses. The drysuit is a waterproof suit that is sealed at the wrists, ankles and neck with neoprene gaskets. With the water tight seals, the boater can wear normal clothing and remain perfectly dry in the water. Normally, people will wear polypro garments underneath. Conceptually, the drysuit is equivalent to putting on a windbreaker over a sweater except that it is also water tight.

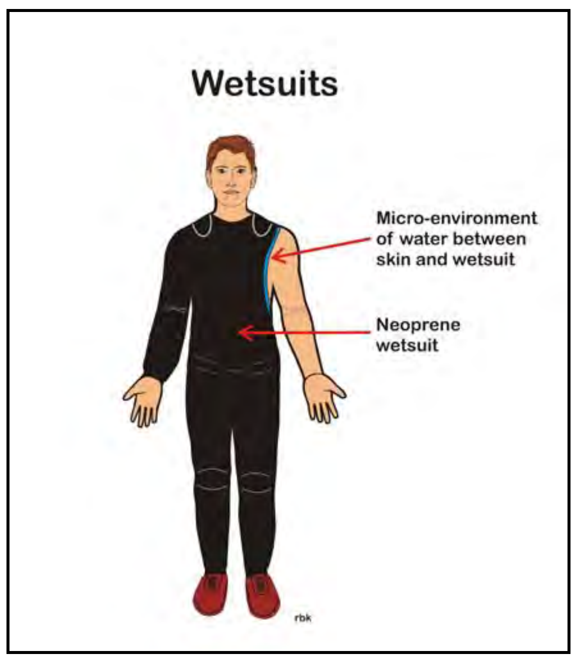

Figure 5.10: Wetsuits – Constructed from closed cell neoprene, wetsuits provide insulation for the body. Source: author – [file:\SH-Wetsuit.cdr]

<b>**<u>Wetsuits</u>** (Figure 5.10) – A wetsuit surrounds the body with insulating foam. Neoprene is a closed cell foam. This means that each tiny air cell is self-contained and not connected to adjacent cells. This prevents water infiltration into the foam which would reduce its insulating ability. The water and sweat form the micro-climate in contact with the skin.

An important sidebar with wearing a wetsuit is the following. Wearing a wetsuit out of the water and in the sun can lead to excessive dehydration. The body is heated by the sun. The body's temperature rises. The body sweats and expects the sweat to evaporate and cool the body. The wetsuit prevents evaporation resulting in the body's temperature rising. In response the body sweats more, but again the wetsuit prevents evaporation and cooling of the body. The result is that the body can overheat and the loss of water can lead to dehydration. The corollary is that when out of the water, open up the wetsuit to allow the natural cooling process of the body to occur. Or, be sensitive to becoming overheated.

It is worth noting that wearing wetsuits and even drysuits can easily lead to dehydration. For this reason, it is important to increase water intake.

<b>**Paddling Jacket** (Figure 5.11) – This strategy uses a paddling jacket and pants as a windbreaker and the layering of polypro undergarments in proportion to the air and water temperature. Essentially, it acts like the drysuit except that it isn't waterproof when immersion occurs. In the water, the garments will become saturated with water. However, because of the tightly fitting seals at the wrists, neck and waist and the windbreak effect, this approach maintains considerable warmth even when wet. This approach works well in shedding splashes from waves.

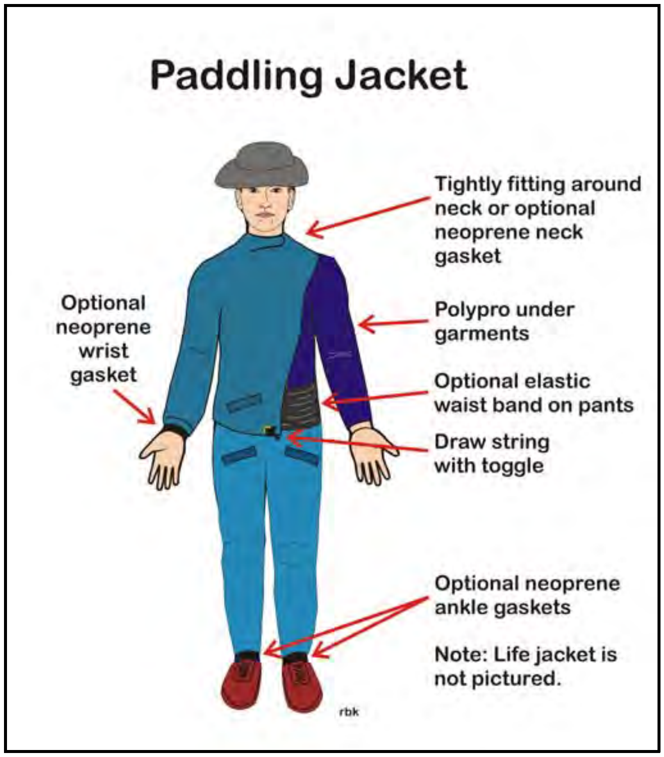

Figure 5.11: Paddle Jacket – Although it is not water tight, the paddling jacket offers many of the same benefits of a drysuit as long as the paddler doesn't become immersed. Source: author – [file:\SH-PaddlingJacket.cdr]

In Figure 5.11, the neoprene gaskets are optional. They are particularly useful if considerable wading is occurring. Also, they help maintain an air tight seal and reduce energy loss. In situations where the boater is not in the water, they are of less importance and velcro straps work equally as well.

Usually, this author wears a tightly fitting paddling jacket for its comfort, water shedding ability and flexibility of movement. It assumes a low probability of flipping the raft and being in the water. In addition, it is used in boating situations when there are less extreme conditions in terms of water and air temperature (see 120 degree rule). As always, the raft can flip too.

Signaling

Communications on the river is important. Usually, signaling involves the use of paddles, whistles, or hands. Signaling utilizes the recommendation of the American Whitewater Safety Code (Safety Code of American Whitewater, 2005). The code notes that a group can substitute signals that are agreed upon by the group.

<b>**<u>Universal River Signals</u>** (Figure 5.12) – The Universal River Signals utilize paddle, hand and whistles. The paddle signals are fairly straightforward. Obviously, in oar rigs, hand and arm signals can be used.

<c>***Stop*** – Holding the paddle horizontally above the head means **stop**. The same message can be conveyed by extending the arms horizontally. Usually, the arms are waived up and down. The code does not provide a whistle code for stop.

<c>***Help/Emergency*** – Extending the paddle vertical and rotating it in a circular pattern indicates **help/emergency**. The same message is sent with an arm extended vertically and rotated, or with three blasts on a whistle.

<c>***All Clear - Come Ahead*** – Hold the paddle vertical above the head. Be sure not to rotate the paddle because this is an indication of help or emergency. Unless the paddle lowers the paddle to an angle to indicate direction of travel, the signal means to come ahead in the main channel or center. The code does non provide a whistle code for all clear. The group may agree that a single blast is an indication of all clear.

Figure 7.12: Paddle Signals – Developed by the AWA, the Universal River Signals using a paddle. Source: author – [file:\SA-Signals.cdr]

<c>***Go This Way*** – Lower the paddle to an angle of 45 degrees to indicate the direction of travel. Point the paddle in the direction of desired travel. Do not point at the object to be avoided. The boater can point direction of travel with their arm also. Again, there is not whistle code for direction of travel.

<c>***Hand Tapping on the Helmet*** (Not shown) – Derived from the diving community the hand tapping on the top of the helmet is a sign that you are okay. It works as follows. The rescuer looks directly at the potential victim and taps the top of his helmet three or four times. The rescuer is asking the question "*Are you okay*." If the victim is okay, he/she responds in kind by tapping the top of their helmet. The response indicates that "*I am okay*." No response indicates that they are not okay and need assistance.

Figure 7.13: Whistles –A pealess whistle, the Foxfire 40 whistle or similar whistles provide a good communication device for boaters. They are over 90 decibels. Source: author – [file:\SA-Whistles.cdr]

<b>**<u>Whistles</u>** (Figure 7.13) – Pealess whistles are a standard safety item. Pictured, the Foxfire 40 ® is one of several pealess whistles available. Whistles with peas should be avoided since getting the pea wet can impair its use. Caution should be used when using the Forfire 40 ® or similar whistles since they can easily generate over 90 decibels which is sufficient to cause harm to a bystander's hearing. Avoid attaching the whistle to the zipper on the life jacket since the water action against the zipper can unzip the zipper. If a string is used to fasten the whistle to the life jacket, keep the string short to avoid possible entanglement.

Summary

This chapter focuses on general safety principles rather than specific rescue techniques. Raft related rescue techniques are included in the next chapter. This chapter introduces the rescue curve. Well prepared boaters begin with safety and prevention measures and self-rescue. Then it focuses on the physiological aspects of river running with an emphasis on hypothermia and to a lesser extent hyperthermia. Since man is a tropical animal, boaters need protection in a cold water environment. This leads into a discussion of clothing including wetsuits and drysuits. Last, the chapter presents the American Whitewater Universal River Signals. It is important that everyone on the trip understand the signals and use them to communicate.

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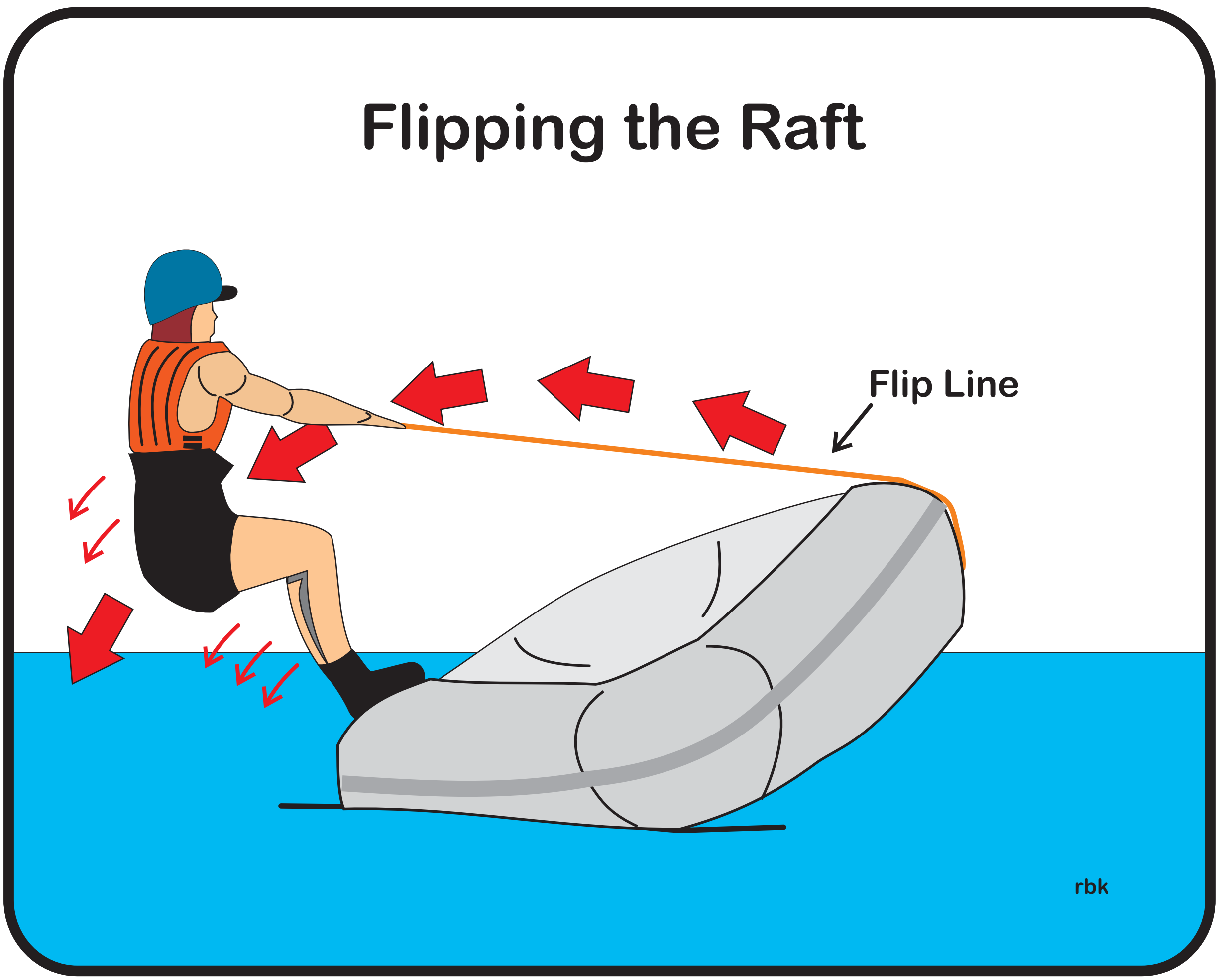
Chapter 6:
Rescue Techniques



Chapter 6.0:
Rescue Techniques [1]

This chapter focuses on raft rescue techniques. Where the previous chapter focused more on general safety, this chapter focuses on raft rescue techniques for rafters. The general flow of the chapter begins with search and rescue techniques. Although the location of the victim is usually known in river rescues, there are occasions where the victim's location is not known. A primer on search technique is provided. Next, throw bags are covered. This is followed by rescue techniques involving mobility in the water with swimming and wading techniques. Then the chapter moves into rescue techniques. Initially, it focuses on traditional entrapment cases. Then it moves to self rescue and reentry techniques. The chapter finishes with raft rescue techniques including bumping, unpinning rafts, and using rafts as a rescue platform.

Search Techniques for Rafters

In most cases, the location of the victim is known and a search for the victim is not necessary. However occasionally, the victim needs to be found. The following section is a primer applying search and rescue techniques to a rafting situation. The case study used in this section is based on an incident on the Arkansas River where the raft guides lost sight of one of the passengers. Also, the materials in this section were adapted from Kauffman (2017), *Swiftwater Rescue Manual*.

This discussion is delimited in its focus to groups already on the river such as private boaters and commercial rafters and not to rescue squads who usually arrive later. In terms of the rescue curve, its focus is "*rescue by others in your group*." It does not include extended searches by rescue squads. The section draws upon three sources: (Kauffman and Moiseichik, 2013, Ch.10; Setnicka, T., 1980; Stoffel, R., 2001). To a certain extent, the materials used are adapted from land base techniques.

<b>**Search and Rescue Phases** (Figure xx01) – In a normal search and rescue operation there are five phases. They are the search, rescue, first aid (medical), evacuation and management Kauffman and Moiseichik, 2013, Ch.10). Except for the management phase, the phases are generally sequential. This means that before performing the rescue phase, the victim needs to be found. Before performing first aid, the victim needs to be removed from the MOI (Mechanism of Injury). This reduces the likelihood of a second victim. And, before evacuation, the victim needs to be stabilized and prepared for transportation (i.e. first aid).

<c>***Search Phase*** – The search phase is the first phase. The purpose of the search phase is to locate the victim. Usually, but not always, the search phase is fairly easy because the victim is easily located. However, this is not always the case and it is important to prepare for situations where a search needs to be conducted. The search phase will be addressed in greater depth regarding swiftwater rescue in the next section.

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[1] This chapter was written by Robert B. Kauffman who is solely responsible for its content. This section is copyrighted © Robert B. Kauffman, 2017.

<c>***Rescue Phase*** – The purpose of the rescue phase is to remove the person from the source of harm or MOI (i.e. Mechanism of Injury). This is the primary focus of most swiftwater rescue skill instruction. It is the focus of this book and subsequent chapters.

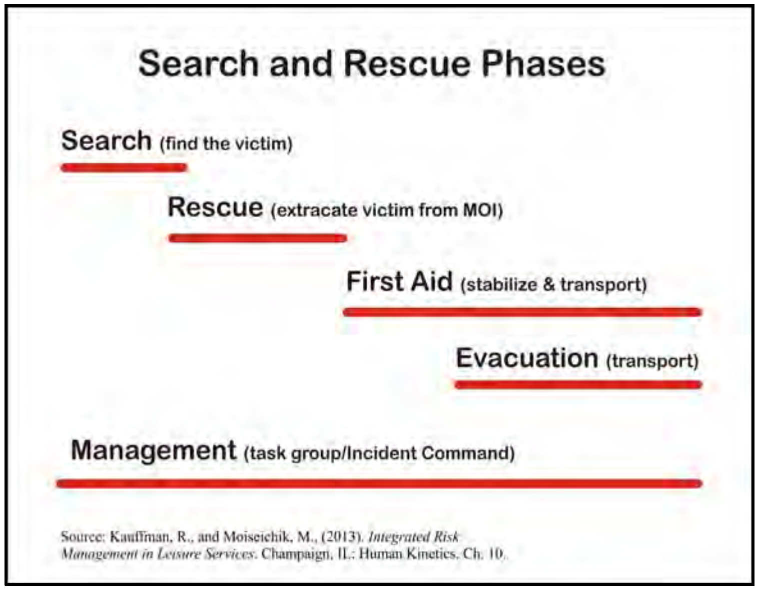

Figure 6.1: Search and Rescue Phases – Caption: In general, the four phases are sequential. Before extrication, the victim must be found (search). Before rendering first aid, the victim needs to be extricated (rescue), Before evacuation, the victim need to be stabilized and prepared to transport (First Aid). Source: Author – [file:\PHIL-S&RPhases.cdr]

<c>***First Aid (Medical) Phase*** – The purpose of the first aid or medical phase is to stabilize the victim and prepare them for evacuation or transport. Conceptually, this phase follows the rescue phase. First aid skills are generally covered in Wilderness First Responder and similar courses. First aid techniques are not included here.

<c>***Evacuation Phase*** – The purpose of the evacuation phase is to transport the victim to a location where they can be transported to the hospital or appropriate facility. Usually, this phase receives passing consideration or everyone assumes the helicopter will simply lift the victim out of the incident site. Unfortunately, not every site is accessible by helicopter nor is a helicopter always available. Anyone who has done a mock evacuation carrying a loaded stokes litter understands the difficulty and energy consumption of the evacuation process. Although more consideration should be given to evacuation, it too receives limited discussion in this section.

<c>***Management Phase*** – The purpose of the management phase is to provide the administrative support to a search and rescue operation. In most search and rescue operations associated with private boaters and commercial rafters, the management structure tends toward a task group in contrast to the incident command structure associated with larger and more formal SAR efforts.

The incident command structure was outgrowth of efforts to fight wildfires in the 1970s. It divides the administrative structure into operations, planning, logistics, and finance and administration. The incident command structure is mentioned because it is usually associated with rescue squads and larger groups. In contrast, swiftwater rescue situations associated with private boaters and commercial rafters tend to involve a smaller group of rescuers, and they are not extended multi-day efforts. For this reason, they tend to use a task group structure where one of the rescuers takes on the leadership role.

<b>**<u>Search Phases for Rafters</u>** – As noted in the beginning of this section, there may be times when it is necessary to search for the victim. For this reason, it is appropriate to integrate some of the search principles into swiftwater rescue training. In a river situation, the objective is to locate the victim as quickly as possible. Usually, time is of the essence. Pre-incident activities are important because the first step is to recognize that someone is missing. This is not always as easy as it may sound. Next, determine the Point Last Seen (PLS) for the victim. This along with the river current and hazards determines the search areas and where the hasty search is conducted.

<c>***Pre-Incident*** – Pre-incident behavior and procedures followed by the group is important. This is the first line of defense because when an incident occurs, everything seems to unravel. This is the nature of incidents. There are two important objectives of any group on the river. First, boaters need to keep track of the people in their boat and when possible other boats also. Know the count. Be sure to keep track of the other boats on the trip. Follow normal river running procedures and protocols. Second, when one or more people fall into the water, it is important to keep track of the swimmers. Doing so minimizes the need for a search. Key to the process is that once an incident occurs, people can easily become dispersed and it is important to account for everyone so that a search can begin if someone is missing.

<c>***Point Last Seen (PLS)*** – The Point Last Seen (PLS) is the location where a witness last saw the victim. Determining the PLS is important because it helps determine the search area. It is one of the first tasks of the rescuers to determine. Be sure to ask other people on the trip including passengers on commercial trips. In Figure 6.2, the PLS was identified at the bend of the river. Area (a) is the logical area to begin the search.

<c>***Last Known Position (LKP)*** – Some of the safety literature mentions the Last Known Position (LKP) also. This is the last place where the victim was known to be based on physical evidence. In a swiftwater rescue situation, it determines the upper limit of the search area. In Figure 6.2, the LKP is where the victim falls out of the raft in the large breaking wave. As a practical matter, the LKP and PLS are often the same location. It is mentioned, but as a matter of practicality, most rescuers will refer to and use the PLS.

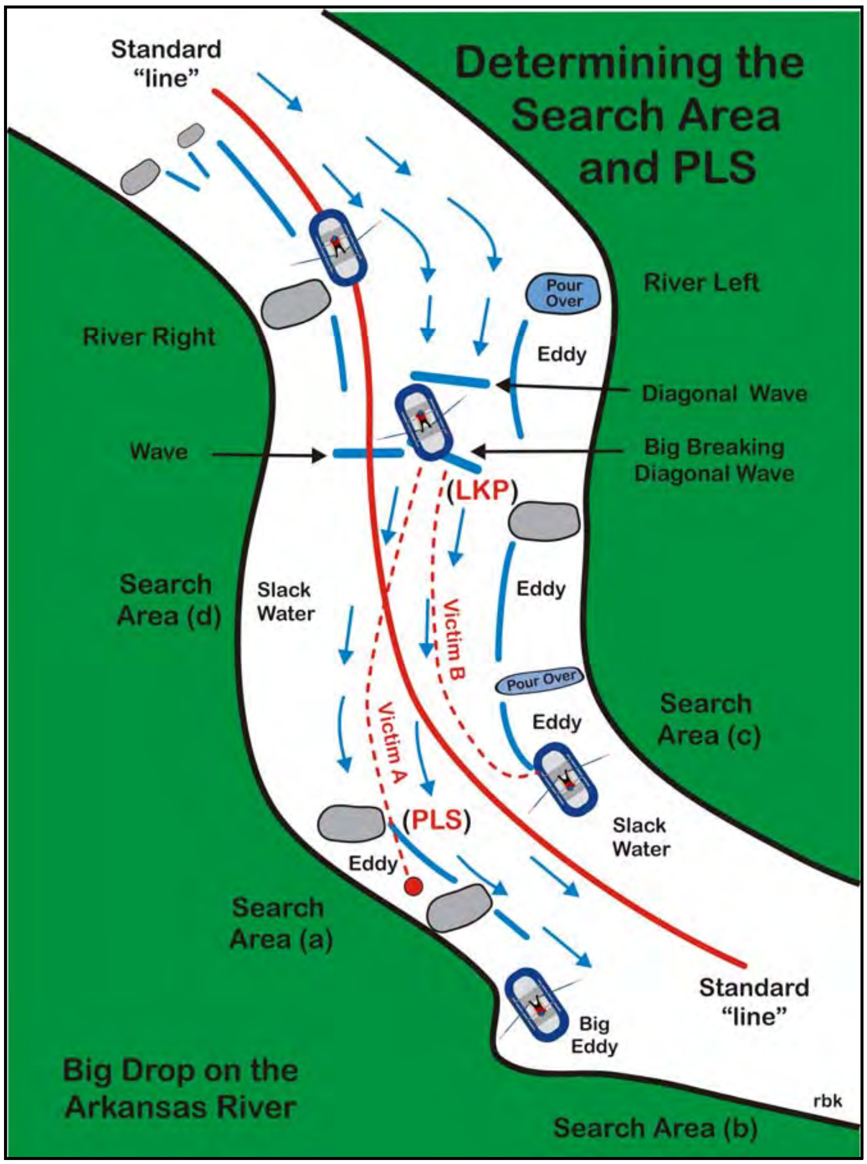

Figure 6.2: Determining the Search Area and PLS – Big Drop on the Arkansas River, Colorado. Source: Author – [file:\PHIL-PLS.cdr]

<c>***Determining the Search Area*** – Once the PLS is determined, determine the search area and prepare to conduct a search. A hasty search may already be initiated. In river situations, consider the following in determining the search area. It is unlikely that the victim will be found upstream of the PLS. It is likely that the victim's location will be affected by river dynamics and currents. It is more likely

that the victim will be found on the outside of a bend in the river where the current is stronger than on the inside of the bend where it is shallower and the current is less strong. Known hazards such as strainers and undercut rocks are likely collectors of victims and are a likely place to search.

Using Figure 6.2 as an example, a raft dumps two passengers in a large breaking wave at the top of the rapids (LKP). The one passenger drifts downstream toward river left and is picked up by another raft on the inside of the bend at the bottom of the rapids. The other passenger drifts downstream with the current. The PLS was determined by one of the passengers in another raft who thought he saw the victim above the tight bend in the river. The importance of determining the PLS is that it focuses the search on the most likely place to begin the search.

Based on the PLS, the first area to be searched is area (a). Based on the river currents and known hazards present, a hasty search discussed in the next section can be conducted immediately. A second area in which to conduct a search is area (b). This assumes the victim was swept through the rapids and further downstream. Also, remember that the victim would float past the raft situated in the eddy on river right without being noticed. After a search of area (a) and (b), area [c] and (d) may also be included. Area [c] is on the inside of the bend where it is shallower and where the current tends to be moving toward river right than river left. Area (d) is above the PLS site and less likely to have the victim. It depends on the strength of the those who determined the PLS. If it is weak, this area may be included earlier in the search.

<c>***Hasty Search*** – As the name implies, the purpose of a hasty search is to perform a quick search in the most likely area where the victim is most likely to be found. Its emphasis is on speed. If personnel are available, it may be conducted simultaneously with determining the PLS. Searchers should use the buddy system where the buddies are in close visual contact with each other. In a swiftwater rescue situation, the hasty search is influenced by river dynamics, known hazards and if readily determined, by the PLS.

Returning to Figure 6.2, the main current plows into the river bend at the bottom of the rapids before exiting river left. Also, there is a known hazard of undercut rocks on the bend. A drifting passenger is very likely to become entangled in the undercut rocks on the bend. Even without identifying the PLS, area (a) would be a logical location to search for the victim since the river current would normally sweep a person into the eddies and undercut rocks located on the bend of the river. If the water is deep, paddles or sticks could be used to locate an underwater victim.

<c>***Take Care of Non-searchers*** – If there are passengers on a commercial trip or people in a private boating group who are not involved in the search, make sure they are in a safe and secure area. If needed, have someone supervise them. You don't want a second victim.

<b>**Search Techniques Summary** – This section addresses a niche in swiftwater rescue. Often, but not always the victim is readily found and the rescue can begin. However, there are instances where the victim needs to be found first before the rescue can be performed. This section adapts basic search techniques and protocols to swiftwater rescue situations.

Safety and Prevention – Throw Bags

Safety and prevention is interwoven throughout the manual. Wearing wetsuits, drysuits and paddling jackets covered in the previous chapter on safety is an example of safety and prevention. The same can be said of most of the equipment in Chapter 2. This section includes a discussion of throw bags.

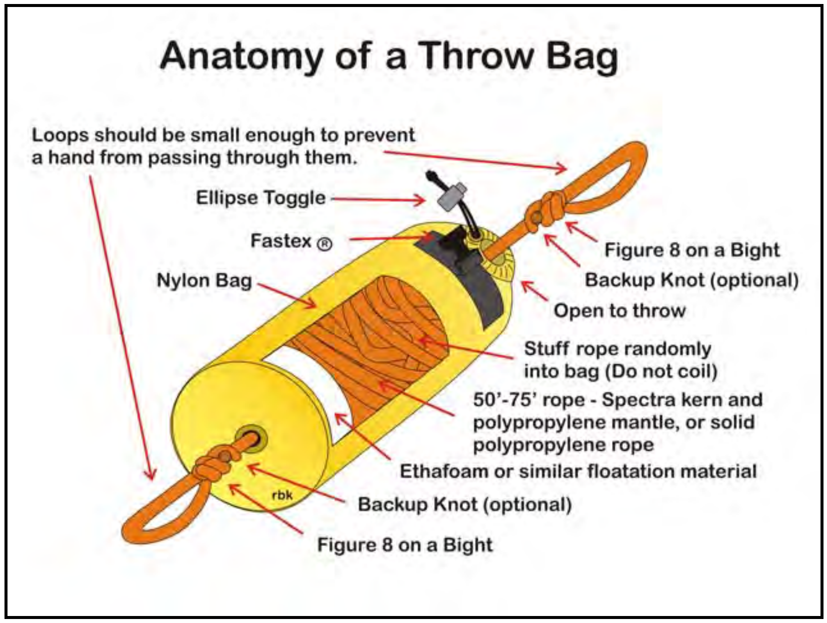

Figure 6.3: Anatomy of a Throw Bag – Caption: Throw bags come in may sizes and shapes. The bag diagramed is a typical bag used by the author. Remember to choose a bag that you will carry with you. Source: Author – [file: \BAG-AnatomyThrowbag.cdr]

Throw bags come in many sizes and shapes. One of the main determinants for selecting a throw bag is to ask yourself the following question. "***Will you take it with you at all times?***" If you don't have it with you, you can't use it. The bag may be one like the author's pictured in Figure 6.3, a hip belt, or a small hand bag. Regardless, the first and most important rule is that the throw bag is of no use if it isn't with you.

<b>**<u>Anatomy of a Throw Bag</u>** (Figure 6.3) – The design of a throw bag is relatively straightforward. The rope is stored in the bag. One end is knotted and passes out the bottom end of the bag into a loop. The other end of the rope passes out the opening in the top of the bag. When the bag is thrown, the rope in the bag feeds out through the opening in the bag. The following sections discuss the items identified in Figure 6.3.

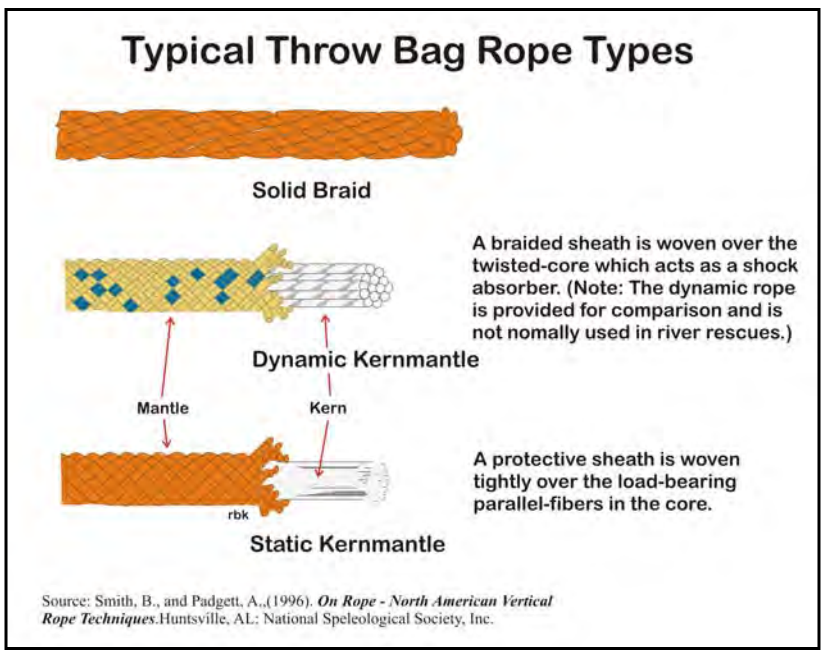

Figure 6.4: Typical Throw Bag Rope Types – Caption: There are many different types of rope construction. Typically, throw bags use either a braided or static kernmantle rope. Source: Author – [file: \BAG-RopeTypes.cdr]

<b>**<u>Types of Ropes</u>** (Figure 6.4) – Generally, two types of ropes are used in swiftwater rescues. These are braided and static kernmantle ropes. Static kernmantle is preferred.

Generally, in river situations, a kernmantle static rope constructed using Spectra rope is preferred over a braided throw rope. Spectra floats and is as strong as steel. Unlike nylon, it has little stretch even when wet. A less expensive rope that floats uses polypropylene. Polypropylene has less tensile strength. Also, it is often used as the mantle layer surrounding the Spectra kern.

<b>**Stuffing a Throw Bag** (Figure 6.5) – There are many different ways to re-stuff throw bags. The method presented in Figure 6.5 was used by an employee whose job it was to stuff throw bags for sale. It was the method he used to stuff hundreds of bag for sale. The key to stuffing the throw bag is to randomly stuff the rope into the bag. DO NOT COIL THE ROPE, it will only become entangled. There have been numerous tests performed and randomly stuffing the rope into the bag results in the least chance or the rope becoming entangled when the bag is thrown. As a footnote, may graphic artists incorrectly draw a neatly coiled rope in the throw bag. This is incorrect.

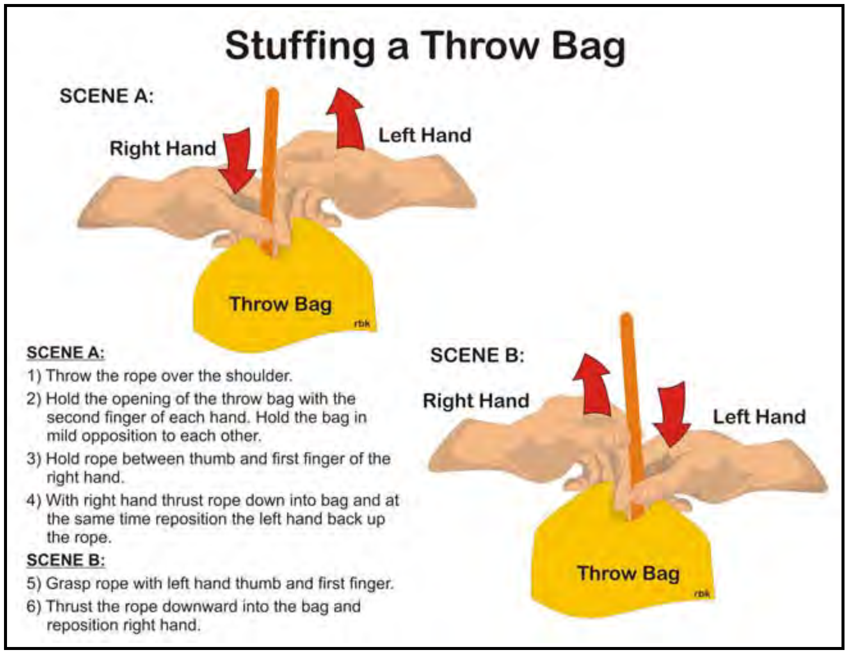

Figure 6.5: Stuffing a Throw Bag – Caption: There are many ways to stuff a throw bag. This method was used by an employee who stuffed hundreds of throw bags for sale. Source: Author – [file: \BAG-StuffingThrowbag.cdr]

The recommended method of re-stuffing a throw bag is as follows. Open the end of the throw bag. Hold the bag open using the middle finger of each hand. The fourth and fifth fingers may be used also but most people will find using the middle fingers most comfortable. This frees up the first finger and thumb to grasp and stuff the rope. Place the rope over the shoulder. The life jacket prevents the rope from slipping off the shoulder. With the thumb and first finger, grasp the rope and thrust it downward into the bag. At the same time, the other hand repositions itself up the rope. In a hand-over-hand motion, stuff the rope into the bag. If the rope needs to be settled in the bag to create more room for rope, quickly drop the bag five to six inches so that the inertia of the rope will pack it snugly into the bag.

<b>**Throwing Throw Bag** – There are three approaches to throwing a throw bag. These are the underhand, sidearm an overhand approaches. All can be use effectively. Generally, the farthest throws occur underhand. When standing in knee deep or deeper water or when standing in a raft, the underhand throw may become impractical and a side arm or overhand throw will need to be used. Practice all three methods and determine which works best in different situations.

Rather than throwing the entire bag, a second alternative is pull line from the bag, coil it and throw the coil. The bag remains in the boat. Generally, most of the throws from a raft are less than 20 feet from the boat. This is because most swimming victims remain in close proximity to the raft.

Self-rescue – Swimming

Falling out of the raft is not an uncommon experience. Rafters and passengers should be familiar with defensive and aggressive swimming and the back ferry in the following sections. In most cases, the guide will provide swimming instructions to passengers. It may be to look for the raft and swim toward it where the guide will pickup any swimmers. Or, it may be swim to the shore. Relevant hazards such as strainers or undercut rocks should be noted by the guide also.

This author paddles R-1 in his Shredder. Around the rear tube is a nine foot NRS strap used to fasten the spare paddle. Roughly four feet in length, its tail is left floating in the water. Others note the dragging tail in the water. It serves the purpose that the author can tow the raft by the tail after falling out of the raft and swimming to shore. It serves this purpose quite well. An no, it doesn't become entangled.

<b>**Defensive Swimming** (Figure 6.6 and Figure 6.7) – In defensive swimming, the swimmer floats on her back with her feet on the surface and pointing downstream. If the swimmer wants to move laterally or across the current, she rotates her body so that is no longer parallel with the current and uses her arms to back paddle. Back paddling at an angle against the current executes the basic back ferry. Also, it slows the downstream movement of the swimmer. Both are good outcomes.

Figure 6.6: Defensive and Aggressive Swimming – Source: Author – [file: \SWR-DefensiveAggressiveSwimming]

<b>**Aggressive Swimming** (Figure 6.6) – Aggressive swimming is the crawl stroke with the head up out of the water as much as possible so that the swimmer can see where she is swimming. When swimming, the emphasis is on pulling the swimmer through the water with the arms. Excessive kicking uses more energy than the propulsion it provides.

As might be expected, there is often a controversy regarding which method is better, which method is faster, or which method is safer. Generally, defensive swimming uses less energy, and the swimmer moves slower in the water. The butt absorbs hits and often there is a tendency for the butt to hang down in the water because of the sitting position. Also with defensive swimming, the swimmer has a broader view of the waterscape. However, if the swimmer wants to get from one point to another quickly, aggressive swimming will do it. Also, when using the swiftwater entry, the swimmer enters the water in position for aggressive swimming. For these reasons, the two swimming methods are used interchangeably as a changing situation demands.

<b>**<u>Back Ferrying</u>** (Figure 6.7) – The back ferry is a fundamental technique used to maneuver a swimmer or boat in moving water. In fact, most swimmers in the defensive swimming mode intuitively preform the back ferry. In a canoe, kayak or raft, the back ferry occurs with the bow of the boat pointing downstream and with the boater facing downstream. This differentiates it from the forward ferry where the bow is point upstream. Similarly, for the defensive swimmer, the feet or bow is pointing downstream and the defensive swimmer is facing downstream also. Also, the back paddling of the swimmer has the same effect as reverse strokes used in a canoe, kayak or raft. Hence, the defensive swimmer in defensive swimming mode is back ferrying. Also, it is why this section is titled back ferrying.

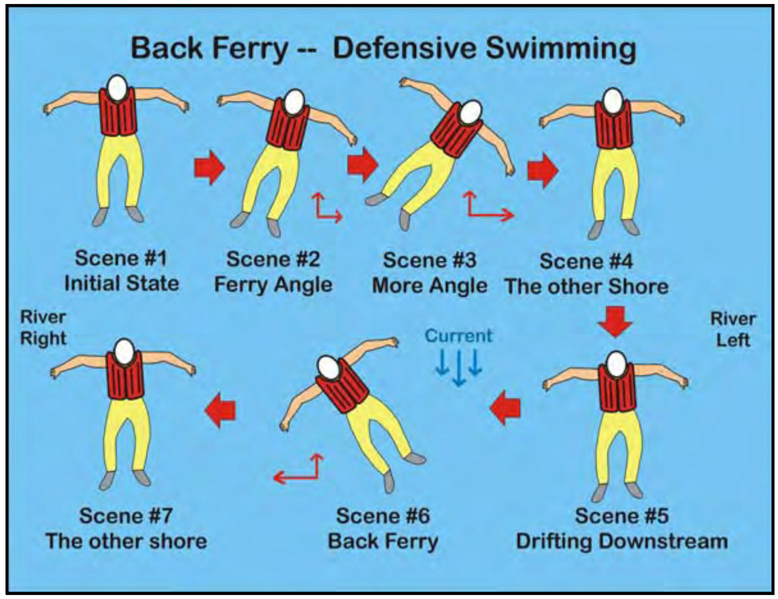

Figure 6.7: Back Ferry – Source: Author – [file: \SWR-BackFerry.jpg]

To perform a back ferry, the swimmer must do two things. First, the swimmer points her head toward the shore where she wants to go. This creates an angle with the main current. Her body is no longer parallel with the current. Second, the defensive swimmer back paddles with her arms. Back paddling at an angle against the current creates both a horizontal and vertical force. The vertical force slows the swimmer in the current and the horizontal component moves the swimmer toward the shore to which the head is pointing. This method of moving laterally or across the current is a back ferry. The simple instructions to passengers is to back paddle toward where you want to go.

Self-rescue – Rafts

Self-rescue is defined as what the boater can do to rescue themselves. The simple but important self-rescue technique of high siding is easily overlooked as a self-rescue technique. It is no different than an Eskimo roll for a kayaker. Other self-rescue techniques included in this section include aggressive and passive swimming, and self-reentry into a raft. For the sake of discussion, self-rescue includes the rescue of other in your raft. Rescue by others in your group is defined as rescue by other rafts in your group.

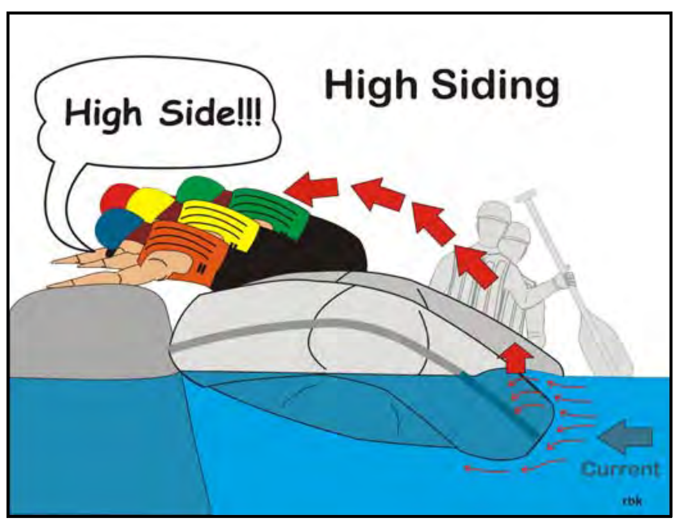

Figure 6.8: High Siding – High siding is a self-rescue technique where everyone on the upstream side moves to the downstream side of raft pinned on a rock. The strategy is that the upstream tube will float and not be pinned. Source: author – [file: \HighSide.cdr]

<b>**<u>High Siding</u>** (Figure 6.8) – High Siding is a self-rescue technique. When the raft becomes pinned broadside on a rock, the

current attempts to catch the upstream side of the raft and thoroughly pin the raft on the rock. If passengers remain on the upstream tube, they can potentially fall into the water as the tube is pulled underneath the water. In addition, their weight on the tube helps to submerge the tube and pin the raft.

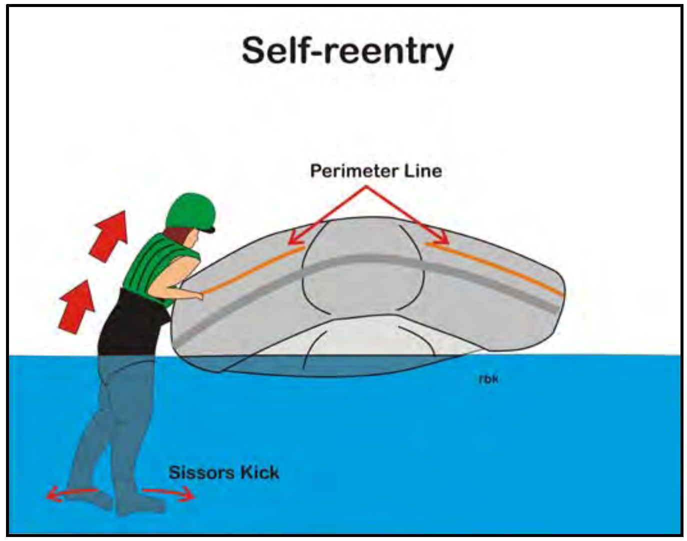

Figure 6.9: Self-reentry – Grab onto the perimeter line with both hands, kick hard and role into the raft. Source: author [file: \ReentrySelf.cdr]

The strategy of high siding is to move everyone to the high side which is the downstream tube pinned against the rock. This enables the upstream tube to break the surface. Once it breaks the surface the current will go under the raft rather than over the tube. This makes the extrication of the raft off the rock much easier.

High siding is a skill that should be practiced as part of the guide's training of the crew. At minimum, it should be verbal. In practice, the passengers can practice it. An alternative is that the guide can demonstrate it. High siding is reactive and when the command is given, there is little time for passengers to think about what they need to do. They need to do it. So consider a demonstration and actually practicing it as part of the guide's pre-trip preparations.

<b>**<u>Self-reentry</u>** (Figure 6.9) – Self-reentry is dependent, in part, on the type of raft and how it is outfitted. If the raft is outfitted with a perimeter line, the person in the water can hoist themself up and onto the tube. The person can kick with their feet and gain some extra momentum. Boaters paddling Shredders or similar boats can proceed to the stern, loop one leg over one of the tubes, and hoist themselves into the raft. A third option is to use the flip line or webbing to create a stirrup to aid in stepping into the raft.

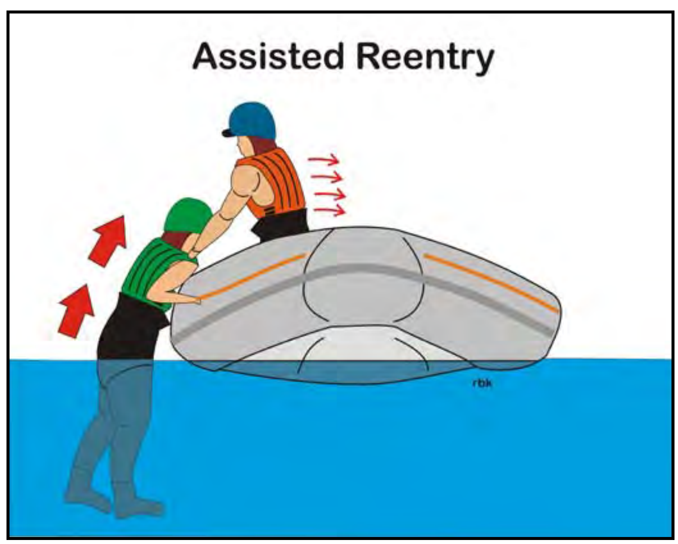

Figure 6.10: Assisted Reentry – Holding onto the should straps of the swimmer, lean backwards and use your body weight to pull the swimmer into the raft. Source: Author – [file: \RS-ReentryAssisted.cdr]

<b>**<u>Assisted Reentry</u>** (Figure 6.10) – It is not uncommon for passengers to fall out of the raft. Some can reenter themselves using the perimeter line to hoist themselves over the side of the tube. Most people will need or appreciate assistance. First, make sure there are no other hazards or dangers present. If need be, wait until after the drop and then pull the swimmer into the boat.

Next, the swimmer should face the tube. They can assist by hoisting themselves using the perimeter line. Normally, it is recommended that the rescuer grab the swimmer under the arm pits and lift them into the boat. As a practical matter this is easier said than done and presents some disadvantages. First, it is difficult to get a good grasp underneath the armpits. Next, it requires bending over which encourages lifting with the back. In contrast, grabbing the life jacket shoulder straps is easy, convenient and easier to lift without using the back.

If the swimmer is lifted using the life jacket, visually, make sure that when the victim is hoisted, the life jacket will not come off. When pulling the swimmer into the raft. The rescuer should use his/her weight to pull the swimmer into the raft. Step backwards to prevent falling over in the raft. This will result in less strain on the back.

<b> **<u>Flipping a Raft</u>** (Figure 6.11) – Flipping a raft is best practiced in a safe flatwater stretch. Be sure there is adequate depth. The first step is for one or more rafters to climb back on top of the overturned raft. Several methods may be used. The rafter can use the perimeter line to hoist him/herself over the tube. Sometimes the rafter can climb over the end of the raft. The rocker of an overturned raft creates a sloping bottom. If needed a sling can be attached to a D-ring creating a step.

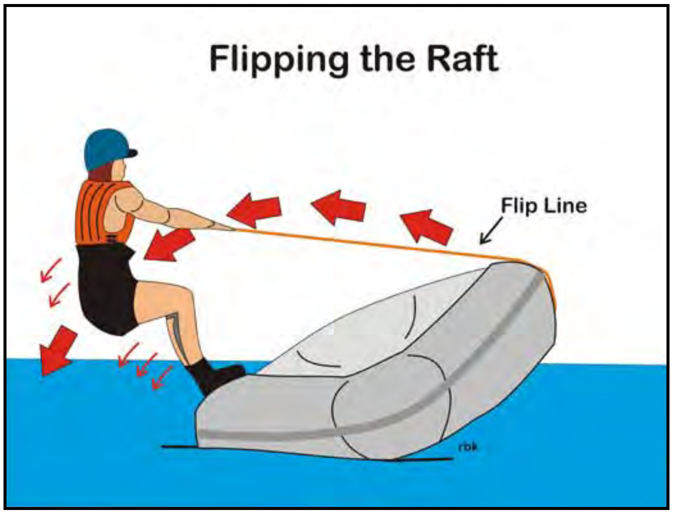

Figure 6.11: Flipping a Raft – Climb onto the overturned raft. Attach a flip line to the side tube. Lean backwards on the other tube and flip the raft. Climb back into the raft. Source: author – [file: \FlipRaft.cdr]

Once on top the overturned raft, the rafter can attach a flip line to one of the D-rings on the side tube of the raft. If easier, the flip line can be attached to the perimeter line. The flip line is ten feet of webbing worn like a belt around the waist. It is buckled together using one or two carabiners. The flip line should fit snugly around the waist to prevent snagging and entrapment.

Some rafters will have a flip line pre-attached to the side tube. It is a mini-throw bag with ten to fifteen feet on line in it. Before climbing up onto the raft, the line is tossed over the raft. It can be used to assist in reentering the raft.

Standing on the side tube and as pictured in Figure 6.11), the rafter leans backward against the taught flip line. As the rafter falls backwards into the water, the weight of the rafter and the thrust of the feet inward on the side tube flips the raft over and right side up. Depending on the size of the rafter and the raft, flipping the raft may require more than one person. Using one of the methods of reentry, the rafter needs to reenter the raft.

Depending on the situation, it should be noted that it may be easier to paddle the raft to shore upside down where it can be righted.

Rescue of Others in Your Group – Wading Rescues

Rescues of others in your group include the rescues of other rafts in the group. It should be noted that some of the rescues techniques in the self-rescue section are applicable to this section also. If another raft on the trip uses the assisted reentry to haul in a passenger from another raft, the reentry falls into this group.

The ACA Rafting course lists several suggested rescue techniques. Most of the items in this section were borrowed from the Swiftwater Rescue Manual. Wading and entrapment skills are always worthwhile skills to know.

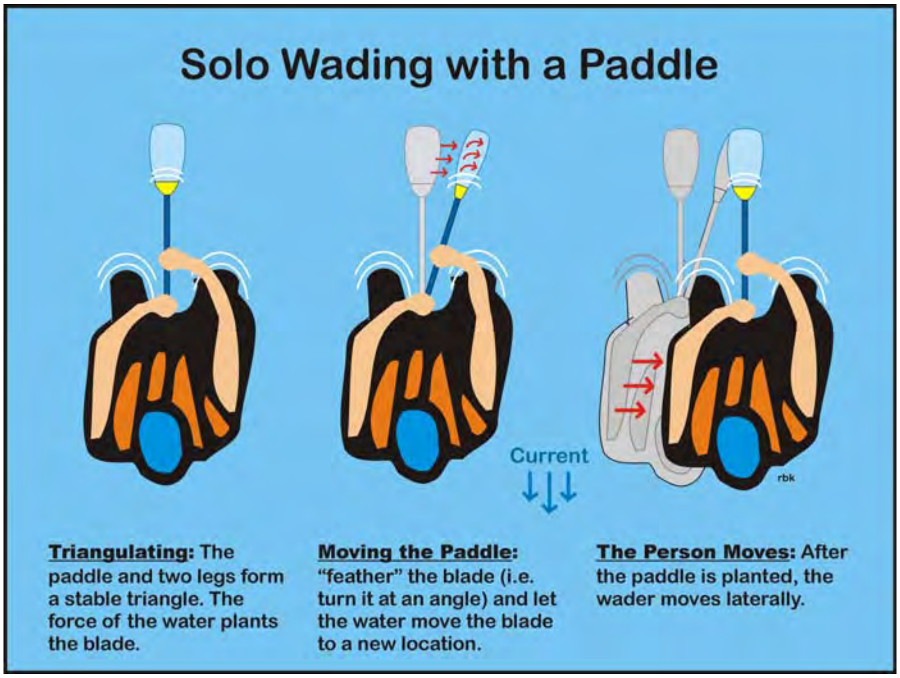

Figure 6.12: Solo Wading with a Paddle The paddle and two legs of the wader triangulate and create a stable base in the water. Source: author – [file:\SWM-WadeSolo.cdr]

<b>**Solo Wading with a Paddle** (Figure 6.12) – The river bottom is rocky and uneven. A three-legged stool is very stable, even on an uneven floor. The three legs create triangulation and the stool easily adjusts to the unevenness. Solo wading with a paddle creates the same type of stable triangulation using the paddle and the two legs of the wader. Triangulating with a paddle can create the stability provided by a three-legged stool on an uneven river bottom.

To move in the water using this technique, place the tip of the blade on the river bottom. The current will force the blade downward which helps to keep the blade fixed to the river bottom. This makes the paddle very stable. Using the paddle for stability, the wader can move laterally in the water. Avoid crossing the feet since this reduces stability. When the feet are stable, reposition the paddle.

Repositioning the paddle can be done two ways. The paddle can simply be lifted out of the water and replaced where it is wanted. This works well in shallow water, but becomes cumbersome in waist deep water. Also, this can lead to instability since the third leg of the triangle is removed, if only briefly.

The second method is to feather the blade of the paddle and use the force of the current to move the paddle in repositioning it (see Figure 6.12). This approach works better in deeper water and maintains stability because it lessen the time the blade isn't in contact with the bottom. Feathering the paddle is turning the blade so that it is parallel with the current. This minimizes the force of the current on the blade. Angle the blade slightly and the force of the current will move the blade in the direction that the top of the blade is pointing. Reverse the angle of the blade and the force of the current moves the paddle the other direction. Quickly turn the blade to the current and the force of the current repositions it on the bottom.

<b>**Simple Rope Tether** (Figure 6.13) – The simple rope tether illustrates that often simple techniques can be done quickly and efficiently to effect a rescue. For this reason, it is included in this section. This technique illustrates a technique that can be setup quickly and with little fanfare. In the simple rope tether, the rescuer uses a belayed line for stability. In the solo rescue with a paddle, the paddle provides the same stability. In the two person rescue, the second person provides this stability. In this rescue, the belayer on the shore provides this stability. A belayer is shown in Figure 6.13. However, a rock, tree, or other object can just as easily provide the belay point for the rescuer to pendulum out to the victim using the belayed

line for stability.

<b>**Stabilization Line** (Figure 6.14) – The purpose of a stabilization line is to provide support with which the victim can raise his head above the water to breath, particularly in a heads-down foot entrapment. It provides enough support for the victim to brace themselves against the line with their hands and arms.

The pressure on the belayers is considerable. Also, the stabilization line can be fatiguing when the time frame becomes extended. Hip belays are recommended. Also, consider the 120^{o} rule where if the angle between the victim and the two belayers is 120^{o}, the force is equal on the victim and the two belayers. If there is 100 lbs of force on the victim, there is 100 lbs of force on each belayers. Although it is not always possible, the belayers want to minimize the angle between them and the victim to reduce the force on the belayers. When possible, the belayers should be backed up. Holding onto the shoulder straps of the life jacket, the backup pulls downward on the belayer to prevent them sliding off the rock.

Position both upstream and downstream safeties. When there is a stabilization line or any line across the river, use an upstream safety. The purpose of the upstream safety is to redirect or stop anyone coming down the river. One or more downstream safeties should be provided. The downstream safeties provide two services. If one of the rescuers becomes a swimmer, they can rescue the rescuer. When a conscious or unconscious victim is extricated, they will need to be rescued or they will continue to float downstream.

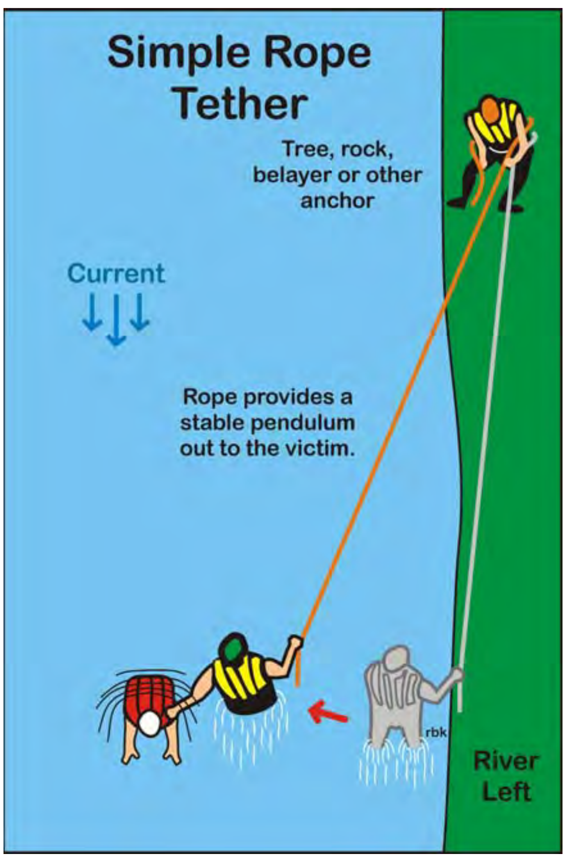

Figure 6.13: Simple Rope Tether – The simple rope tether illustrates that sometimes keeping it simple can create an effective rescue. The rescuer uses the belayed rope for stability as she wades out to the victim. Source: author – [file:\ROPE-SimpleRopeTether.cdr]

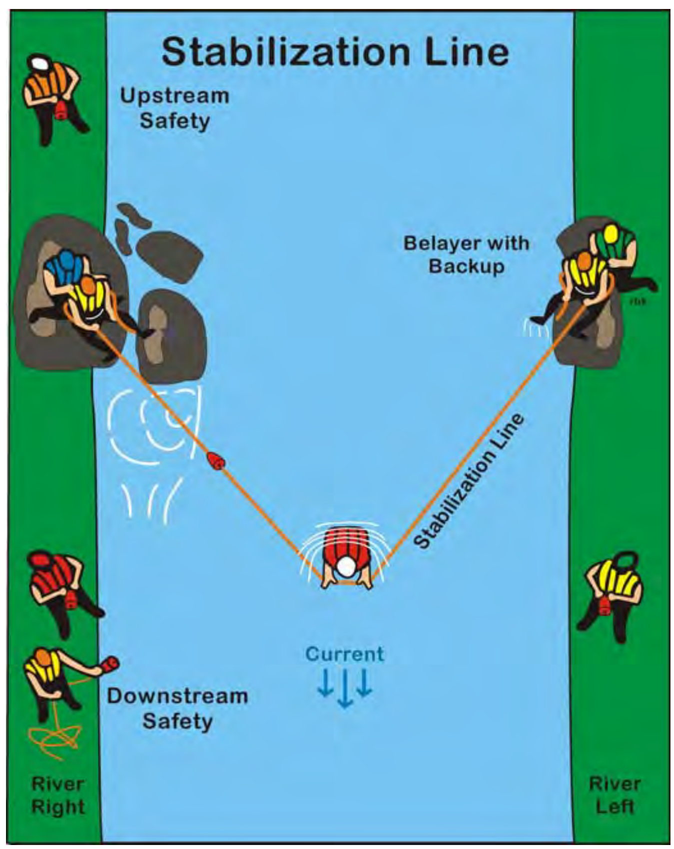

Figure 6.14: Stabilization Lines – The purpose of the stabilization line is to provide sufficient support to the victim so that they can breath. Source: author – [file:\ROPE-StabilizationLine.cdr]

Rescue of Others in Your Group – Raft Rescues

Reentering the raft can occur several different ways. The raft can eddy out along the shore and the passenger or swimmer can step into the raft. Two rafts can gunwale up together and the passenger can step over the two tubes to enter the other raft. Discussed in the next sections, two additional ways to reenter include reentering the raft alone or with the assistance of another person.

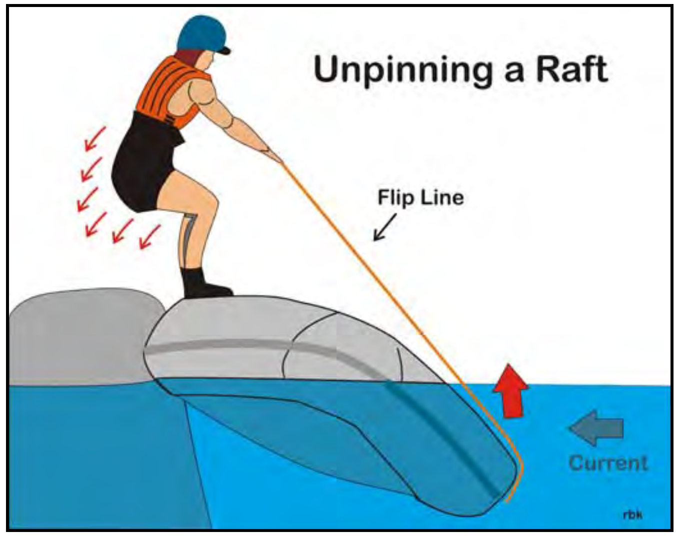

Figure 6.15: Unpinning a Raft – A flip line is attached to the underwater tube. The upward pressure lifts the tube toward the surface where it breaks free. Source: author – [file: \RS-PinnedRaft.cdr]

The focus of this section is on raft oriented rescues. In terms of the Rescue Curve, its focus is on self-rescue (e.g. high siding and flipping a raft) and rescue by others in your group (e.g. bumping and unpinning rafts). The section on using rafts as a rescue platform is an example of rescue by others outside your group. The raft trip performed a foot entrapment rescue when they came upon another group conducting the throw bag drill.

<b>**Bumping** (not shown) – An overturned or empty raft can be bumped to shore by another raft. Two words of caution. First, rescue passengers first. Usually, this assumes that others are picking up swimmers or they are self-rescuing. Second, when bumping another raft, be sure not to endanger your own raft. It is easy to pin your raft on a rock or to be somewhere you don't want to be when bumping.

<b>**Unpinning Rafts** (Figure 6.15 and Figure 6.16) – The force of the water against the raft can easily pin a raft against a rock, bridge abutment, or other obstacle. As a general rule, when the tube underwater surfaces, the raft will float free. When possible, the trick is to use the force of the water and the flotation provided by the inflated tubes to free the raft. Unpinning a raft is as much an art as it is a science. There are numerous stories where a group is working to extricate the raft without any luck. Another rescuer comes along, tries a different angle on the rope or does something slightly different, and the raft pops free.

The author came across a pinned raft depicted in Figure 6.17 at World's End on the Youghiogheny River. He climbed up on the exposed tube, reached down and fastened a line with a carabiner to the upstream tube.

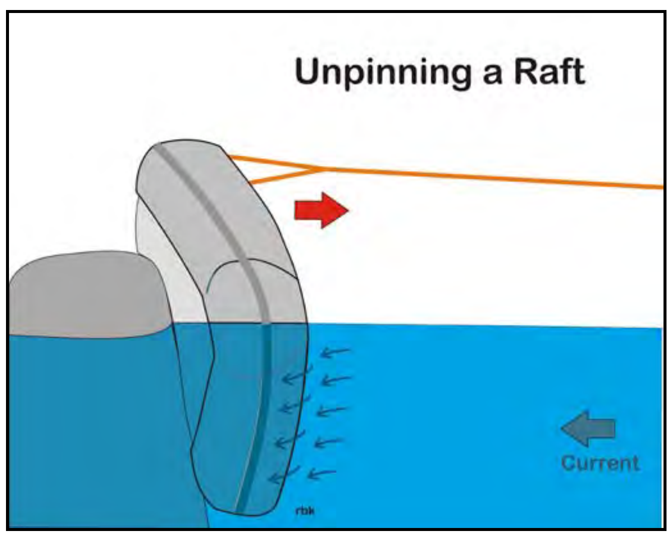

Figure 6.16: Unpinning a Raft – A line is attached to the tube out of the water. The strategy is to rotate the raft reducing the current pinning the raft and allowing the inflated tube to float to the surface. A mechanical advantage system can be used on the haul line. Source: author – [file: \RS-PinnedRaft02.cdr]

Caution needs to be used to avoid pinning the rescuer. Gently leaning backwards, the rescuer pulls on the submerged tube. It begins to rise. When it reaches the surface, the raft popped free. Unlike in the raft flipping, the rescuer is not off balance and doesn't fall into the water. Also, consider attaching an end line to pull the freed raft into shore.

Figure 6.17: Unpinning a Raft on the Upper Yough – A line was tied to the out-of-water tube and the raft was rotated until it popped free. Source: author – [file: \5-7-05 sat may 062.jpg]

A second strategy is to pull on the exposed tube with a line (Figure 6.16). The strategy is to rotate the raft so that the water flows underneath the raft. The rotation reduces friction between the raft and the pinning object and inflated tube underneath the water begins to float upward. As a general rule, this method will work if at least half of the raft is exposed or if the current is moderate. When possible attach the main line to more than one D-ring on the tube. Consider using a self-equalizing anchor formed using an inline Figure-8 follow through. It may be important to distribute the load to more than one D-ring. The "arm strong" method or mechanical advantage can be used to pull on the haul line. Note in the rescue on the Upper Yough in the Figure 6.17 that the line was attached to the out–of-water tube and the raft was rotated until it popped free.

<b> **Mechanical Advantage** – For a complete discussion of mechanical advantage systems, consult Chapter 6 in the Swiftwater Rescue Manual (Kauffman, 2017). Topics discussed include range of the system, concept of throw, internal versus external systems, and types of systems. If mechanical advantage is used, consider the 5:1 pulley system (Figure 6.18).

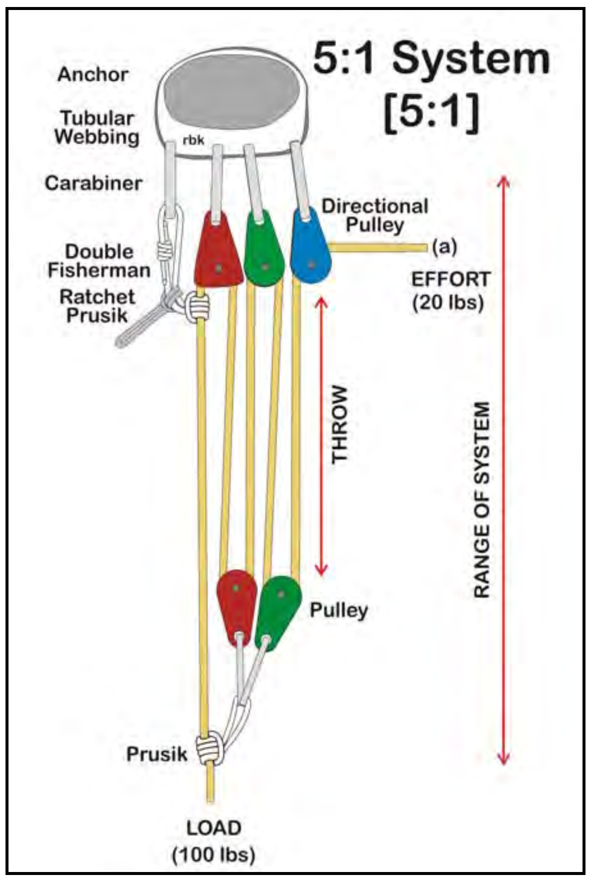

Figure 6.18: 5:1 Pulley System – The 5:1 Pulley System provides good mechanical advantage. It has good throw, and it can quickly be converted to a 9:1 double Z-rig system. Source: author – [file:\RS-51PulleySystem.cdr]

In terms of the previous discussion on extricating a pinned raft, if there are enough people present consider using the "arm strong" method. This is where everyone pulls on the line. If mechanical advantage is going to be used, consider starting with the 5:1 system (Figure 6.18). It can work as either an internal or external system. Also, it has good throw where the system doesn't need to be constantly readjusted. Also, if more mechanical advantage is needed, it can easily and quickly be converted to double Z-rig system with a 9:1 mechanical advantage.

As a practical matter, the use of a 3:1 Z-rig is of little use. It is the commonly taught system and along with the 2:1 system forms one of the three base systems from which other systems are created. Angle of pull and friction can easily reduce its effective mechanical advantage to a 2:1 system. If there are a lot of people present, the arm strong method will work equally well without having to do all the setup. If mechanical advantage is needed, it only makes sense to maximize mechanical advantage. The 5:1 system provides the mechanical advantage needed. It requires two additional pulleys and two carabiners in the pulley bag over the traditional Z-rig.

<b> **<u>Rafts as a Rescue Platform</u>** (Figure 6.19) – Rafts can serve as a rescue platform. The first example is from the Dzialo incident on the Deerfield River in Massachusetts (Kauffman and Gullian, 2006). Crab Apple Rafting came upon the heads-down foot entrapment and proceeded to assist in the rescue. After trying swimming and wading rescues, they stretched a line across the river using two throw bags. They lowered a raft extricated Adam Dzialo from the foot entrapment and placed him on a backboard in the raft.

It is important to transition from the type of craft used and the affect of weigh on the effect of the type of craft. Jokingly stated, backpackers count ounces, canoeists and kayakers count pounds, and rafters count tons. The point is that larger rafts can carry rescue equipment that canoeists and kayakers would provide as prohibitively. Carrying pulleys and lines is not usually an issue of the carrying capacity of rafts.

Potpourri

The following items are a potpourri of safety items listed in the ACA course syllabus. Some of these items tend to be more ancillary to raft safety. They are included to help this document be complete in terms of the ACA syllabus.

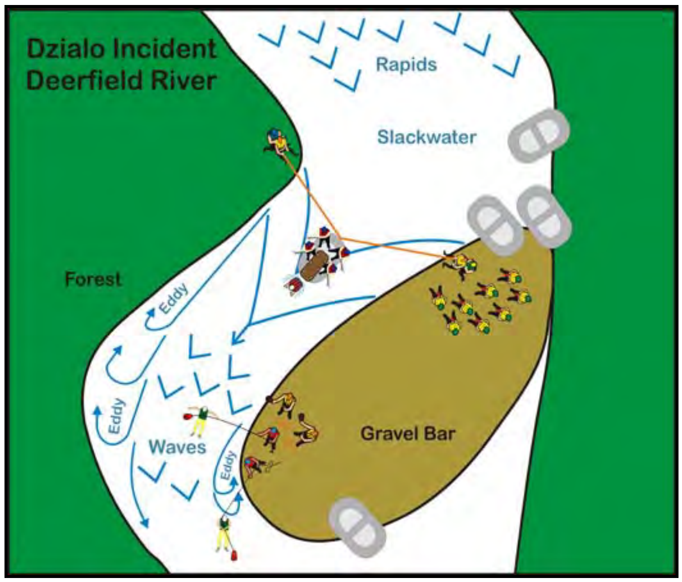

Figure 6.19: Using a Raft as a Rescue Platform – Rafts can be used as a rescue platform. In the Dzialo incident on the Deerfield River, a raft was lower to help extricate the victim. Source: author – [file: \RS-Deerfield.cdr]

<u>RETHROG</u> – RETHROG is an acronym standing for REach, THrow, ROw, and Go. It originates with the lifeguard community. The problem was that training tended to emphasize swimming rescues. In mock rescues the lifeguards tended to jump in the water and enact a swimming rescue rather than reaching out to the victim or throwing a rope to them.

Other than swimming, the other rescues are used by rafters although not necessarily in the order prescribed. The translation of RETHROG into the boating community is as follows. Assume a rafter is in whitewater with a victim in the water. If the victim is close enough to the raft, extend a paddle to them. If they are beyond the range of reach with a paddle, use a throw rope to reach them. If the raft is an oar rig, row to the victim. Otherwise, paddle to the victim. It is unlikely that the guide will enact a swimming rescue.

<u>Rescue Priorities</u> – The normal rule is to rescue people first and then rescue boats and equipment next. As a general rule this is always true. Often, the victim is self-rescuing or there are other boaters assisting in the rescue of the victim. In this case, it may be appropriate to rescue the boat and equipment which will flush downstream if no one pursues them. If there is any question, rescue the people first. Equipment can always be replaced.

<u>Towing a Swimmer/Boat</u> – In general, this author has never had to tow a swimmer behind the raft. Having noted this, there are two instances that conceptually are applicable. In the first, a swimmer grabs hold of the perimeter line of the raft and drifts with the raft through the rapids. It is normal protocol for the victim to move toward the stern (i.e. rear) of the raft and of course keep their feet up toward the surface. Second, I do have a nine foot NRS strap around the rear tub of my Shredder. By design, the five to six foot tail is purposely trailed behind the raft. As an R1 paddler, if I am a swimmer, I use the tail to tow my boat to shore.

Summary

The chapter covers basic rescue techniques for rafters. There are the fundamentals such as search techniques and throw bags. The chapter covers swimming and wading techniques including defensive and aggressive swimming and the back ferry. Then it moves into self-rescue techniques including reentry into the raft. From there it moves into raft rescue techniques including bumping, flipping overturned rafts, unpinning rafts, and using rafts as a platform for rescue.

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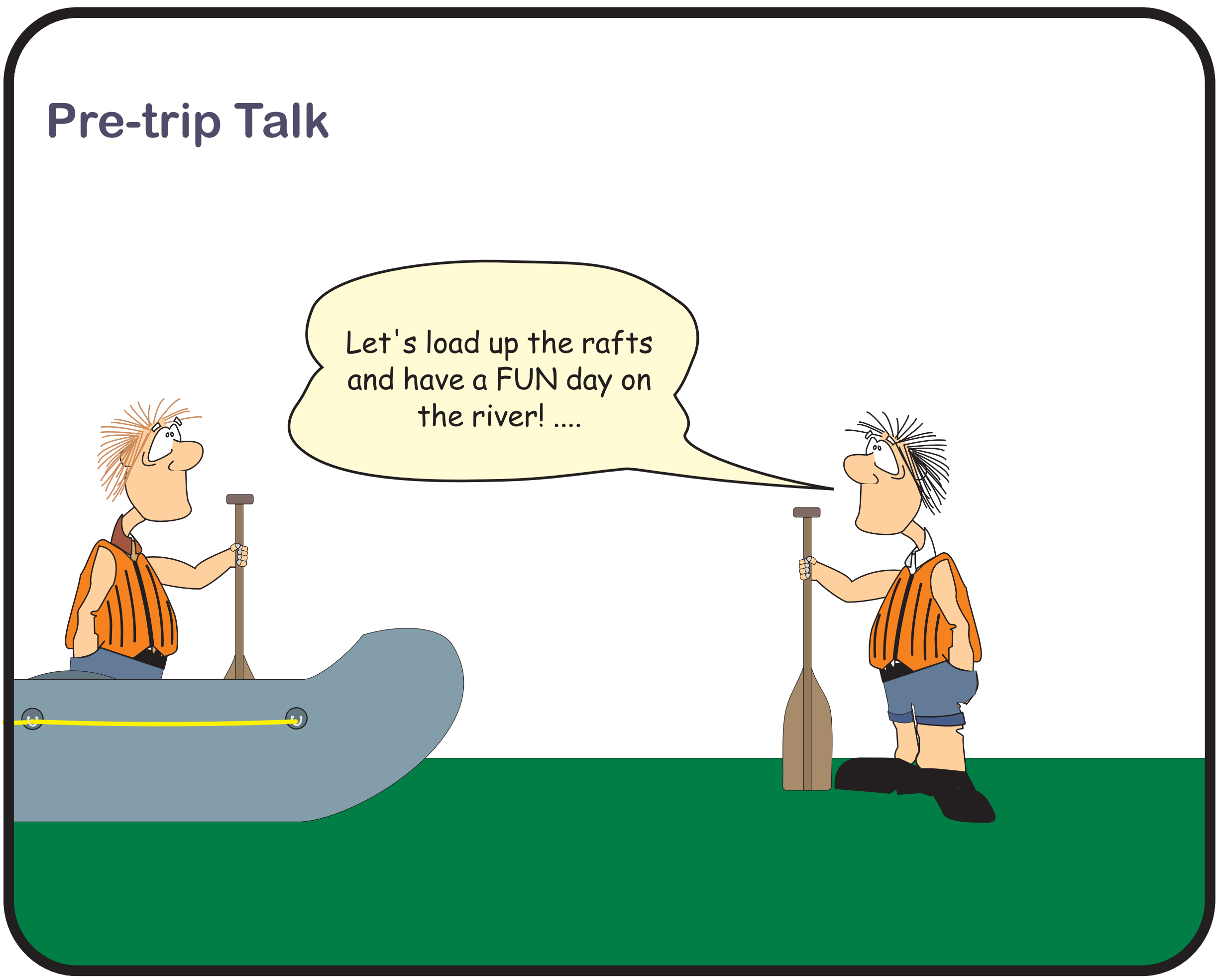
Chapter 7:
Trip Leadership



Chapter 7.0:
Trip Leadership [1]

This chapter is titled Trip Leadership. A general approach was utilized. It includes trip leader and guide leadership on commercial trips as well as on private trips. In this way it is more inclusive and consistent with the ACA materials. In terms of ACA materials, this chapter incorporates some of the topics listed under "Responsibilities of Captain (guide)."

Leadership begins with framing the experience for passengers. The flow model is used for this frame. Next, is a section on the pre-trip talk at the beginning of the trip. Third, this chapter discusses group management which involves managing rafts on the trip. This includes river running techniques. Fourth, there is a section of evaluating passenger comfort in the water. On a trip, this is important. In terms of a rafting instructional course, the throw bag drill is important in accomplishing this task for students.

The Experience

There are two distinctly different approaches toward creating the experience for participants. Interestingly, both approaches have their roots in the same research. The discussion begins with the flow model and "*seeking mastery*." With the introduction of perceived risks and a leader or guide who provides considerable knowledge, skills and experience to the activity, the second "*roller coaster experience*" approach emerges.

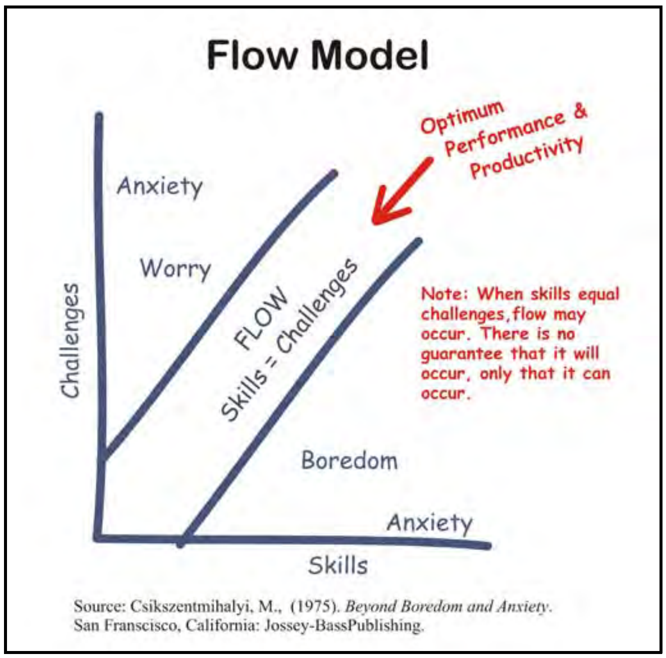


Figure 7.1: Flow Model – In the flow model, the participant seeks to match their skills with the challenges present. Their knowledge, skills and experience help them to create this match. Source: Csikszentmihalyi – [file:\RK-Flow.cdr]

<b>**Seeking Mastery** – A boater or for that matter anyone seeking mastery, attempts to bring all of their knowledge, skills and experiences to match the challenges present (Figure 7.1). Conceptually, the flow model suggests the relationship between the challenges present and the skills of the individual. Although Csikszentmihyi didn't focus on perceived risks in discussing the flow experience, a person seeking mastery seeks to minimize perceived risks because perceive risks potentially diminish the matching process of the skills to the challenges. Or, perhaps better stated, they modify the relationship. This should become apparent in the next section on the Adventure Experience

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Paradigm.

Typically, surfing a wave, making a precise eddy turn, or making another maneuver is an art form where the boater matches the challenge of the maneuver with their ability to perform the maneuver. Mastery is the ability to find the fine line between challenges and skills. In terms of the flow model, flow can occur when this happens. Flow may or may not occur, only that it ***can*** occur. The boater knows when it occurs because according to flow methodology, typical symptoms of a flow experience include a merging of the activity and experience, a loss of external reality, and a oneness with the experience. A classic symptom of not being in a flow experience is consciously thinking about and analyzing what he/she is doing to obtain it. In this situation, the boater is viewing the activity externally and the flow experience is not occurring.

Athletes and boaters seeking mastery require, knowledge, skill and experience. Practice and experience provides the boater with the ability and skill to be able to find the edge and to place the boat and boater in a kinesthetic dance with the moving water. Over time, the athlete and boater increase their skills and this ratchets up the challenges to correspond with the new skills developed. It is a process of skill development and seeking mastery of the activity.

It is worth noting the other position in the flow model. If the challenges greatly exceed the skills, anxiety occurs and if they mildly exceed the skills, worry occurs. On the bottom of the graph, if skills greatly exceed the challenges, anxiety will occur and if they mildly exceed the challenges, boredom occurs.

<b>**<u>Adventure Experience Paradigm</u>** (AEP) – Developed by Priest and Gass (1997), the Adventure Experience Paradigm incorporates a generic flow model embedded in the

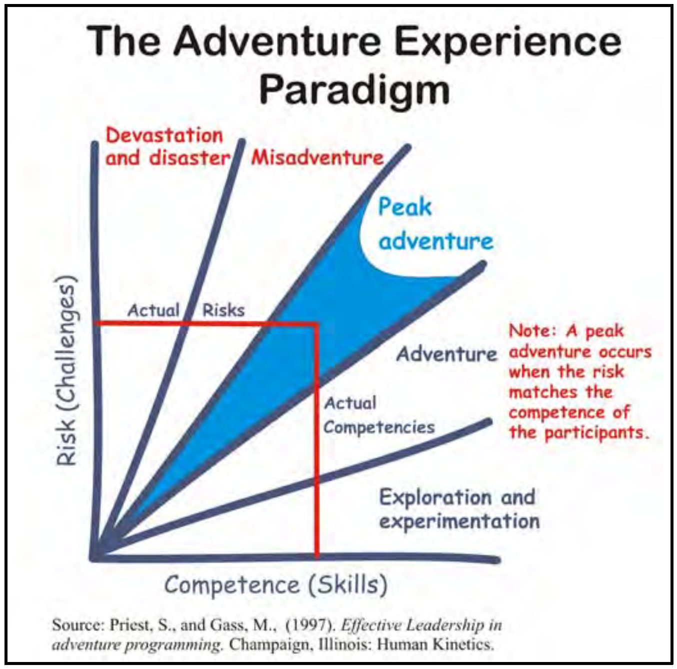

Figure 7.2: Adventure Experience Paradigm(AEP) – Caption: The AEP embeds the flow model into it to create a peak adventure where the risks and challenges match the competencies and skills of the participants. Source: Priest and Gass – [file:\RK-AdvenExperParadigm.cdr].

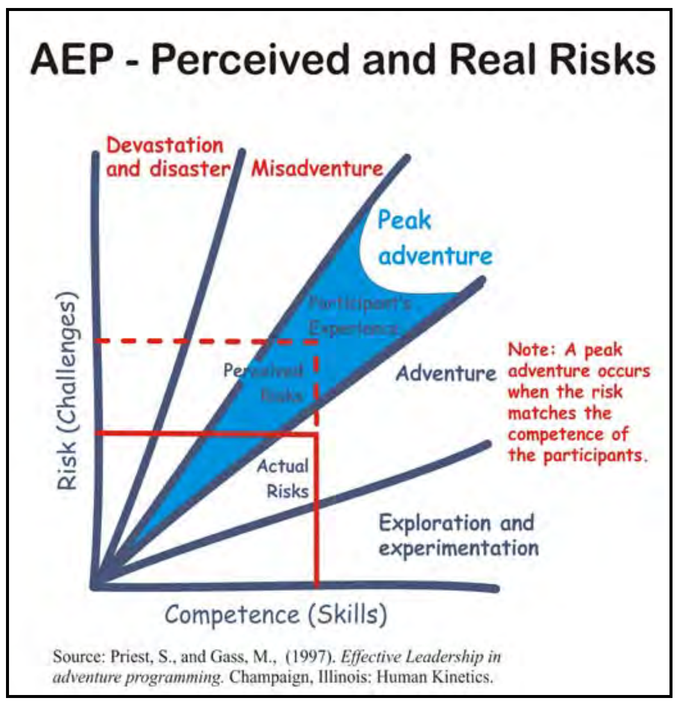

Figure 7.3: AEP - Perceived Risks – Caption: Instead of matching actual risks and challenges to provide a peak experience, perceived risks and challenges are provided to create a peak adventure. It returns to a variation of the roller coaster. Source: Priest and Gass – [file:\RK-AdvenExperParadigm3.cdr].

paradigm (Figure 7.2). From a programming perspective, the paradigm is foundational. There are two significant differences from the flow model. The flow model focuses on the individual. The AEP introduces a leader or programmer who facilitates the experience. Second is the introduction of perceived risks and perceived competencies.

As in the flow model, the programmer seeks to match the challenges and risks present in the activity with the skills and competencies of the participants. A peak adventure occurs when the two are matched or are in equilibrium. A misadventure and devastation and disaster occur when the risks and challenges greatly exceed the competencies and expectations of the participants. Providing activities in this range can easily lead to participant dissatisfaction and can eventually lead to being sued. If the competencies and skills exceed the challenges, an “adventure” and “exploration and experimentation” experience can occur.

Since the leader or programmer brings considerable knowledge, skills and experience to the activity, their ability can easily compensate for the lack thereof on the part of the participant. Or with the introduction of perceived risks and challenges, the leader or programmer can create a peak adventure while at the same time reduce actual risks (Figure 7.3). This makes the activity safer. This describes the roller coaster experience discussed in the next section.

In the case of raft guides, the guide increases perceived risks while reducing or managing actual risks. Choosing the designated or standard route through a rapids is an example of reducing actual risks. Making it an exciting run increases the perceived risks and challenges. It is the application of the roller coaster experience to create the desired experience while making the activity safer also.

<b>**Pseudo 4** – As an important sidebar to this discussion, the participant can have perceived competence or perceived skills. A “*pseudo-4*" is a person who believes they have the skill and ability when they don’t. It is based on the Hershey (1984) *The Situation Leadership* and (Kauffman, 2011). In the model, the leader is in the *delegate phase* where they have the ability to do the task and they have the motivation or willingness to do it. In terms of a guided raft trip, the passengers have just successfully negotiated big rapids and whitewater. They are willing and motivated to run whitewater and it is easy for them to believe the have the skill to do it when they really don’t. They don’t realize that they successfully negotiated the river due the ability of the guide. Hence, the “*pseudo-4*.” The simple solution is to remind passengers not to try river running without the guidance of a trained guide.

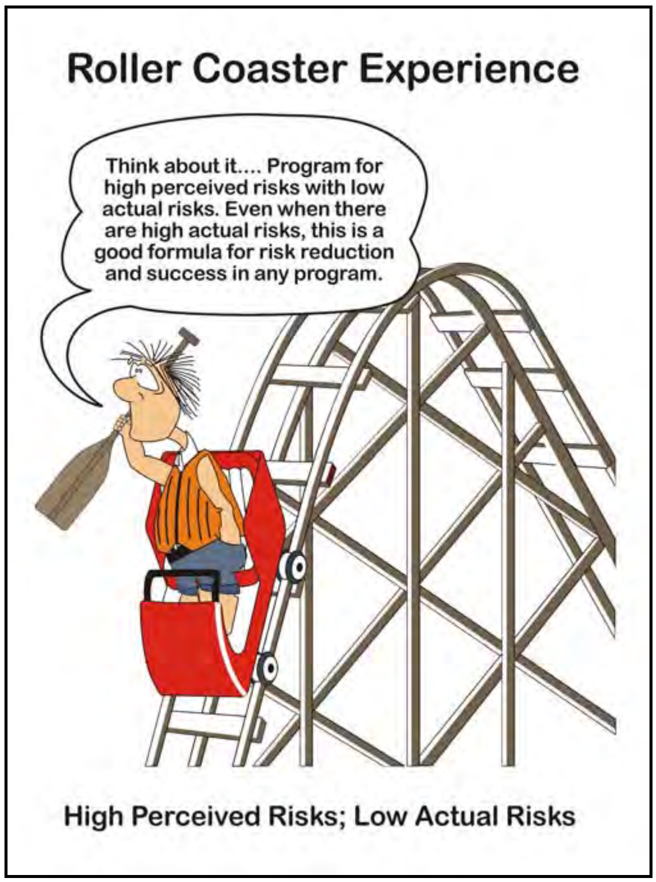

Figure 7.4: The Roller Coaster – When designing an experience, think of a roller coaster. It minimizes actual risks and increases perceived risks. Source: author – [file:\PHIL-RollerCoaster.cdr]

<b>**Roller Coaster Experience** (Figure 7.4) – Perceived risks and challenges and the reliance upon a leader or programmer for participant skills are the factors behind the roller coaster experience. Quite simply in terms of the AEP, the leader or programmer seeks to enhance the experience by increasing perceived risk while at the same time reducing and managing actual risks. It provides a peak experience that is safer at the same time.

Consider the roller coaster. It is high on perceived risk and low (hopefully low) on actual risk. The roller coaster is inspected daily. The probability of a person getting on a roller coaster having a successful ride is fairly high. The roller coaster rides on a track. There are safety devices to keep people safely within the coaster. The ride is designed to minimize actual risk. When was the last time a roller coaster came off the track? It is designed to create high perceived risks with low actual risks.

As a matter of practice, an adventure sports programmer wants to create a roller coaster type experience by decreasing actual risks and increasing perceived risk. Yes, there are risks in running rivers. Never-the-less, the guide seeks to reduce the actual risks while maximizing perceived risks.

For the raft guide or adventure sport's programmer, the roller coaster is a good model to utilize. Although the actual risks can't be eliminated to the extent of an actual roller coaster, they can be minimized. The guide takes the designated route. It is as if the boat is on a set of rails, much like a roller coaster. Taking a designated or standard route consistently reduces risks. In addition, the trip avoids high water levels. At the same time the guide can increase perceived risks. This can be done verbally or by purposely brushing against rocks to create the perception of greater risks by the participants. It is the roller coaster experience which minimizes actual risks while increasing perceived risks.

<b>**Raft Trip from Hell** (Figure 7.5) – The previous discussion discussed the concept of matching the skills to the challenges of the participants to create an optimum adventure experience. Although it may seem obvious, in practice, it may not be an easy thing to do.

On September 30, 2004, a group of employees from a major company in the Washington metropolitan region participated in a team building exercise on the Shenandoah River near Harpers Ferry, West Virginia. The raft trip down the Shenandoah River was one of the major components of the program. The river was at flood. Several of the rafts flipped and one of the passengers drowned on the trip. The following passages were taken from the deposition of one of the participants who participated in that team building experience (Figure 7.5). As the title suggests, this trip turned out to be the raft trip from Hell for the participants.

It was a classic example of the company (i.e. guides) not matching the experience provided with the experience delivered. The river was up. They ran it at flood because it was where they were at, not where their passengers were at. In terms of the adventure paradigm, it became a "devastation and disaster" experience. Although there was a settlement regarding the deceased, the other participants sued for mental damages. They didn't win their case for damages. Regardless, the experience they had is not the experience most professional guides want their passengers to have after a day of rafting.

Figure 7.5: Raft Trip from Hell

Q: Plaintiff's Lawyer
A: "Jane Doe"

Excerpts from Deposition of [xxxx xxxxxxx]

Page 33:
A. I remember feeling the boat shift. I remember the boat flipping over, myself being thrown into the water. I remember the water was very rough, waves, a lot of waves, being pushed down deep into the water. I remember gulping in a lot of water right away and then came up (Crying) - - excuse me. I

Page 34:
remember coming back up underneath the raft, panicking because I felt like I wasn't getting enough air. It was very difficult to get - - to get some air and to go - - I was pushed back down again several times, so I was taking in a lot of water.
And I remember came - - coming up under the raft, trying to get some air and I couldn't. And I remember thinking if I'm going to get out of this, I have to get from underneath the boat. So I remember trying to - - when I got pushed down again, trying to force myself to swim - - swim backwards to try and get from underneath the boat - -

(page 33 line 18-23; page 34 line 1-12)

Page 47:
Q. In your interrogatory answers, you note that you have nightmares and flashbacks and difficulty going into the ocean and, you know, general mental and emotional suffering and anguish. Why don't you explain to me that claim or those claims?
A. Right, well I have a severe fear of deep water now. I - -
Q. Let me ask you something: what do you consider "deep water"?
A. Anything taller than myself.
Q. Okay.
A. It was - - right away, it was very difficult to deal with water at all, feeling of having water splashed in my face reminded me of the - - of the

Page 48:
event. I've been in situations where I've been on vacation since where I've had panic attacks when having to, you know, go in - - in the ocean, near the ocean or dealing with any kind of boats. I no longer want to - - no longer like being on a boat or being any - - near any rivers such as the river we were in.
I had a lot of anxiety about the event that happened, feelings that I could have died. I was supposed to sit in the seat that Roger sat in at the front of the boat. That could have been myself. I felt that I - - could have drowned that day.

(page 47 line 10-23; page 48 line 1-11)

Source: River Riders Inc., v Cathy Freeman, et al.(2007). Deposition of [xxxx xxxxxxx], Circuit Court of Jefferson County, West Virginia, October 18.

Pre-trip Talk

If a rafter is taking passengers in their raft, it is important to do a pre-trip talk-up. This includes private trips as well as commercial trips. On a private trip, the pre-trip talk-up has several benefits. It provides an overview of the experience on the river and what is expected of the passengers (i.e. crew). Don't assume the passengers know what "high siding" is. It provides them with safety procedures in case they fall out or if there is another mishap. It allows the captain to cover the commands that they can expect to use to maneuver the boat. It helps them to feel comfortable in the boat and that the captain (guide) are in charge and know what they are doing. The pre-trip talk can occur on land, in the water, or both.

Commercial trips will usually break the pre-trip talk into an onshore and in-the-boat talk. The pre-trip talk is usually done as a group. Due to lawsuits, it has taken on an importance and formality not afforded other river activities. There are examples where the pre-trip talk has been videotaped or a guide has a check-off list to insure that all the topics were covered by the presenters.

The in-the-boat talk is usually done by each raft guide. Its focus is on strokes, commands and other specific skills the passengers will need to become a cohesive team while under the command of the guide.

For oar rigs, the pre-trip talk up will have a slightly different focus since there is no need to cover paddle strokes and commands. However, most of the other topics are included.

Regarding this section, the following disclaimer is noted. The topics are suggestions and do not constitute an industry standard. Each group needs to use these suggestions as a foundation and build upon them to meet the specific needs of their situation. As noted with the oar rigs, some topics may not be included.

<b>**Introduction** (Figure 7.6)– The purpose of the introduction is to introduce yourself, other guides if appropriate, and that it is going to be a fun day on the river. Some pointers to consider are listed below.

- Who you are and your role.
- Introduce the other guides and their role on the trip (e.g. lead and sweep).
- Provide an overview of the river, its difficulty, and what they can expect on the river.
- What is expected from the passengers.
- Emphasize that it will be a fun trip and the pre-trip talk will help to make if a fun trip!

<b>**Experience** (Figure 7.7) – As a general rule, the guide wants to match the experience sought by the passengers with that provided. Be realistic in describing the experience in terms of its physical and mental requirements. Look for any excessive apprehension in passengers and address it. It may be necessary to do this in private and it may be appropriate for the passenger not to go on the trip. Many fatalities begin with customers who intuitively don't want to go on the trip and they continue with the trip when they really shouldn't.

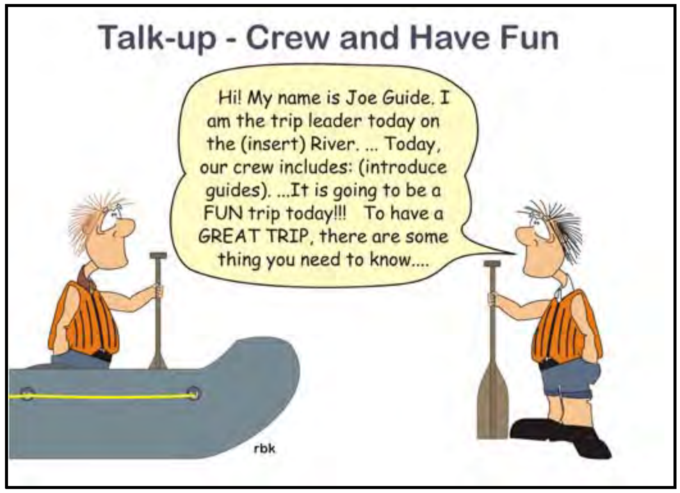

Figure 7.6: Pre-trip Introduction – Source: Author [file: \LDR-PreTripTalk.cdr]

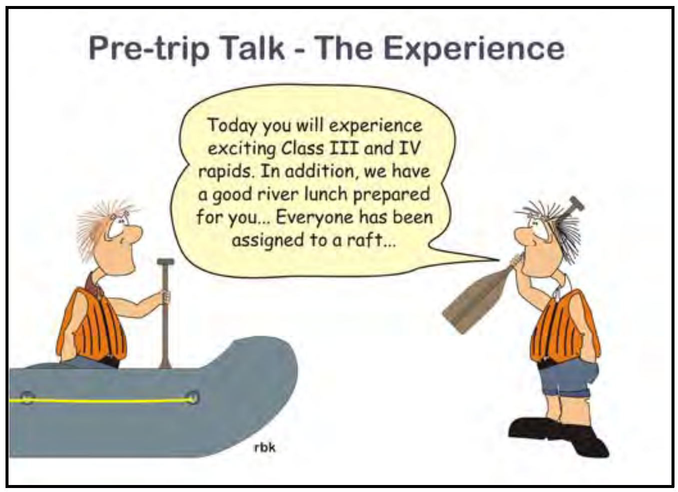

Figure 7.7: The Experience – Source: Author [file: \LDR-PreTripTalk.cdr]

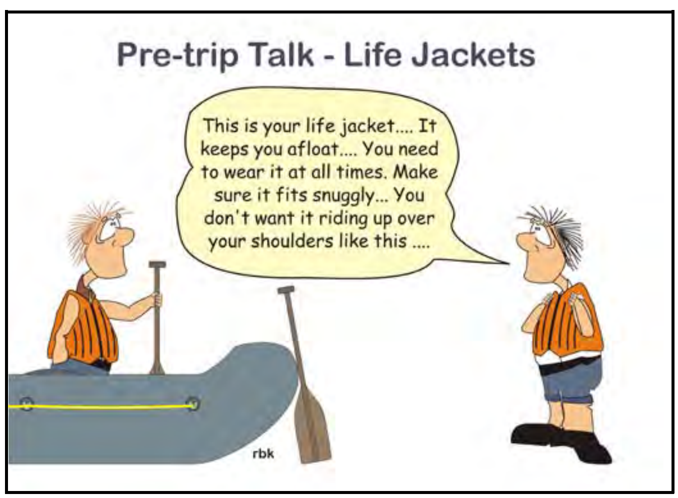

Figure 7.8: Life Jackets – Source: Author [file: \LDR-PreTripTalk.cdr]

Solutions may include putting the passenger in a strong raft or pulling them from the trip. Some pointers to consider are listed below.

- Provide an overview of the river, its difficulty, and what they can expect on the river.
- Provide what the passengers are expected to do on the trip today.
- Indicate the degree of physical exertion required and if there are any medical or health considerations that the guide needs to know.

<b>**<u>Life Jackets</u>** (Figure 7.8) – Most companies use Type V PFDs which require the life jacket to be worn to meet the Coast Guard carriage requirements. They are not much different that the Type III life jackets. For passengers, it is important for them to know when they need to be worn and how they should be fitted correctly. It is important for the guide to inspect the fitting of each passenger’s life jacket. Some pointers to consider are listed below.

- Indicate when it needs to be worn... Answer: At all times on the river.
- Emphasize that it needs to fit snugly.
- Guides will check the fit. It is important for the guide to inspect the fitting of each passenger’s life jacket.
- If you fall out of the raft, the life jacket will help to keep your head above water and breath.

<b>**<u>Paddles</u>** (Figure 7.9) – Paddles can be dangerous. They should not be used for splashing other paddlers. Many people have been injured by paddles. Regarding splashing, treat it like any other activity with rules regarding its conduct and with specialized equipment designed to spray other people. Some pointers to consider are listed below.

- How to hold the grip and throat of the paddle
- Always hold on to the grip
- Paddles can cause injury
- Absolutely no splashing of other passengers with paddles ... It is dangerous.

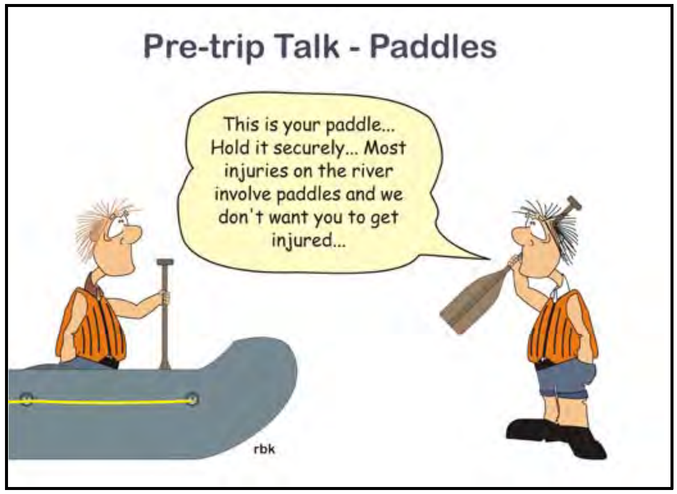

Figure 7.9: Paddles – Source: Author [file: \LDR-PreTripTalk.cdr]

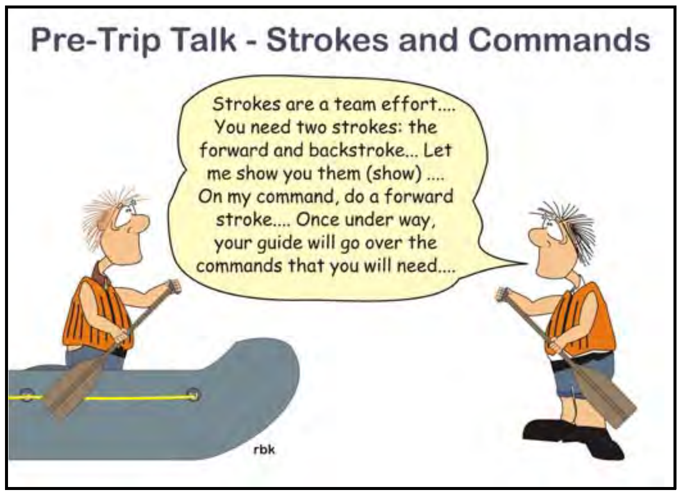

Figure 7.10: Strokes and Commands – Source: Author [file: \LDR-PreTripTalk.cdr]

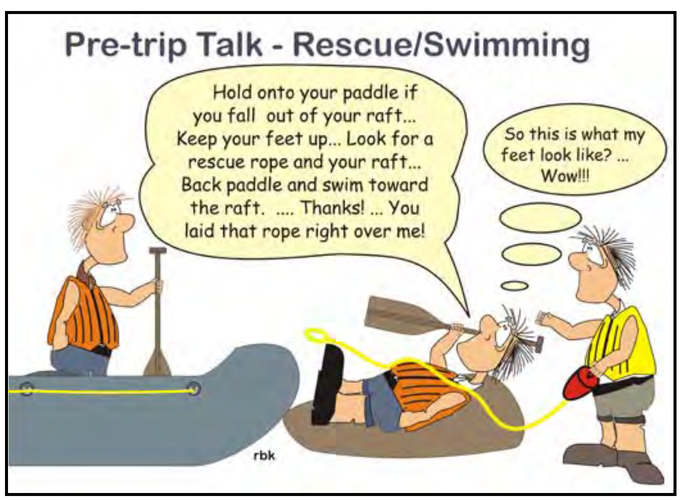

Figure 7.11: Rescue/Swimming – Source: Author [file: \LDR-PreTripTalk.cdr]

<b>**Strokes and Commands** (Figure 7.10) – Often the strokes and commands are covered by the specific guides when they have their crews assembled in their boats. Each guide has the task of getting the crew to respond as a team under the guide's commands. Some pointers to consider are listed below.

- Passengers need to know two strokes: forward and backstrokes.
- Basic stroke commands.
- High-side command.

<b>**Rescue/Swimming** (Figure 7.11) – Each river will have general procedures regarding rescue whether it is from shore or from rafts. For example, a trip using the "follow-the-leader" approach will tend to use boat rescues. In contrast, trips using the eddy hoping approach may emphasize shore based rescue. Either way, passengers need to know what to expect. Some pointers to consider are listed below.

- Show active and passive swimming
- Swim toward your raft
- When to look for a rope from the shore
- Remember to keep your feet up!
- How to breath in the waves

Figure 7.12: To the River – Source: Author [file: \LDR-PreTripTalk.cdr]

<b>**To the River** (Figure 7.12) – This is the conclusion. It should be short and the group needs to move to the river. Some pointers to consider are listed below.

- Kept the talk short or you will lose the audience
- There maybe points that need to be covered for liability purposes. Know what they are and make sure that you cover them.
- Try inserting some humor... But keep it clean and politically correct and not at the expense of anyone.
- Emphasize that it will be a fun day on the river?

Guide Commands

The following points are taken from a handout by the author (Kauffman, 2014). Usually, the commands used by the captain of the raft are individualized in the sense that each captain tailors his commands to what is comfortable for him (Figure 7.13). This is fine. It is important to train your crew, be directive, simply your commands, and be consistent in their use. The following are pointers to consider.

<b>**Train your crew** – It is important to train your crew with your commands. The crew needs to be familiar with your commands. Literally, train your crew. It is better to practice in calm waters before you need to perform a crux move in a rapids.

<b>**Be directive** – In general, you are dealing with people who have little or no concept regarding river reading and paddling. In general, this requires the captain to be directive. Being directive is telling the passengers specifically what to do ("give me two forwards on the right") and when they need to do it ("get ready for a critical move....").

<b>**Simplify your commands** – For some, the command of “left turn” may be to complicated. It may require the paddlers to think what they need to do. In contrast “back one left” is simpler and more direct. Also, keep your strokes simple and usually all the passengers need to use are the forward and backstrokes.

<b>**Be consistent** – Be consistent with your commands. If you use “back one left” and “forward one right” than don’t use “left turn.” First, it requires them to think (i.e. The “left turn” command requires them to think whether they should do a backstroke or a forward stroke?). However, if you train your crew to the “left turn” command, then by all means use it. Just be cautious not to mix commands.

<b>**Call out the strokes** – One technique that synchronizes the paddlers in your boat is to call out the cadence with “stroke, stoke, stroke....” This establishes the cadence and synchronizes all the paddlers. Also, it is directive.

<b>**Timing Tip** – There is a lag time between when you give a command and when the crew performs the stroke. If you are used to paddling by yourself, there is no lag time. With a crew, you will find that you will need to give your command a second or two before you need the actual move. It is an easy adjustment to make for those who are used to paddling by themself.

Figure 7.13: Commands for the Crew

Commands – Adapt and modify the commands to your needs. Practice your commands with your crew so that they know exactly what to do upon your command. The following is a list of some typical commands. They are presented as a suggestion. Individualize the commands to your specific needs and comfort level.

- **All forward**
- **All forward** – (call out the strokes with “stoke, stroke, stroke”)
- **All forward two strokes** – (call out the number of strokes)
- **All reverse**
- **All reverse two strokes** – (call out the number of strokes)
- **Back one left, forward one right** – (left turn) (call out the number of strokes)
- **Back one right, forward one left** – (right turn) (call out the number of strokes)
- **Half-back left** – (football pun intended) (with no right side command)
- **Half-back right** – (football pun intended) (with no left side command)
- **High Side**

Source: Kauffman, R., (2014). Rafting Manual. Unpublished handout.

Group Management

In part, group management is an issue of supervision. In terms of conducting an activity, there are three types of supervision: general, specific and transitional supervision (Kauffman and Moiseichik, 2013, p.18). ***General supervision*** means that the leader must be in the activity area and overseeing the activity. This would favor keeping everyone in sight of everyone else on the trip. ***Specific* supervision** means that the leader has hands-on involvement in the activity. Handling a pinned raft or administering first aid are examples. ***Transitional supervision*** occurs when the leader moves from general to specific supervision or from specific to general supervision. On a river, this is not always an easy thing to do. Also, it requires positioning oneself strategically and involves the river running techniques.

Group management is divided into three components. First, this section discusses river running strategies from the perspective of the principles of supervision. The principles of supervision provide the rubric for the discussion of the other topics. Next, it discusses the roles of the lead, sweep and rover rafts. This is followed by a discussion of maintaining visual contact and spacing. Last, three river running approaches are discussed. These are: follow the leader. eddy hopping and leap frogging. These approach are river dependent where the topography of the river will suggest the approach.

<b>**Lead, Sweep and Rover** – Generally, there are three trip roles. These roles are the lead raft, sweep and rover. The ***lead raft*** has the following responsibilities. It sets the travel pace for the group. The lead raft should know the route which makes it easy for the other rafts to "follow the leader." Normally, the other rafts do not pass the lead raft. This does not include leap frogging or eddy hopping situations. Often, the lead raft is the trip leader, but this need not be the case.

The ***sweep raft*** brings up the rear of the trip. Generally, it has the following responsibilities. Normally, the sweep carries the first aid kit. The sweep should be one of the most skilled boaters since they need to be able to access most anywhere on the river in order to affect a rescue. As with the lead, other boats need to stay in front of the sweep. As with the lead, there are organized situations such as leap frogging or eddy hopping where the sweep many not technically be the last boat. Usually, the trip leader is not the sweep. Regardless, it is the responsibility of the sweep to bring up the rear and to provide assistance to anyone in trouble anywhere on the river.

A ***rover*** roves from the beginning to the end of the trip. This position is optional. Often the trip leader will utilize this role since it provides good general supervision. There are several good reasons why it is not advantageous that trip leader is not the lead raft. If the trip leader needs to transition to specific supervision, the trip leader as lead raft is no longer lead. This requires everyone else to stop or someone else to assume the lead role. As a rover, the trip leader can setup safety at the bottom of a drop and move into position to assist rescue if needed.

<b>**Maintaining Visual Sight** – Generally, there are two approaches to maintaining visual sight and general supervision of other boats on the trip. The first keeps everyone in the sight of everyone else. This is the favored strategy. There are specific situations where keeping visual contact with the boat in front and back is used. However, it is flawed as a general river running strategy. These strategies are discussed below.

<c>***Everyone Keeps Everyone Else in Visual Sight*** – The lead boat keeps the sweep boat in sight and the sweep boat keeps the lead boat in sight. Every boat is in sight of every other boat. Since everyone is in visual sight of everyone else, general supervision is easily maintained. Since the sweep boat traditional carries the first aid kit, transitional supervision is facilitated because the sweep boat can access downstream boats. Categorically, follow-the-leader river running exemplifies keeping everyone in sight and general supervision.

Boaters are quick to point out that there are times on the river where boats are out of sight of the other boat. This is true. When eddy hopping or leap frogging, one or more boats can temporarily be out of sight of the other boats. These situations are viewed as acceptable exceptions to the rule necessitated by the topography of the river. Regardless, as a general rule, boaters should seek to keep everyone in sight of everyone else knowing that there are situations when this is not possible.

<c>***Maintain Visual Sight of Boat Before and Boat Behind*** (Figure 7.14) – Under this river running strategy, each boater is only required to keep the boat in front of them and the boat behind them in sight. There are times on the river when this method of supervision is acceptable or appropriate. However, as a general rule, this river running strategy is flawed because it doesn't maintain general

supervision. In addition, it easily breaks down into a situation where boaters break the chain and lose sight of either the boat in front or behind them. One of the biggest reasons this strategy fails is because the rafters look forward at where they are going and they don't turn around and look behind them.

This river running strategy easily breaks down and is demonstrated in the Cheryl Taylor fatality on the New River in 1992. (Exhibit 8, 1992) Figure 7.14 is a frame captured from the video taken by the videographer accompanying the trip. The commercial rafting company practiced the principle of maintaining visual sight of the boat before and behind. The incident demonstrates how easily the chain can be broken. First, Joy's raft (trip leader and #2 raft) is leading the other rafts through Upper Keeney and eddying out behind Whale Rock. The spacing between rafts is good and except for Scott's raft, it is a tightly run trip through the rapids.

However, Scott got out in front of the group, dump trucked, and had several swimmers. He was ten to fifteen boat lengths ahead of the group. The visual chain was broken. The rest of the trip was unaware of his situation and they did not aid in the rescue until after running the rapids themselves. It could be argued that Joy did not have general supervision of the entire group and this resulted in her not being able to transition to specific supervision and aid Scott.

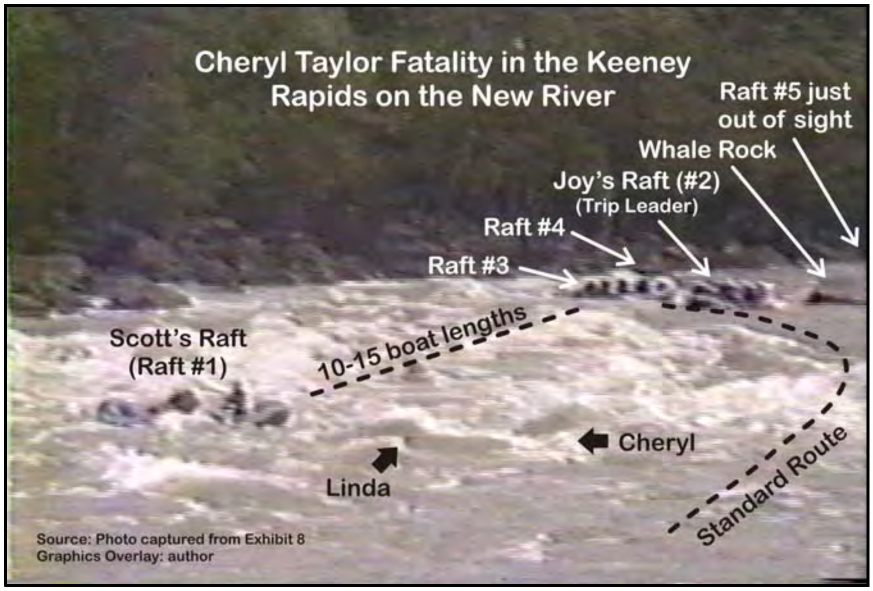

Figure 7.14: Spacing and Maintaining Visual Sight of Boats – The trip maintained good spacing but didn't maintain visual contact with all of the boats on the trip. A fatality resulted. Source: author – [file:\RR_TaylorIncident.cdr]

<b>**Spacing** (Figure 7.14) – Spacing between rafts on a trip will vary with the situation. Delimiting the discussion to the follow-the-leader situation, boats need to be far enough apart that they aren't bumping into each other. However, they need to be close enough to render assistance to swimmers and other rescues. In addition, the group wants to keep all rafts in the group within visual sight. As a "thumb rule," a spacing of five to six boat lengths between boats is typical. As previously noted in Figure 7.14, there is good, tight spacing between Joy's raft and the two rafts behind it.

<b>**Follow-the-Leader** (Figure 7.15) – Follow-the-leader is a standard river running technique on continuous drop rivers or on pool/drop rivers where the drop is not particularly significant in terms of hazards and rescue. As the name implies, the lead boat leads and the other boats follow. The sweep boat brings up the rear. In general, the sweep boat carries the first aid kit (i.e. if there is one first aid kit on the trip) since it is best suited to rescue other boats. This is because the sweep is following everyone else and in general, can reach other rafts more easily.

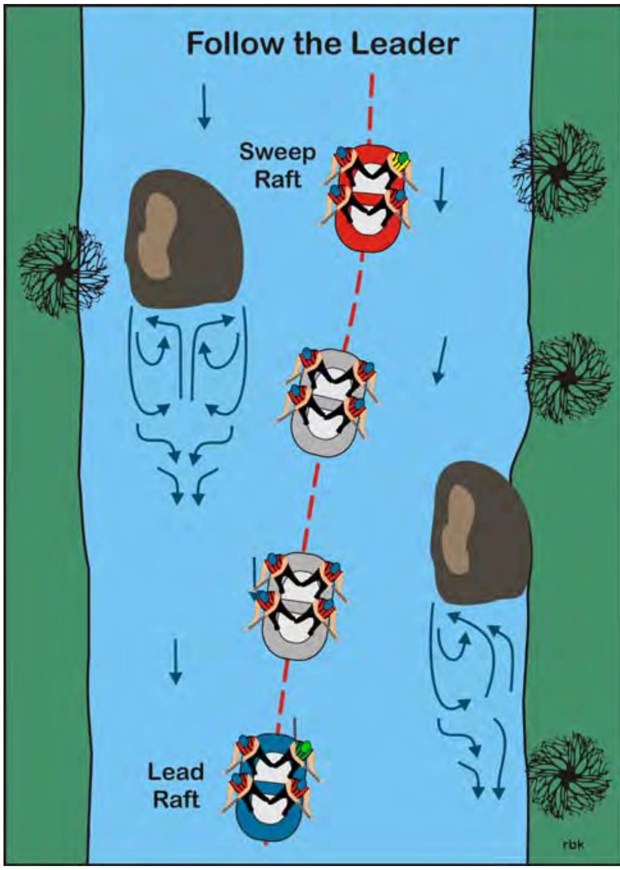

Figure 7.15: Follow-the-Leader –This method is used to run continuous drop or moderately pool/drop rivers. Source: author – [file:\RR_FollowLeader.cdr]

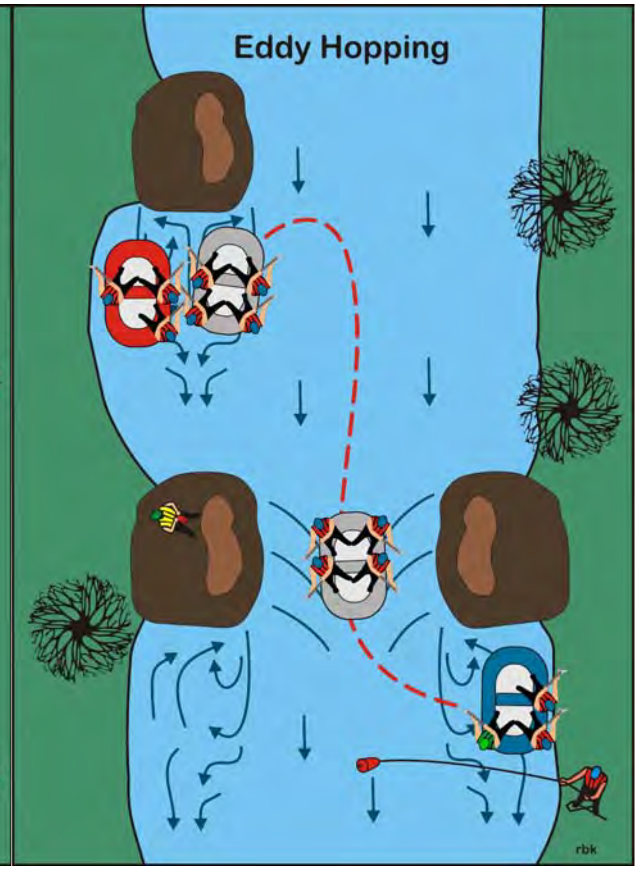

Figure 7.16: Eddy Hopping – Eddy hopping is a standard river running technique. The boats eddy out above the drop or hazard and then systematically run the drop and eddy out below it. Source: author – [file:\RR_EddyHopping.cdr]

<b>**<u>Eddy Hopping</u>** (Figure 7.16) – This is a standard river running technique. It has many variations based on river topography, the characteristics of the rapids, and the skill of the boaters. It is a standard river running technique on pool/drop rivers on rivers where there is a big drop, or where there is a major hazzard.

In the simplest form of eddy hopping, the lead or sweep runs the drop first and sets up safety in the eddy below the drop. Everyone else follows one at a time or in single file with good spacing between boats. The sweep goes last. The process is repeated at the next drop. In river running, this approach is used countless times. From this approach, the setup can become as sophisticated as needed and as described in the four steps below. On the Upper Yough, this approach is used on rapids such as Bastard Falls and Triple Drop. The following steps are as follows.

<c>**Step #1: *Everyone Eddies Out above Drop*** – Everyone eddies out above the drop. Often, the group will get out and scout the rapids. Scouting has its pluses and minuses. It is useful when guides or those running the rapids are unfamiliar with the rapids. Also, it has psychological value for passengers and increases their excitement and apprehension. On the minus side, it is often difficult to transfer the view from the side of the river to a river view. Also, it takes time. In terms of apprehension, sometimes it is simply easier to run the rapids, particularly when the guides know the route.

<c>**Step #2**: ***Setup Safety*** – Setting up safety can occur one of several ways. Often the lead or sweep boat will run the drop and setup safety. This approach is depicted in figure 7.15. Safety may be either in boat or on the shore. Both are shown. In some cases, safeties will portage, setup safety and then return and run the rapids. This provides safety for everyone including the sweep boat. Often, the safety is also the trip leader or the person on the trip responsible for evaluating the performance of guides. Positioned below the drop, this person can easily observe and evaluate the runs of the other guides.

<c>**Step #3: *Setup Communications and Command Structure*** – Command structure involves determining who goes when through the rapids. Communications between guides accomplishes the command structure. Communications can be between the downstream and upstream raft using a whistle, paddle or hand signals. Often if there is a restricted view a guide may position himself where there is a view of the upstream eddy, drop, and downstream safeties. This guide orchestrates the rafts one by one through the rapids.

<c>**Step #4: *Last Raft Runs Drop*** – The last raft runs the drop. This may be the lead or sweep boat. If there is a guide on the rock, he will generally be the last raft. With everyone downstream of the drop, the group proceeds down river.

<b>**<u>Leap Frogging</u>** (Figure 7.17) – Leap frogging is an in between strategy between follow-the-leader and eddy hopping. When approaching a moderate drop, the sweep boat advances to the beginning of the trip, runs the drop, and then eddies out below the drop. The sweep provides safety and observes the other rafts passing through the drop. When the rest of the trip has run the drop, the sweep returns to the sweeping position. An advantage of this approach is that if the trip leader is also the sweep boat, the leader can evaluate the performance of the other boats.

When all the boats are traveling at the same speed, this approach is not always an easy method to use. This is the case where the entire group is comprised of rafts. It favors a hard boater (e.g. canoe or kayak) accompanying the trip where they can easily pass the group and advance to the front of the group. Usually, in a raft group, the trip will temporarily eddy out and the sweep boat will head through the drop and eddy out below the drop. The rest of the group follows quickly. Or the group can drift in the current and allow the sweep to overtake the group.

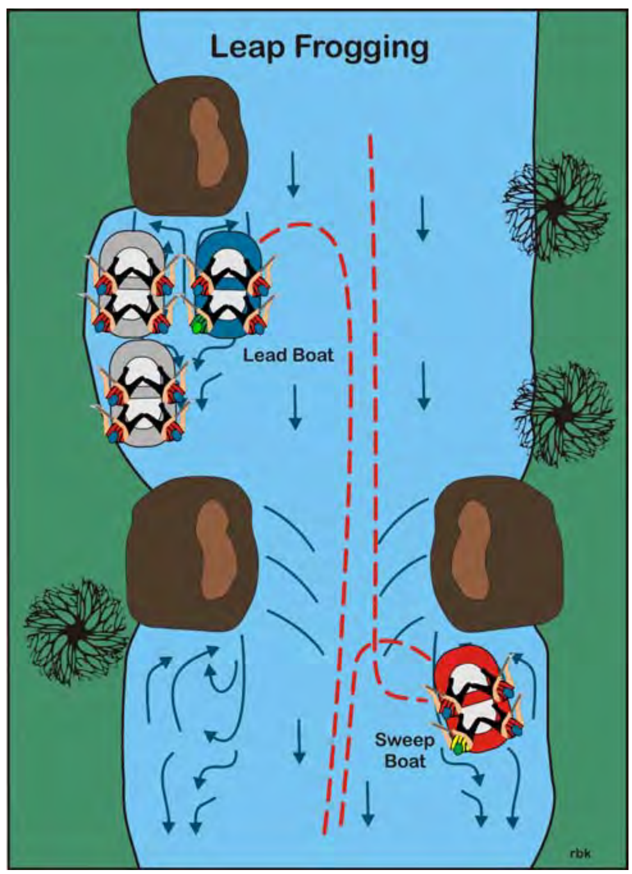

Figure 7.17: Leap Frogging –The sweep pulls ahead, eddies out, and sets up safety. The rest of the trip runs the rapids and the sweep returns to the sweep. Source: author – [file:\RR_LeapFrog.cdr]

Evaluating Water Confidence of Passengers

Passengers should feel comfortable in the water. This is important for several reasons. It is assumed that passengers will eventually fall out of the raft.

This can be for a host of reasons including simply losing balance and falling out of the raft, unstable footing in the bottom of the raft, and hitting a hole that dump trucks passengers into the water. Next, a swimmer who feels comfortable in the water can aid in their rescue. They can swim toward the raft, avoid obstacles in the river using defensive swimming, and grab a rope thrown to them.

Being able to swim in a swimming pool is a very different experience than swimming and feeling comfortable in swiftwater. Guides need to take this into account. Also, this is the professional opinion of this author and may not be universally shared. Swimming pools are a known body of water in terms of the sides and bottom. Its water is clear. In most places, a swimmer can stand up in a swimming pool and stand comfortably on the bottom. In fact, many people will confuse wading with swimming ability. Regardless, swimming in a swimming pool may indicate a certain level of comfort in the water.

Swimming in a river is a very different experience. The water is moving. There are obstacles with which to contend. Coordinating breathing in between waves can easily be disorientating. Couple this with the psychology of the unknown and it can easily lead to a disoriented and panicky passenger when in the water. The bottom line is that just because a person is a good swimmer in a swimming pool, don't assume they are a good swimmer in swiftwater.

<b>**Ask Them** – Consider this the starting point. Ask the passengers who can swim and who can't. Usually, this will give the guide a good starting point. Look for hesitancy in responses. Also, there can be follow up questions such as swimming in a pool or at the beach. The beach is still wading, but it is wading in moving water.

<b>**Jump-off Rock or Water Activity** - Many trips have a jump-off rock or other fun type activity where passengers are in the water. This provides a chance to evaluate who enters the water and who doesn't. Also, it provides an opportunity to evaluate people's behavior in or near the water. It should be noted that this evaluation can be performed informally and without the conscious knowledge of the passengers.

Although this author doesn't recommend jump-off rocks, the activity should be treated as any other activity in terms of its conduct and safety considerations. The site should be examined visually and with a paddle inserted into the water to make sure that there is sufficient depth and no obstacles. This needs to be done even if the site is used on a continuous basis. Debris can easily be swept into the site. There needs to be general and specific supervision of the activity. This includes who jumps and when. There need to be rules. Everyone wears their life jacket and a guide checks it for fit. One person jumps at a time.

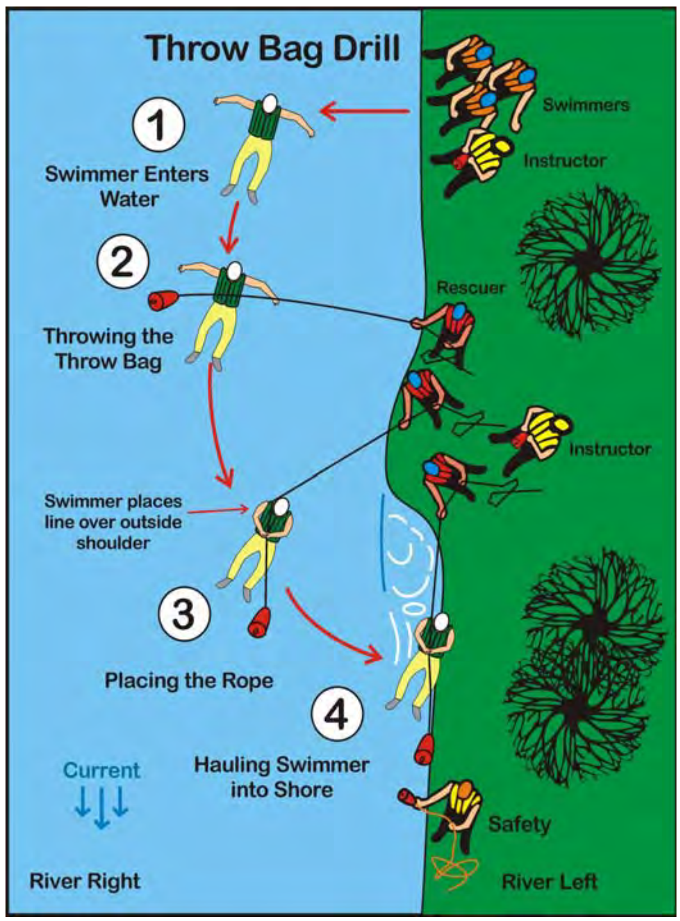

Figure 7.18: Throw Bag Drill – The throw bag drill is a two activities in one. It is both a defensive swimming and throw bag throwing exercise. Source: author – [file:\BAG-ThrowRopeDrill.cdr]

<b>**Throw Bag Drill** (Figure 7.18) – In general, the throw bag drill is more applicable in an instructional setting than on a commercial trip. From an instructional perspective, the throw bag drill provides several benefits. It allows students the opportunity to practice defensive and active swimming in swiftwater. Students gain experience in throwing throw bags. In terms of the discussion of being comfortable in moving water, it provides the instructor with an opportunity to evaluate student comfort in swiftwater. Instructors and guides need to evaluate their students and passengers on a continuous basis.

Conducting the throw bag drill is described in more detail in the Swiftwater Rescue Manual (Kauffman, 2017). The manual describes the role of the instructor and specific details regarding swimming, throwing the throw bag and setting up safety. Also, it discusses how to conduct the activity safely. There has been at least one lawsuit associated with throw bag drill (Dzialo, 1998, and Kauffman and Gullian, 2006). In terms of this section, this discussion is equally applicable to the previous discussion on the jump-off rock activity. The instructor needs to consider site selection for the activity, general and specific supervision, rules, and rescue in case of mishap.

Seating Arrangements

It is important for the guide to position passengers in the raft to optimize performance. This may include breaking up groups rafting together if necessary. Bennett (1999, p.40) notes three consideration for positioning people in the raft. These are 1) even strength determination, 2) even weight distribution, and 3) providing paddlers adequate room to paddle.

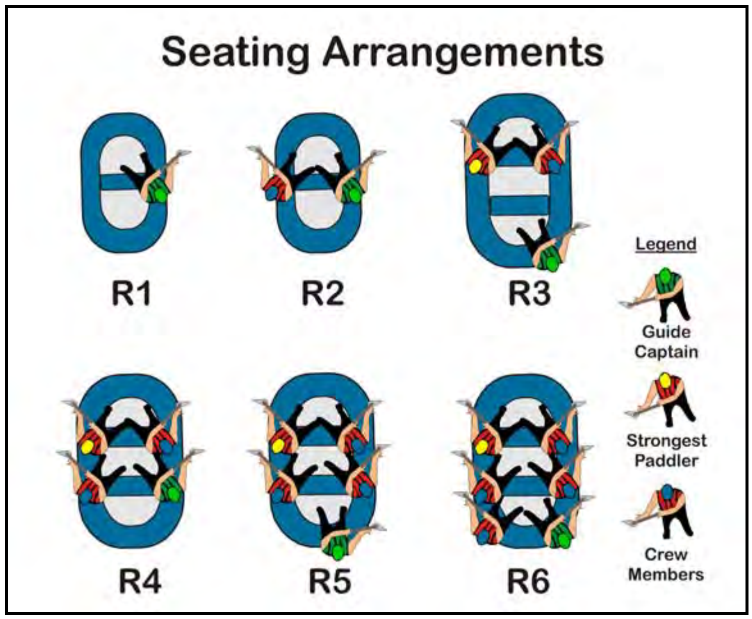

Figure 7.19: Seating Arrangements – Suggested seating arrangements are provided for R1 through R6 configurations. Source: author – [file:\LDR_Seating.cdr]

Suggested seating arrangements are provided in Figure 7.19 for R1 through R6 configurations. First, examination of the seating arrangements for R1 through R6 suggests relatively even weight distribution bow to stern (front to back). This will result in relatively good trim. Next, assuming the guide (right rear) is the strongest paddler, place the next strongest paddler (yellow helmet) in the front left to help counter the guide's strong strokes. Also, both bow paddlers should be strong paddlers and their role is to help set the cadence and rhythm of the other paddlers.

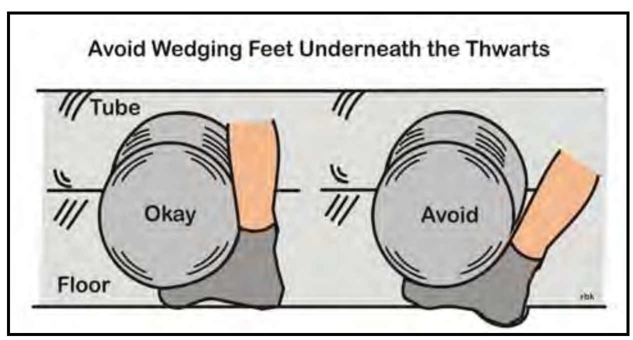

Figure 7.20: Throw Bag Drill – Excessive wedging of feet underneath the tubes can lead to paddler harm. Source: author – [file:\EQUIP_FootTubes.cdr]

Generally, the weakest paddler is place in the rear next to the guide. Guides with passengers who are fearing of whitewater but who are still on the trip anyway will find this a good location for these passengers. This enables the guide to monitor them, calm them, and chat with them. Also, they feel securer sitting next to the guide. There is one other feature of having them sit here. They are the most likely to fall out of the raft. On more than one occasion, this author has reached over, grabbed them by the life jacket, and kept them from falling into the water. If they were sitting elsewhere in the raft, they would fall into the water.

Boaters like to be part of the raft. If there are foot cups, use them. Often rafts are outfitted with two foot cups in the bow only. Paddlers in the middle and rear of the raft will often wedge their foot under the tube. Although this is perfectly okay, caution should be taken not to wedge the foot under the tube that prevents easy extrication (Figure 7.20). If the foot becomes stuck, passengers can sprain or break their ankles if they were to fall out of the raft or if it were to flip. The guide should check for foot placement of passengers underneath the tubes as part of their normal routine.

Negligence

The following is a primer on negligence. For a more in depth discussion, see Kauffman and Moiseichik (2013). In terms of this chapter this section complements the other sections including the experience provided passengers, river running approaches and group management. Also, know the common practices for the activity you are performing and practice them. This is the standard of care to which you will be held. If all other groups on the river wear helmets, then wearing helmets is considered a common practice. If there is an accident with a head injury on your trip and the passenger is not wearing a helmet, the guide in question may not have followed the common practices of his industry and may be considered negligent.

<b>**Four Components** – For negligence to occur, four elements must be present. First, there must be a ***duty*** (i.e. contractual obligation) between the raft company and participant. A raft guide has a duty to provide a "safe environment", but there is no guarantee that it will provide safety. Second, there must be a ***breach of duty***. Either, the guide didn't do what they were supposed to do (i.e. omission), or what the guide did was incorrect (i.e. commission). Not warning passengers of a hazard would constitute an omission, and not taking the standard route through the rapids might be considered an act of commission. Third, there must be ***proximate cause*** or some relationship between the breach of duty and the injury, damage, or loss. If a passenger drowns, it needs to be shown that it was due to the passenger swimming into a hazard without being warned, or because the guide took the wrong route. Fourth, there is ***injury, damage or loss***. In the previous example, drowning is an example of an injury, damage or loss.

All four elements must be present for negligence to occur. If one of them isn't present, there is no negligence. A possible breach of duty, the guide doesn't warn passengers of an undercut rock. A passenger falls out of the raft, successfully swims past the undercut rock, and is pulled back into the raft by the guide without any injury. Although not warning the passenger potentially constitutes a breach of duty, there is no negligence because there is no injury, damage or loss.

<b>**Common Practices** – Regarding the duty owed to the passenger, a raft guide is required to provide a standard of care that represents the ***common practices*** or ***industry standards*** for the activity they are conducting. This is a higher standard than what a reasonable and prudent person would be expected to do. It is what other raft guides and companies would do. It is a higher standard. It is the standard of a professional, not an unknowledgeable person.

In terms of risk management strategies, there are several defenses available to guides and companies. Overall, there are two strategies: risk reduction (e.g. risk reduction and avoidance) and transfer the costs (e.g. waivers, insurance and subcontracting).

<b>**Risk Reduction** – If you are in the business, you are into ***risk reduction*** as a risk management strategy. It is really this simple. Essentially, this means that the guide and company seek to reduce risks (e.g. roller coaster experience). This doesn't mean all risks can be eliminated, they can't. However, decreasing actual risks and increasing perceived risks are always a good strategy. Avoidance or not performing the activity is a viable alternative also. If the river is at flood and above the cutoff level on the gauge, taking passengers down the river may be terminated.

<b>**Waivers** – A word on waivers. They are an important tool. They do not reduce or eliminate an accident from happening. Waivers attempt to transfer the cost of injury back to the participant, even when the guide or company are essentially in the wrong (i.e. breach of duty). The value of waivers is strictly a state by state basis and it can vary from being worthless to generally being upheld. In one case, the lawyers were arguing whether the body was on the Georgia or South Carolina side. In South Carolina, waivers have no value. In Georgia, they have a higher standard and the plaintiff needs to show gross negligence.

Know what the common practices and follow them. "*The bottom line is that a recreation professional will be held to the standard of care that represents the common practices or industry standards for the activity he is conducting*." (Kauffman and Moiseichik, 2013, p.17). Conceptually, the roller coaster is a good model to follow. Reduce actual risks and increase perceived risks to enhance the experience of your passengers. It is a good formula for reducing accidents.

Summary

This chapter focuses on the trip leader and guides leadership responsibilities. It starts by discussing the flow experience. One take-away for a successful trip leader or guide is to create an optimum experience for passengers by matching the challenges present with the skills and expectations of the participants. The roller coaster provides a good model where the trip leader or guide minimizes actual risks while maximizing perceived risk. This is true even on rivers with challenges. Next, the chapter discusses and provides suggestions for the pre-trip talk. Third, river running is discussed in term of the principle of supervision. Strategies are suggested and the Cheryl Taylor incident underlines the importance of spacing and proper supervision. Fourth, the chapter discusses the importance of assessing people's comfort in the water. This section has an emphasis on instructional programs. Next, seating arrangements are discussed in terms of providing proper trim and motive power. Last, there is a primer on negligence. It brings full-circle the discussion regarding minimizing actual risks and maximizing perceived risks to achieve the optimum experience for passengers.

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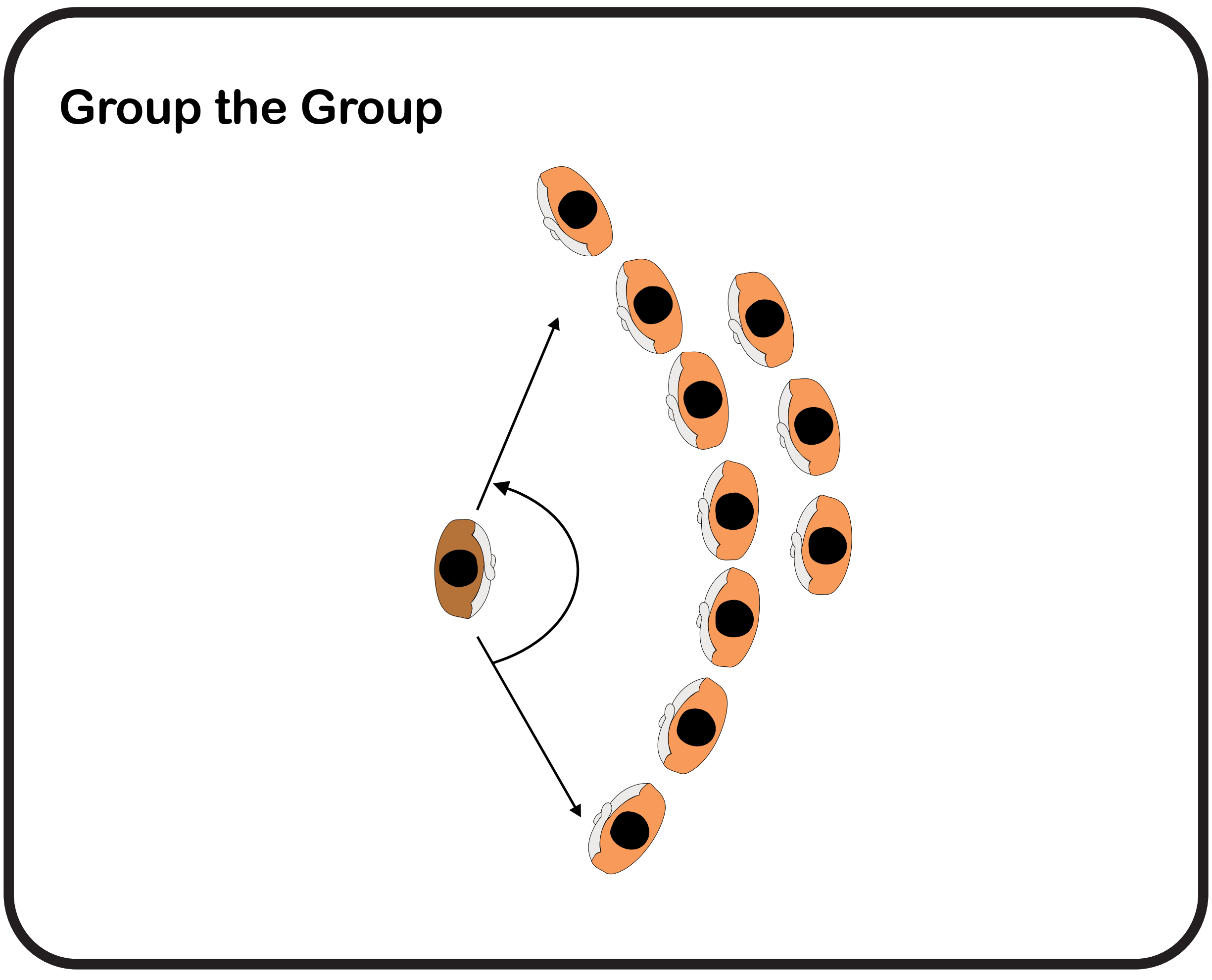
Chapter 8: IDW, teaching, and learning processes



Chapter 8.0:

IDW – Teaching and Learning Processes [1]

The topics in this chapter focus on teaching. They include materials that have traditionally been involved in the Instructional Development Workshop (IDW) and the Instructor Certification Examination (ICE). The discussion of teaching styles begins with a brief discussion of informal, semi-fixed feature space and fixed-feature space. Spatiality is one of the underpinnings of the instruction. Next, the section describes in some depth the small group presentation and discussion approaches. There is discussion of the enjoyment curve, which focuses on determining the length of time for an activity or program. Also, the station approaches are discussed. The focus is on how people move through space. Two additional topics are discussed based on handouts. These are the Learning Style Inventory and covering the subject.

Teaching Styles

Spatiality is one of the underpinnings of the instruction. The discussion of teaching styles begins with a brief discussion of informal, semi-fixed feature space and fixed-feature space. Next, this section describes in some depth the small group presentation and discussion approaches. There are other approaches including guided discovery and problem solving which are not discussed.

<b>**Informal, Semi-fixed Feature and Fixed-feature Space** – This section builds upon the research of Hall, E, (1990), Hall, E, (1981), Nierenberg and Calero, (1971), and Sommers, (1969). In addition, it provides the conceptual foundation of spatial determinants of behavior. There are three type of space: informal, semi-fixed and fixed-feature space. All three classifications are predicated on informal space which is defined as the space people maintain between themselves. Informal space is based on physiology and culture. Physiology is based on the senses (e.g. sight, hearing, smell, feeling). In terms of small group presentation the senses of sight, voice and hearing are of primary interest. They are related to the distance maintained between people.

Fixed-feature space is defined as space which can't be changed. Rooms and buildings are usually defined as fixed feature space. Actually, a raft might be defined as fixed-feature space since its features are fixed and people can reposition themselves in terms of the tubes in the raft. Semi-fixed feature space is defined as moveable items like chairs and furniture that are moveable but that are not normally moved. Chairs can be moved closer together. Rafts can be moved close to each other and linked together. For small group presentations, informal space is of primary interest.

<b>**Small Group Lecture/Presentations** (Figure 8.1) – An instructor and ten students are presented in the small group lecture presented in Figure 8.1. It is a staple in instruction. It is a lecture format where the instructor presents and the students listen to the message. It doesn't preclude discussion, but the discussion is primarily between the students and the instruction. The spatial layout facilitates this type of interaction. The instructor is looking at the students and the students are looking at the instructor. The small group lecture can be used to discuss throw bags, describe the parts of a raft, describe the parts of a paddle, or when scouting a rapids to explain the dynamics of the rapids. Components to consider include

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[1] This chapter was written by Robert B. Kauffman who is solely responsible for its content. This chapter is copyrighted © Robert B. Kauffman, 2018.

grouping the group (i.e. angle), speaking to three people, read their body language and modulate and project your voice.

<c>***Grouping the Group*** – The instructor has control over the group, as much as one can have control. If left alone, most people will organize themselves in a close variation of the scene depicted in Figure 8.1. Those who are less interested will tend to move to the second row where they are visually more hidden from the instructor or move to the sides for the same reason. If there is a rock to sit upon, they may sit upon it. Usually, the students will position themselves seven to ten feet away from where the instructor is standing. Remember, most students have been students before and they are intuitively experienced in understanding these spatial relationships.

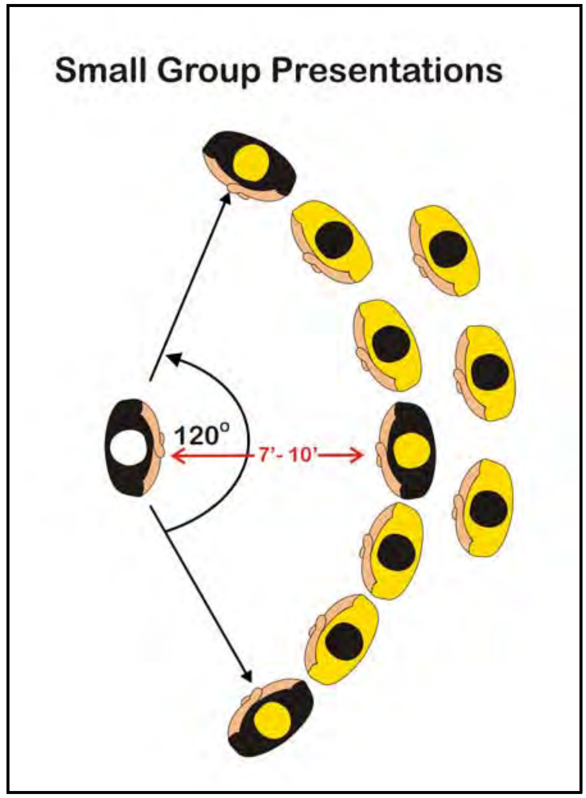

Figure 8.1: Small Group Presentations – Source: author [\IDW_SmallGroup.cdr]

The first rule is that the instructor can regroup the group. The instructor can move closer to the group or move the group closer to the instructor. Using a directive command, the instructor can simply direct students to move in closer to the instructor. Lower the voice slightly helps to draw the group closer. Or the instructor can move in closer to the group. If the members of the group are sitting rocks or leaning against a fence, it is usually easier for the instructor to move closer to the group.

<c>***90^o-120^o Grouping*** – When regrouping the group, pull the sides in toward the middle. Generally, a 90^o-120^o is maintained from end to end. Sometimes a student will purposely sit outside and away from the group. If consistently done, it may be an indicator that they don't consider themselves as part of the group. When the spread angle becomes more than 120^o, it becomes more difficult for the instructor to systematically speak to the entire group. Again, the instructor can corral students closer together to maintain less than an 120^o angle.

<c>***Speak to Three Members of the Group*** – This is a speaking tip to novice presenters. In a small group of four people, most people can easily speak to the other three members in the group. The trick here is to select three members in the group of ten and speak to them. In Figure 8.1, one student is in the middle and the other two students are on the ends of the group. Speak to the student to the left. After a sentence or two, switch to the center student. Again, after a sentence or two, switch to the student on the right. Make passing eye contact with the other students.

<c>***Read Their Body Language*** – Read the body language of the three people. This is done one at a time. If the person has a questioning look on their face, respond with a rhetoric question. If this student seems to be less than interested, move on to another student and use them as your contact person. This is a normal process. If all the students seem to be less than interested, it may be time to shorten the presentation and move on, take a break, or continue on as is knowing that the message is most likely not being received.

<c>***Voice Modulation and Projection*** – In Hall's (1990) classification system, a distance of 7'-10' between the instructor and student is the "far phase of social distance". Very quickly it can become the "near phase of public distance." These distances are at the edge of the instructor needing to become more animated with gestures and voice projection. It is at the edge because the instructor will get by in most cases using a normal voice.

For an instructor, voice modulation is an important tool also. Modulation of the voice is a common technique used by story tellers. Soften the tone and speaking with less intensity draws the group toward the instructor. The group leans forward in an effort to hear better. It is a simple but effective technique. Sometimes a point can be better made by lowering one's voice and using the change in intensity to move the group inward toward the instructor rather than increasing the intensity of speech and moving people away from the instructor.

<b>**<u>In Raft Instruction</u>** – Several approaches to in raft instruction are provided. Each has its advantages and disadvantages. Although these are listed under the group presentation method, several of the in-raft approaches quickly merge into the discussion or interactive approach between two or more people.

<c>***In Raft Instruction as a Crew Member*** (Figure 8.2) – The first is where the instructor instructs students as a member of the crew (Figure 8.2). Pictured is a five person raft with the instructor paddling in the rear of the raft opposite of the student who is guiding from the rear. This position works best with a student who is in the elementary phases of the learning process. If they screw up, the guide can usually take corrective action. One disadvantage of this approach is that the instructor may compensate too much for the student. Another disadvantage is that the instructor needs to look behind herself while facing forward to evaluate what the student is doing. However, in spatial terms, one advantage is that the instructor is three to four feet away from the student which makes for easy discussion between the student and the instructor and where the instructor can often provide immediate feedback to the student.

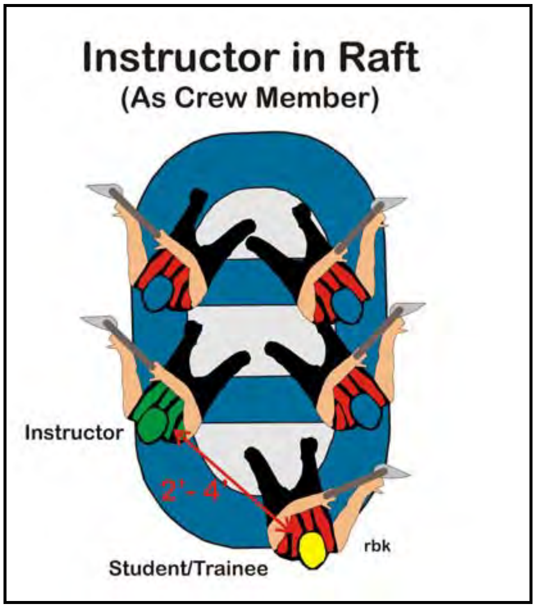

Figure 8.2: In-Raft Instruction as a Crew Member – Source: author [\IDW_InstructorInRaft02.cdr]

A significant consideration for the instructor involves the concept of general and specific supervision by the instructor of the group, in this case other rafts in the group. It is clear from the previous discussion that the instructor is providing specific supervision of the student who is guiding. In doing so, the instructor is not providing general supervision of the entire group. This is not insurmountable, but something the instructor needs to be cognizant of and periodically focus on the entire trip.

<c>***In Raft Instruction as a Passenger*** (Figure 8.3) – This approach is listed second because the instructor has less control over the outcome. In this approach, the instructor sits on the tube facing backwards toward the guide. Essentially, the instructor is along for the ride. It has the same advantages and disadvantages of the previous approach in terms of providing immediate feedback and having a conversation with the student guide. The problems associated with general supervision are present also.

<c>***Instruction from another Raft*** (Figure 8.4) – In this approach, the student guide and her crew are paddling the raft with out direct supervision by the instructor. This approach is most appropriate when the student guide has gained some competency on her part. Spatially, the two rafts can easily be separated from each other by 15' to 20', even if the instructor is paddling on the left side. In terms of Hall’s (1990) paradigm, these distances are the “near phase of public distances.” Essentially, this distance of separation requires an elevated voice (i.e. mild shouting) to be heard by the student guide in the other raft. Also, since both rafts are moving in the water, both the student and instructor are focused on where they are going rather than on taking corrective action. Also, maintaining close proximity to the student raft in moving water can be problematic at best. For this reason, effective communication can only occur in an eddy after the fact. This approach precludes making fine corrections in technique on the part of the student by the instructor which is perfectly okay for students with some experience.

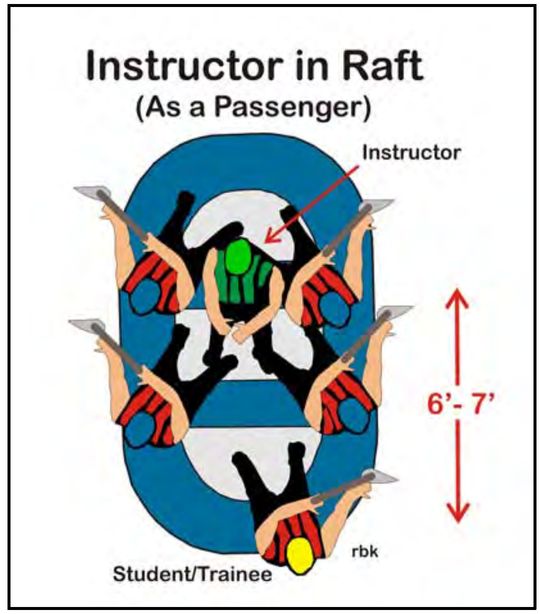

Figure 8.3: In-Raft Instruction as a Passenger – Source: author [\IDW_InstructorInRaft.cdr]

Some students with experience prefer this approach since the instructor is scrutinizing their every move and they can figure it out for themselves. For this reason, this approach is most effective after students have gained some of the fundamentals first.

<c>***The Message*** – The following are suggestions on how to deliver the message. Consider using the “Sell it. Show it. Use it” approach discussed later in this chapter. The main objective is for the group to “buy-into” the message. As the title suggests, selling the idea involves the listener seeing relevance in the forthcoming message. Other approaches can involve story telling, using brief examples, or past experiences experienced by the group.

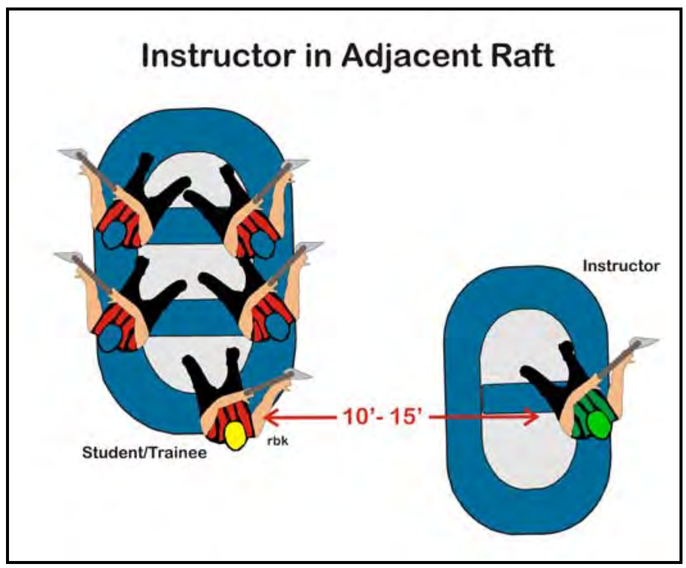

Figure 8.4: Instruction from Adjacent Raft – Source: author [\IDW_InstructorAdjacentRaft.cdr]

Discussion (Interactive)

Where lecture is one way communication from the presenter to the group, a discussion is two-way or multi-way communications between people in the group. Two discussion formats are presented. The first is the classic “sharing circle” and the second is an in-raft discussion.

<b>**<u>Sharing Circle</u>** (Figure 8.5) – The sharing circle is the classic discussion format. It is used in debriefings after completing a series of activities or at the end of the day. The format is fairly straightforward. Everyone stands in a circle equal distance from everyone else. Although the figure lists six to eight foot diameter, larger diameters can be used as can smaller diameters also. However, somewhere around 15' to 20' or at the beginning of the “far public distance,” discussion begins to break down because people need to project their voices. Also, a true discussion can’t occur involving all the participants because of the large number of people.

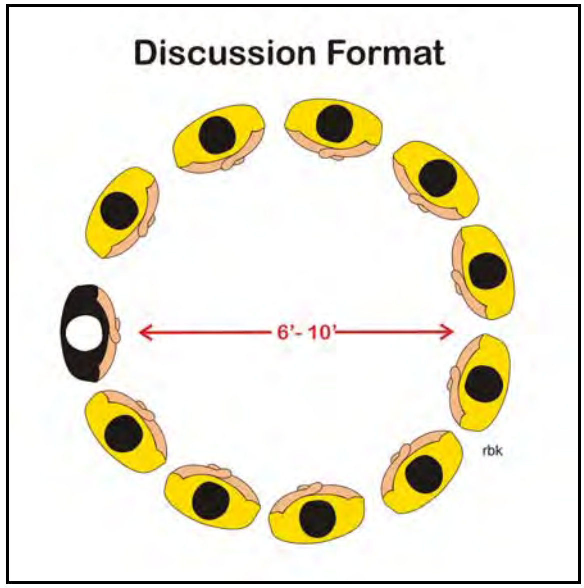

Figure 8.5: Sharing Circle – Source: author [\IDW_Discussion.cdr]

Regarding the debriefing circle, consider the following format (Kauffman and Moiseichik, 2013). The formal debriefing process is a six phase process. It can be condensed into a three phase process moving from concrete to emotion back to concrete. The session starts with facts (concrete) such as what you did during the day. It would be a factual review of the day’s activities. This is followed by people expressing their feelings (emotion). “How did you feel about the day’s activities?” “How did it impact you?” Then the discussion returns to more prescriptive observations (concrete). Statements regarding how the learning might be applied elsewhere or what should be done tomorrow. Stated another way, move from facts to emotion and back again to prescriptive facts.

<b>**<u>In-raft Instruction</u>** (Figure 8.6) – Semi-fixed feature and fixed-feature space influence discussion. The positioning of chairs can facilitate or impede discussion. In Figure 8.5, everyone could be sitting on chairs in a circle rather than standing. More often seats previously set up in rows for a lecture impede discussion and make having a discussion more difficult. Often, people will often turn and move the chairs in the lecture format to face each other in a circular format. Also, small enclaves of chairs positioned around a coffee table facilitates discussion in small groups of three or four people.

The scene depicted in Figure 8.6 is an example of a rafting group adapting the fixed-feature space of a raft where everyone is normally facing forward into a discussion format. The raft is designed to seat passengers facing forward to take forward strokes. It is not normally designed for a discussion format.

People in the raft can reposition themselves to facilitate a discussion. Imagine the raft has just negotiated a rapids and is sitting in an eddy. The instructor facilitates a discussion with the group. Notice how the group realigns themselves in the raft.

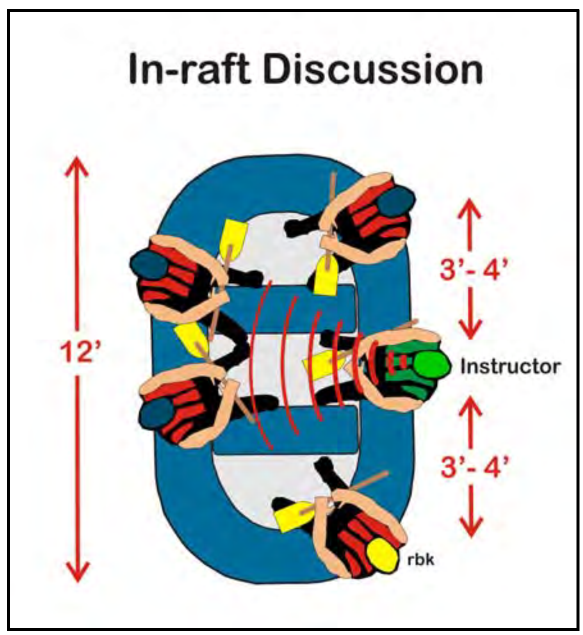

Figure 8.6: In-raft Instruction – Source: author [\IDW_InraftDiscussion.cdr]

The front left paddler rotates and straddles the cross-tube. Others simply turn in their seats on the tubes. They are seated in a circle, if only an imperfect circle, facing everyone else in the raft.

The instructor may find it useful to use a variation of the debriefing. “We successfully negotiated the rapids (fact).” “How do you think we did (emotion)?” “What should we have done differently (directions for the future)?”

Enjoyment Curve

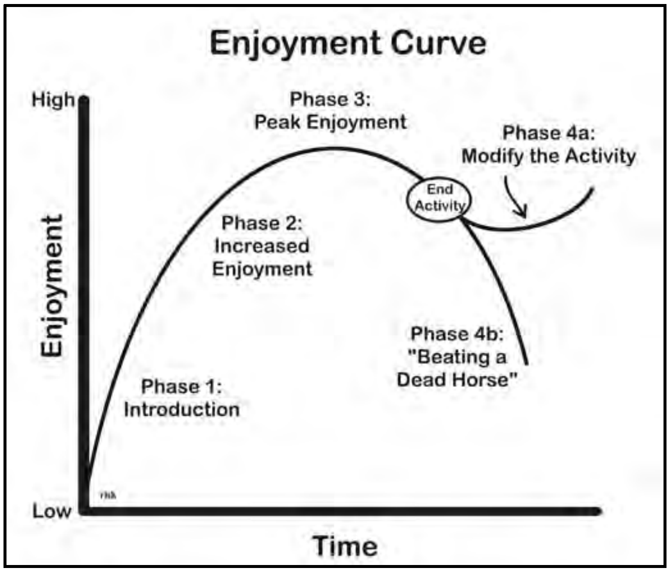

Figure 8.7: Enjoyment Curve – Source: author [\IDW_EnjyCrv.cdr]

The “*enjoyment curve*” is an adaption of the traditional growth curve to the presentation of an activity or program (Figure 8.7). The phases are discussed below. The take-away for instructors is to recognize when the activity has peaked and either end it or modify it.

Phase 1: Introduction – The activity is beginning. People are warming up; they are learning the activity; they are getting into the activity. Enjoyment of the group is increasing.

Phase 2: Increased Enjoyment – As the activity progresses, people's enjoyment will increase and eventually begin to level off.

Phase 3: Peaked Enjoyment – The enjoyment of the group has peaked and is now on the down side of the curve. Basically, there are three choices. 1) End the activity. 2) Restructure or modify the existing activity to create newness and thus maintain enjoyment (i.e. in essence, this is creating a new activity). 3) Continue the existing activity and “beat a dead horse." It is important to recognize a group or participants that has just peaked so that the appropriate action can be taken.

Phase 4a: Modify the Activity – If the activity is restructured or modified, enjoyment should again increase. Depending on the extent of the changes, it is a return to either Phase 1 or Phase 2.

Phase 4b: "Beating a Dead Horse" – If the activity is ended or changed, enjoyment will continue to decrease. Eventually, it will become evident to everyone that everyone is fatigued and beating a dead horse. No one is having fun any more.

Station Approaches

The station approaches focus on the use of space to conduct different activities. The classroom is one station. The patio outside the classroom is another station. The gym next to the classroom is another station. These stations can be used to conduct different activities. The following approaches help to delineate the different station approaches.

<b>**Single and Multiple Single Station** (No figure) – In the single station approach, the entire group utilizes one site for the instruction. This is the usual approach. The location could be a classroom, gym or beach area. Most likely groups will use multiple single stations. This is where the entire group moves from one site to the next. Typically, the group will move from the classroom to another room for an activity and then back into the classroom. The group can move from the classroom into the gym or outside to a patio or grass area to perform an activity and then return to the classroom. A variation is to have an activity area within the classroom where the group moves from the classroom to complete the activity. Key to this approach is that the entire group moves back and forth between two or more stations.

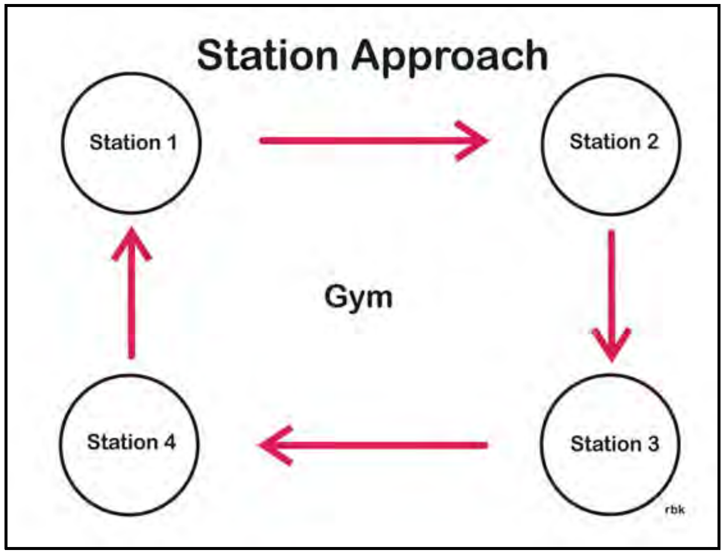

Figure 8.8: Station Approach – Source: author [\IDW_StationApproach.cdr]

<b>**Station Approach** (Figure 8.8) – In the traditional station approach several activities areas are located around the gym. Normally, the group is divided into four sub-groups and each sub-group is assigned to a station. Activity A is done at Station 1, Activity B is done at Station 2, etc. After a specified period of time, the groups rotate to the next station where the activity at that station is repeated for the new group. The advantage of this approach is that multiple activities can be presented simultaneously. Also, large groups can be broken down into smaller sub-groups.

The disadvantage of the station approach is that it assumes equal time is needed to present different activities at the stations. A second disadvantage involves the travel distance between stations. Stations can be located in different rooms or different buildings. At some point travel time between station can become wasted time. If the rotation is done in a small area such as a gym, the rotation is not a problem. Third, the approach assumes that the stations don't require sequential delivery where a group has to complete Station 1 before Station 4.

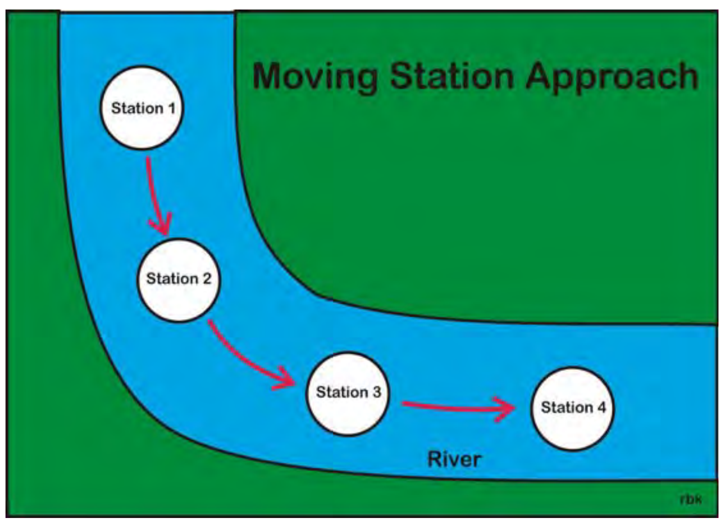

Figure 8.9: Moving Station Approach – Source: author [\IDW_MovingStation.cdr]

<b>**Moving Station** (Figure 8.9) – In the moving station approach, rather than rotating equal sized groups through the stations, the entire group travels to each station sequentially. The group visits Station 1 and completes Activity A. Then it travels to Station 2 and completes Activity 2, etc. As much time as needed can be spent on each activity at each station because there is only one group. If the travel time between stations becomes too long, the

excessive travel time can be considered a disadvantage because the travel time takes away for teaching time.

The moving station is the inherent method used in river instruction where different activities are divvied up for different rapids and locations along the river. The stations can be either on the shore or in the river such as a rapids. As the group travels down the river, it stops at the next station and completes the designated activity at the station.

Types of Learning

The "Learning Style Inventory" is attached (Fuller, 1981). It is useful in three ways. First, it makes the point that people learn differently. Second, it suggests providing different instructional strategies that appeal to the different learning styles. Third, it is interesting as a self-assessment tool.

The inventory consists of four sets of words where the person taking the inventory rank orders each column. The inventory results a plotted on a graph. The four quadrants represent the different learning styles. They are concrete experiences (i.e. Doers), reflective observation (i.e. Watchers), abstract conceptualization (i.e. thinker), and active experimentation (i.e. Feeler).

<b>**Concrete Experience (The Doer)** – According to the article, "People in this category tend to be pragmatic, practical and functional: they are searchers who see a purpose in learning; they are good problem-solvers and work well with others."

<b>**Reflective Observation (The Watcher)** – According to the article, "These people like to get the picture, like to know the purpose of practice. They need to watch others, are good listeners, introspective and contemplative."

<b>**Abstract Conceptualization (The Thinker)** – According to the article, "Such people are analytical, logical, thorough and theoretical. They would rather read than listen to lectures, are often loners or dreamers. At times they are meticulous to a level of obsession."

<b>**Active Experimentation (The Feeler)** – According to the article, "People of this nature are receptive learners: they learn predominantly through "gut" intuition. They try many things to find a way. They tend to be emotional. They learn by doing and evaluating on the way."

Cover the Subject

A handout titled "Teaching Paddling" suggests the following teaching paradigm: Sell it. Show it. Use it (Teaching Paddling, 2017). It provides teaching suggestions for each of the three phases.

<b>**Sell It** – The first step is to sell it. This is to motivate the student. It addresses the "why" they need to know or want to perform the task.

<b>**Show It** – The second phase is to show it. In this phase, arrange for all to see the demonstration. Teach one skill at a time. Good modeling is useful. For the student's benefit, model from different angles. Consider using the whole-part-whole method. This is where the skill is broken down into its component parts. Each part is covered individually and then the skill is reassembled as the whole. The forward stroke

(i.e. whole) consists of three phases (i.e. parts). These are the catch, power stroke, and recovery, Each component is discussed individually. Then the entire stroke is reassembled and demonstrated (i.e. whole). Emphasize key points in doing the skill (e.g. position of grip hand, blade angle, etc.).

<b>**Do It** – The third phase is to do it. This is where the students perform the skill themselves. Consider the different learning styles. Watchers like to observe. Doers like to do. Feelers like to figure it out for themselves. Thinkers like to analytically work through the skill. If appropriate, the skill can be practiced as the whole-part-whole. If needed, the forward stroke can be broken into its parts of catch, power stroke and recovery and each part practiced individually. Watch for and correct immediately errors immediately. Be sure to complement success and encourage students. Provide mechanisms by which students can evaluate their own performance. This instructor used buoys and the English Gate as an instructional tool for teaching strokes (Kauffman, 1980, 1976). The buoys provided immediate feedback to students.

Summary

The main focus of this section was on small group presentation and discussion approaches. The materials cover some of the topic areas of an Instruction Development Workshop (IDW). The backdrop is that of a rafting course. In addition, the chapter focuses on timing activities with the enjoyment curve and on moving groups in space with the station approaches.

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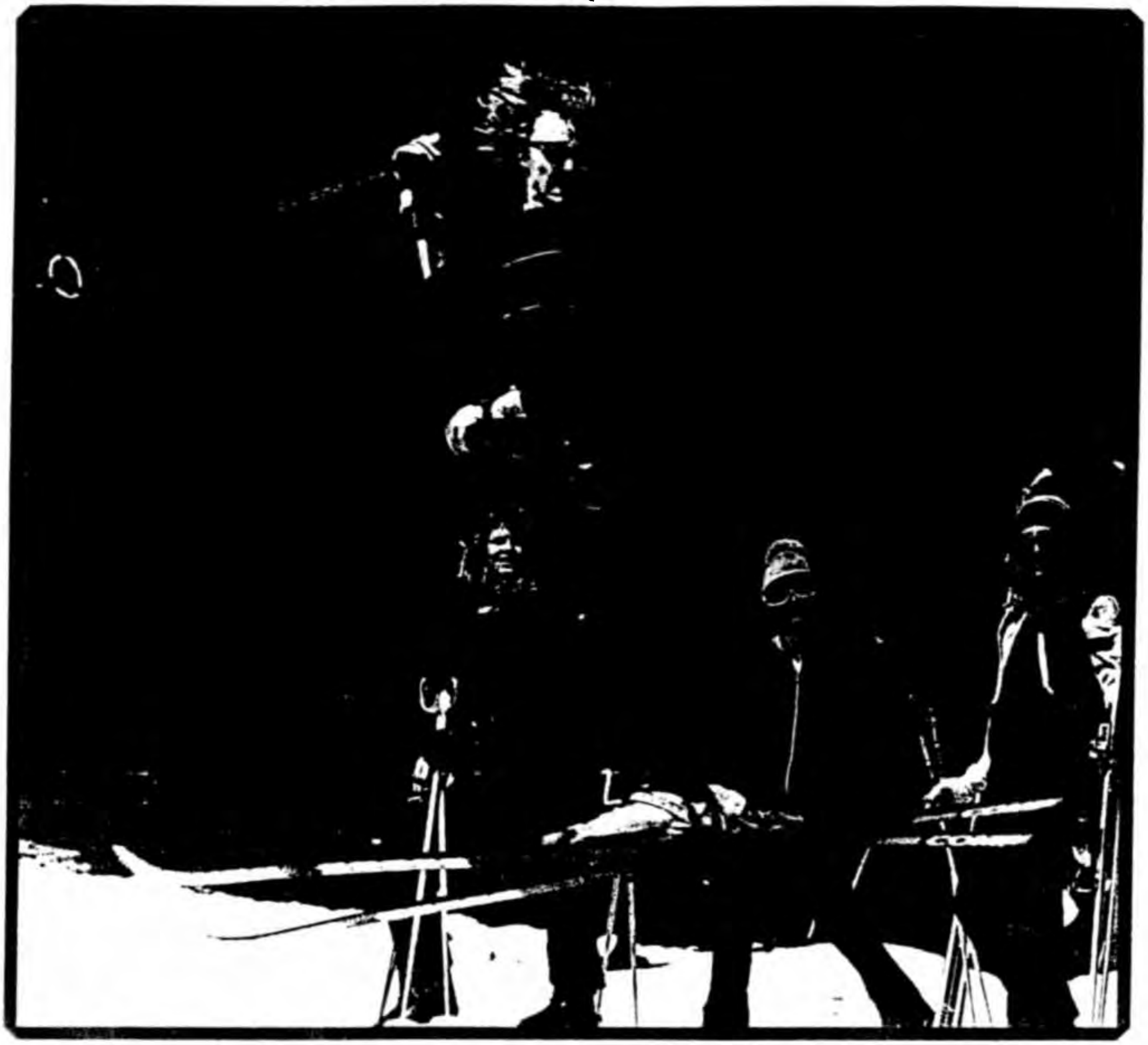


LEARNING STYLE INVENTORY

"Understanding one's own magical mystery is one of the teacher's most important assets if he is to understand that everyone is thus differently equipped."

Buckminster Fuller

Since any instructional process' effectiveness relies heavily upon how the teacher "comes through" to his students, it is of value to consider the concept of dominant learning style. The value of recognizing how you learn is that it tends to be the way you teach.

The following learning style inventory, originally introduced by Dick Leider of Human Renewal Associates in Minneapolis, Minnesota, is designed to assess your method of learning. As you take the inventory, give a high rank to those words which best characterize the way you learn and low rank to the words which are least characteristic of your learning style. You may find it hard to choose the words that best describe your learning style because there are no right or wrong answers. Different characteristics described in the inventory are equally "good." The aim of this inventory is to focus on *how* your learn, *not* to evaluate your learning ability.

LEARNING STYLE INVENTORY INSTRUCTIONS

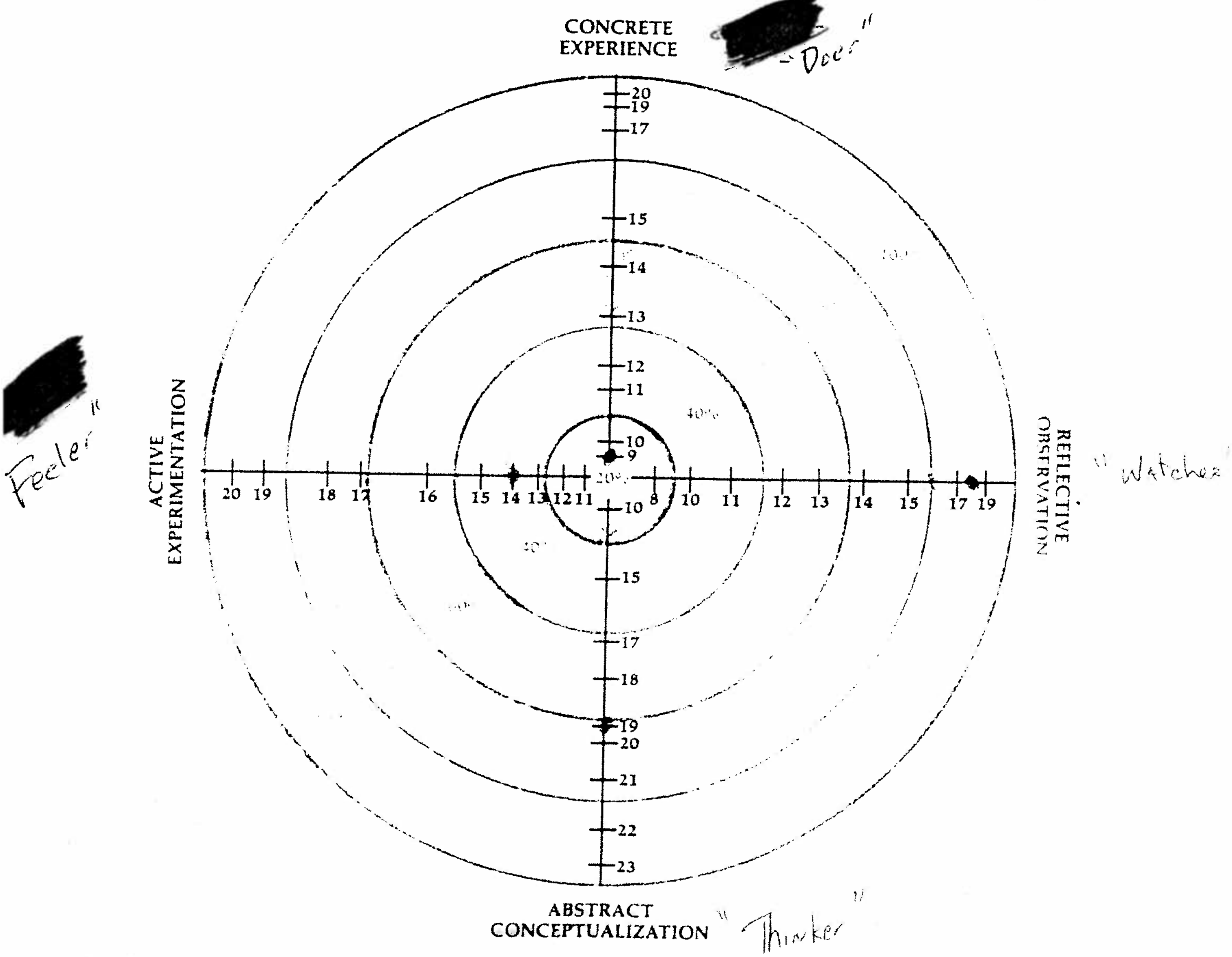
There are nine sets of four (4) words listed below. Rank order each set of words assigning a 4 to the word which best characterizes your learning style, a 3 to the word which next best characterizes your learning style, a 2 by the next most characteristic word and a 1 with the word least characteristic of you as a learner. Be sure to assign a DIFFERENT rank number of each of the four words in each set.

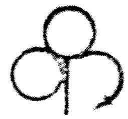
1.	____ discriminating	____ tentative	____ involved	____ practical
2.	____ receptive	____ relevant	____ analytical	____ impartial
3.	____ feeling	____ watching	____ thinking	____ doing
4.	____ accepting	____ risk-taker	____ evaluative	____ aware
5.	____ intuitive	____ productive	____ logical	____ questioning
6.	____ abstract	____ observing	____ concrete	____ active
7.	____ present-oriented	____ reflecting	____ future-oriented	____ pragmatic
8.	____ experience	____ observation	____ conceptualization	____ experimentation
9.	____ intense	____ reserved	____ rational	____ responsible

CE ____________________ RO ____________________ AC ____________________ AE ____________________

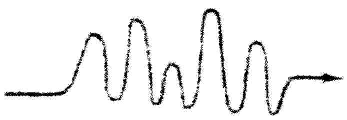
2 3 4 5 7 8 — 1 3 6 7 8 9 — 2 3 4 5 8 9 — 1 3 6 7 8 9

Add the totaled numerical values of the six word-sets listed under the four scoring lines. Then total each of the four lines and enter these values in their proper axis on the target. CE stands for CONCRETE EXPERIENCE, RO is REFLECTIVE OBSERVATION, AC is ACTIVE CONCEPTUALIZATION, and the AE number transposes to ACTIVE EXPERIMENTATION. Once your totals have been entered on the target you can determine your type of learning style. Leider has taken this self-assessment a bit further and expands on the characteristics of each learning style (following page).

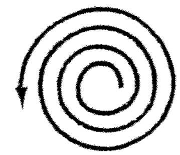




CONCRETE EXPERIENCE
"THE DOER"
People in this category tend to be pragmatic, practical and functional; they are searchers who see a purpose in learning; they are good problem-solvers and work well with others.



ACTIVE EXPERIMENTATION
"THE FEELER"
People of this nature are receptive learners; they learn predominantly through "gut" intuition. They try many things to find a way. They tend to be emotional. They learn by doing and by evaluating on the way.



REFLECTIVE OBSERVATION
"THE WATCHER"
These people like to get the picture, like to know the purpose of practice. They need to watch others, are good listeners, introspective and contemplative.

ABSTRACT CONCEPTUALIZATION
"THE THINKER"
Such people are analytical, logical, thorough and theoretical. They would rather read than listen to lectures, are often loners or dreamers. At times they are meticulous to a level of obsession.

In learning situations, these characteristic styles are immediately recognizable.

THE DOER: He will be constantly on the move. Standing and waiting are not for him; he will be seen anxiously poking the snow with his ski poles until he is moving. He learns by doing and nothing else seems to be worth his attention.

THE FEELER: This type is also "doing-oriented," though he will be far more sensitive to the connection between what he does and sequences. This type of learner is aware of similarities and differences of experiences. He is particularly kinesthetic and will learn sports relatively easily because of strong awareness, a very important ingredient in acquiring skills of any sort. If instruction is mostly analytical, this student will quickly lose interest, yet feeling and sensory association have great value for him.

THE WATCHER: He tends to "hang back" in the ski class, studying everyone's performance. This provides him with the essential guidance necessary; he emulates what he sees. Talk will be largely useless with a person like this, unless verbal directives create images of a viable nature. This type of learner will sometimes do well skiing right behind the instructor but, more often than not, will wish to go last, garnering as many visual references as possible.

THE THINKER: He is often the type of skier who has read books and magazines about skiing long before taking a skiing vacation to learn to ski. He may be full of "shoulds" and "oughts." This learner will need detailed explanations from the instructor in order to understand what to do. Lift rides and lunch breaks will become welcome forums for this person to "squeeze" the teacher for more verbal information.

Though we are all mixtures of each of these learning styles, we each have a dominant learning technique, regardless of the situation. Since an instructor is likely to teach very much the way he learns, it is easy to see why, at times, incompatible teacher/student relationships can occur. "Gosh, I had a hard time with my students today," or "I did not get anything I found useful out of the teacher" are statements that can be traced to a conflict of teaching and learning styles.

For a teacher to be most effective, it is useful for him to be aware of his teaching style, and then to practice (for the benefit of students who require a different approach), other methods as well. The versatile instructor can deal with any point in a graspable, meaningful manner to any "doer," "feeler," "watcher," or "thinker." Careful observation will soon allow this educator to pinpoint what mode each of his students responds to best.

Coaching or instruction in any sport must transcend a dominating preoccupation with mechanical analysis. The harmonious mixture of motor control, awareness, self-perception, imagination and spiritual strength is the secret of top performance and learning. Though a valuable realization for the learner, it is an indispensable one for the coach and teacher. Knowing about these elements and skillfully applying the knowledge gives validity to the term "professional." Only with this understanding will we actually function as ski teachers and coaches, readily converting potential into talent.

Dr. Richard Farson, from the University of Southern California, delivered a speech at one of the 1973 Rocky Mountain Instructors functions in Keystone, Colorado. Giving professionals much to think about, the crux of his approach is anchored in these ten "Instructional Paradoxes":

1. People learn most when talking, not when listening.

2. More of certain types of learning can take place when one does not make an effort to teach.

3. Some things are learnable, but not teachable.

4. Everything we try works.

5. What is true for children is probably also true for adults.

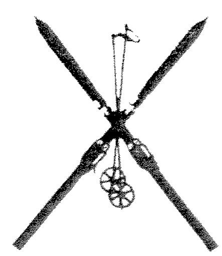
6. We think we learn from our failures, and from other people's successes, but it's the other way around.

7. We grow from calamities, not from perfection.

8. Don't try to improve people — improve the situation.

9. Students can learn more from each other than from their teachers.

10. We learn to ski in summer and we learn to swim in winter.



Teaching Paddling
Sell it, Show it, Use it

1. **Preparation, Motivation, or "SELL IT"**
   a. Put your student at ease
   b. Name the skill
   c. Possibly use game, prior experience, or story to prove importance of skill
   d. Give necessary background
   e. Purpose of skill
      i. When it is used
      ii. How it is used
      iii. Why it is used
      iv. Where it is used

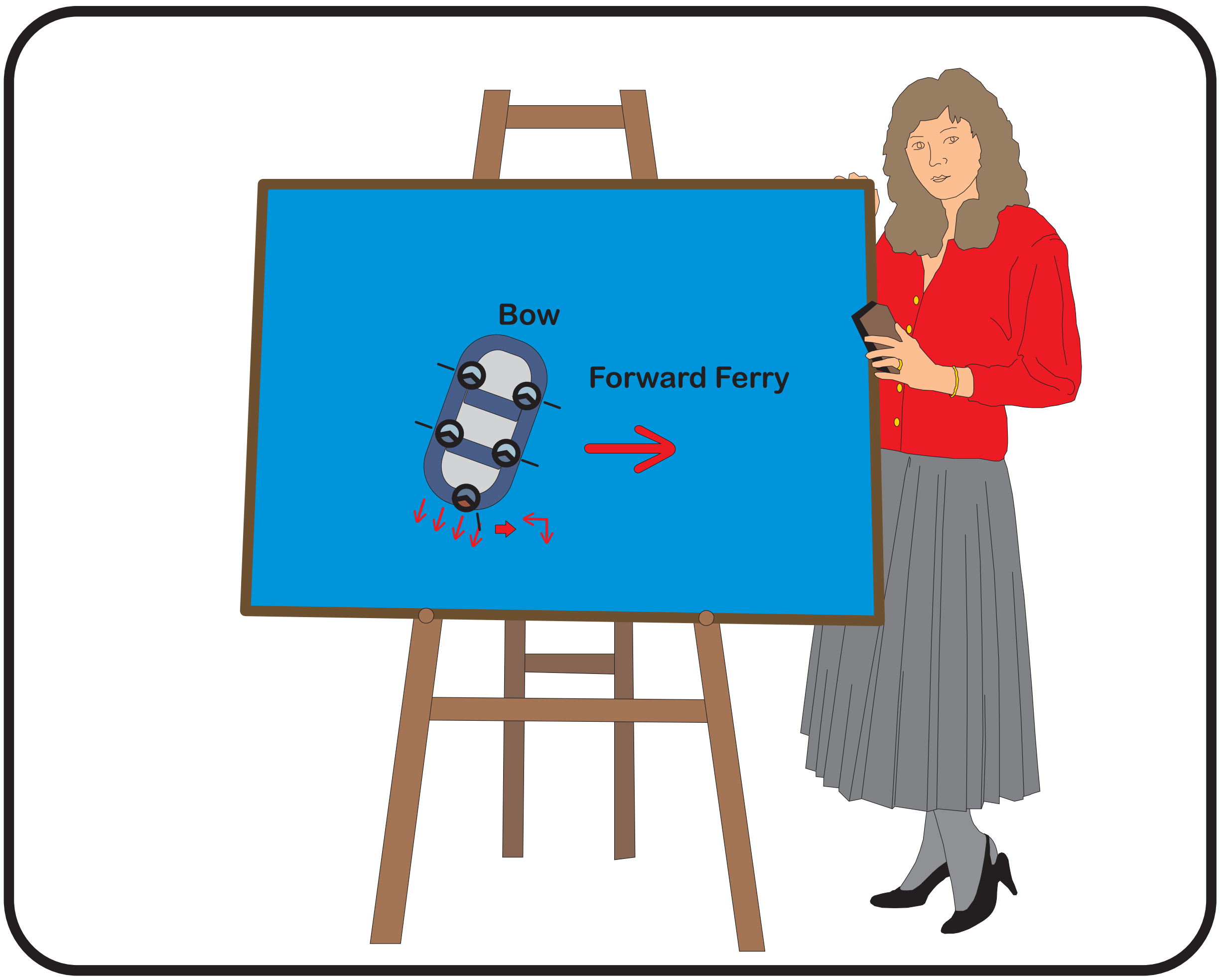
2. **Presentation, demonstration, or "SHOW IT"**
   a. Arrange for all to see demonstration, Face your students while telling and showing
   b. Teach one skill at a time
   c. Explain while showing. Use good modeling skills of demonstration quality: :
      i. Whole-Part-Whole method of presenting skills
      ii. Half speed, pause at transitions
      iii. Exaggeration of lean, rotation, stretch (make it obvious)
      iv. Complete in range of motion
   d. Stress the key points of the skill

3. **Application, practice or "DO IT"**
   a. Have students do the skill
   b. Address Doers, Feelers, Thinkers, Watchers in way that helps each the most.
   c. Have students practice slowly, whole part whole if possible.
   d. Watch for and correct errors immediately.
      i. Re-visit students who have difficulty
      ii. Compliment and encourage your students.
      iii. Set up ways for periodic practice. Use progressively harder practice situations
      iv. Testing
      v. Daily practice of yesterdays skills.

Some Instructional Methods:

Lecture, fast, covers lots of material, but boring, poor retention
Lecture with some Directed questions, a little better, more student participation
Discussion, still more student participation, but slower and harder to direct
Task Groups problem solving in small groups, then share answers
Role Playing, gets peoples attention, assigned roles
Brainstorming, looking for ideas
Paper scenario, quicker to set up than live scenario, requires analysis and problem solving, teamwork
Scenario, problem solving, real life, often harder and longer to set up
Demonstration, keep it brief, may be more effective after students have tried it
Explanation of Demo points out key topics
Team Teach, one demos while other explains
Practice, warm-up first, immediate feedback during practice
Video review, show and critique quickly

Appendix A: Examinations



Raft Instructor Course – Examination

____
Student's Name

Date: ____________

1. The following multiple choice questions. Please write the correct response on the blank in front of the question. (2.0 points each)

_______ 1) As a raft guide, your number one objective is to get all your passengers safely down the river. (Note: *Do we really need to give you a hint on this one?*)
   a) true
   b) false

Chapter 1: Demonstrate a knowledge of ACA paperwork

_______ 2) Having a properly signed waiver will make the activity safer by reducing the likelihood of an accident occurring? [nope]
   a) true
   b) false

_______ 3) The purpose of a waiver is to transfer the actual costs of the injury, damage, or loss to someone else, the victim.
   a) true
   b) false

_______ 4) A waiver will protect you against nearly all instances of negligence.
   a) true
   b) false

_______ 5) When the parent signs a waiver on behalf of a minor, the parent signs away the rights of the child to sue. [only sign their right to sue]
   a) true
   b) false

Chapter 2: Equipment and Repairs

_______ 6) All of the following are typical paddle terms except one. What is it?
   a) blade
   b) shaft
   c) throat
   d) broom
   e) handle/grip

Chapter 3: River Dynamics

_______ 7) Which of the following best describes what a tongue is?
   a) upstream V
   b) downstream V
   c) pillow
   d) standing wave
   e) hydraulic

_______ 8) Looking downstream, the water flowing between two rock creates which of the following?
   a) upstream V
   b) downstream V

_______ 9) In Figure 1, the eddy line is found in which of the segments?
   a) In segment (5a) only
   b) In segments (5a) and (5b) only
   c) In segments (5a), (5b), and (5c)
   d) In segment (5b) only
   e) In segment (5b) and (5c) only

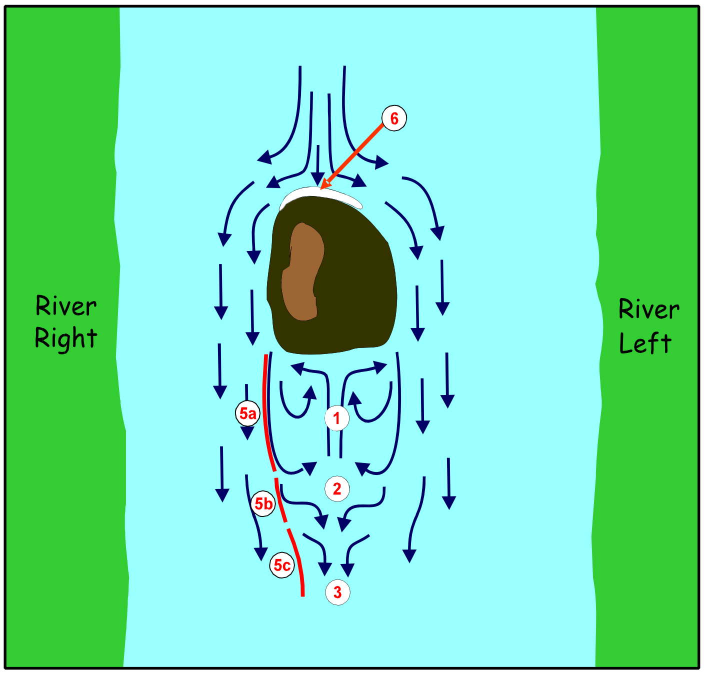


Figure 1

_______ 10) In Figure 1, a student's boat eddies out in section (3). The group cheers and applauds on how great their eddy turn was. As the instructor, which of the following commands is most appropriate?
a) take a rest, you are in the eddy... good eddy turn
b) you missed the eddy, try again
c) paddle forward, or you will drift out of the eddy

_______ 11) In Figure 2, location (1) is called which of the following?
a) boil
b) hole
c) current moving downstream
d) rooster tail
e) eddy

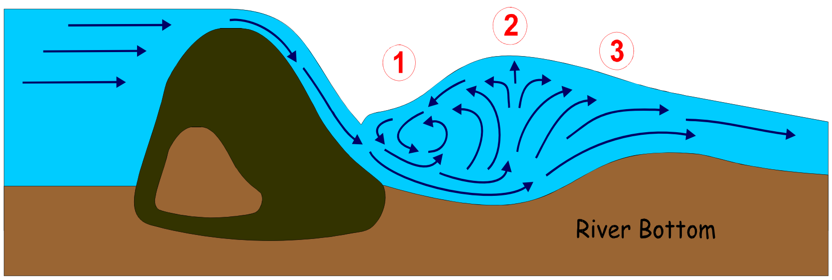


Figure 2.

_______ 12) In Figure 2, location (2) is called which of the following?
a) boil
b) hole
c) current moving downstream
d) rooster tail
e) eddy

_______ 13) In Figure 2, if your raft is sitting at point (2) which of the following will occur?
a) you will be sucked back into the hole
b) you will float downstream
c) you will neither be sucked into the hole or float downstream
d) you will explode

Chapter 4: Stokes and Maneuvers

_______ 14) As the raft is propelled forward, the turning circle moves toward the stern or rear of the raft. This is why it is easier for the bow paddlers to turn the raft. [moves forward; easier for stern paddlers]
a) true
b) false

_______ 15) In a forward ferry, the bow of the raft is pointing downstream. [upstream]
a) true
b) false

_______ 16) If the raft is going the same speed as the current, you can't ferry the raft. [must be different speed]
a) true
b) false

Chapter 5: Safety

_______ 17) Man is a tropical animal.
a) true
b) false

_______ 18) Radiation is the transfer of thermal energy through a solid or between two solids in contact with each other. [conduction]
a) true
b) false

_______ 19) Convection is the transfer of thermal energy by the circulation of a fluid.
a) true
b) false

_______ 20) Against ***convection*** loses, a cubic foot of steel wool will do just about as well as goose down.
a) true
b) false

_______ 21) Against ***conduction*** loses, a cubic foot of steel wool will do just about as well as goose down.
a) true
b) false

_______ 22) There are three ways that the body can warm itself. These are it can receive heat from an external heat source, it can generate heat itself, or it can insulate itself and reduce the loss of heat.
a) true
b) false

_______ 23) For negligence to occur, there are four components that must be fulfilled. All but one of the following are one of those components. Which is it?
a) duty
b) breach of duty
c) proximal cause
d) injury, damage, or loss
e) All of the components above are components necessary for negligence.

_______ 24) If it is established that you don't have a duty to the plaintiff, you can still be negligent.
a) true
b) false

_______ 25) Commission is an example of doing something you should have done but you have done it incorrectly. [omission]
a) true
b) false

_______ 26) The ***gag reflex*** occurs when a person comes into contact with warm water. [quick cold water]
a) true
b) false

_______ 27) The key symptom of hypothermia is shivering while the person is sitting down or at rest.
a) true
b) false

_______ 28) The easiest way to tell when a person has totally rewarmed is that they will develop beads of sweat on their forehead.
a) true
b) false

_______ 29) Someone throws you a rope while you are swimming a rapids. You grab it and swing into the shore. After grabbing onto the rope, you are still self-rescuing.
a) true
b) false

_______ 30) In terms of the rescue curve, your first line of defense is safety and prevention.
a) true
b) false

_______ 31) In terms of the rescue curve, your second line of defense is to call the rescue squad.
a) true
b) false

_______ 32) The 120 degree rule states the following. If the load on a normally 2:1 pulley system is 100 pounds and if the angle made between the anchor side and the pulling side is 120 degrees, the force on the anchor is 50 pounds and on the pulling side is also 50 pounds. The system is still a 2:1 mechanical advantage.
a) true
b) false

_______ 33) Dressing a knot is tying the knot so that all the parts of the knot look as if they were in a textbook.
a) true
b) false

_______ 34) In a pulley system , the "**throw**" is defined as how far the system moves before the pulleys have to be readjusted.
a) true
b) false

_______ 35) In terms of "**throw**," a double-Z drag has more throw than a 5:1 system.
a) true
b) false

_______ 36) A double Z drag has a six to one mechanical advantage.
a) true
b) false

Chapter 6: Raft Rescue

_______ 37) PLS stands for Point Last Seen.
a) true
b) false

_______ 38) The proper method of storing a rope in the throw bag is to neatly coil the rope in the throw bag.
a) true
b) false

_______ 39) Spectra is not a good rope to use in throw bags because it has a low tensile strength and it doesn't float.
a) true
b) false

_______ 40) Using a crawl stroke is an example of defensive swimming.
a) true
b) false

_______ 41) High siding is making sure everyone sits high and upright on the tubes of the raft.
a) true
b) false

_______ 42) When pulling a person back into the raft with an assisted rescue, as a practical matter, it is okay to grab the shoulder straps of the life jacket to make it easier to pull the person into the raft.
a) true
b) false

_______ 43) The purpose of the stabilization line is to snag the victim and extricate them from the river.
a) true
b) false

_______ 44) The author suggests that the Z-rig by itself is of little use because of frictional loses and because a theoretical 3:1 advantage is not really that much of an advantage.
a) true
b) false

Chapter 7: Trip Leadership

________ 45) As a leader, it is axiomatic (a rule) that you seek to provide activities that match the challenges of the activity with the skills of the group.
a) true
b) false

________ 46) There are three types of supervision: group, individual and transitional. [general, specific and transitional]
a) true
b) false

_______ 47) In the **Adventure Experience Paradigm**, if you provide a **"devastation and disaster**" experience, you have increased the likelihood of being sued.
a) true
b) false

_______ 48) The ***roller coaster*** experience is a high actual risk and high perceived risk activity. [low actual risk]
a) true
b) false

_______ 49) As a raft guide, a good strategy is to create high perceived risk and low actual risk activities.
a) true
b) false

_______ 50) In the talk-up you would include all of the following items except one. Which of the following items would you not normally be included.
a) introduce the crew
b) describe the equipment they will need including life jackets and paddles
c) paddle stokes and commands
d) rescue and how to swim with the feet up
e) All of the above would be included

_______ 51) You can use different commands than the ones recommended in the text. However, whatever commands that you use should be simple to understand and that you be consistent in their use.
a) true
b) false

_______ 52) For negligence to occur, there are four components that must be fulfilled. All but one of the following are one of those components. Which is it?
a) duty
b) breach of duty
c) proximal cause
d) injury, damage, or loss
e) All of the components above are components necessary for negligence.

_______ 53) It is established that you **<u>don't</u>** have a duty to the plaintiff and you take no action. You can still be negligent?
a) true
b) false

_______ 54) Commission is an example of doing something you should have done but you have done it incorrectly. [omission]
a) true
b) false

_______ 55) "Follow the leader" is the normal method to run the rapids.
a) true
b) false

_______ 56) In the "Leap Frog Method," the sweep runs first, eddies out to set up rescue and then brings up the rear when all the rafts have passed by.
a) true
b) false

Chapter 8: IDW – Teaching and Learning Processes

_______ 57) "Selling" the skill includes indicating when it is used, why it is used, how it is used and where it will be used.
a) true
b) false

_______ 58) The progression of instruction is normally to do it first, followed by showing it, and then selling it. [reverse order]
a) true
b) false

_______ 59) The following is a teaching tip. When speaking to a group, select three people in the group and talk to them. Anyone can easily speak to a group of three people.
a) true
b) false

_______ 60) When teaching a group outdoors, normally place the sun behind you (i.e. the instructor) so that you can easily see the eyes and facial expressions of your students. [place sun behind group]
a) true
b) false