ROARING FORK



RIVER CURRENTS

ONSERVANCS Bringing People Together to Protect Our Rivers®

Reading the River

by Rick Lofaro, Executive Director & Heather Lewin, Director of Science & Policy

Every river has a story to tell. The story may be written in the rocks or the banks, the rapids or the eddies, the fish or the insects. As we interact with the river, we learn to read the story the river is telling through observation, experience and tradition. For many, the perspective from which we read the river relates directly to one's preferred forms of recreation. For the seasoned river enthusiast, knowing how to read the rocks and rapids to ensure safe boat passage or honing in on that really BIG trout's hiding spot is second nature. For others, it may be knowing where a particular sediment deposit might reveal gold, or the way that a river moves over time to benefit a larger ecosystem.

In Mark Twain's A River Pilot Looks At The Mississippi he compares river boating and reading the river to critically examining literature, registering how perspectives change with experience and knowledge. With time spent on and around the river, one's perception evolves as a deeper understanding of what we are truly observing is unveiled. It is often through this understanding that we develop a greater connection to the river and discover that even the most experienced river reader – whether angler or boater - is still humbled by the river, knowing that there is always more to learn. This, perhaps, is what draws so many to the river. It's not a book to read once and forever know how it will end. It is reading that holds eternal secrets, and unveiling one leads only to the desire to

learn and understand more. Through this exploration, one begins to internalize the value of the river; and the need to protect and care for it becomes a mission, because the story is so compelling and too valuable to be lost.

Learning to read the river creates new opportunities to explore, study or simply enjoy them. With so many different perspectives, professions and passions, the river speaks to its readers in many different languages. Some read the river to help plan – for trips or activities, floods or droughts. Other read the river in data points, sample collections or hydrographs. As river professionals, we at Roaring Fork Conservancy (RFC) must become fluent in reading rivers in a variety of ways - and the necessary river-reading skills can vary day to day. A thorough and thoughtful read can result in an accurate weekly river report, a fun day of floating or the perfect cast. In some form or another, we are all continuing to learn to read the river each time we interact with it. That is part of the fun, magic and passion.

This newsletter looks at how we can read rivers and landscapes to help inform and shape the work we do in the watershed and beyond. I encourage each of you to take a stroll or a wade or a float along your favorite river and start your own reading list – be it books, rapids, or rocks – to further your knowledge and passion. Most importantly, take a moment to enjoy a unique reading of the river every time you visit its banks.

Watershed: an area of land where all the water drains to one place (a.k.a. drainage basin, catchment area)

by Christina Medved, Director of Community Outreach

Watersheds are delineated by topography; ridges are the high points (watershed divide) and streams or lakes are the low points. As it rains and snows on natural groundcover, the water travels through soil (percolation) which acts as a sponge. When underground, it is used up by plant roots or travels into the groundwater supply and eventually makes its way to a waterway at the bottom of the watershed. Precipitation that lands on hard, impervious surfaces like roads and parking lots runs off into a storm drain and into the local waterway.

Anytime you are standing on land, anywhere in the world, you are in a watershed. Get to know your local watershed, because what is on the land is either going to have a positive or negative impact on your local waterway. Keep in mind that vegetated riparian areas and natural groundcover allow precipitation to slow down, be spread out and absorbed into the ground, where plant roots will actually clean and filter pollutants before entering waterways.

The Roaring Fork Watershed is 1,420 square miles, roughly the size of the state of Rhode Island. The headwaters of its three major rivers - Crystal, Fryingpan and Roaring Fork - all begin in



Center for Watershed Protection

designated wilderness areas. What's on the land in these areas? Trees and a diversity of plants with deep roots that help keep our rivers healthy.

The Keep It Clean West Slope Partners remind you **ONLY RAIN DOWN** THE STORM DRAIN!



This beautiful area where we live, play and work are headwaters to rivers AND sources of someone's drinking water.

Find these signs along local rivers reminding us to **KEEP THEM CLEAN because** many downstream depend on it!

For more information visit www.roaringfork.org/KeepItClean

When it comes to studying stream health, many people naturally think of studying the water itself. Others might remember that stream banks, called the riparian area, are also important. But how many people consider studying the bottom of a river?

The river bottom, called the stream bed or benthic zone, is inextricably linked with stream health, affecting water movement, water quality, groundwater interactions and even which organisms live in a body of water. Studying these components can provide important insights into the overall condition of a stream.

Physically, the stream bed contains rocks and organic material called substrate. The size and makeup of substrate can be studied to determine stream classification, effects on water movement and influences



on aquatic life. In addition, some pollutants bind with sediment and thus can be sampled for water quality concerns.

Biologically, the stream bed is home to many aquatic organisms and studying them gives important insights into stream health. Aquatic insects, called benthic macroinvertebrates (macros), are typically found amongst the substrate and can be sample to provide information on nutrient sources, water quality and habitat. They are also a critical link in the food chain. Aquatic plants serve as indicators of stream health, particularly when they are noticeably scarce or overabundant.

Numerous factors can influence the physical, chemical and biological characteristics of a stream bed. Large algal blooms can form due to excessive nutrient loads and coat the stream bed, impacting habitat and depleting oxygen levels critical to aquatic life. Sediment from human or natural causes can settle on the stream bed, smothering habitat and transporting pollutants. In winter, anchor ice can form on stream beds with low flows and negatively impact aquatic life. On the positive side, spring runoff can improve stream health by flushing sediment and pollutants downstream, scouring algae and creating new habitat for aquatic life.

So, what does a healthy mountain stream bed look like from

Want to "read" your local watershed? Think about where you are right now and ask yourself the following questions:

- Is there a river nearby and, if so, what's it called?
- Where does it begin?
- What's on the land upstream from you?
- What do you know about the health of this river?

Generally, the health (or impairment) of a river can be determined by what is on the land upstream and adjacent to it. Get to know your watershed and remember, everyone lives downstream. That is why each of us has a responsibility to help keep them clean!



by Chad Rudow, Water Quality Program Manager

This simple tool — a 5 gallon bucket with plexiglass bottom — allows researchers to study stream beds (without sticking their heads underwater!).

below? In general, it contains a diverse mix of substrate, aquatic plants and macros, and lacks excessive levels of sediment and algae. Next time you're at the river, study the stream bed or pick up a rock and see what it tells you.



This algae, part of a 2016 bloom in the Roaring Fork River, is Cladophora Glomerata commonly known as "cotton mat" or "blanket weed."

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The Three C's of Fish Habitat



Our summer-long runoff has drawn to a close with the rivers and streams of the Roaring Fork Valley dropping to seasonal flows. Lower autumn and winter stream flows allow the wading angler a better opportunity to fish a stretch of the river more intimately than when floating. Whether you float or wade a river, having the skill to "read the water" will put you in front of more fish more frequently.

Learning to recognize where and how fish exploit their habitat will improve your fishing skill set.

"...having the skill to "read the water" will put you in front of more fish more frequently."

water is not complicated if you take into consideration that fish need three things for primary survival: a respite from the **current, cover** from above and a **conveyor belt** (current that delivers an abundant food source to trout). These three factors can give you several stream-channel features at which to look. When you find a place with all three elements, you have water worthy of fishing.

Respite from the current can come in a couple of forms physical obstructions and hydraulic dynamics. Trout prefer a current speed in which they can comfortably hold steady while expending the least amount of energy. Look for current rate from a stroll to a brisk walk and a depth of one



to four feet. Fish will hold in much stronger or shallower currents if the bottom rubble is softball to bowling ballsized. Low-pressure gradients occur on the downstream side of rocks – much like how an airplane wing works – which allows the fish to hold with minimal effort.

When looking for fishable water, look for hydraulic features that funnel drifting material into bubble lanes. The best way to find these bubble lanes or current seams is to look for lines of bubbles drifting in single-file lines.





Observe how the bubbles and foam always seem to take the same path as they get caught into micro-vortices. That is your indication that the currents are also gathering drifting food into a defined path akin to a conveyor belt.

Adding all three elements together is not hard to do. As you move from pool to pool, look for walking-speed currents flowing over softball to bowling ball-sized cobble that has observable bubble lanes. Then look for other clues as to where the fish might hold nearby while waiting to ambush drifting insects.

Roaring Fork Conservancy promotes stewardship of our rivers through watershed level education, with a mission that inspires us to explore, value and protect the rivers and streams of the Roaring Fork Watershed. Understanding how fish exploit their habitat will help guide you in finding fish and protecting habitats. Keeping the three C's - current - cover, and a conveyor belt - in mind while enjoying your day on the water will make you a better angler and observer, and in turn a better river steward.







2019 Fall & 2020 Winter Speaker Series

October 16, 2019

1,000 miles into the future: 150 years after John Wesley Powell's journey into the arid West

A presentation by:

Tom Minckley, Ph.D., Professor of Geology, University of Wyoming

This summer, 63 scientists, artists, authors, journalists, academics and graduate students spent 70 days retracing John Wesley Powell's 1,000 mile journey on the Colorado River. Expedition leader, Dr. Tom Minckley, will share personal stories about this adventure, what stayed the same or changed since Powell was there 150 years ago, and what the next 150 years will hold for the Colorado River basin if we don't heed his and Powell's on-the-ground observations.

November 12, 2019

Science Be Dammed; How ignoring inconvenient science drained the Colorado, and its relevance to the future of the Colorado River

A presentation by:

Eric Kuhn, Retired General Manager of the Colorado River Water Conservation District and coauthor, with John Fleck, of Science Be Dammed: How Ignoring Inconvenient Science Drained the Colorado River

In 2018, Eric Kuhn partnered with John Fleck, author of Water is The Amazon River: Facing fears, chasing for Fighting Over and Other Myths about Water in the West, to write a book about our understanding of Colorado River hydrology. dreams, and a quest to kayak the largest river Conventional wisdom is that the compact negotiators did the best they could with a limited gage record that happened to be from source to sea during a very wet period. Kuhn and Fleck show that contrary A presentation by: to this myth, the politicians, states, and water agencies that Darcy Gaechter, World Kayaker & Owner/Operator of shaped the development of the river had the science available to them to make better decisions, but political expedience Small World Adventures in Ecuador prevailed and the science was ignored. Today, the Colorado Darcy is the first woman to kayak the Amazon River from source to River is overused and facing a future where climate change sea! What did it take for her to make her dream come true? Among is reducing its flows. As we shape the future of the Colorado stunning scenery and Class V rapids, she also encountered ruthless River, will we learn from our past mistakes or will we continue poachers and narco-traffickers, pled for mercy at the hands of one to ignore inconvenient science? of the tribe's, and cut her hair to pass as a boy in hopes of saving her life. Darcy will share these stories and more about her 148-day journey down the Amazon River. Her book Amazon Woman: Facing Fears, Chasing Dreams, and My Quest to Kayak the Largest River from Source to Sea will also be available for purchase.

The Brooksher Watershed Institute

December 12, 2019

Predicting Powder and the Science of Snow with meteorologist Joel Gratz

A presentation by:

Joel Gratz, Founding Meteorologist, Open Snow

Join Joel for a fun and entertaining evening full of snow and science! Joel will present what the latest research says about how far in advance we can predict powder, he'll pinpoint which weather patterns bring the most snow to central Colorado, and he will also take you through a live forecast by showing the same satellite, radar, and weather model maps that he uses to make his daily predictions.

February 13, 2020

Anchor Ice in Mountain Rivers

A presentation by:

Edward Kempema, Ph.D., Senior Research Scientist,

University of Wyoming

Anchor ice forms underwater and attaches to the beds of rivers, lakes, and seas in cold regions. It is a fascinating and poorly understood phenomenon. Dr. Kempema, who has studied ice for 40 years, will discuss the conditions leading to anchor ice formation, distribution in small mountain rivers, and impacts on mountain river systems - including winter flooding - and what potential management practices are available.

March 11, 2020

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Additional details and registration can be found at www.roaringfork.org/events.



Making the Hydrograph Your Favorite Graph

by Heather Lewin, Director of Watershed Science & Policy

I've been told before that not everyone has a favorite graph, so if you are one of those people still dabbling in pie charts and scatter plots, do I have the graph for you!? The hydrograph will tell you just about everything (ok, maybe not EVERYTHING) you want to know about your favorite river. What is the flow today? Check the hydrograph! What is the base flow? Check the hydrograph! What is the base flow? Check the hydrograph! When does the river usually peak? Check the hydrograph! Still seems complicated? Let's break it down.

A "typical" hydrograph in a "typical" water year

Notice that the river rings in the New Year not on January 1, but October 1. Good idea, river - way to avoid the crowds and cold weather! Well, there may be more to it than that. A water year measures a full year of precipitation, but because most precipitation falls in the winter and melts through the spring and summer, following the Gregorian calendar doesn't make sense. Besides, rivers like to function a bit outside the box. They don't always conform well, no matter how much we continue to try!



Same location, multi-year view

At RFC, we use past and current hydrograph information to assess daily flows for safety and ecological needs, and to compare current to past conditions. Looking at several years worth of data at the same place can tell the story of wet and dry years, fast and slow runoff, and patterns over time, such as shifting peak timing or declining base flows. Hydrographs can also show abnormally high or low flow events, such as microburst or monsoon storms, or ice jam breaks through irregular spikes.

The Crystal River above Redstone is one of the best places in the valley to depict a "typical" hydrograph because it is one of the few places where little water management affects the hydrograph. There are no dams or diversions above this point. The graph typically moves in a smooth curve as snow falls, melts and falls again. But, as many of you know, very little water in the west remains unmanaged. Through reservoirs and diversions, water is put to beneficial use to serve a variety of needs. A managed hydrograph can look quite different.

≊USGS



A managed waterway

If we consider a "typical" water year for the Fryingpan River below Ruedi Reservoir, it bares little to no resemblance to the unmanaged hydrograph. The curve depicted at Redstone is replaced by the angular movements of water out of the reservoir. Baseflow remains flat from about November 1 to mid-April. At that point, releases decline – perhaps to match inflow to Ruedi, which is the legal minimum release, or perhaps for human activity such as fish counts or other studies. Flows rise again, and a spring flushing flow takes place in early July. Managing reservoirs with higher flows to mimic the natural hydrograph is important to clean sediments and algae that grow over the winter, and the process benefits the natural geomorphology of the stream. Flows fluctuate through the late summer and fall based on how contract water is allocated - for endangered fish in the "15-Mile Reach," for irrigation in the Grand Valley, or for other uses before returning to base flows in November. Notice the greatest peak on the Fryingpan often occurs in the fall, based on managed flows, rather than in the late spring or early summer when the "typical" hydrograph peaks.

Managed systems in some ways mimic natural systems, and in some ways look quite different. Considering a managed system hydrograph over several years shows management trends over time. Coupled with anecdotal and biological data, lessons of management impacts and benefits are learned.

> Sign up for our weekly river and snowpack reports at www.roaringfork.org/ your-watershed/river-flows/

Hydrographs, whether natural or managed, tell a story about the river. From wet years to dry years, there is much to learn from flows and timing. Following trends from year to year, and month to month show cumulative impacts of climate change, and even land use and development.

So now that the hydrograph is firmly established as your favorite graph, visit <u>www.roaringfork.org/your-watershed/river-flows</u> and historical hydrographs throughout the watershed!



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Students Develop Sense of Place & Connection by Reading Rivers and Watershed Maps

by Megan Dean, Director of Education

We are told in school that life is a reading test. In our watershed education programs, we teach students to explore and understand information illuminated in nature, by discovering how to "see" and "read" the patterns that are embedded in our natural surroundings.

One of the ways we teach students to see patterns is by introducing them to a map of the Roaring Fork Watershed. Students learn to see a similar design and pattern between the physical map of our watershed and the gill structure of a macroinvertebrate. Guiding students to observe and read the patterns of nature allows them to understand the interconnectedness between the systems that construct and define our world.

Students learn to read outside the pages of a book when they are identifying

anatomic structures in riparian animals then comparing that to a dichotomas key that outlines how those species indicate a river's health. It is incredibly exciting to watch students of all



on Coal Creek to that on the Crystal River. Photo: McKenna Miller







Our 5th grade geomorpology program teaches students to read the path of a river based on its geology, gradient and sinuosity

(continued)

ages delight in the ability to observe a macroinvertebrate breathing through fluttering gills under a brock scope.

Students also learn to read their surroundings in our geomorphology programs which guide them through assessing the biological, chemical and physical health of our rivers and streams.

Our 5th grade geomorpology program teaches students to read the path of a river based on its geology, gradient and sinuosity.

Students gather knowledge by comparing the geomorphology on Coal Creek to that on the Crystal River.

In order to read the layers of our watershed, students often start with activities that allow them to create and explore their own maps.

For example, a fun activity is to crumple a piece of paper then slowly spread it out allowing the new wrinkles to become mountain ridges and valleys. Coloring the ridges with markers allow them to be more visible. Use a water bottle to make it rain and the marker will bleed and flow down into the valleys of the paper map, simulating a real working watershed!

Once students understand the basic components of how watersheds work, they can move onto more complex maps and models taking

Guiding students to learn about river systems through uncovering the biology, geology and chemistry, layer by layer is like creating a book, chapter by chapter. As students progress through grade levels in school, we are there with programs that build and deepen their river knowledge.

their understanding simulate how nonpoint even deeper. The pollution flows through a watershed learning how Enviroscape model allows students to become to create landscaping entities of a community, and structural changes to decrease or eliminate creating both positive and negative effects. pollutants from entering They use the model to the watershed.

Looking for a good book to read? How about one of these, written by two of our

upcoming Brooksher Watershed Institute presenters!



Science Be Dammed: How Ignoring Inconvenient Science Drained the Colorado *River* by Eric Kuhn and John Fleck

ailable at University

of Arizona Press







Amazon Woman: Facing Fears, Chasing Dreams, and My Quest to Kayak the Largest River from Source to Sea by Darcy Gaechter

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Thank you for supporting essential river research, education and conservation work!

Staff Flows _____ Thank you!



Liza Mitchell served as RFC's education program manager since 2015. She combined her education, research and outdoor experiences to create unique, hands-on programs for thousands of students and created partnerships with agencies and organizations that will remain long into the future. Earlier this year, Liza accepted a Natural Resource Planner and Ecologist position with Pitkin County Open Space and Trails. Thank you, Liza, for your hard work and contributions to RFC. We wish you the best in your new position and look forward to continuing to work with you!



Kristen Doyle has served as RFC's watershed educator since 2017. Among her many talents, Kristen brought her research in fisheries to the education programs and to reigniting a citizen science initiative Hot Spots for Trout last summer. She is also an incredible artist and used her talents to further evolve RFC's art and science education programs both at The River Center and with partners across the Roaring Fork Valley. Kristen recently accepted a position as the Teen Services Librarian at Basalt Regional Library. We wish you the best in your new position and look forward to working with you in your new role!



Michael Schuster joined RFC in 2015 and worked seasonally through May 2019 as a water quality program associate. During this time he earned a Masters in Environmental Management through Western Colorado University and earlier this summer started a full-time position with the City of Glenwood Springs. Thanks to Mike for 4 years of dedicated service and we wish him the best moving forward!



Matthew Anderson returned to RFC for a third summer to assist our watershed science team as a water quality program associate. Matthew is finishing his senior year in the Environmental Science and Resource Management program at the University of Washington in Seattle. Matthew helped conduct water quality program administration, field-work, data management, and conservation easement monitoring throughout the Roaring Fork watershed. Best of luck on your road to graduation!

5TH ANNUAL FLY TYING COMPETITION

FEBRUARY I, 2020 * 4 - 10 PM

The Tipsy Trout, Basalt, CO

Details can be found at roaringfork.org/events



50TH ANNIVERSARY OF EARTH DAY 1970-2020

What's with the Gray Bird?

The little gray bird in the RFC logo is called an American dipper (Cinclus mexicanus), also known as a water ouzel. It lives along healthy mountain streams which provide abundant macroinvertebrates (e.g., aquatic insects) for them to eat, along with diverse, undisturbed riparian habitat.

Look for a dipper the next time you are out on the river. Often found in the fastestmoving section of the river, you can see them standing and "dipping" on a rock, and then suddenly they dive into the water! They swim for short segments in search of the aquatic insects they find so delicious.

Seeing dippers in our local streams lets us know in a quick snapshot that the stream food web is healthy, as the macroinvertebrates they eat are also indicators of healthy streams.



Watershed.

Teach Your Children to Read the River with Dee Dee the Fryingpan River Dipper

You can help teach your children, grandchildren, nieces, nephews and friends how to read the river by introducing them to Dee Dee, an American dipper!

Follow Dee Dee's adventures in the Fryingpan River, then use the five-page River Journal in the back of the book for your own exploring.

Illustrated by 4th graders at Basalt Elementary and written by RFC staff, children and adults of all ages will enjoy

and learn from this book (though

it is primarily intended for elementary-aged students). Dee Dee the Fryingpan River Dipper may be purchased at The River Center in Basalt.

Learn more at www.roaringfork.org/education-and-outreach/american-dipper-childrens-book/



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The American dipper continues to remain the perfect "mascot" for RFC - a champion of, and constant presence in, healthy streams of the Roaring Fork

RIVER CURRENTS

is published biannually by Roaring Roaring Fork Conservancy has inspired people to explore, value and protect the Roaring Fork Watershed. We bring people together to protect our rivers and work to keep water in the streams, monitor water quality, and preserve riparian habitat. Roaring Fork Conservancy is an independent 501(c)(3) not-forprofit organization registered in the state of Colorado.

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From all of us at Roaring Fork Conservancy, thank you for your support!

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