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RULING YOUR FLY DEPTH

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ROB ARNOLD PHOTO

Don't get hung up on sink rate—it's your actual fly depth that really matters.

WHEN YOU ARE FISHING your favorite steelhead or salmon run, is your fly getting down to where you believe the fish are, or is it above them? Even if you know the sink rate of your fly line, you still don't know how deep your fly is since the manufacturer's advertised sink rate was not measured in flowing water where the sinking-tip length, diameter, and grain weight are also important factors in determining your fly's actual depth.

For many anglers, the array of sinking-tip choices is bewildering. There are sinking tips of different lengths, grain weights, and sink rates, as well as density-compensated lines. Amid all this confusion, there is a simple, practical system for delivering your fly to the depth you desire.

We have found that every uniformly constructed sinking line has its own characteristic "rule number." This rule number is the number of feet of sinking line required to deliver a small, unweighted fly to a hang-down depth of 1 foot in 3-mph water. [*See "How We Did It" on page 44 for an explanation of the authors' experiments and conclusions.* THE EDITOR.]

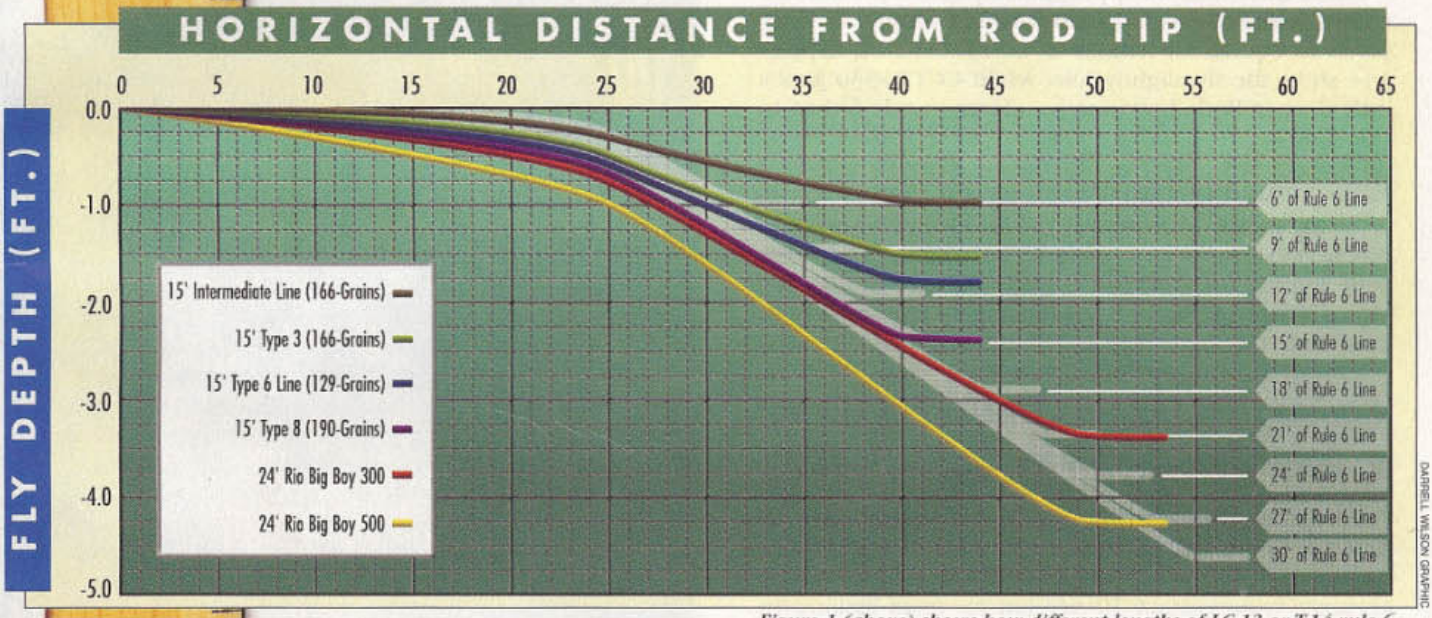

Figure 1 (above) shows how different lengths of LC-13 or T-14 rule 6 line compare to standard lengths of other sinking tips in 3 mph water. Each line consists of 26 feet of floating line, the sinking tip, a 3-foot leader, and a small unweighted fly.

For example, the intermediate sinking tip we tested is rule 16, which means 16 feet of this line delivers the fly to a hangdown depth of about 1 foot in moving water.

Ten feet of type 3 sinking-tip line delivers the fly to about 1 foot, making it approximately rule 10. As shown in Figure 1 (above), 15 feet of this line delivers the fly to a depth of about 1 1/2 feet.

LC-13 (Cortland) and T-14 (Rio) sinking tips are approximately rule 6. With 6 feet of this line, fly depth is about 1 foot. With 12 feet of the same line, fly depth is about 2 feet; with 30 feet, fly depth is about 5 feet. Thus, with short loop-to-loop increments of these lines, fly fishers can conveniently adjust their fishing setup to deliver the fly to almost any desired depth.

LC-13 and T-14 get a fly down more efficiently—to the same depth with a shorter length of line and/or less

Authors Bob Pauli (left, top) and Tom Keelin (left, bottom) determined the actual depth of their sinking line systems and put their findings to work in the steelhead rivers of British Columbia.

weight—than the other lines we tested. This is especially important for ease of casting and line management when you need to fish deep. For example, a 300-grain, 24-foot sinking tip—such as Rio's Big Boy 300 shown in Figure 1—delivers the fly to a hangdown depth of 3.3 feet. By contrast, 21 feet of LC-13 or T-14 line brings your fly to about the same depth and weighs about 10 percent less. The shorter, lighter line is easier to cast and manage. Similarly, a 500-grain, 24-foot sinking tip delivers the fly to a depth of 4.25 feet but 27 feet of LC-13 or T-14, which weighs 25 to 30 percent less, reaches the same depth.

While LC-13 and T-14 are both rule 6, they do have differences. LC-13 is a lead-core line, weighs 13 grains per foot (hence the name), and has a natural stiffness that makes it behave well in your leader wallet. It also has no memory. If you straighten it, it stays straight. T-14 is a tungsten-impregnated line and weighs 14 grains per foot but has a slightly larger diameter than LC-13. As a result, both lines perform almost identically in delivering a fly to a specific depth in moving water.

Other lines that are approximately rule 6 include Scientific Anglers Express 14+ and Airflo CCT20-330. Compared to equivalent lengths of LC-13 and T-14, Express 14+ sinks the fly slightly less, while CCT20-330 gets a little deeper. Both, however, are closer to rule 6 than to rule 5 or 7.

Pick Your Fly Depth

ONCE YOU UNDERSTAND the rule of six, it's time to put it to practical use. Suppose you would like your fly to be 2 feet deep at hangdown and you estimate the current flow at 3 mph. How many feet of rule 6 sinking-tip line should you use? Here is a simple way to make an estimate:

Sinking-tip length (feet) = 2 X water velocity (mph) X fly depth (feet)

Using this formula, delivering the fly to a desired hangdown depth of 2 feet, when the current flow is 3 mph, requires 2 x 3 x 2 = 12 feet of rule 6 line. This formula is accurate within about 10 percent for most sinking-tip

Pick Your Fly Depth

FLY DEPTH	WATER SPEED .5 MPH	1 MPH	2 MPH	3 MPH	4 MPH	5 MPH
1'	1	2	4	6	8	9
2'	2	4	9	12	16	20
3'	3	7	13	19	25	31
4'	4	9	18	26	34	43
5'	5	11	22	32	43	54
6'	6	13	27	39	53	66
7'	7	15	31	46	62	78
8'	8	18	36	53	71	90
9'	9	20	40	60	81	102
10'	10	22	45	67	90	114

Figure 2 (above) shows the length of Cortland LC-13 or Rio T-14 line needed to bring a fly to a specific depth at different water speeds. For instance, you need 13 feet of either line to bring the fly to a hangdown depth of 3 feet in water moving at 2 mph. Other approximately rule 6 products include Scientific Anglers Express 14+ and Airflo CCT20-330.

The authors measured fly depth by attaching a yardstick to the leg of a step ladder in a pool.

How We Did It

WE DETERMINED the actual depth of a fly at the hangdown position—the end of the drift, directly downstream of you—using various sinking tips in water flowing at 3 mph. This is about the velocity of a typical steelhead or salmon run and roughly the speed of a brisk walk. The sinking tips were all attached to the same floating line, tippet, and fly combination. The floating line used with all the tips was a 650-grain, 27-foot Rio Skagit Head. The leader was 3 feet of 15-pound-test monofilament, and the fly was a small unweighted steelhead fly.

In one experiment, we attached 3-, 6-, 12-, and 18-foot lengths of LC-13 to the blade of a hockey stick and dragged them simultaneously at various speeds in a swimming pool. We found that no matter how slow or fast we moved the hockey stick along the surface of the water, the four lengths of LC-13 remained parallel. We repeated similar experiments for other lines shown in Figure 1 and saw similar results. Thus, we concluded that the angle of hangdown in the current does not depend on the length of the sinking tip. By implication, for a sinking tip with uniform properties across its length, doubling the length of the sinking tip doubles the fly depth at hangdown.

We also compared lines with published stillwater sink rates similar to each other and found that in every case, heavier lines get deeper in moving water. For example, using the hockey stick we simultaneously dragged four 15-foot tips with weights of 109, 129, 166, and 190 grains. All the lines were designated by the manufacturers as type 8 lines with advertised sink rates of 8 inches per second (ips). We found that the heavier tips held deeper in flowing water even though they all had the same designated sink rate. From this we concluded that knowing the sink rate of a fly line isn't enough and went on to develop the concept of rule numbers.

We also developed a mathematical simulation model based on the laws of fluid dynamics to verify what we discovered in the swimming pool. The simulation model confirmed our observations and led to unexpected insights that we subsequently confirmed by further experiments. For example, the mathematical simulation predicted that our 24-foot, 500-grain line would hang slightly more steeply than LC-13 and T-14 even though our initial data suggested otherwise. When we tested the 500-grain line again, we found that the simulation was correct and that there was an error in our initial measurements. [*See flyfishing research.net for the authors' fluid dynamics equations as well as animations of a fly line sinking to hangdown position.* The Editor.]

We discovered the pick-your-depth formula by rerunning the simulation for many different water velocities. We then verified the simulation's predictions vis-à-vis data we had recorded and found them to be accurate.

In the process, we learned that statements about what matters in a sinking tip—such as "only sink rate matters," "only overall line weight matters," or "only line density matters"—are all incorrect. What matters are line length, line weight (in grains), line diameter, and water temperature. Knowing these factors alone is enough to determine fishing depth at hangdown for any given equipment setup. Due to variability in line manufacturing and real-time stream conditions, your lines may perform a little differently but the pick-your-depth formula is a good guide.

WE CAUGHT MORE STEELHEAD

We field-tested these methods extensively in 2005 and 2006 on the Babine, Bulkley, Dean, Kispiox, and Skeena rivers in British Columbia. Using the pick-your-depth formula, we caught and released more than our usual total number of steelhead and landed an unusually large number of steelhead over 20 pounds. In addition, we decreased gear load and increased fishing time by reducing our number of tip-changing episodes. In other words, by using the rule of six, we were able to eliminate much of the guesswork that usually accompanies fishing with sinking-tip lines.

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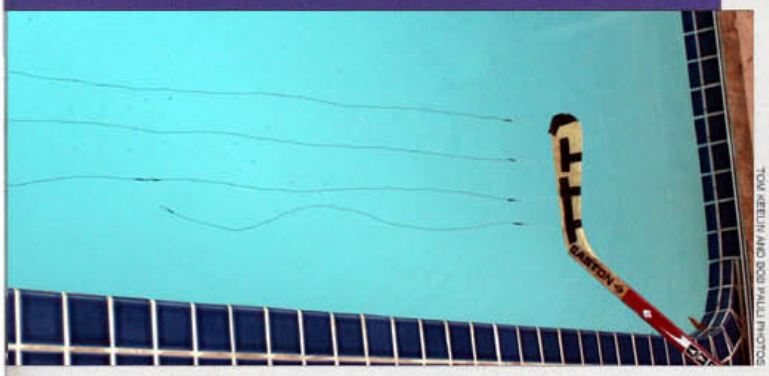

TOM KEELIN AND BOB PAULI PHOTOS

Once you understand the rule of six, it's time to put it to practical use.

fishing on rivers. For greater accuracy over a broader range of conditions, refer to the table in Figure 2.

Like Figure 1, the data in Figure 2 assumes the use of a Skagit 650-grain floating head and a small (#2 or smaller) unweighted fly in uniformly flowing fresh water at a water temperature of 50 degrees F. Adjustments may be appropriate to account for other equipment or water conditions as described below.

Floating Heads

The rule of six is consistent over the range of floating heads we tested. In addition to the 650-grain Rio Skagit Head, we also tested the 450-grain, 550-grain, and 750-grain Skagit Head floating lines. Because of the varying line diameters, the smaller-diameter 450-grain head allows the sinking tip and fly to get slightly deeper than the 750-grain head but the differences are less than 3 inches in depth under practical fishing conditions.

In addition, we tested several WindCutter lines (8/9/10, 9/10/11, and 10/11/12) by removing the 15-foot floating tip and replacing it with the various sinking tips shown in the chart. Compared to the Skagit heads, the WindCutters have a longer head length, smaller diameter, and less weight per foot, but greater buoyancy per foot. The net result of these factors is that the WindCutters and Skagit heads deliver the fly to similar depths.

We prefer to cast sinking-tip lines with the Skagit-type heads developed in the Pacific Northwest. With Skagit heads, sinking-tip length doesn't matter much. With only slight adjustments to your casting technique, it is easy to cast any length of sinking tip, from 6 feet to 24 feet or longer. In our experience, Rio Skagit Heads from 550 to 750 grains all work well with a wide range of Spey rods from 12 to 16 feet, and from 6- to 11-weight. This flexibility reduces the need to precisely match a particular rod to a particular line and makes it easy to put the methods of this article into practice. You can loop various lengths and types of sinking tips onto a single foundation floating head.

However, if you use short lengths—10 feet or less—of rule 6 line with a 14-foot or longer Spey rod, you may find casting easier if you add 5 to 10 feet of additional floating line—sometimes called a cheater—between the end of your Skagit head and your sinking tip. This makes no significant difference to fly depth.

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Flies and Leaders

OUR FLY-DEPTH STUDIES were conducted using a 3-foot, 15-pound leader and a small unweighted fly. When the fly remains a constant, using other leader diameters or lengths from 1 to 10 feet makes no discernible difference to the fly depth. If, instead of a small, slim, unweighted fly, you use a more bulky unweighted fly such as a large tube fly or leech pattern, the extra drag tends to lift the fly slightly—but the difference is typically a few inches or less.

Not surprisingly, a weighted tube fly or leech with big lead eyes goes a bit deeper. The 3/16-inch lead-eye tube fly we tested on a 3-foot leader increases hangdown depth by about 4 inches at 3 mph of water velocity.

Water Flow

UNDER TYPICAL FLOW conditions, water velocity in a river is fastest just under the surface and much slower near the bottom—especially when boulders or other obstructions are in the streambed. It is often better to assume that the average water velocity across the entire water column is slower than the velocity at the surface. In addition, turbulent water adds random variability.

Water Temperature

AS WATER COOLS, its viscosity and density increase. These factors mean that fly lines and flies sink less. This effect is most significant in slow water. For example, with a water velocity of 1 mph, 15 feet of LC-13 or T-14 delivers the fly about 4 inches shallower in 35-degree F. water than in 65-degree water. In faster water, this effect is likely too small to notice.

Line Control

ONE FACTOR that *does not* make a difference in hangdown depth is the path the line and fly followed prior to reaching hangdown. Whether you cast across-stream at 45 or 90 degrees, whether you mend or not, whether you deliver your full length of line or cast short and feed line, does not affect the depth of the fly at final hangdown.

All these factors make a difference in how deep the fly fishes throughout the presentation and how fast it travels during the swing—both critical factors in catching steelhead—but not in the fly's final depth after reaching its hangdown. Proficient anglers use cast angles, mends, and line feeding to maximize fishing effectiveness during the swing.

TOM KEELIN and BOB PAULI are engineers and members of the Golden Gate Angling and Casting Club. They thank Professor Graig Spolek of Portland State University for his coaching in the application of fluid dynamics and for his helpful comments on multiple drafts of this article.