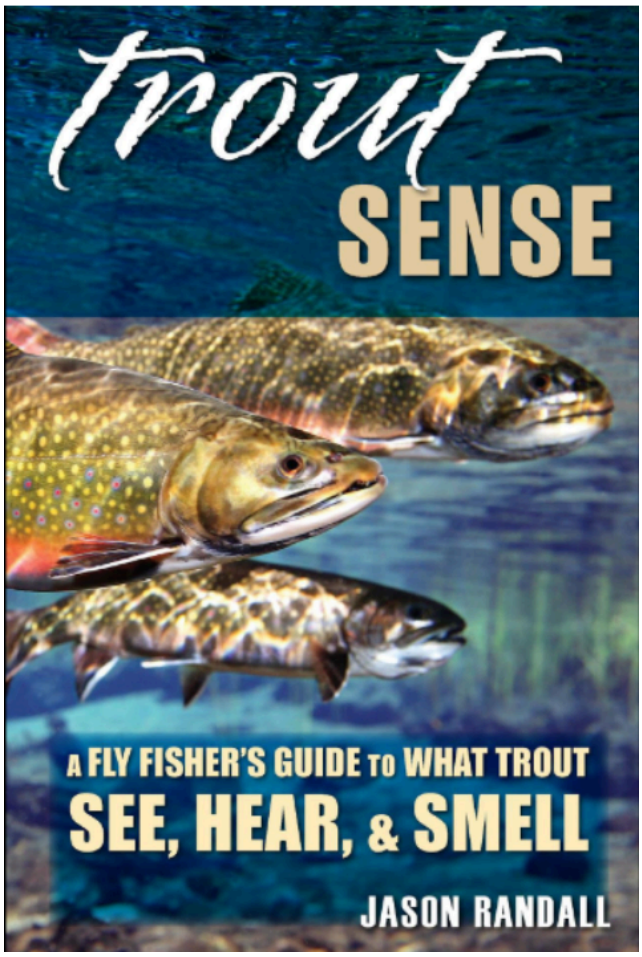
Stained Water

By Beth Jappay

The past couple of years I have had multiple requests for an article about trout vision. I lacked the time to research this very broad topic until this past July, when I broke both of my ankles, and ended up keeping myself occupied by researching and writing articles. Diving into this topic, I ended up using Google Scholar for the first time ever and even reading scientific papers written decades ago. If this sounds too esoteric to be interesting, think again. What I have learned has me rethinking how to approach/stalk trout, as well as my fly choices and presentation. Since the overall topic is so big, I have decided to break it down into manageable chunks. The information in this first article may significantly change how you pick the color of your fly.



This month's topic was inspired by the book "Trout Sense". Jason Randall is a veterinarian who specializes in fish health and medicine He has a nicely concise way of explaining things like trout vision and hearing as well as the physics of light, etc. My favorite part of this book is when he put on scuba gear and enlisted his wife for underwater photography. The result is a great demonstration of how water conditions affect a trout's perspective. This book completely changed my understanding about how water depth and water turbidity or staining would affect the choice of color of a fly.

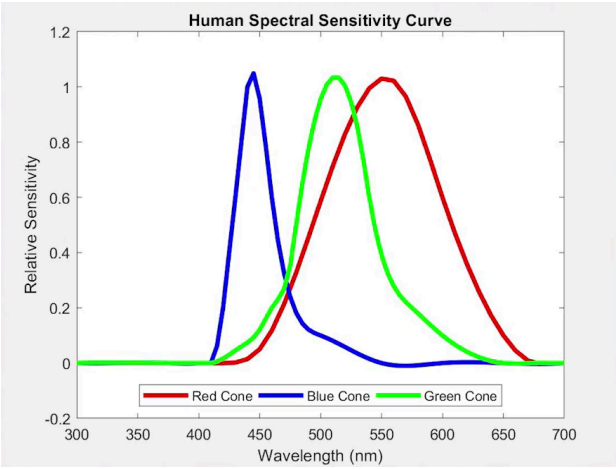
Trout are visual predators and a large proportion of their brains are dedicated to the processing of visual stimuli, necessary both for foraging for food as well as avoiding predation. In assessing potential food, color is the least important of the four main properties of size, shape, behavior, and color. However, when dealing with stained, turbid, or particularly deep water, the

color of the fly can make a difference on whether or not the trout even notices a fly. After reading this book I felt I had a much better understanding of how and why to choose particular colors in these situations.

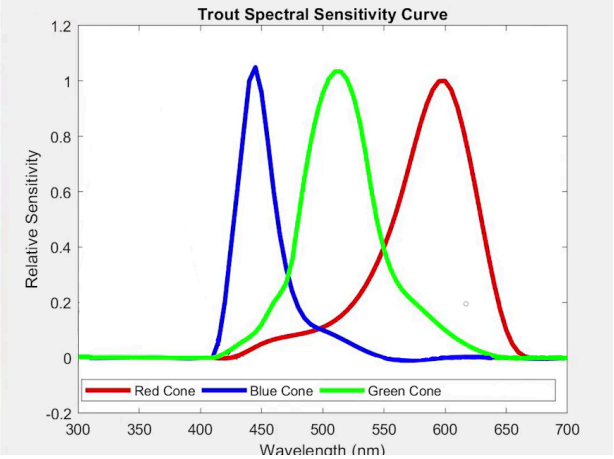
The physics of light

First, a quick review of light spectrum and color. Visible light is the range of the electromagnetic spectrum that excites photoreceptors of the back of the eye. Interestingly, the color-sensing cones of mature trout are similar to ours (I will address the UV-sensing abilities of juvenile trout in another article).

Human



Trout

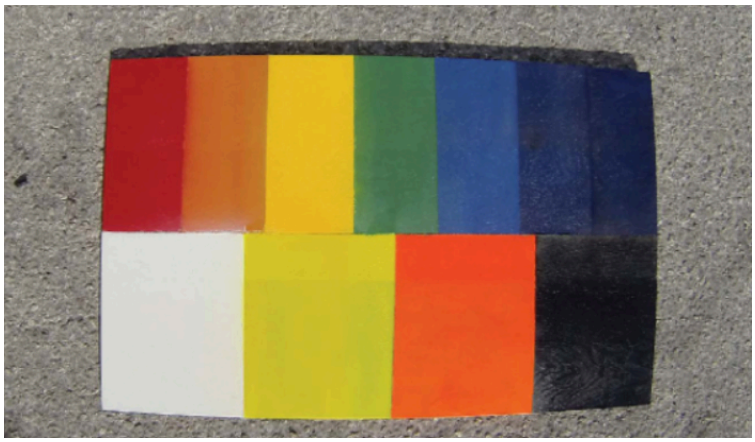


An object that is green is visible because that object's surface reflects the green spectrum of light and absorbs the rest of the visible spectrum (red, orange, blues). As light passes through air or water that has a lot of suspended particles, increasing amounts of light are absorbed and less and less end up reflected. After passing through enough particles, the light being absorbed tends to disappear from the spectrum of light visualized. If the suspended particles are of a uniform color (such as algae blooms) it can cause a profound color shift (like looking through green-tinted glasses).

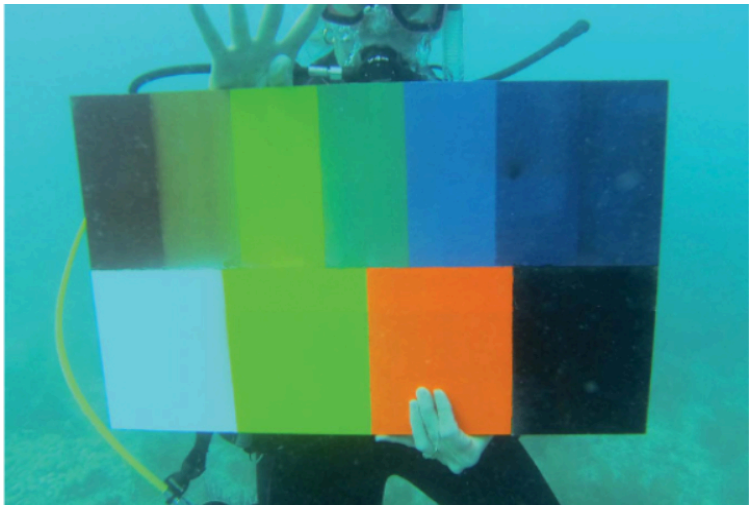
The effect of water depth on color

Another source of color shifts can be the depth of the water. Even water with no suspended particles will reflect and absorb different wavelengths of light at different rates (the longer wavelengths are absorbed first). For example, if one were to dive in the ocean at a 5 foot depth the reds would turn gray, by 10 feet the oranges, etc. Blues last the longest, thus the blue water of the ocean and of photography at significant depths. However trout don't have to be deep to have water affect color. A trout in 2 feet of water will not perceive the red in a streamer 15 feet away. The red will become apparent to him as he moves closer, though.

One of my favorite parts of this book is when the author painted a piece of plywood and then roped his wife into helping him photograph it under varying underwater conditions.



Here is the “control” board. The top row has the spectrum of light visible to humans (and trout) The lower row has white, fluorescent yellow, fluorescent orange, and black



In this photo the author put a very heavy weight belt on his wife so that she was able to drag the (buoyant) plywood color board to a depth of 20’ in the ocean. Note how blue the surrounding water is and how muddied the red and orange are in the upper row. Now the upper-row blue is the most “true” color on the board. How interesting that the fluorescent orange “pops”, and that both white and especially black still provide good contrast.

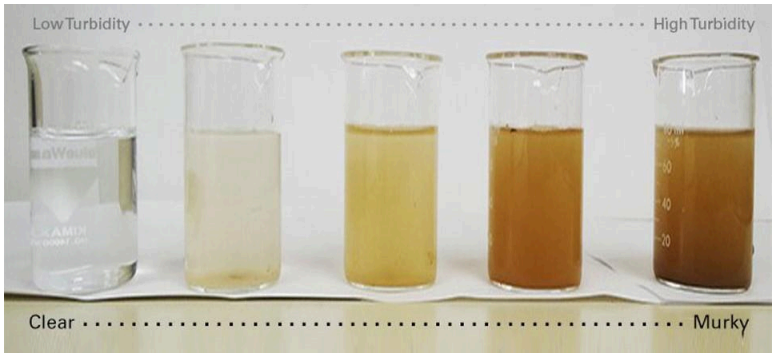
Stained and turbid water

So what is the difference between “stained” water and “turbid” water?

Stained water has smaller *dissolved* particles (e.g. dropping brown sugar in water) and is translucent…like looking through tinted glasses. Minerals and tannins commonly stain water. Tannins are due to a breaking down of organic material and are typically yellow-brown in color (like iced tea). Minerals can impart a green, blue, or white tint to water.

Turbid (a.k.a. dingy) water is caused by larger particles such as soil, organic matter and algae that are *suspended* (like dropping silt in water). Turbid water clears faster than stained water as the suspended particles fall to the bottom. Brown turbidity from eroded soil would be commonly seen in the winter with heavy rains and with the spring run off. Algae blooms commonly cause green turbidity in warm summer months.

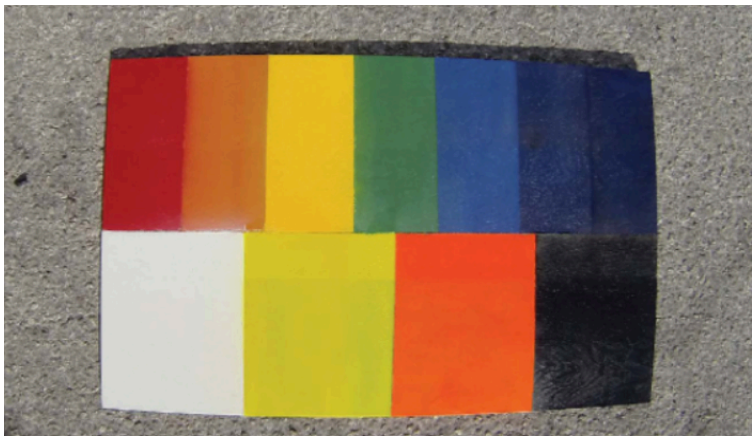
Turbidity obscures vision, decreasing both the distance that the fish can see, as well as visual acuity.



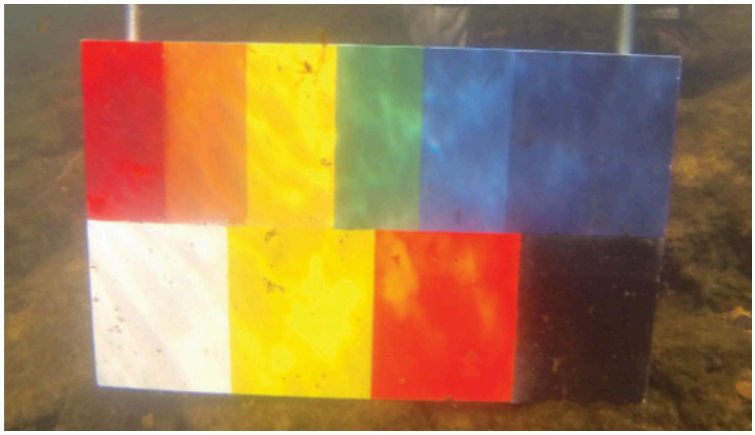
There are scientific scales for measuring turbidity.

Yellow-brown color shifts

The author only published one color board demonstrating yellow-brown color shift.



Here is the control board again.

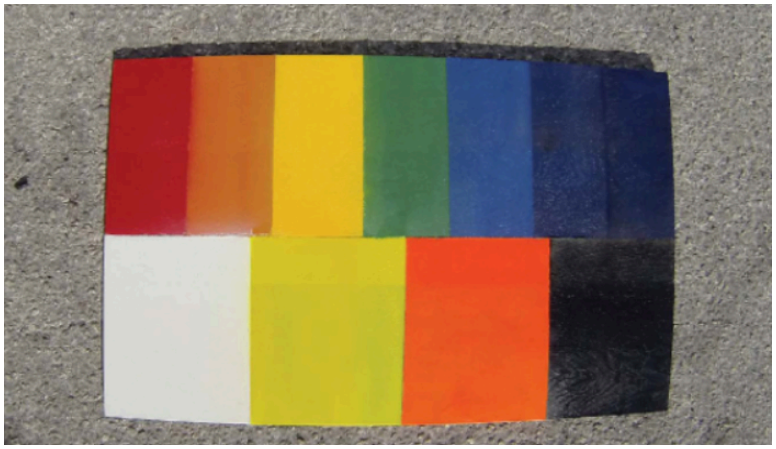


Here is the color board photographed in mildly tannin-stained water. Notice that yellow and green are very visible, whereas things get muddied at the end of the blue spectrum. Both fluorescent orange and particularly fluorescent yellow seem to “pop”. Heavier staining and/or viewing from greater distances through the water would emphasize these changes. A lake or river that is turbid with soil +/- organic debris will have a similar color shift (as they are similarly yellow-brown) but will also have problematic loss of visibility.

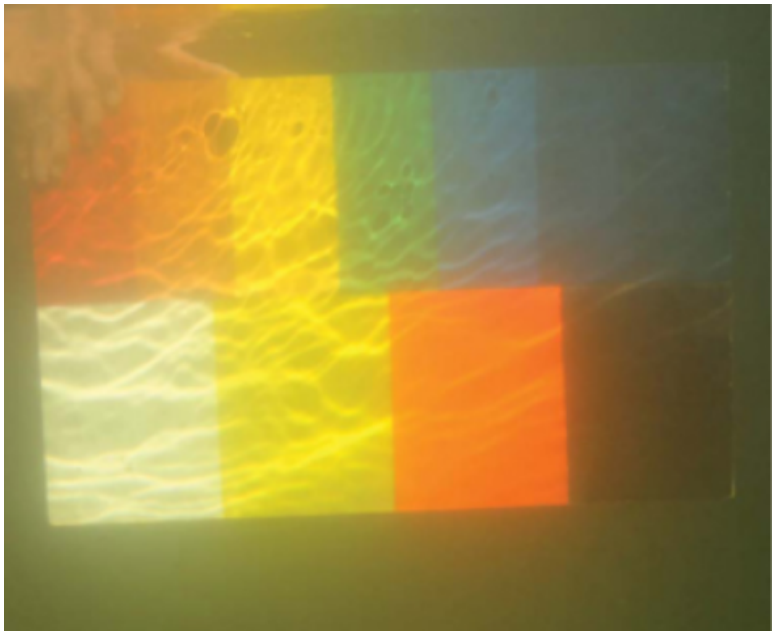
The colors yellow and green (especially if fluorescent) are good fly choices here. The trout eye is engineered to detect contrast, so combining the chartreuse with black (or white) +/- flash will make a fly even more successful.. When fishing in dirty water the late great Lefty Kreh used to say “If it ain't chartreuse, then it ain't no use”.

Algae blooms

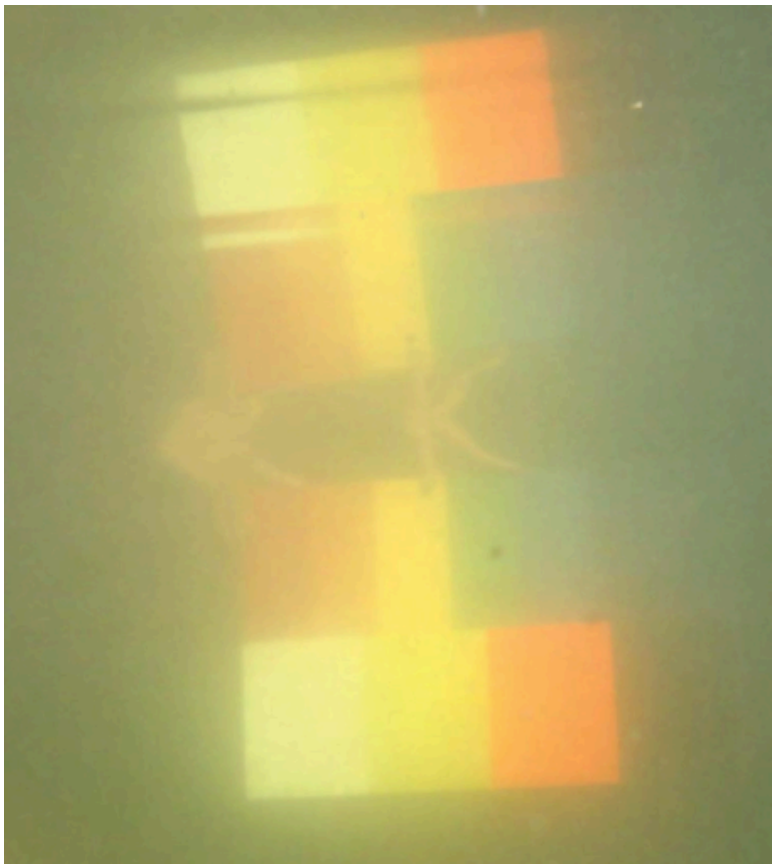
The author did a separate set of color boards for the color shift that occurs with algae blooms and algae-stained water:



Here is the baseline color board again.



Here is the same board photographed at only 3’ away, in green-stained water. Note that the yellow and green are already standing out at this short distance.



This was photographed in the same green-stained river, now 8 ‘ away (with a reflection above it). Notice that the blue and violet have almost disappeared, and the red and orange have muddied into brown. Yellow and green are still recognizable, especially if fluorescent. It makes sense that a good fly choice for green-stained water (like muddied or tannin-stained) would also be bright/fluorescent green or chartreuse, with contrasting white (or black).

So, what’s the scoop with the fluorescent colors? Fluorescence occurs where a surface has the property of absorbing ultraviolet radiation and converting its energy to be reflected as a longer visible wavelength. This converted reflection is added to the reflection of normally visible light wavelengths, causing the color to appear more intense. Since UV light is shorter it penetrates deeper in the water than even blue light. I found two authors who theorized that UV colors would be useless in stained water, but these color boards say otherwise.

Doing research for this article has me completely rethinking including yellows and chartreuse in my streamer and euro boxes, as well as my color choices when steelhead fishing in turbid water. In addition, I will also be thinking about fluorescent hot spots for some of my stillwater patterns.