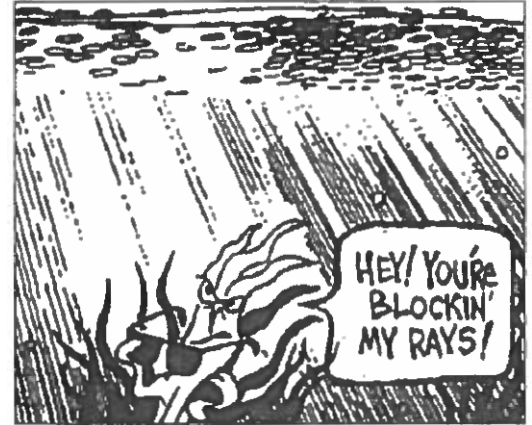


- *Water clarity (clearness) is one of the most obvious measures of water quality.*
- *Water clarity can be a useful indicator of runoff from construction sites, fields, logging activity, industrial discharges and other sources.*
- *Monitoring transparency before, during and immediately after rain can provide a useful picture of potential runoff problems.*

Murky water is easily seen as unhealthy. However, natural substances which are not harmful to the water can sometimes make water appear brown and murky. How do we know if the murky water is a cause for concern?

Scientists have found a way to quantify the cloudiness of water by measuring its **turbidity**, (its cloudiness) which relates to the amount of suspended particles in the water. These small particles of soil, algae, fine sediment, dead organic matter, plankton, and other materials generally range in size from the microscopic level to about one millimeter, (about as thick as a pencil lead). More free-floating particles cause greater turbidity, resulting in less light penetration through the water. This hinders photosynthesis, necessary for healthy aquatic plant growth and production of dissolved oxygen. The water also becomes warmer because the suspended particles absorb heat.



Sources of turbidity include: erosion from fields, construction sites, urban runoff from rainstorms and melting snow, eroding stream banks, large number of bottom feeders (such as carp) which stir up bottom sediments, and excessive algal growth. The faster a stream flows, the more energy it has and the more sediment it can carry. Scientists don't directly count how many suspended particles are in the water. Instead they measure the transparency of the water, which takes into account both color and suspended particles. Scientists measure water clarity in centimeters (cm) using a transparency tube that is approximately 120 cm long. There is a black and white disc in the bottom of the tube that they look down - through the water sample - to attempt to see. If they cannot see the disc in the bottom of the tube, they open a release valve that allows water to flow out of the tube. Then they close the valve when they can just see the contrast between black and white on the disc. They then report the number of cm of water still left in the tube. If they can see the disc with the tube full, the transparency is at least 120 cm and may be more than that. This high transparency indicates good water quality.



All streams have background turbidity/transparency, or a baseline standard for a natural amount of turbidity/transparency. Fish and aquatic life that are native to streams have evolved over time to adapt to varying levels of background water clarity. For example, some native fish and aquatic life in the Mississippi River are very happy with their murky environment. What causes problems in any stream or river are unusual concentrations of suspended particles and how long the water clarity stays at a deviated level.

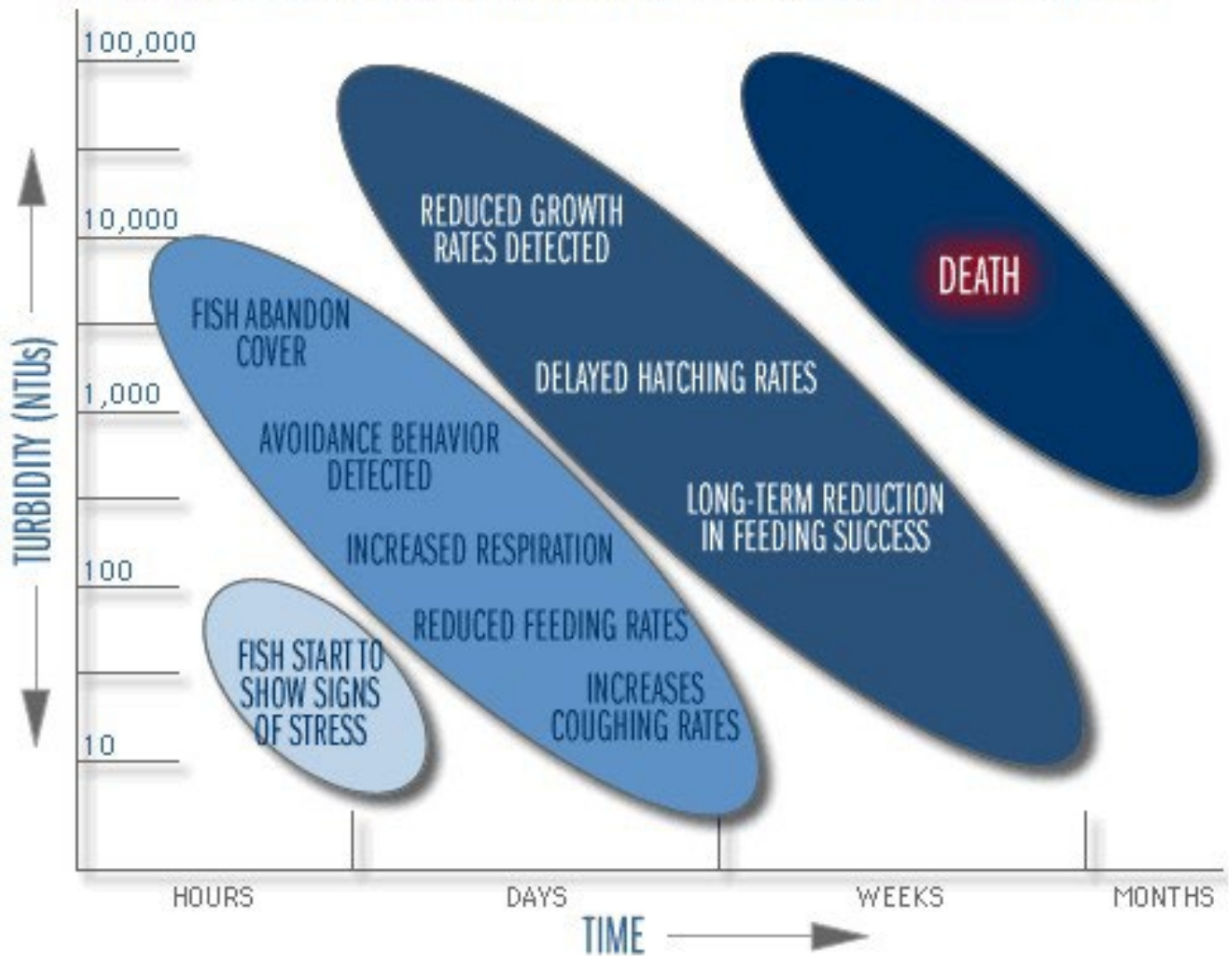
The longer the water remains at unusually high values, the greater effect it has on fish and other aquatic life. Fish can become very stressed in waters that remain highly turbid for a long time. Signs of stress include increased respiration rate, reduced growth and feeding rates, delayed hatching, and in severe cases, death. Fish eggs are ten times more sensitive to turbidity than adult fish.

High turbidity levels affect humans too. An acceptable turbidity level for recreation is 5 NTU and an acceptable level for human consumption ranges from 1-5 NTU.

Turbidity is measured in Nephelometric Turbidity Units (NTU) Scientists can also use a special meter, called a nephelometer, to assess this parameter. This type of meter shines light through a water sample and measures how much light is scattered by suspended material in the sample.



RELATIONAL TRENDS OF FRESH WATER FISH ACTIVITY TO TURBIDITY VALUES AND TIME



Turbidity Conversion Chart

Cm	NTU	Cm	NTU	Cm	NTU
< 7	> 240	21 to 24	35	44 to 46	13
7 to 8	185	24 to 26	30	46 to 49	12
8 to 9	150	26 to 29	27	49 to 51	11
9 to 10	120	29 to 31	24	51 to 54	10
10 to 12	100	31 to 34	21	54 to 57	9
12 to 14	84	34 to 36	19	57 to 60	8
14 to 16	60	36 to 39	17	60 to 70	7
16 to 19	48	39 to 41	15	70 to 85	6
19 to 21	40	41 to 44	14	> 85	< 5

ANALYSIS:

1. What is turbidity? _____
2. What particles may be suspended in water? (5pts)
 - 1 _____ 4 _____
 - 2 _____ 5 _____
 - 3 _____
3. High turbidity hinders a plant's ability to do what?

4. High turbidity hinders the production of which gas?

5. Turbid waters often have a higher temperature because the suspended particles absorb...

6. Turbidity is measured in what units? _____
7. If the NTUs are a high number, is the water clear or murky?

8. How does the transparency tube work?

9. What are the signs that fish are stressed due to a high NTU rating? (5 pts)
 - 1 _____ 4 _____
 - 2 _____ 5 _____
 - 3 _____
10. How many NTUs are acceptable if humans are to drink the water?

11. When scientists assess transparency, they take several measurements with the transparency tube and then calculate the average transparency (cm). Why?

12. If their transparency tube readings were 10 cm, 13 cm, 8cm, and 7cm, what is the average transparency? What turbidity does that convert to? (2PTS)

13. If the fish were exposed to the turbidity you calculated above for hours, what would be the consequence?

14. If the turbidity of stream water reached 500 NTUs for days, what might happen to fish? (5)
 - 1 _____ 4 _____
 - 2 _____ 5 _____
 - 3 _____
15. What about 1000 NTUs for weeks? (3pts)
 - 1 _____ 2 _____ 3 _____
16. What about 10,000 NTUs for months?