Ecological Considerations for Assessing Stream Crossings

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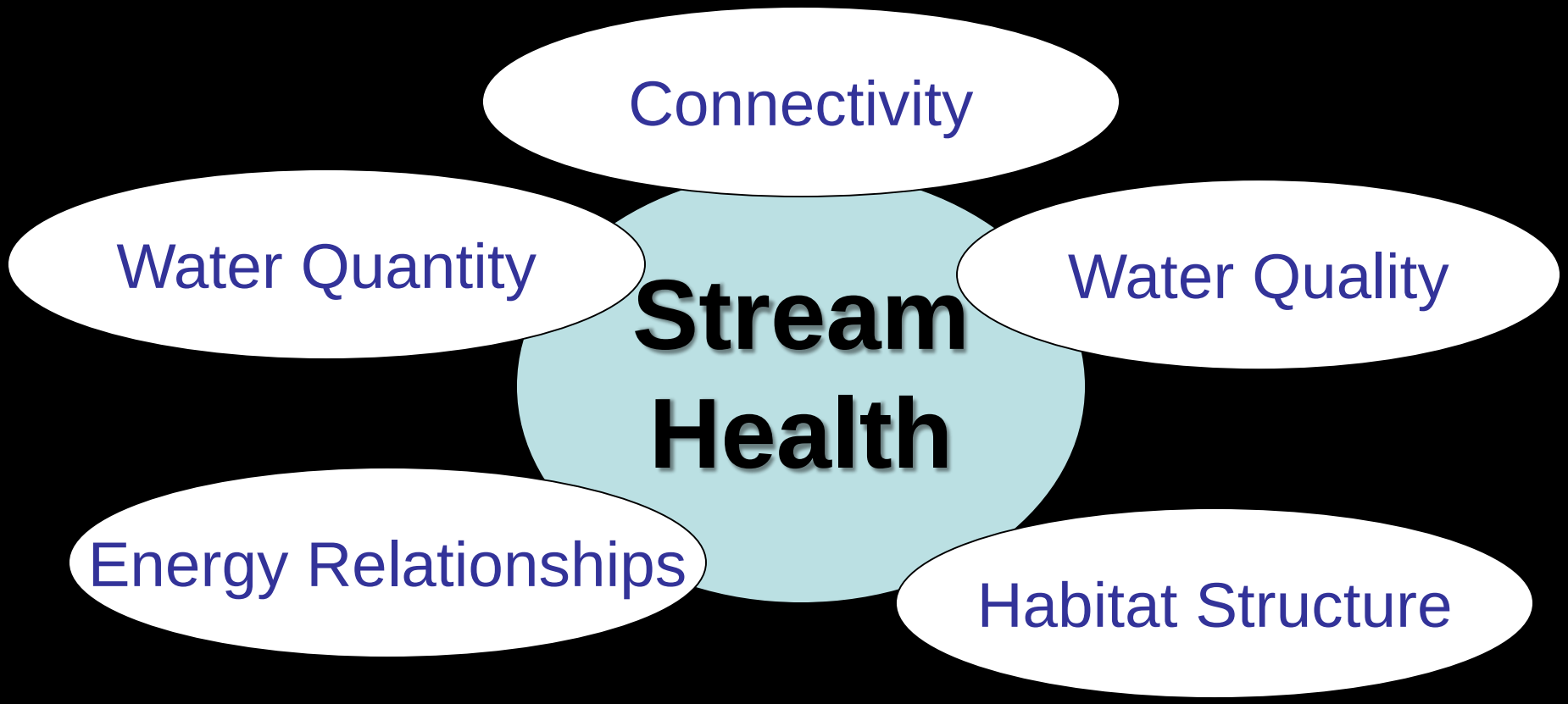
Why did the fish cross the road?

Major Determinants of Stream Health



Earth's Circumference:
25,000 mi.

WI <u>Perennial</u> Streams:
42,000 mi.

- 102,000 roadway miles
- 84,000 stream miles
- 80,000+ road crossings

Overview:

- Ecological importance of continuity
- Physical aspects of stream fragmentation

Ecological Importance of Stream Continuity

To function, both roads and rivers need to be connected.

What ecologic functions are lost?

Less Obvious Barriers

Perching

Shallow water

High Velocity Flows

Primary design consideration: move water

Is this a barrier?

Wood Turtle

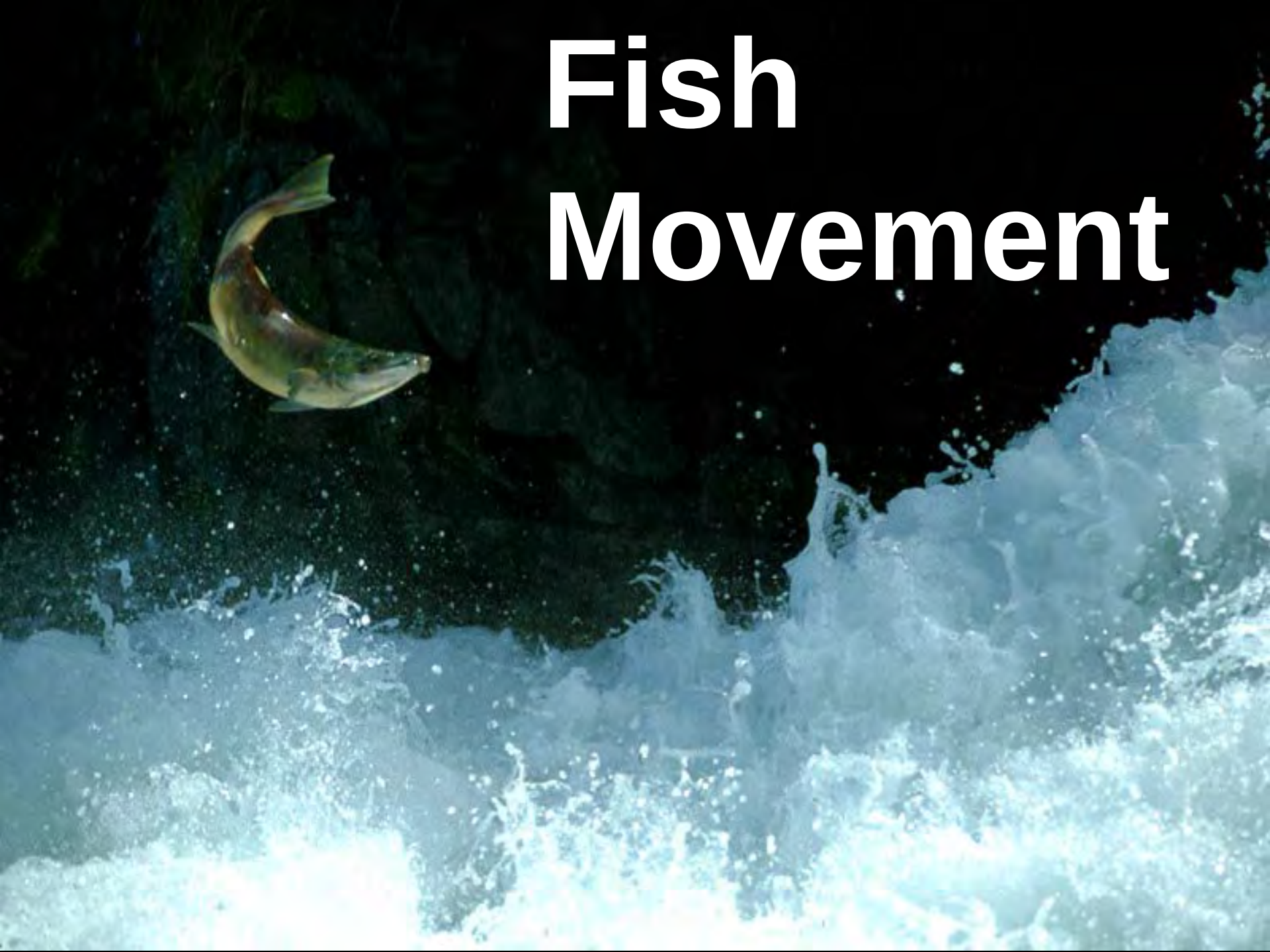
- Semi-terrestrial
- 1.5 mi. home range
- 17 yrs. to maturity
- Reproduce for decades

Go Badgers!
Stream corridors increasingly important wildlife pathways

River Continuum Concept

- From headwaters to mouth, streams change:
  - Size
  - Temperature
  - Habitats
  - Energy Sources
  - Biotic Communities
  - Etc. etc.

Fish Movement



Numerous species migrate, most will disperse

Seasonal Fragmentation

Fall Low Flows

Photo: J. Simonsen

Upstream spawning migrations of trout

Clean, well-oxygenated gravel for eggs, sac - fry

Nursery habitats for young

Seasonal fragmentation
Spring High Flows

Downstream movements

to overwintering habitats

- Trout
- Catfish
- Smallmouth bass
- Turtles

March of the Mayflies

Significant (100s of meters) upstream movement of mayflies, amphipods, snails.

Turtles too!

Fragmentation influences animal inter-dependencies

Bait and switch

Whether turtle or trout, the environment is a patchy place. Habitats, food, mates, are <u>not</u> found in one place.

Physical Aspects of Stream Fragmentation

Raised “perched” culvert outlets make ponds out of streams

- Impounds water
- Raises water level
- Widens channel
- Slows flow, deposits silt
- Warms water
- Alters habitats

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After

Perched Outlets

One – way biological check valves

Trout can jump
2 - 3x body length

Mottled Sculpin

Animals differ in their ability to move against stream currents

Culverts often create a single (high) velocity environment

Culvert length

- **Behavioral barrier**:

  Dark, ***scary*** place; avoidance by wildlife

- **Physical barrier**:

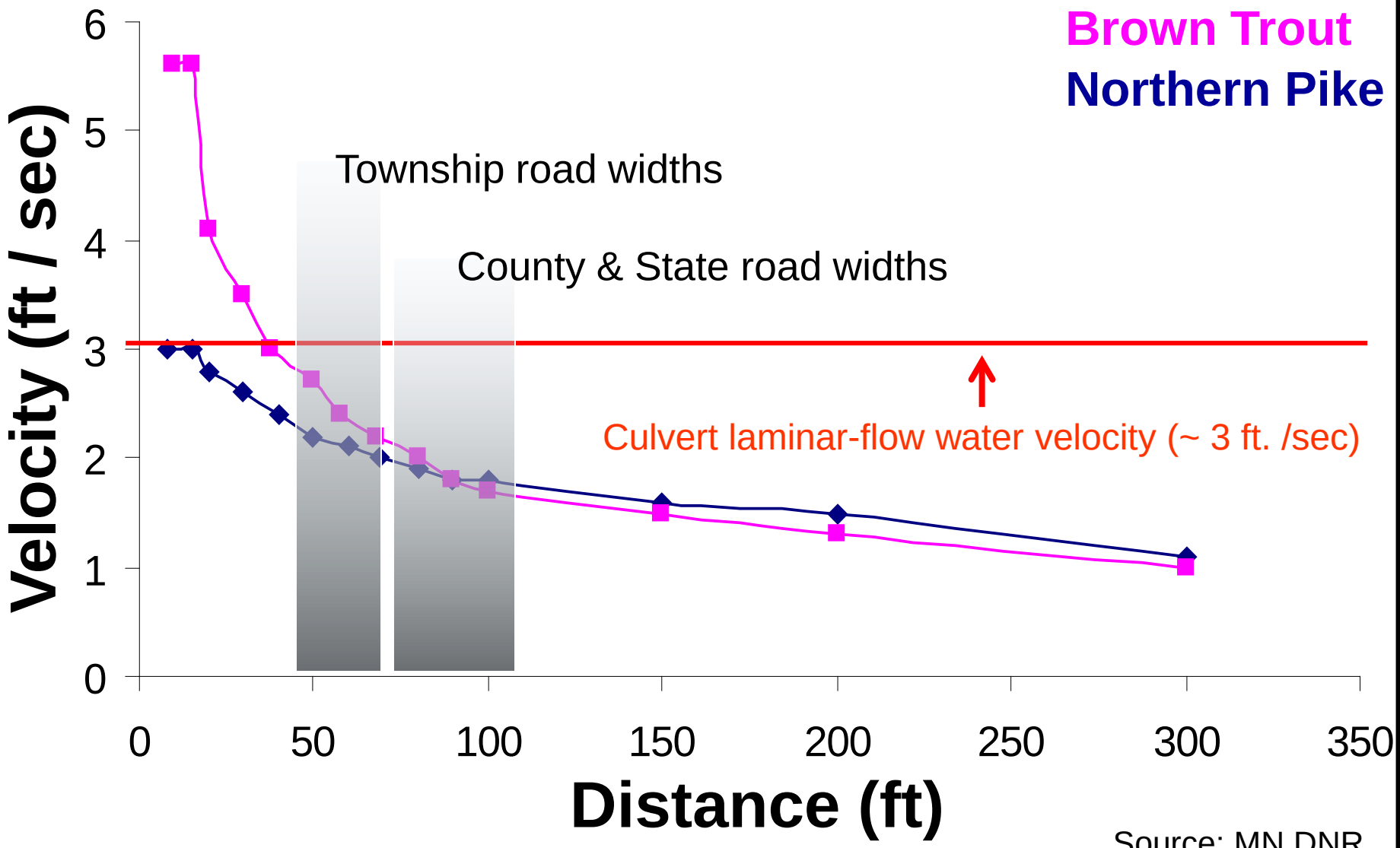
  Fish and amphibians may tire before reaching upstream end

Fish sustained swimming speeds

Fish Species	**Size** (inches)	**Speed** (ft./sec.)
Brook Trout	4	1.0
Northern Pike	24	1.4
Brook Trout	8	1.5
B. Stickleback	2	1.5
White Sucker	8	1.6
Walleye	16	2.5
Redhorse Sucker	8	4.0
Brown Trout	8	5.0

Culvert
high-flow velocities
3 ft./sec.

Fish swim distance versus water velocity



Source: MN DNR

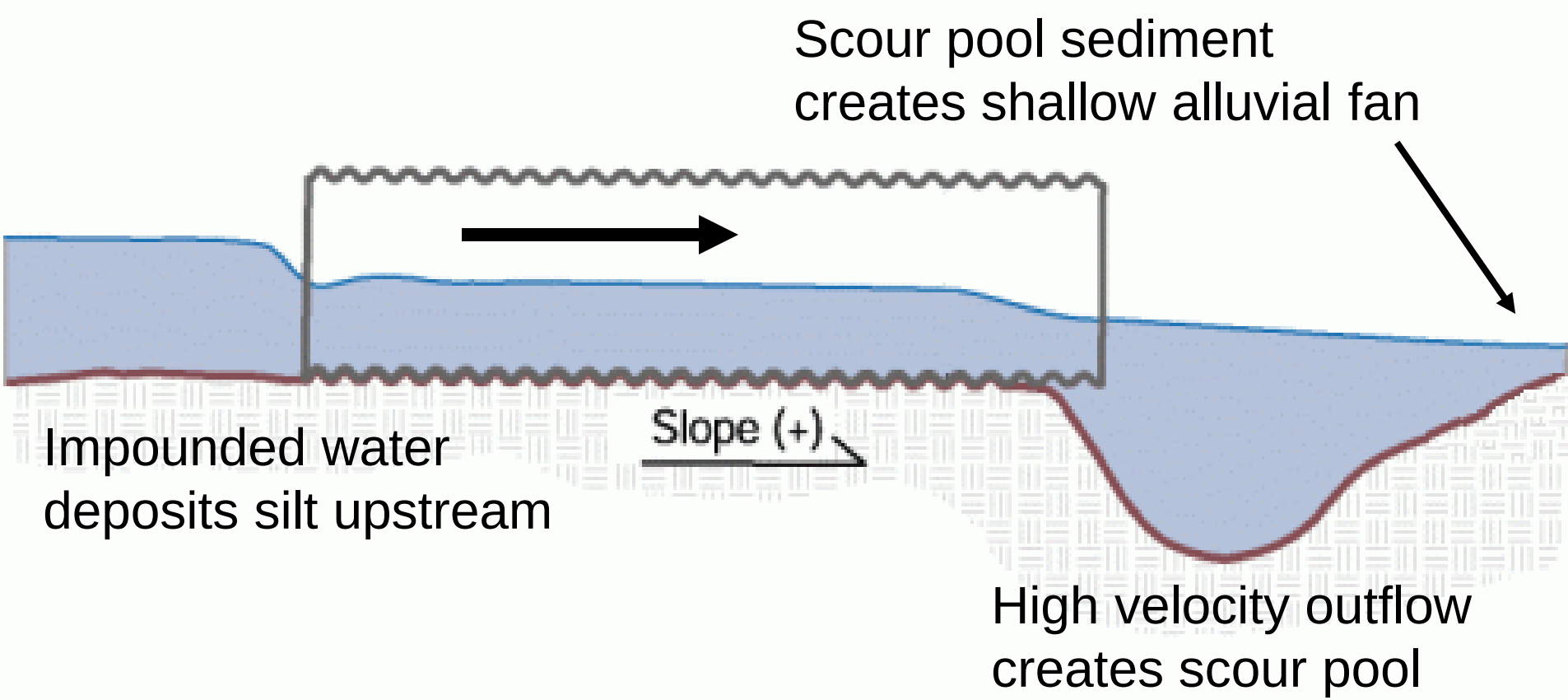
Water depth

Shallow water:

- Avoidance by fish
- Inefficient swimming
- Reduced passage potential

Streambed alterations

Effects of undersized or improperly set culverts



Debris blockage

- Blockage
- Constrictions increase water velocity

Riprap can become pits-traps for young animals

Review:

- Importance of continuity
- How streams get fragmented

Questions?