

Fish Passage and Entrainment: A General Overview

Ian Wilson

White River Project Manager

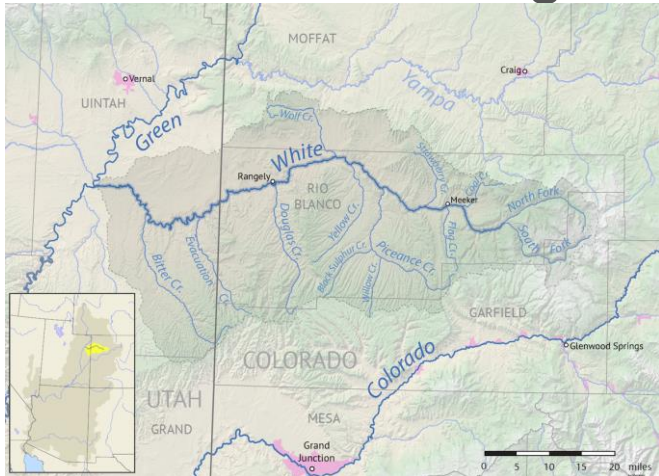


www.tu.org

Fish Passage



- Fish need to move!
 - Access spawning habitat to complete life cycle
 - Feed
 - Thermal refugia
 - Nutrient cycling (more with anadromous fish species like salmon)
 - Avoid anglers or other recreation (think tubing on the Yampa)



Physical Features that inhibit fish passage



- **Structure Height**
 - Too tall?
- **Plunge Pool Depth**
 - Too shallow?
- **Water Velocity**
 - Too high?
 - At certain flows?
 - Younger age classes of fish?

Some Definitions



Barrier: any artificial obstruction (dam, diversion, road, culvert, bridge, etc.) that precludes or prevents the migration of migratory fish. Barriers can be complete, blocking 100% of fish movement, or partial, preventing some fish movement at certain flows or life stages.

Migratory fish: a fish that moves on a regular basis, on time scales ranging from daily, to annually, to longer over varying distances in order to feed, reproduce, or find thermal refuges during warm months. Some migratory fish movements are not yet fully understood.

More definitions



Fish Entrainment: fish being transported along with the flow of water out of their normal river or stream into unnatural and/or harmful environments. Think of fish getting stuck in irrigation ditches when headgates get closed in the Fall.

Fish Passage: the ability of fish or other aquatic species to move throughout an aquatic system among all habitats necessary to complete their life cycle.

Barrier Examples



Barrier Examples



Examples of passage structures



Examples of passage structures



- Fixes can be simple - rearranging boulders during normal maintenance

How it happens

- Open headgate or control structure
- Lack of screening device
- Flow going directly into ditch, no backwatering=no suction
- High flows- fish look to escape high velocities of main channel
- When headgate or control structure is closed, flow stops (or slows), and fish are stranded and die unless salvaged.
 - Increased water temperature
 - Low dissolved oxygen
 - Isolated pools freeze in winter

Fish Entrainment Solutions



- Screens
 - Active and Passive
 - Can be costly
 - Can be maintenance intensive
- Structural
 - Headgate re-alignment
 - ex. 90° to thalweg
 - Can sometimes be better solution than screening
 - Less maintenance
 - Less expensive in long term

- Blank, M. D., K. M. Kappenman, K. Plymesser, K. Banner, and J. Cahoon. 2019. Swimming Performance of Rainbow Trout and Westslope Cutthroat Trout in an Open-Channel Flume. *Journal of Fish and Wildlife Management* 11(1):217–225.
- Bureau of Reclamation. April 2006. Fish Protection at Water Diversions: A guide for planning and designing fish exclusion facilities.
- Kondratieff, M. C., and C.A. Myrick. 2006. How High Can Brook Trout Jump? A Laboratory Evaluation of Brook Trout Jumping Performance. *Transactions of the American Fisheries Society* 135(2):361–370.
- Screen types. (n.d.). . <https://www.fishscreensoc.com/screen-types/>.
- Timm, A., E. Hallerman, C.A. Dolloff, M. Hudy, and R. Kolka. 2015. Identification of a barrier height threshold where brook trout population genetic diversity, differentiation, and relatedness are affected. *Environmental Biology of Fishes* 99(2-3):195–208.
- Washington Dept. of Fish and Wildlife. Heiner, B. (n.d.). Fish Screen Designs.

Questions?