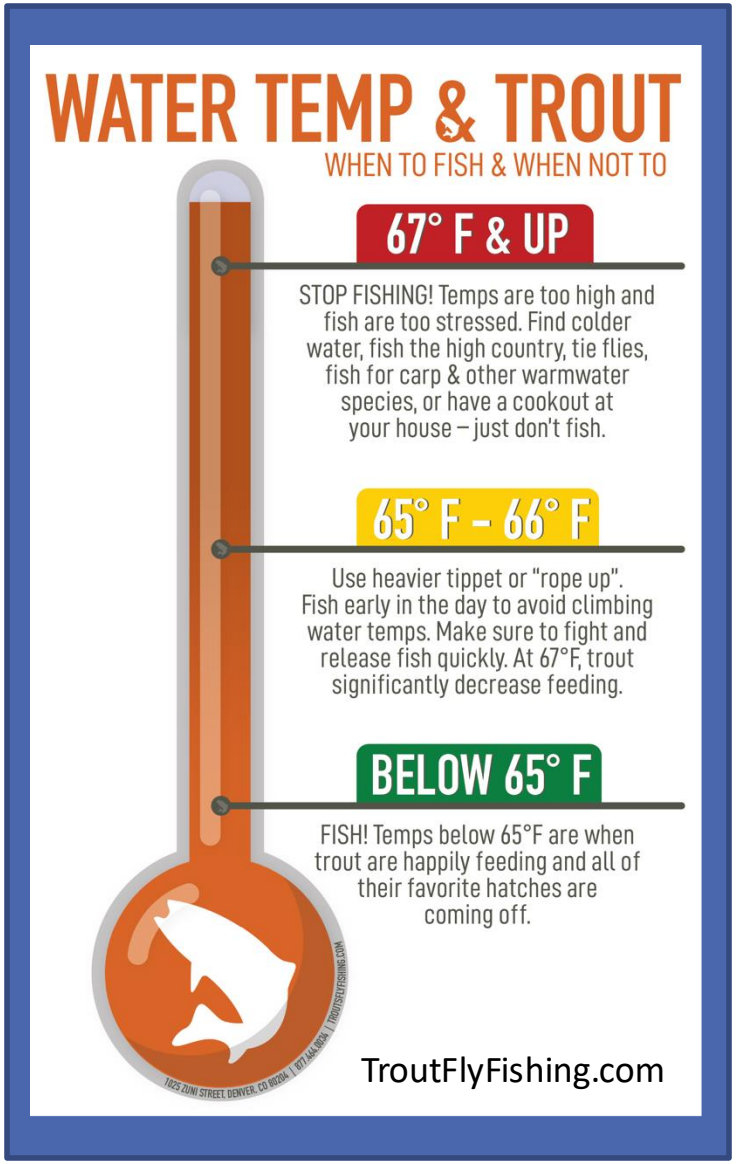
Water temperature

- **Water temperature** influences
  - Biological activity and growth
  - Water chemistry
  - Biodiversity
  - Water quality
- Land use change and climate change can affect water temperature
- Predicting future water temperatures can help resource managers prevent water quality degradation



Thermal stratification

- **Thermal stratification** refers to differences in water temperature at different depths in a reservoir.
- This occurs because the density of water depends on its temperature.
- Denser water sinks to the bottom of the reservoir, while less dense water is at the surface.
- **Thermal stratification** changes over the course of a year in reservoirs located in temperate regions, such as in most of the United States.

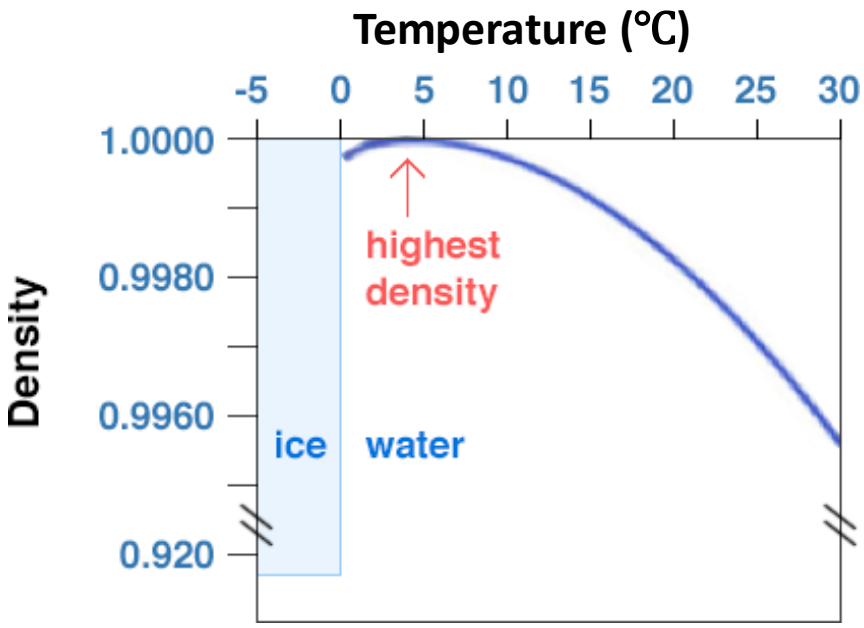
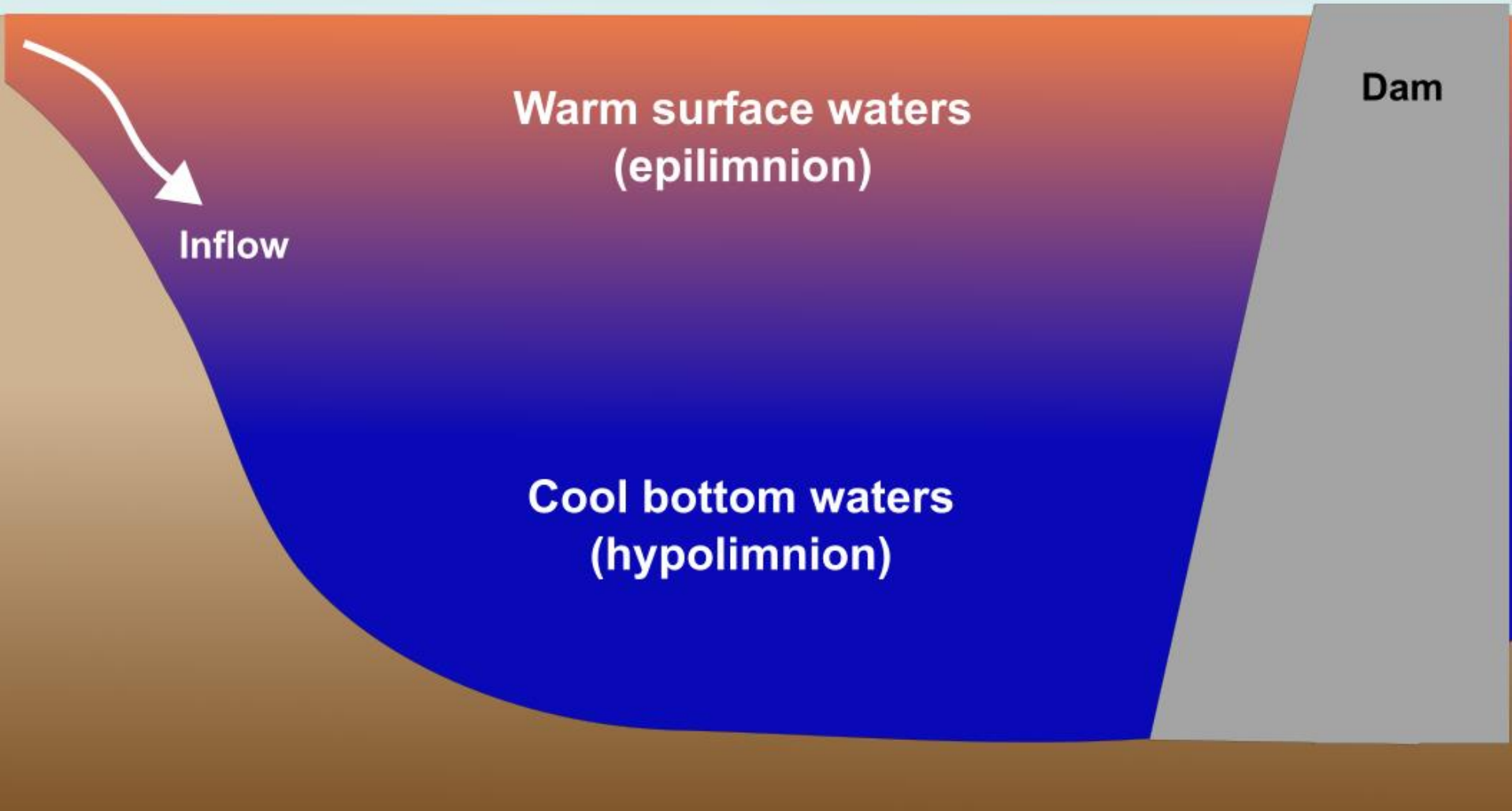


Image source: Mike Arthur and Demian Saffer, accessed at: https://www.e-education.psu.edu/earth111/node/842

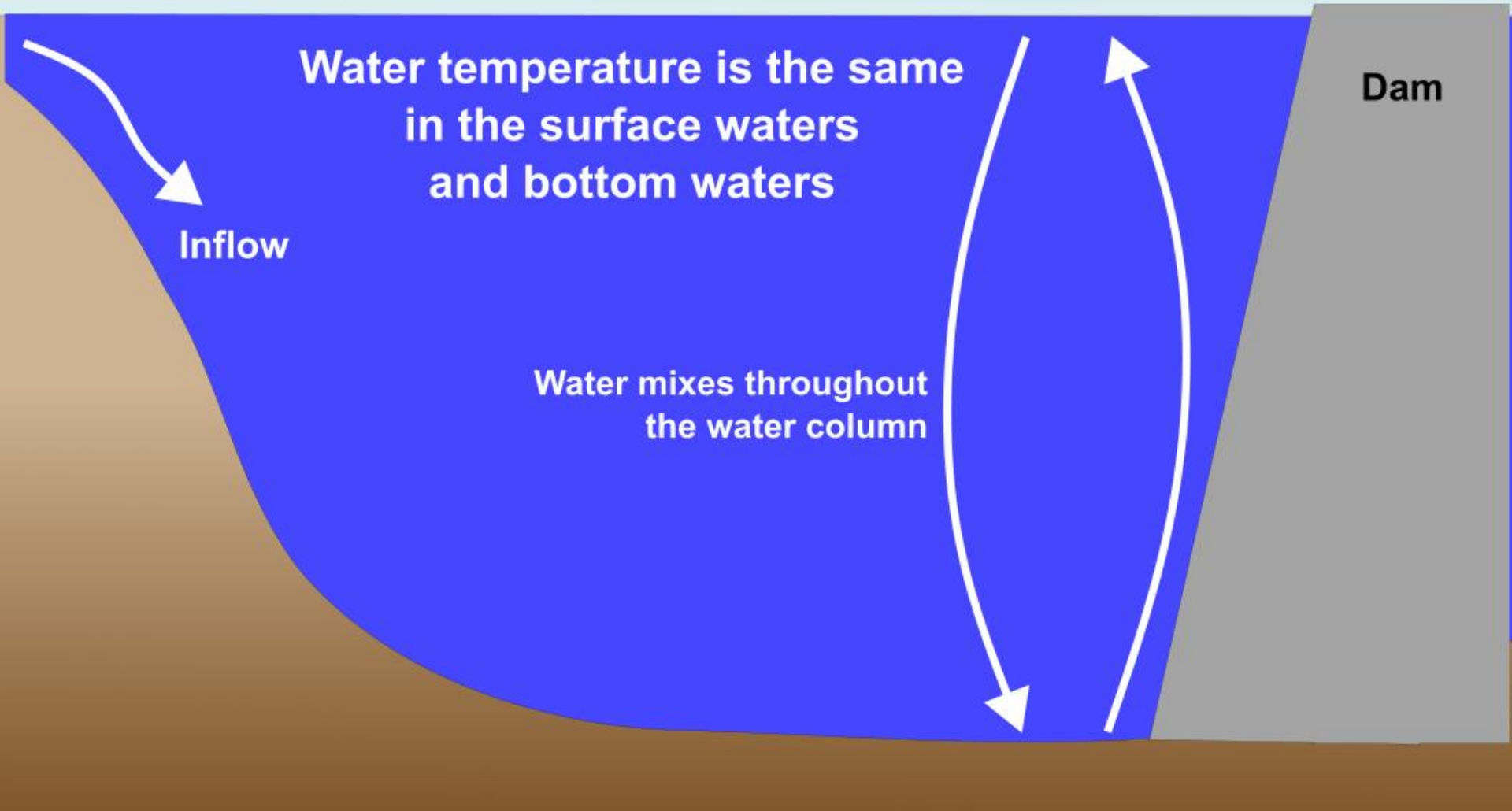
Summer Thermal Stratification in a Reservoir

In summer, warmer, less dense water stays at the surface of the reservoir, while colder, denser water sinks. This leads to 'summer stratification', where the water is warmest at the surface and coldest at the sediments.



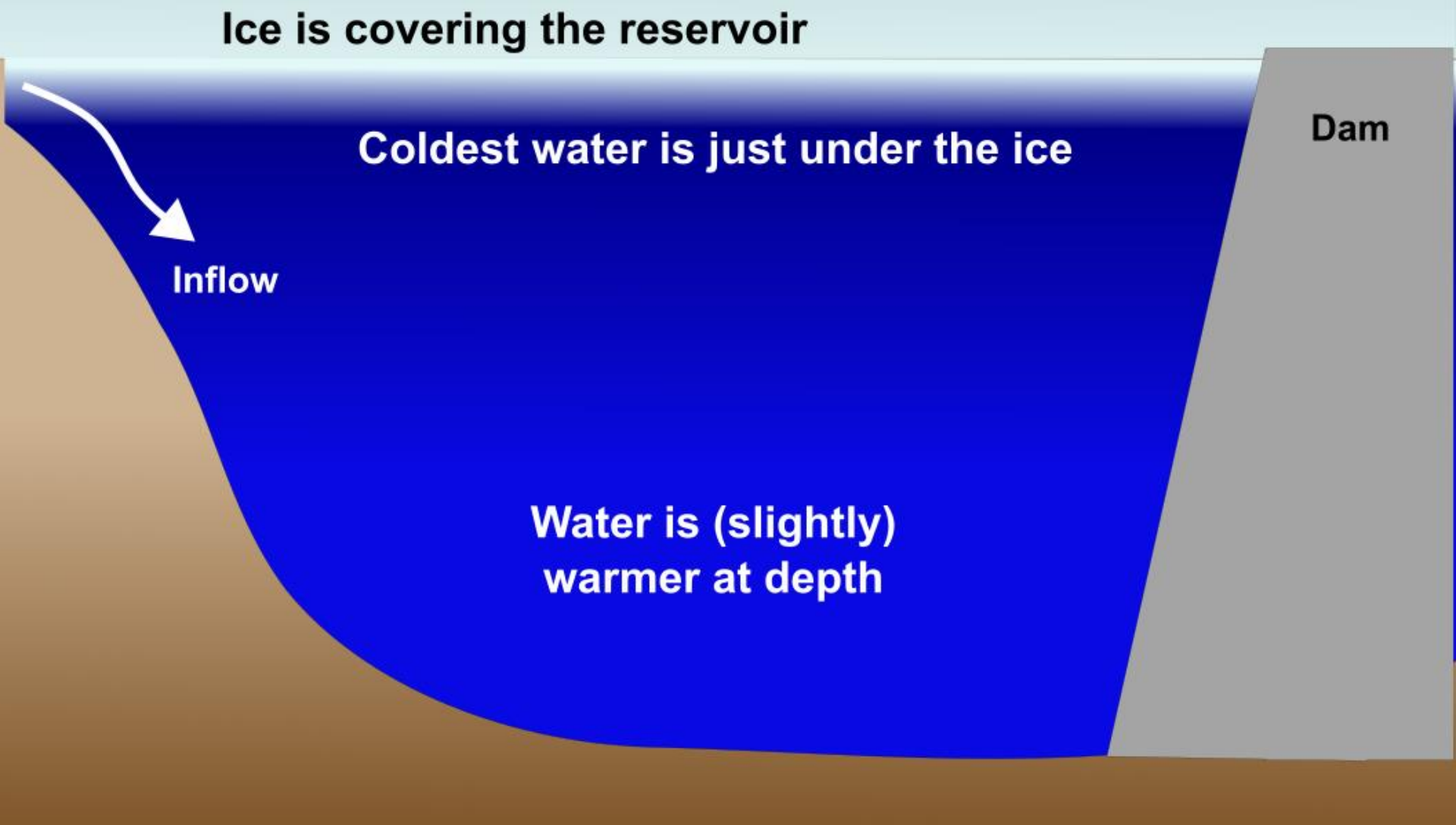
Fall Turnover in a Reservoir

Turnover is when thermal stratification dissipates due to seasonal changes in air temperature. In the fall, turnover occurs as air temperatures decrease, cooling the surface waters. Water temperature becomes the same from the top to the bottom of the water column. When this occurs, we refer to the reservoir as 'mixed'.



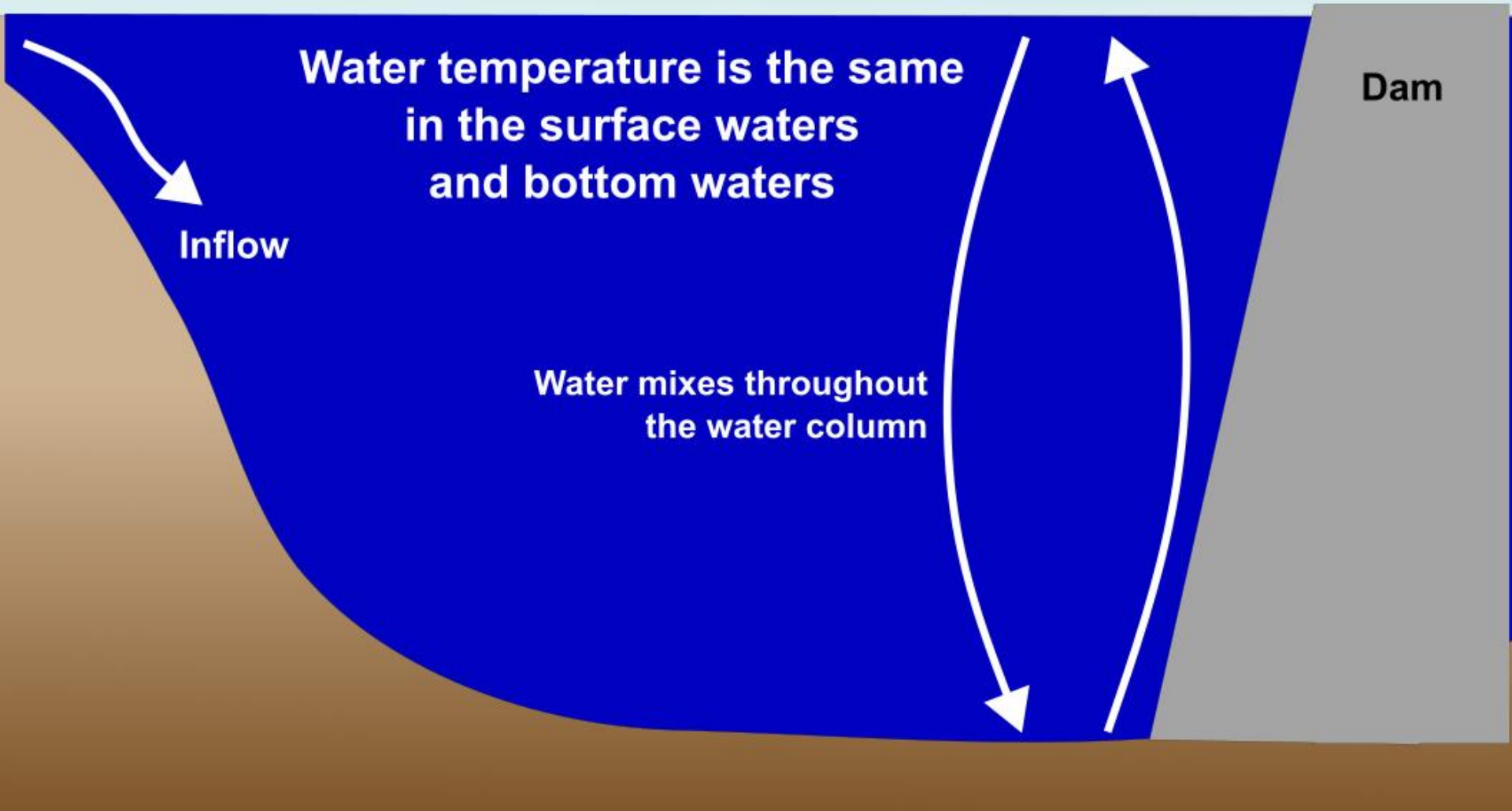
Winter Stratification in a Reservoir

In winter, if ice forms on the reservoir, 'inverse stratification' may occur. In this case, because water is densest at 4 degrees Celsius, the water is slightly warmer at depth than at the icy surface (remember, ice forms at 0 degrees Celsius!).



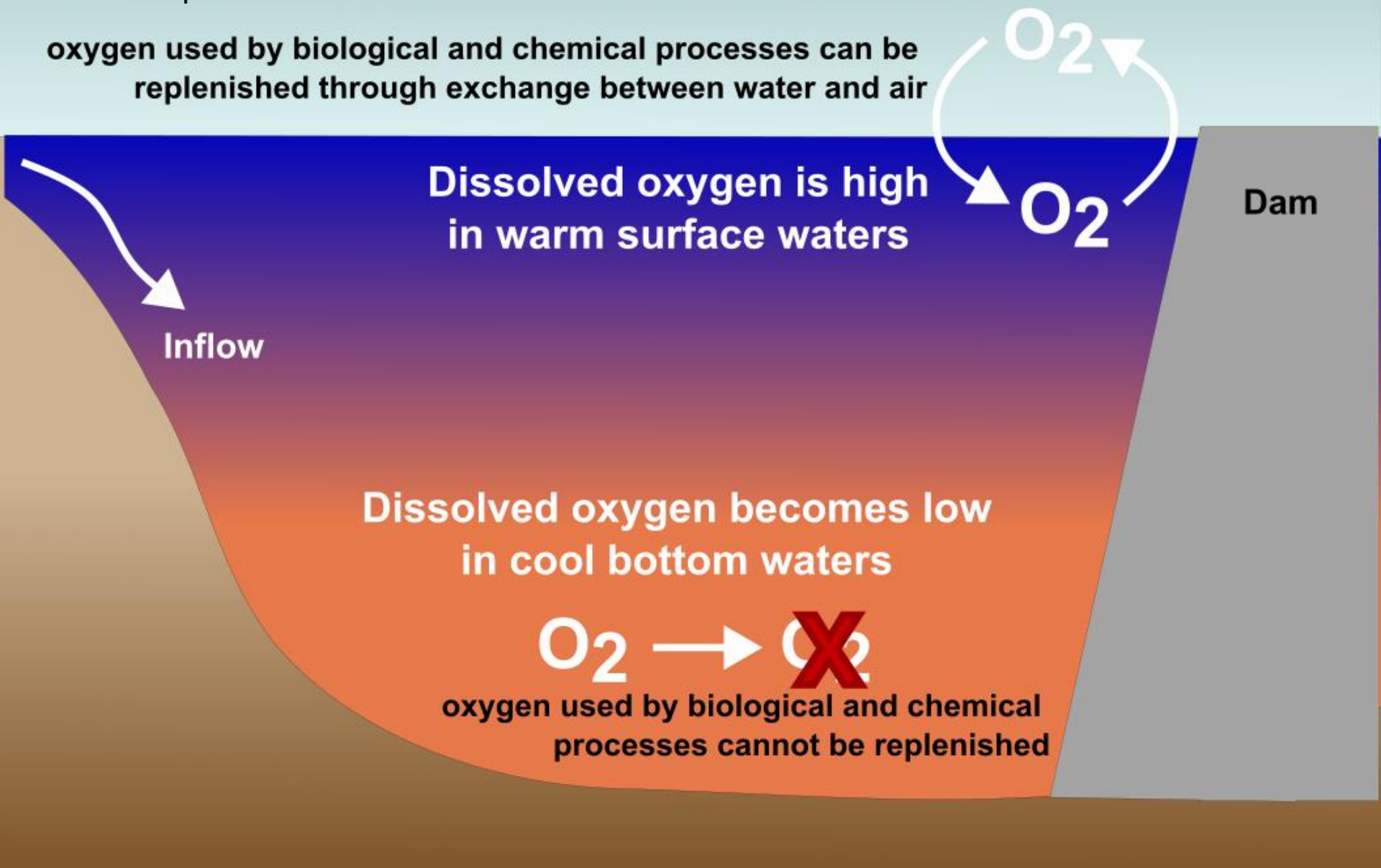
Spring Turnover in a Reservoir

In spring, turnover occurs as ice melts. Once again, water temperature becomes the same from the top to the bottom of the water column.



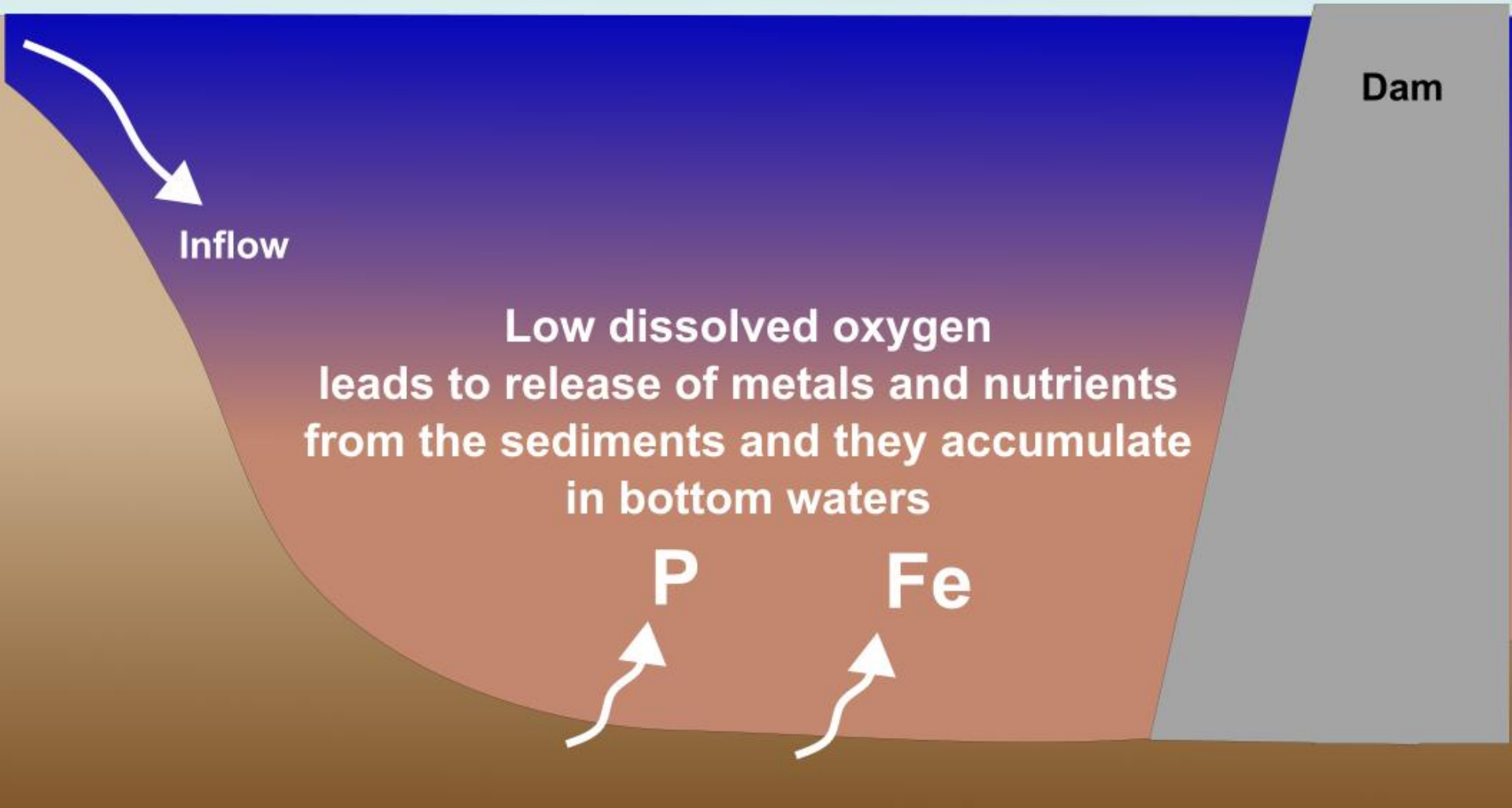
Possible Effects of Summer Thermal Stratification on Water Quality

During summer stratification, water quality conditions can be very different in the surface and bottom depths of a reservoir.



Possible Effects of Summer Thermal Stratification on Water Quality

Depleted oxygen in the bottom of the reservoir can lead to water quality concerns such as release of metals (iron, manganese) and nutrients (nitrogen, phosphorus) from the sediments.



Potential Effects of Fall Turnover on Water Quality

During fall turnover, metals and nutrients that have been released into the bottom waters of the reservoir during the summer can be released to the surface, potentially leading to taste and odor concerns or stimulating harmful algal blooms.