Habitat salinity represents a major abiotic factor that governs the survival and distribution of fishes. The ability to osmoregulate across a range of salinities has allowed teleosts, to cross major physiological and ecological barriers between seawater (SW) and freshwater (FW) (Zydlewski)

Freshwater adapted fishes use their gills to uptake ions from the water, whereas saltwater adapted fishes excrete excess ions through the gills. There are many other organs that play a role in osmotic physiology, but I want to focus on gills today.

Most fish species are adapted to habitats where salinity is stable and they can only tolerate a veeery narrow range of salinity stress. These species are described as Stenohaline.

Other species are more flexible and can tolerate a wide range of salinity stress, these species are described as Euryhaline. These species can adjust their physiological response to match their environment. For example, if a euryhaline species were transferred from low to high salinity water, there would be a rapid short term response in the gills to begin pumping excess salts out, and after more time has passed, the gills undergo structural changes that allows them to do this more efficiently. This process is initiated by osmosensing. Euryhaline species are common in coastal environments that experience large and frequent fluctuation in salinity (Marshall, 2013), and they are also more common in arid regions like desert lakes and creeks.

There are many reasons why it is important to understand this flexible physiology. First, Euryhaline species are likely important for ecological diversification in teleosts, the largest and most diverse group of vertebrates (Hughes et al. 2018). I mentioned that there are a lot more stenohaline species that are adapted to a narrow range of salinity. These species have physiologies that are **specialized** within saltwater and freshwater habitats, whereas euryhaline species are salinity **generalists**. So this flexible physiology is likely an important bridge mediating species diversification. These types of generalist to specialist transitions are common across many evolutionary radiations, and in this particular case it seems like transitions from saltwater specialist to freshwater specialist are most common among fishes.

Another reason it is important to investigate osmotic tolerance is because climate change will continue to increase the frequency of salinity stress and fluctuation in environments around the world.