

TOPICS 2.6

ECOLOGICAL TOLERANCE

Enduring Understanding: Ecosystems have structure and diversity that change over time.

Learning Objectives: Describe ecological tolerance.

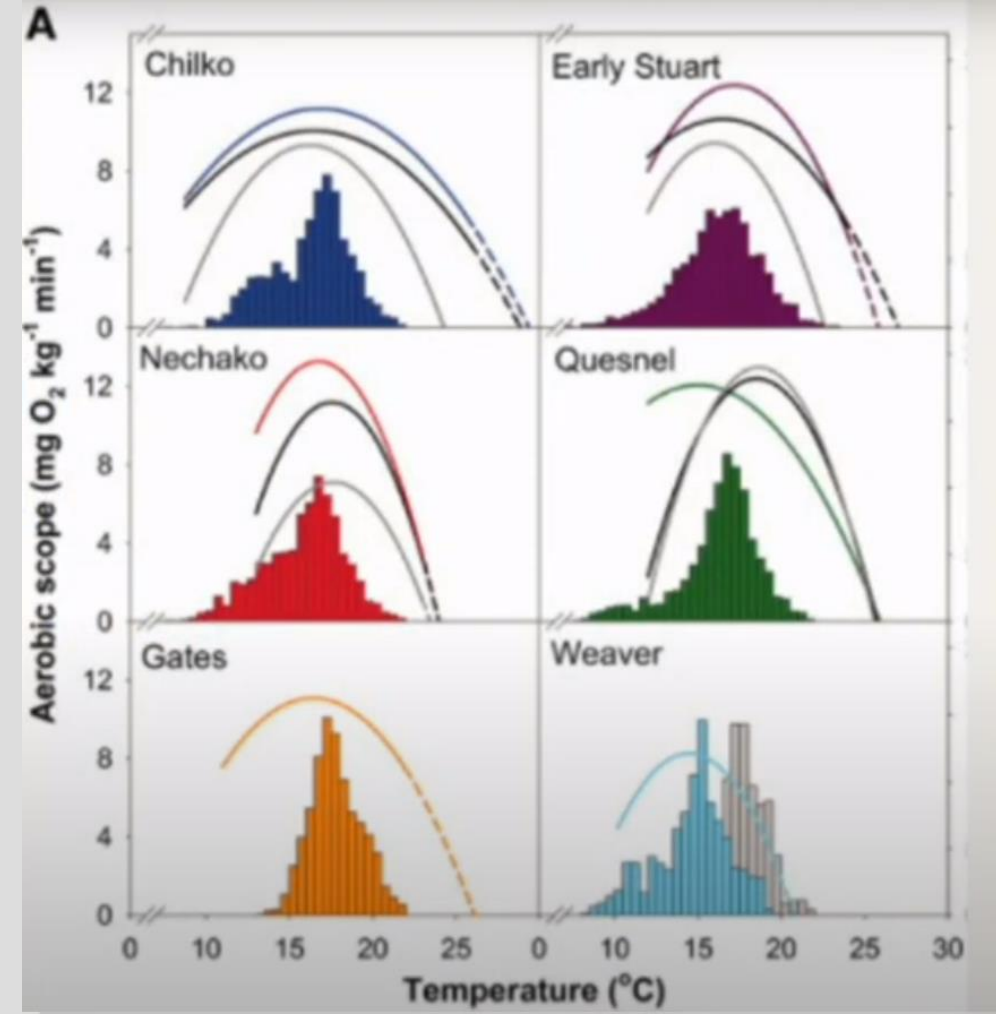
Related Readings: pg 47 - 60, “Environment; The Science Behind the Stories” 4th Edition, Withgott, Jay and Laposata, Matthew.

LAW OF ECOLOGICAL TOLERANCE

- ***Law of Ecological Tolerance:*** For each abiotic factor, a species, population, or individual organism has a tolerance range within which it can survive, grow and reproduce. Towards the extremes of this range, the abiotic factor tends to limit the organisms ability to survive.
- Examples of abiotic factors to which species may evolve a specific range of tolerance include:
 - specific nutrients, light, specific temperature range, salinity range.
- The tolerable range of conditions will vary by species.
 - It may even vary between different life stages for a given species (salinity and salmon)
 - Range of tolerance may vary among individuals of a given species, due to genetic differences
 - Range of tolerance for survival, growth, and reproduction may be different for different species (light and many tree species)
- The Law of Ecological Tolerance helps explain species distributions and responses to ecosystem disturbances.

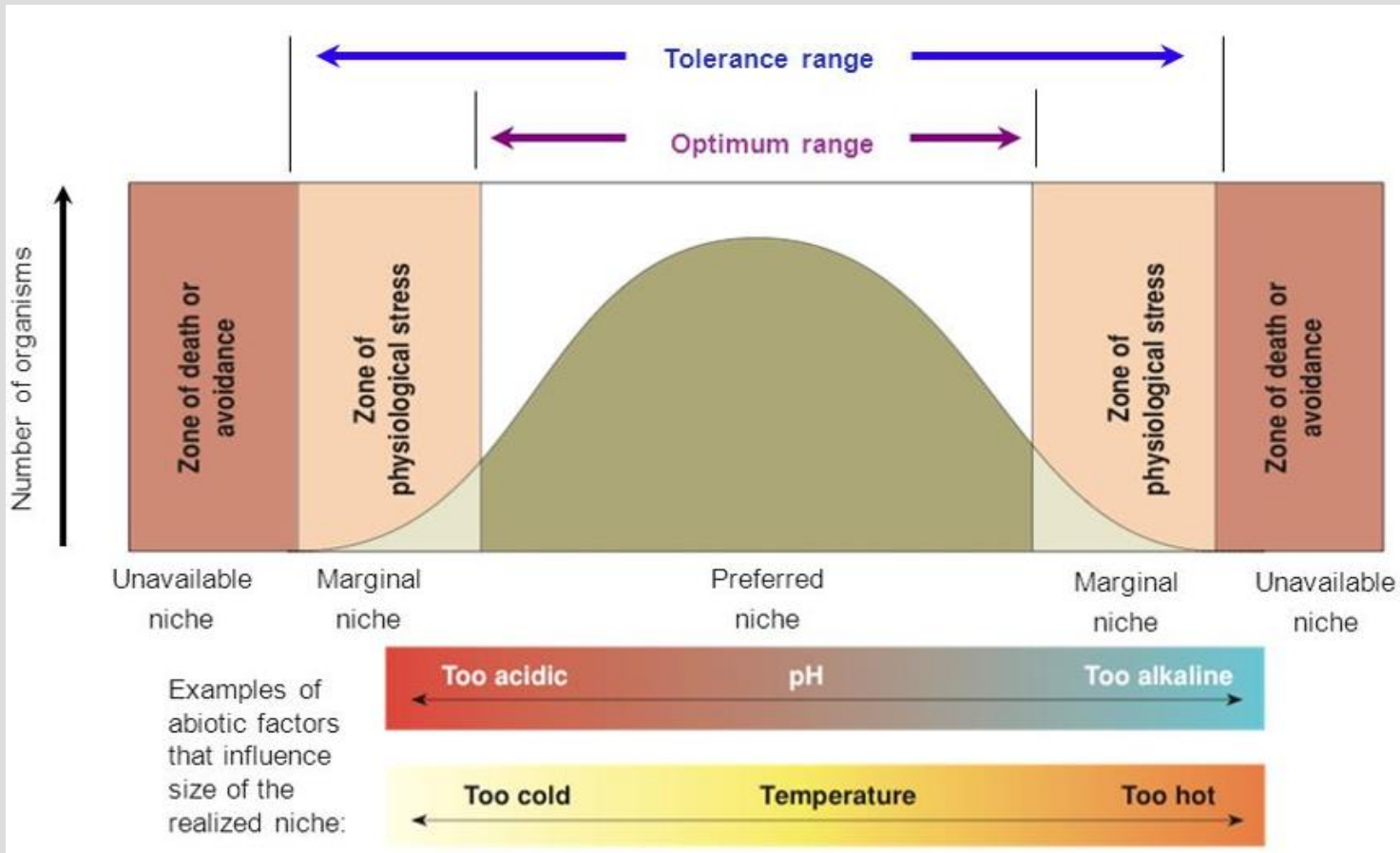
ECOLOGICAL RANGE OF TOLERANCE - SALMON

- Salmon have a basic range of tolerance for temperature, ranging from 6° to 22°C.
- Different populations (subspecies) of salmon will show differences in their range of tolerance
 - Some individual salmon have adaptations that give them a range of tolerance that is outside the basic range for the species.
 - Results from genetic differences between individuals.
 - Greater range of tolerances in a more genetically diverse population
 - Makes species more resistant/resilient to disturbances in their environment.



*Aerobic scope measures how well individuals use oxygen.

ECOLOGICAL RANGE OF TOLERANCE - ZONES

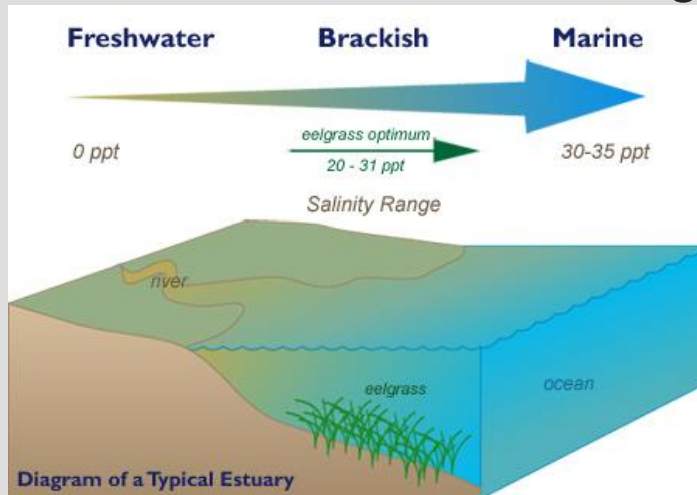


In FRQs: When explaining the effect of a disturbance on a species, apply the concept to range of tolerance (identify the stressor and its physiological effect on the species.)

- **Optimal Range:** range where organisms survive, grow, and reproduce.
 - This is the range where the largest number will survive and the biggest populations will be found
- **Zone of Physiological Stress:** range where organisms survive, but experience stress such as decreased activity, stunted growth, infertility, etc.
 - Fewer individuals with adaptations to tolerate conditions
 - Lower reproductive success when physiologically stressed
 - Smaller population result in this zone.
- **Zone of Intolerance:** Causes organism death or migration to areas with more favorable conditions.

ECOLOGICAL TOLERANCE AND SPECIES DISTRIBUTION

- Salinity in the waters of estuaries varies from ≈ 0 ppt in the river as it enters the estuaries to an average of 35 ppt in the ocean itself.
- Eel grass grows on the ocean floor at shallow depths where it can receive enough light.
- It is also commonly found in estuaries, but it can not grow along the river bottoms, because the lower salinity in freshwater rivers is outside of its range of tolerance.



- Which species has the wider rangel of tolerance for desiccation and submersion? Which species is the stronger competitor? Explain?

