Workshop: Mussels seizes and different Baltic Sea living conditions

Do you know why is osmoregualtion important for marine organisms? The experiment and intervening discussion will introduce you to the concepts of salinity and osmoregulation.

1) Read about salinity and the biodiversity of the Baltic Sea.
2) Run the experiment 1 in groups of 2-3 students. Read the instructions first, conduct the experiment and answer all given questions.

Worksheet 1: Background Information

The Baltic Sea is a unique environment in the world and one of largest semi-enclosed bodies of brackish water. There is also a strong gradient in surface water salinity from almost 0 PSU in the north to over 20 PSU near the Kattegat and Danish Straits. As it creates a stressful environment for many aquatic organisms, it is the primary reason for low Baltic biodiversity. The number of species decreases dramatically along the south-to-north gradient. Physiological stress is manifested in the limited body size and slower growth rate of some marine species that inhabit the Baltic Sea. However, several marine species have populations in the Baltic Sea adapted to the low salinity. They are able to regulate the water content in their cells when the osmotic pressure changes due to the diminishing salt. How do seawater marine organisms and freshwater marine organisms regulate their salt content?

Fig 1. Shells of mussels: *Mytilus galloprovincialis,* Lamarck, 1819; *Mytilus trossulus,* Gould,1850;*Mytilus edulis,* Linnaeus, 1758 (source http://naturalhistory.museumwales.ac.uk/britishbivalves).

Diffusion refers to the "desire" of all matter to be equally concentrated in its environment. If a large concentration of something is put into a particular region of the environment, it will disperse until its concentration is uniform throughout the environment, provided it does not encounter any barriers through which it cannot pass. Salt exists in water as sodium ions (Na^+) and chloride ions (Cl^-). Charged ions like sodium ion and chloride ions are unable to pass through most biological membranes. However, water molecules are able to pass through most biological membranes so salinity imbalances within biological systems are naturally corrected via the diffusion of water across biological membranes to equalize salt concentrations on both sides of the membrane. This process is known as osmosis.
Salinity simply refers to the amount of salt dissolved in the water. Freshwater such as that contained in lakes, rivers, and streams has a lower salt content and thus a lower salinity than seawater. The salinity of the surrounding environment is an important constraint with which marine organisms must deal in order to survive.

Experiment 1: Osmoregulation in Marine Organisms

Materials:

3 potatoes, 3 small beakers, table salt, deionized water, weighing scale

Experiment:

1. Prepare three solutions A, B, and C in beakers .
   Beaker A - deionized water (*hypotonic* solution).
   Beaker B - tap water (*isotonic* solution).
   Beaker C - tap water and 2 teaspoons of salt per 10 ml of water (*hypertonic* solution).
2. Cut 3 cubes of potato (approximately 2cm) and check the weight of each one on the weighing scale, make a note.
3. Place each potato cube in one of the three beakers.
4. Wait approximately 20-30 minutes for experiment to complete (osmosis to occur).
5. Once the experiment is over, check the weight of each cube again.

Tasks:

1. What happened to the potato in the hypo/hyper/isotonic solution? Why?
2. Why is osmoregualtion important for marine organisms?
3. How do freshwater marine and seawater marine organisms regulate their salt content

Notes:

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