Integrity of eggs from aquatic organisms

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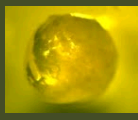
Salmon egg



Whitefish egg

Abstract
Eggs from horseshoe crabs, whitefish, and salmon were used to study cellular process such as osmosis in order to understand the integrity of the egg in relationship to the organism's ecology. For this study, horseshoe crab eggs were obtained from Pickering Beach on Delaware Bay in June, 2009 during the spawning season and then frozen. Salmon and whitefish eggs were obtained from a specialty deli. The eggs were weighed before placing them in water, vinegar, salt and sugar solutions, and weighed again after. The eggs gained or lost weight depending on the solution in which they were placed. Visible differences in appearance were noted. The eggs were photographed under a dissection scope using a Motic camera. The horseshoe crab eggs displayed the most resistance to environmental change, which perhaps reflected the fact that they receive the most abrasion through sand and wave action. There appears to be a relationship between degree of change in egg weight and appearance when placed in various solutions and the ecology of the organisms that produced the egg.

From salmon roe to cured eggs

www.homebrewdepot.com/CuringSalmonRoe.html

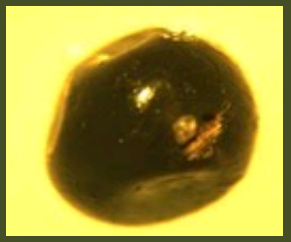
Introduction
This project was developed initially as a teaching tool for osmosis and diffusion. It sparked an interest into how the integrity of the egg was related to its ecology. Besides exposing eggs to various solutions and recording and photographing changes over time, we are exploring new solutions to test on the cell membranes and are looking into ways to record changes in osmotic pressure more accurately.

Horseshoe crabs (*Limulus polyphemus*) are organisms rooted in ancient evolutionary time. Fossils
from 350 million years ago very closely resemble present-day extant horseshoe crabs. However, these ancient, helmet-like creatures are in decline. This is partially for several reasons. Two reasons are: an increase in the use of horseshoe crabs for bait by fishermen and the capture of horseshoe crabs used for the isolation of their hemolymph (their blood), for pharmaceutical companies. Amoebocyte lysate is extracted from their "blood" and is used to test for the presence of bacterial endotoxins in package. Horseshoe crab eggs are also important as a food source for migrating birds, such as the red knot. The birds (and the horseshoe crabs) in turn attract tourists which increase the "value" of horseshoe crabs.

Salmon and whitefish roe needs to be cleaned and "de-membraned". This can be done by scraping the eggs from their membranous sacks. When purchased commercially the eggs have been cured by being placed in proprietary brines, which are most likely composed of salts and sugars.

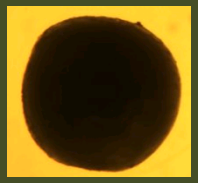
Materials and Methods
Horseshoe crab eggs were obtained from Pickering Beach in June, 2009 and frozen. Salmon and whitefish eggs were obtained from a local deli. Eggs were weighed before and after (two weeks) placing in either 3.5% or 10% NaCl or sucrose solutions, or vinegar or distilled water. Appearance was recorded under dissection scope with a Motic camera.

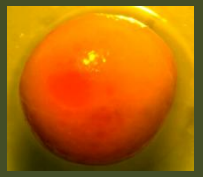
Type of egg	Total # of eggs	Initial weight (mg)	Final weight (mg)	% change
Horseshoe crabin 3.5% NaCl	10	20	20	0
Horseshoe crabin H_2O	10	40	65	+8%
Horseshoe crabin vinegar	10	40	80	+50%
Horseshoe crabin 10% NaCl	10	20	15	-25%
Horseshoe crabin 3.5% sucrose	10	20	23	+15%
Horseshoe crabin 10% sucrose	10	60	65	+8%
Salmon in 3.5% NaCl	10	1010	600	-41%
salmon in H_2O	10	1140	1400	+21%
salmon in vinegar	10	970	1560	+44%
Salmon in 10% NaCl	10	1230	900	-31%
Salmon in 3.5% sucrose	10	950	1115	+17%
Salmon in 10% sucrose	10	1020	1600	+57%
Whitefish in 3.5% NaCl	15	160	90	-44%
Whitefish in H_2O	15	30	55	+83%
Whitefish in vinegar	15	10	20	+100
Whitefish in 10% NaCl	15	80	25	-70%
Whitefish in 3.5% sucrose	15	100	70	-30%
Whitefish in 10% sucrose	15	120	80	-44%

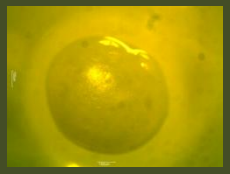


Horseshoe crab eggs

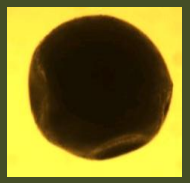
www.wilddelaware.com/2007/10/

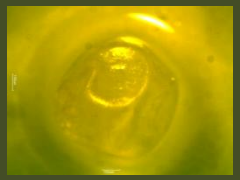






Eggs in distilled water





Eggs in 10% saline

Results
There was a net gain of all eggs in distilled water, which was expected. The whitefish experienced the greatest gain, and the horseshoe crab eggs the least. All eggs gained weight in the vinegar and were discolored (not shone). All eggs lost weight in the 10% NaCl, which was also expected. There was a gain in weight for the horseshoe crab eggs in the sucrose solutions; however, there was a decrease in weight in the whitefish eggs in the sucrose solutions.

Discussion
This appears to be an excellent way to teach osmosis and diffusion to students. The three eggs varied significantly in appearance which piqued the interest of the students. The results were not always consistent; the whitefish eggs lost weight in the sucrose, perhaps because they were cured in a sucrose solution. It is difficult to find out exactly what the eggs were cured in because of proprietary reasons. In the future we would like to purchase an osmometer to more exactly measure the change in osmotic pressure in the eggs, and would consider trying the experiment with fresh roe obtained from the fish. It is expected that the horseshoe crab eggs would have changed less because of their exposure to changes in salinities through tides and outside exposure. They would naturally have an increased cell membrane integrity because of abrasion against the sand also.

kentsimmons.uwinnipeg.ca/16cm05/1116/33-28-Ho...