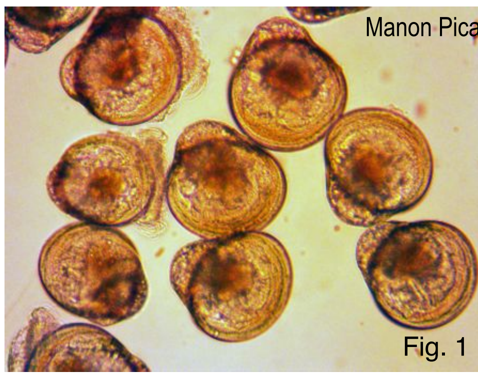
Ocean acidification and its effect on the aquaculture industry

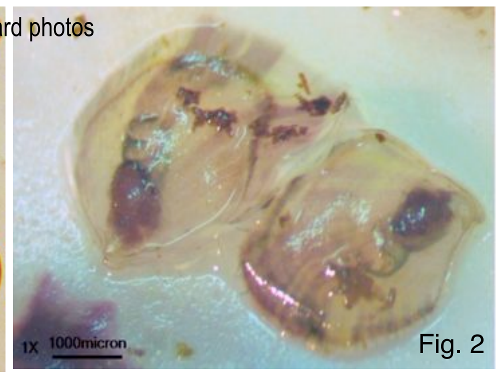
By Manon Picard, MSc Candidate, University of British Columbia, Zoology
2012 Scholarship Recipient

Ocean acidification (OA) has gained a lot of interest recently due to the concern of rising CO_2 in the atmosphere. Rising CO_2 levels not only contribute to climate change but can also cause the pH of the ocean to decrease when atmospheric CO_2 is absorbed into water. The concerns surrounding ocean acidification are often expressed as predictions and future scenarios (IPCC, 2007) but what many people tend to ignore are the repercussions that have already been felt by industries such as aquaculture of mollusks who have already suffered from mass mortality events of their stocks. As the pH of the ocean can fluctuate due to upwellings (Feely et al, 2008), winds, currents, and for other natural reasons, it is apparent that the chemistry of the incoming water can greatly impact the success of hatchery production.

A meta-analysis has found that calcifying organisms such as mollusks are the most vulnerable to ocean acidification especially during earlier stages of their development (Kroeker et al., 2013). However, it is not known when this vulnerability to lowered pH water is the most important. Thus, I conducted this study to determine if there is a period in the lifecycle of a mollusk at which more precautions about OA should be taken in order to preserve the stock.

Crassostrea gigas (Pacific oyster) is an introduced oyster from the east coast of Japan that has been widely used in North America for aquaculture purposes. Recently, many hatcheries are having much difficulty when it comes to growing this species in the Strait of Georgia, which is located between mainland British Columbia and Vancouver Island, Canada. Thus, I had the opportunity last summer to conduct experiments at Island Scallops Inc. in Qualicum Bay on Vancouver Island to investigate potential problems surrounding the aquaculture of *C. gigas* in terms of the pH of the water. My experiments were designed to investigate the effects of OA on the fertilization, larvae development (**Fig. 1**), settlement and post-settlement **(Fig. 2**) of C. gigas.





My experiments were mostly run using the industrial equipment (**Fig. 3**) in order to better mimic the mass production of *C. gigas* than normally possible in a laboratory setting. Although there were no mass mortality events in my findings, I did find that the pH affects the early stage of *C. gigas*, especially in terms of larval and juvenile growth. Preliminary results were showing that lowered pH slowed the growth of the larvae but they reached the same size by the end of the larval experiment at which point the same amount of larvae had survived regardless of the pH treatment. More analyses will have to be conducted to look at other effects that the pH had on the development of *C. gigas* at the various stages of their early development.

Manon Picard -- inspecting her set-up

Acknowledgments

I would like to thank Christopher Beacham, Robert Saunders, Dr. Christopher C.D.G. Harley, Dr. Erin K. McClelland, Dr. Kristi M. Miller and all the employees of Island Scallops for their assistance with the project. I would also like to thank the members of Pacific Northwest Shell Club for the scholarship and Shannan May-McNally for editing.

References:

Feely, R. A., Sabine, C. L., Hernandez-Ayon, J. M., Ianson, D. and Hales, B. 2008. “Evidence for upwelling of corrosive ‘acidified’ water onto the continental shelf”. *Science, 320: 1490–1492*.

IPCC. 2007. “Climate Change 2007: Contribution of Working Group I to the *Fourth Assessment Report of the Intergovernmental Panel on Climate Change*.” Cambridge University Press, Cambridge. Kroeker, K.J., Kordas, R.L., Crim, R., Hendriks, I.E., Ramajo, L, Singh, G.S., Duarte, C.M., and Gattuso, J.P. 2013. “Impacts of ocean acidification on marine organisms: quantifying sensitivities and interaction with warming.” *Global Change Biology. doi: 10.1111/gcb.12179*.