Effects of ocean acidification on the growth of the flat-tree oyster, *Isognomon alatus* (Gmelin, 1791)

By

Lailah G. Lartey-Antwi[1] and Andreas J. Andersson[2]

[1] Department of Oceanography & Fisheries, University of Ghana, P.O. Box LG 99, Legon-Accra, Ghana:

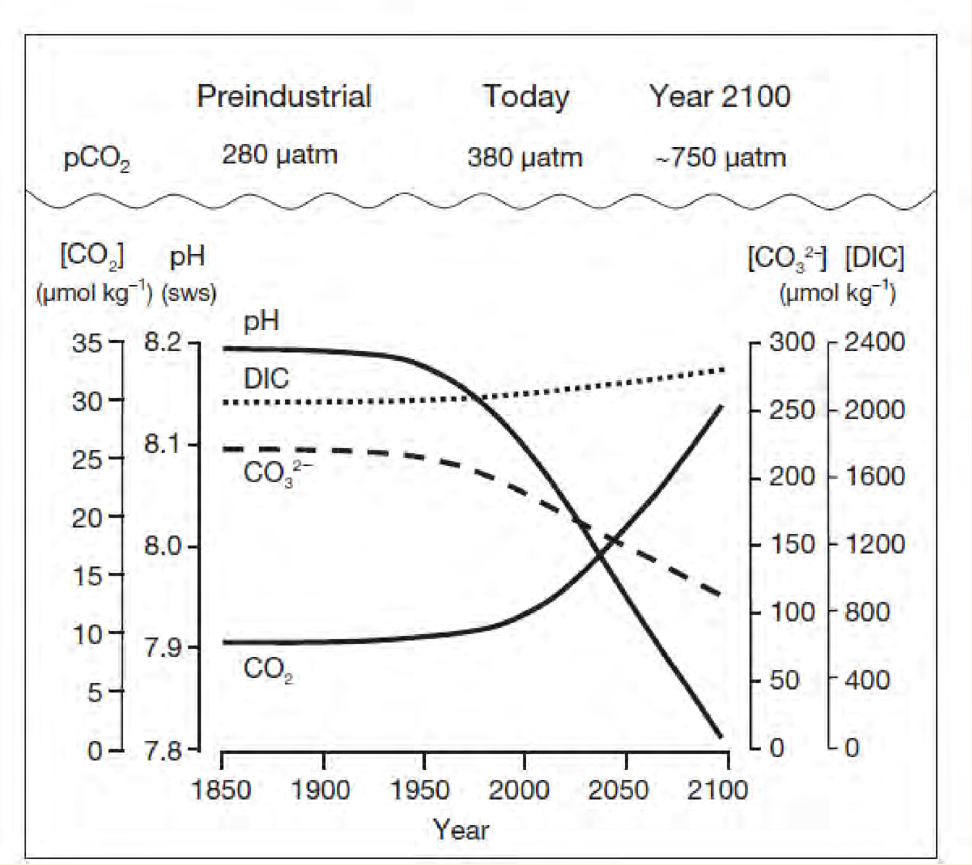
lailah.lailah@gmail.com

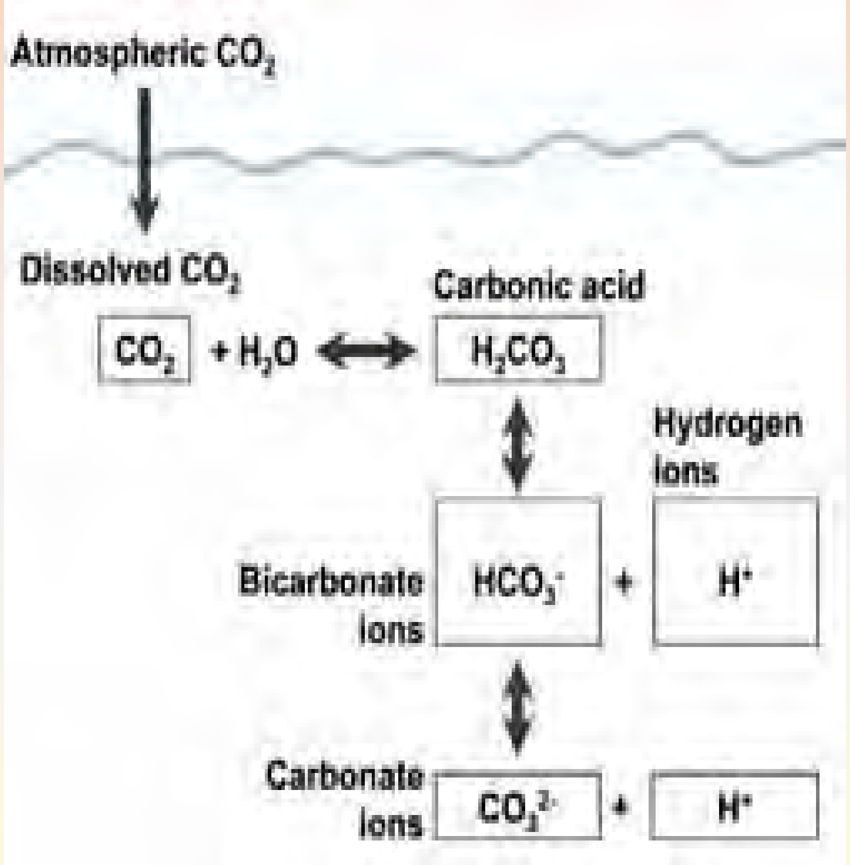
[2] Bermuda Institute of Ocean Sciences, 17 Biological Station, St. George's GE01, Bermuda
andreas.andersson@bios.edu

International Symposium on Climate Change Effects on Fish and Fisheries
25-29 April, 2010
Sendai – Japan

Background

•Shift in the carbonate system equilibrium towards higher CO_2 and lower carbonate ion concentrations





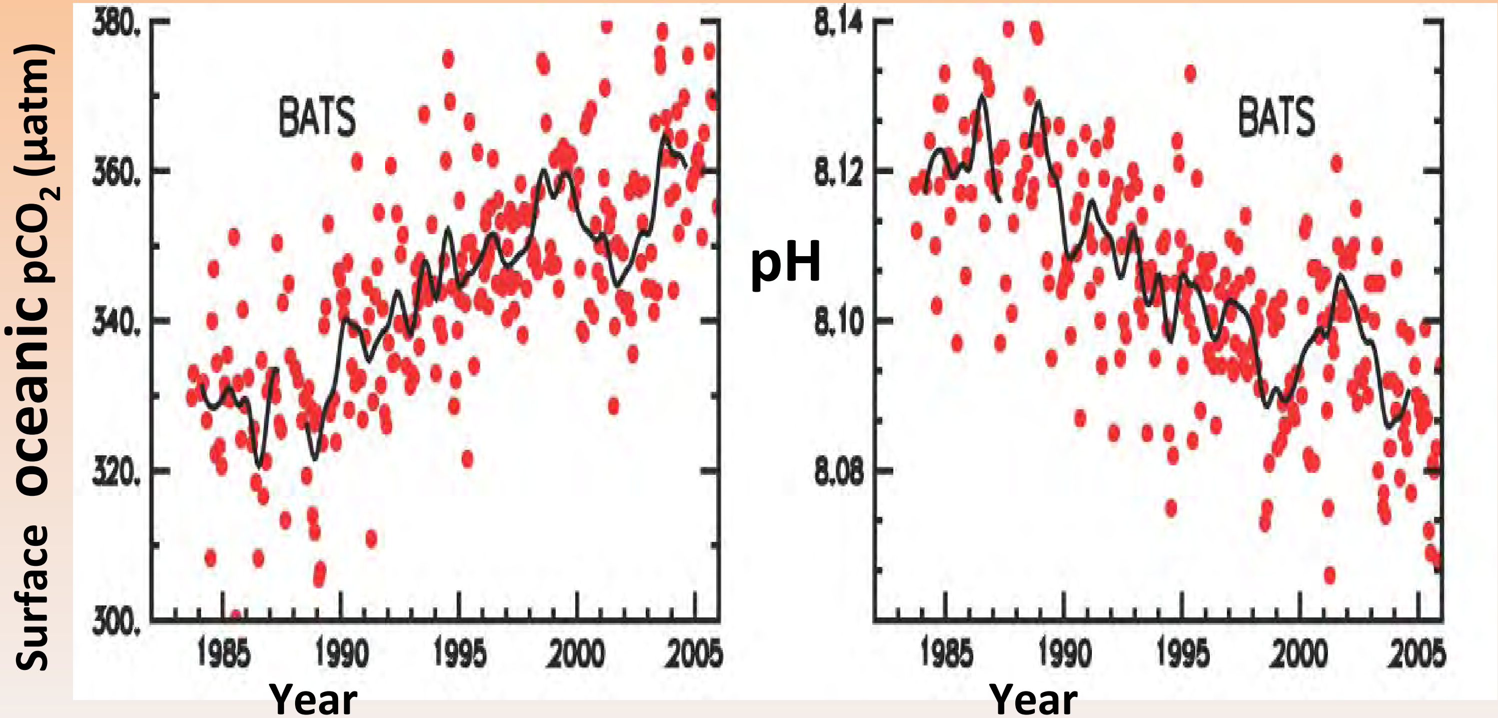
Source : Wolf-Gladrow et al.,1999

Effects of ocean acidification on marine calcifying organisms: Previous Studies

$$Ca^{2+} + CO_3^{2-} \leftrightarrow CaCO_3$$

Species	Cultured pH, CO_2	Duration	Results	Source
Limacina helicina	7.78	30 days	28% decrease in clarification rate	Comeau et al. 2009,
Mytilus edulis and *Crassostrea gigas* 	740 ppm	2 hours	decrease in calcification rate 25% and 15% respectively	Gazeau et al., 2007
Crassostrea gigas	7.4	48 hours	Inhibited larval development	Kurihara et al., 2007
Mytilus galloprovincialis	7.3	3 months	significant decrease of growth rate	Michealidis et al., 2005 Kurihara et al., 2009

Introduction



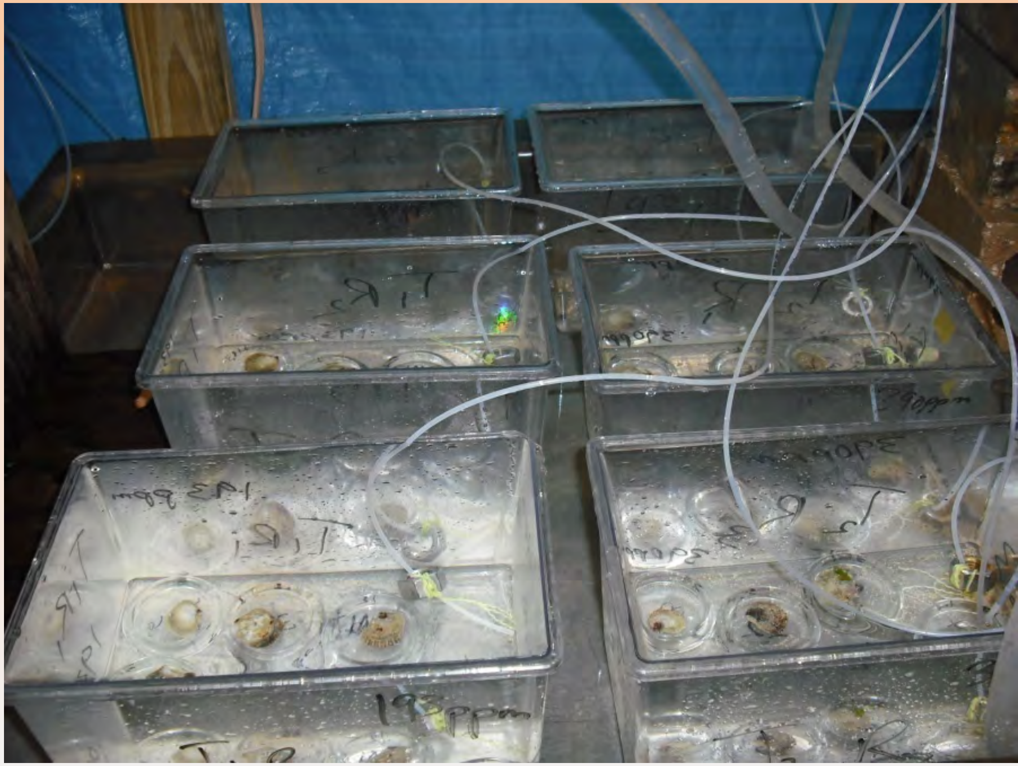
Source: Modified from IPCC, 2007

- Increasing pCO_2 , decrease pH,
- Economic importance of *Isognomon alatus:* Food source , habitat for benthic organism, regulate the update of nutrient flow in coastal ecosystems.

Objective :

- To evaluate the effect of increased seawater pCO_2 (seawater pH, 7.8 -7.9) on growth rate of *Isognomon alatus* (flat-tree or mangrove oyster).

EXPERIMENTAL SET UP



Control -Natural seawater, pH 8.1 - 8.2

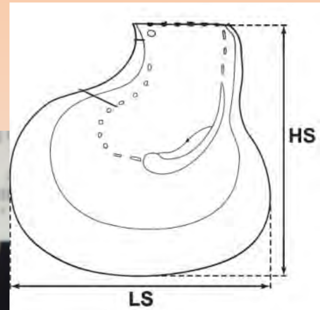
Acidification - acidified seawater, pH 7.8 - 7.9

Field Experiment

- 3 stations transect (A to C) at Mangrove Bay, Ferry Reach, St George, Bermuda (32^{o}37’16’’N, 64^{o}41’38’’W, Area of 70m x 70m and average depth of1.014017m)

Placement of Tanks

DETERMINATION OF SHELL MORPHOLOGICAL AND ENVIRONMENTAL PARAMETERS

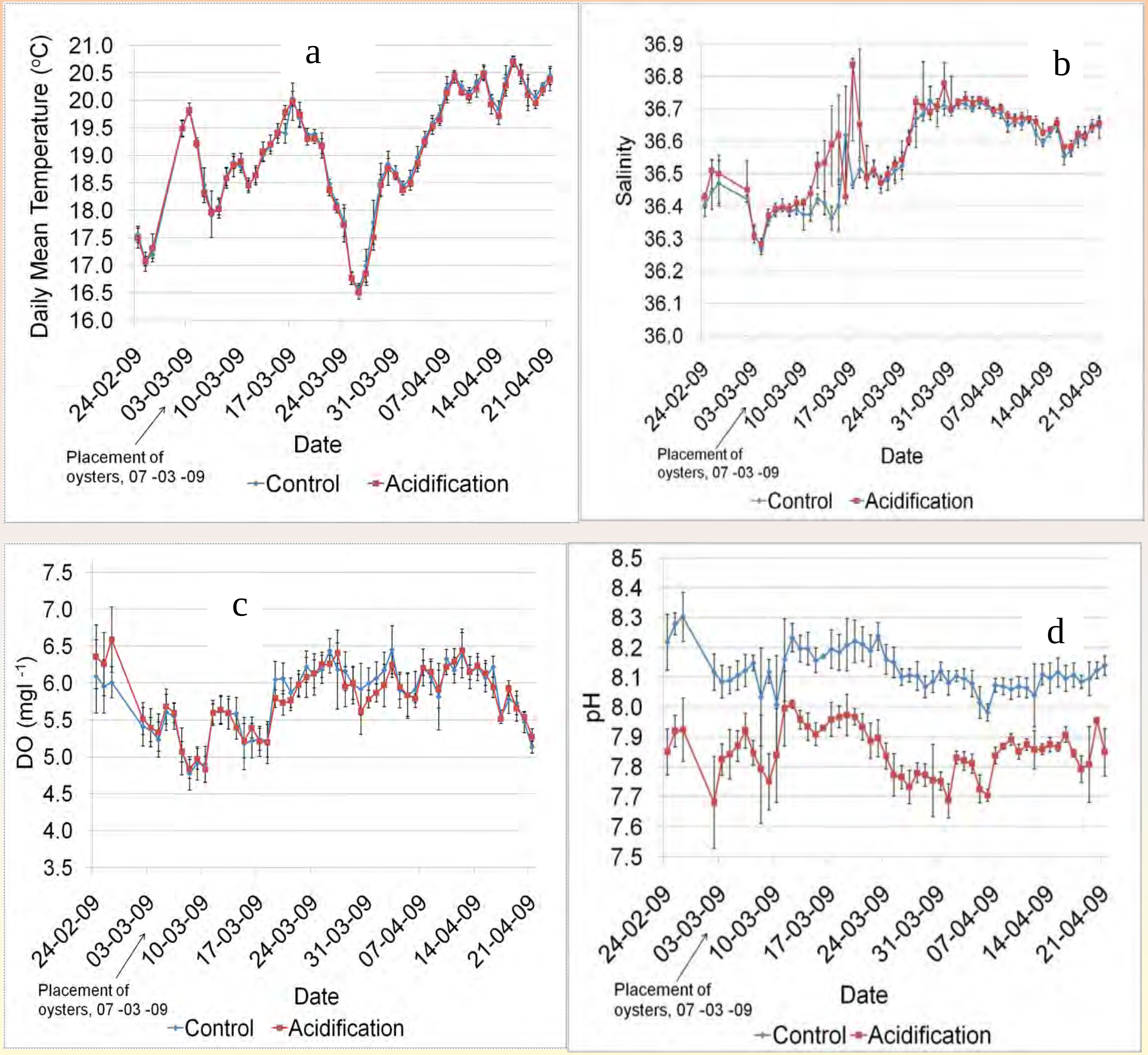


- Height
- Length
- Thickness

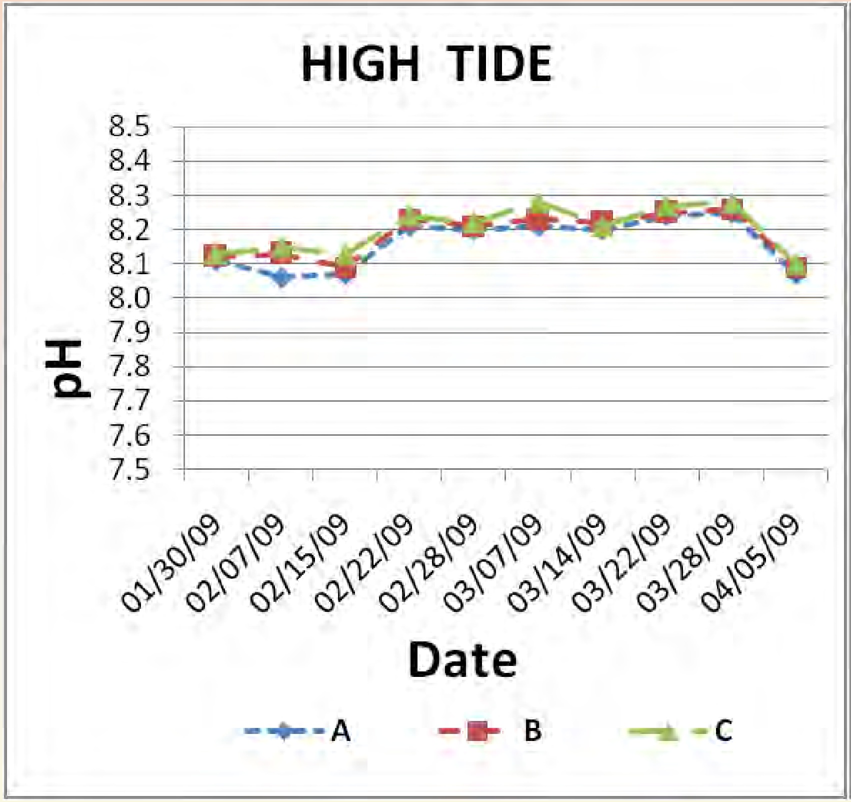
- Buoyant Weight Technique

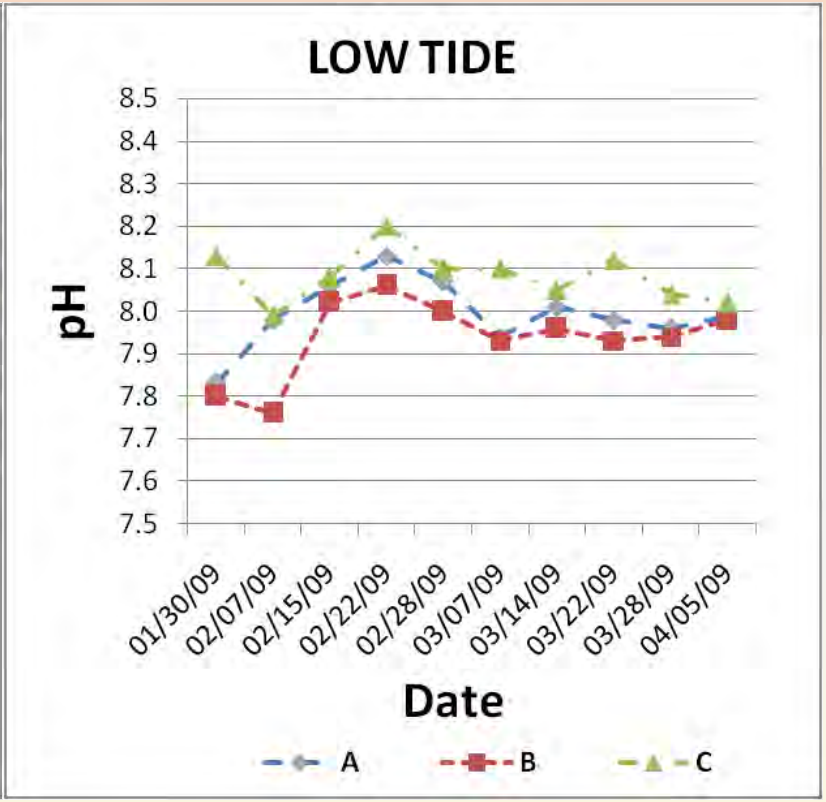
- Temperature
- Salinity
- DO (%)
- DO (mg/l)
- pH

Results: Environmental Parameters

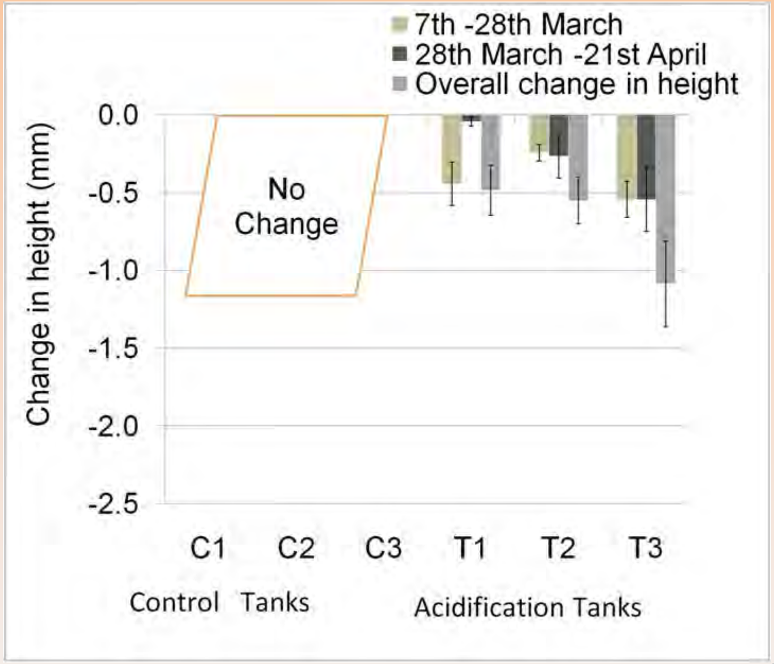


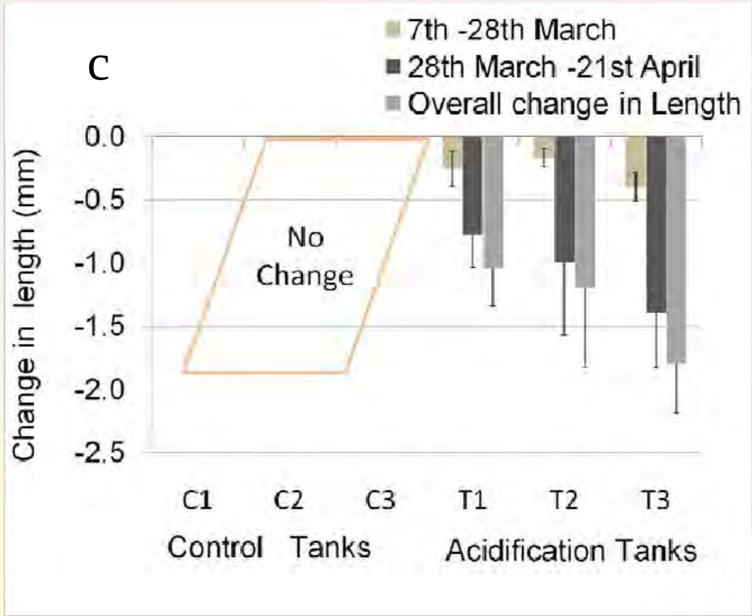
Natural variation of pH in Mangrove Bay

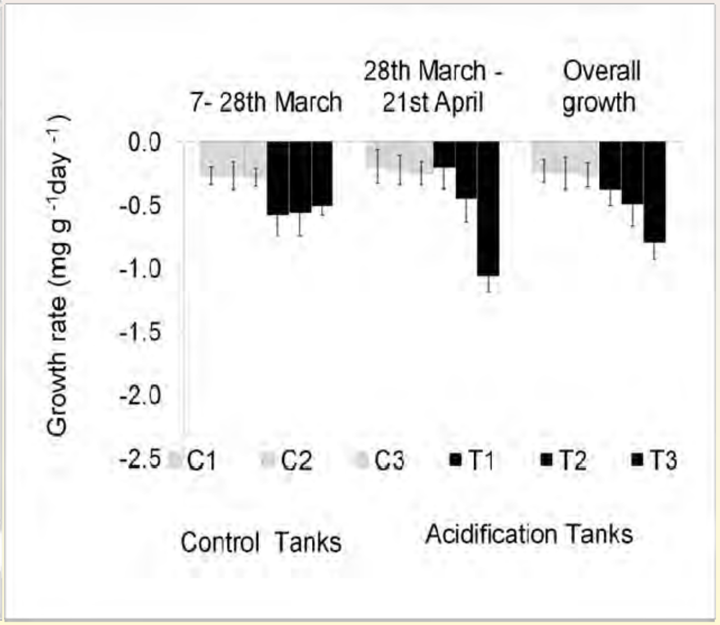




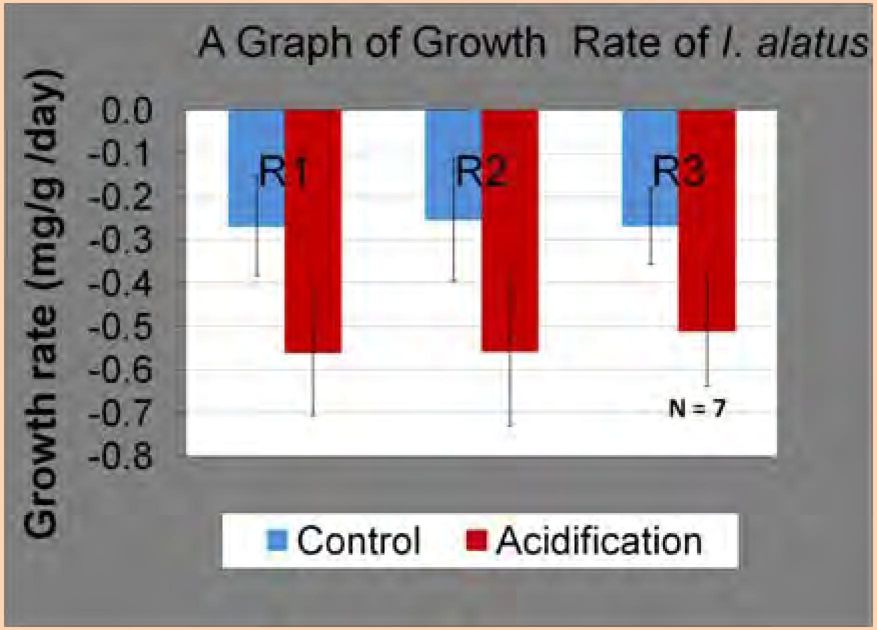
SHELL MORPHOLOGICAL PARAMETERS AND GROWTH RATE (1)



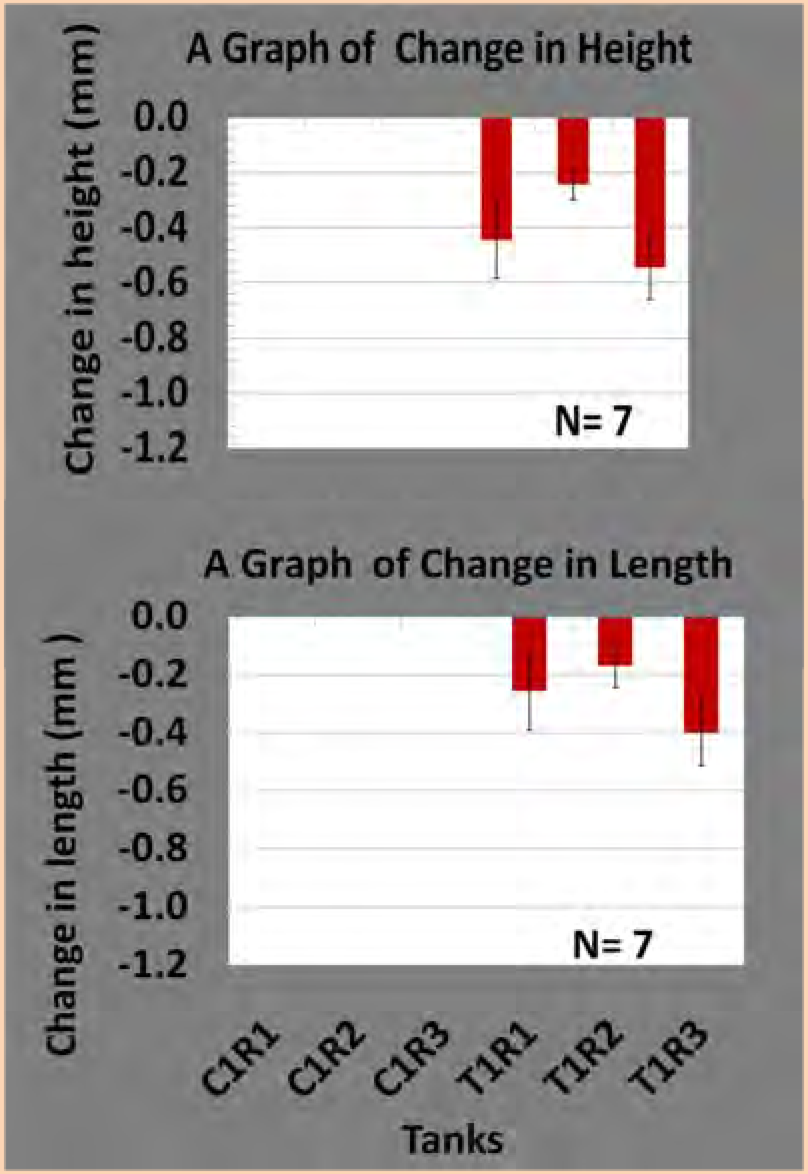




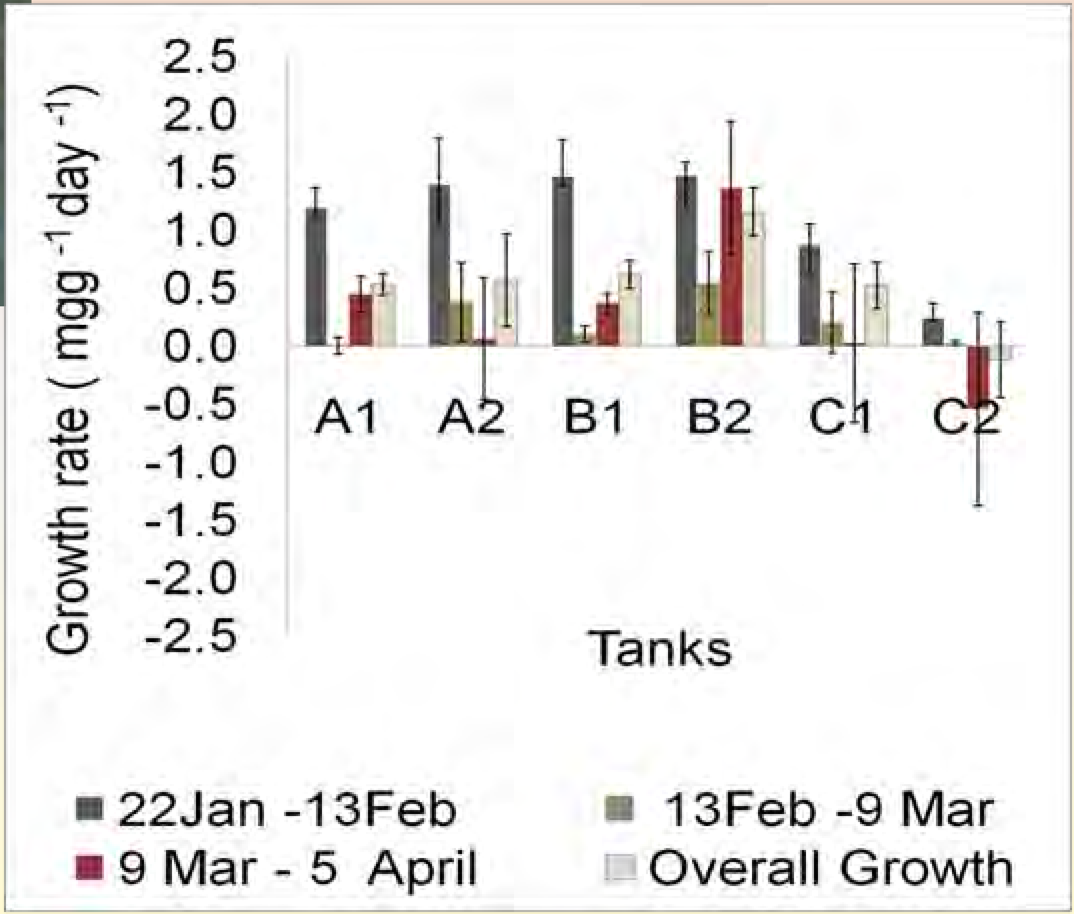
SHELL MORPHOLOGICAL PARAMETERS AND GROWTH RATE (2)



7th -28th March 2009
28th -21st April 2009
Overall:7th March-21st April 2009

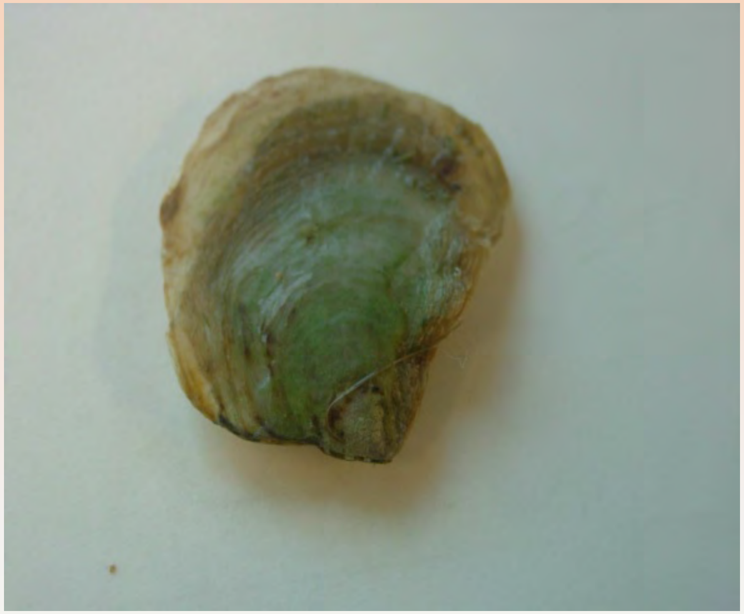


RESULTS FROM THE FIELD EXPERIMENT



Isognomon alatus

An example of ***Isognomon alatus*** exposed to natural seawater



An example of ***Isognomon alatus*** exposed to acidified seawater indicating changes in shell morphology

CONCLUSION

- *I. alatus* lost weight and experienced negative growth rates of –0.56 $\pm$ 0.36 mg $g^{-1}day^{-1}$ under average pH_{total} values of 7.8 compared to a loss of –0.26 $\pm$ 0.23 mg $g^{-1}day^{-1}$ under average ambient pH_{total} conditions of 8.1.
- Loss of mass and negative growth may be due to dissolution.
- Ocean acidification could impact on shellfish such as oysters through reduced physiological function such as growth rate.
- This could affect the survival and ability of oysters to function within its ecological community.
- Impact the human populations that depend on them, coastal ecosystem function, as well as potentially leading to economic loss.

RECOMMENDATION

- Additional factors (e.g., food availability, temperature) need to be considered in evaluating the response of this marine calcifier (*I. alatus*) to these ongoing perturbations.

ACKNOWLEDGMENT

Photo: Andreas

- Dr. Andreas Andersson
- Dr. Samantha de Putron
- Dr. Anthony H. Knap
- Dr. F. Gerald Plumley
- BIOS staff
- Pogonians (2008/2009@BIOS)

日本財団 The Nippon Foundation

http://www.nippon-foundation.or.jp/eng

pogo Partnership for Observation of the Global Oceans

http://ocean-partners.org

BIOS BERMUDA INSTITUTE OF OCEAN SCIENCES

www.bios.edu

THANK YOU

The Power of 10

2009 POGOnian Scholars; Tiago Queiroz, Lailah Lartey-Antwi, Rene Campos, Catia Matias, Dr. Samina Kidwai, Houssem Smati, Toye Akinnigbagbe, Sebasitan Kreiger, Joseph Palermo and Nimit D.J.

In October 2008 the Bermuda Institute of Ocean Sciences (BIOS) welcomed ten students from around the globe, to complete a ten-month training course in observational oceanography. Because of the Institute's excellent teaching resources and capacity to provide students a very practical, hands-on experience of marine science, BIOS was chosen to be this Nippon-funded "Centre of Excellence" for the Partnership for the Observation of the Global Oceans (POGO).

POGO is an international consortium of oceanographic institutes, which has the aim of improving global cooperation and communication in ocean observations. Two thirds of the world's oceans are in the southern hemisphere, yet most of our well-resourced academic centres for this discipline are in the northern hemisphere. With oceanography at the centre of the pressing issue of global climate change, a global approach to the problem is the one likely to have any success.

The idea of the Centre of Excellence arose to address the related need for specialised training in observing the ocean. The 2008 programme that began at BIOS was the first Centre of Excellence for POGO, and so it was a learning experience for BIOS as well as for the POGO Scholars. As Dr. Gerry Plumley—the Director of the POGO programme—puts it: "Ten students, from ten developing countries, for ten months to take ten modules in observational oceanography. The power of ten. It sounded so easy ten months ago. And it has been. Largely. The time has passed quickly. Was the programme everything we hoped it would be? No. Was it more than we dreamed? Yes."