

# Cray-Crayfish

## in Increased Acidity and Predatory Response



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**Pollution often results in the acidification of water.**

**By simulating freshwater environments of varying pH's, differences in crayfish predatory responses can reveal how subtle changes in acidity can alter aquatic organisms' overall survival ability.**

### ***Procambarus clarkii:***

*~ freshwater crayfish species native to southeastern U.S.*

*~ a.k.a. red swamp crayfish, or Louisiana crayfish*

*~ most ecologically plastic species of decapods*

*~economically important because it's a major food product of the South*



Figure 1. *Procambarus clarkii*

# The Experiment

Crayfish were put into tanks of varying pH levels for multiple hours.

After the addition of a predator, a catfish, the location of the tank that the crayfish retreated to was recorded.



*In waters of neutral pH, crayfish would hide farther from the catfish than those crayfish in waters of low pH.*

Figure 2. Crayfish in aggressive stance.

## Procedure

- 1) Tanks with pH levels of approx. 4.0, 4.5, 5.0, 5.5, and 7.0 were set up
- 2) Groups of 3 crayfish were tested at a time
- 3) Crayfish were given about 2-3 hours to acclimate to the pH
- 4) The catfish was placed on one side of the tank, separated by a divider
- 5) Behavior of the crayfish was recorded for a period of two minutes using continuous sampling.



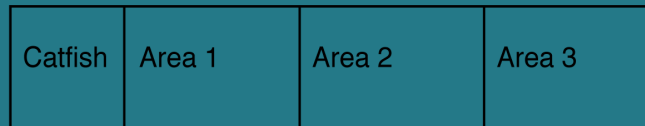
Figure 3. Litmus paper pH tests used to measure water acidity.



Figure 4. The catfish (*Siluriformes*) used in the study weighed about 1.5 lbs.

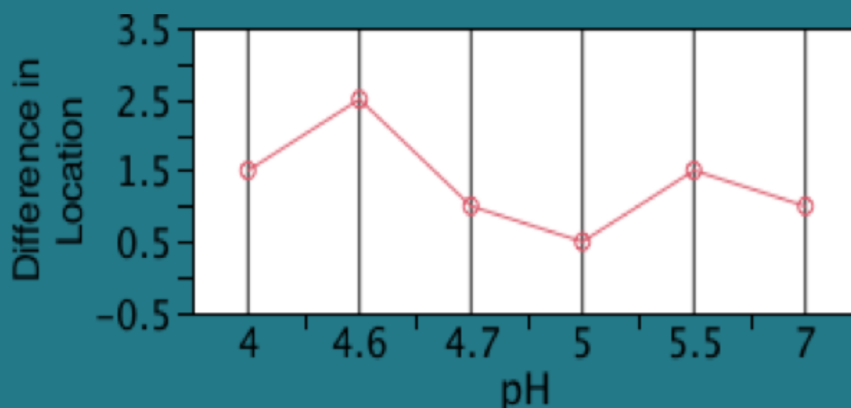
# How We Calculated the Results

- 1) The tank was split into three equal areas, each containing a shelter. One was the closest to the divider and three were the farthest from the divider.



**Figure 5.** Tank Set Up

- 2) The crayfish locations for each trial were added together and then divided by total number of crayfish.
- 3) The crayfish location number for before the catfish were then subtracted from after insertion of the catfish. *This number was then used for the difference in location.*
- 4) For each trial, crayfish location corresponding to each area was recorded prior to the insertion of the crayfish and afterwards.



**Figure 6.** The effect of pH on the crayfish difference in location (ANOVA,  $F=2194$ ,  $df=5, 2$ ,  $P=.9253$ ).

# Conclusion

There was no significant effect of increasingly acidified pH on crayfish predatory response (ANOVA,  $F=2194$ ,  $df=5, 2$ ,  $P=.9253$ ). This could be a result of poor experimental methods.

## Improvements for future experiments:

- ~ Increased acclimation time
- ~ Increase time intervals of observations
- ~ Attempt continuous recording or a different recording method
- ~ Include shelter time as a count
- ~ Change predator or increase the size of the catfish



## References:

Garvey, James E, Stein, Roy A, and Thomas, Heather M. "Assessing how fish predation and interspecific prey competition influence a crayfish assemblage." *Ecology*. 75: (2) 532-547, March 1994

Siewart, HF and Buck, JP. "Effects of low pH on survival of crayfish (*Orconectes-Virilis*). *Journal of Freshwater Ecology*. 6 (1): 87-79, March 1991.

Simpson, SD, Munday, PL, Wittenrich, ML, Manassa, R, Dixon, DL, Yan, HY and Hong, Y. "Ocean acidification erodes crucial auditory behavior in a marine fish." *Biology Letters*. 7.6: 917-920, Dec 23, 2011.

Colorphast PH Indicators. Digital image. Talas. Web. 11 Dec. 2011. <[http://apps.webcreate.com/ecom/catalog/product\\_specific.cfm?ClientID=15&ProductID=23504](http://apps.webcreate.com/ecom/catalog/product_specific.cfm?ClientID=15&ProductID=23504)>.

Crayfish. Digital image. Science and Crayfish Images. Web. 11 Dec. 2011. <<http://teachers.cr.k12.de.us/~galgano/crayfish.htm>>.

Jepster. Urine Signalling, Part 1. Digital image. Moment of Science. The Trustees of Indiana University, 4 Nov. 2008. Web. 11 Dec. 2011. <<http://indianapublicmedia.org/amomentofscience/urine-signalling-part-1/>>.

Herberholz, Jens. Digital image. Crustacean Neurobiology and Behavior. University of Maryland, 23 Aug. 2011. Web. 11 Dec. 2011. <<http://www.bsos.umd.edu/psyc/Herberholz/Research.html>>.

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