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Ocean 443

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## Galapagos Proposal

### ABSTRACT

I will attempt to determine if the copepod *Acartia*'s grazing rates and prey preference will vary with the size of the prey available. To do this I will collect water samples and *Acartia* from the *R/V Thomas G. Thompson* in Academy Bay, off of the southern end of Santa Cruz in Ecuador's Galapagos Islands. These samples will be filtered for zooplankton then incubated for 12, 24, and 36 hrs with an equal number of *Acartia* in each sample. Once the incubations are finished the samples along with an unincubated sample will be size-fractionated and measured for chlorophyll to determine what phytoplankton were preyed on.. Understanding size-selective grazing in the Equatorial Pacific is important because it will provide a better picture of the community composition of Academy Bay and provide additional data for future iron enrichment experiments.

## INTRODUCTION

Copepods are a type of crustacean found in every ocean of the world. A common member of this order is *Acartia* which can be found from the polar seas to tropical bays. *Acartia* are a type of zooplankton, and like all zooplankton feed primarily on phytoplankton. The feeding behavior of *Acartia* can be contributed to by the size, type, and concentration of prey. Copepods tend to feed on larger sized phytoplankton when given a chance as noted by Frost (1972). Roman and Gauzens (1997) stated that copepods in the equatorial Pacific grazed primarily on diatoms as did the copepods collected during the winter-spring bloom in Narragansett Bay, Rhode Island by Durbin and Durbin (1992). More specifically there have been experiments on size-selective grazing of *Acartia* in other areas such as the one by Støttrup and Jensen that found that they retained larger algal cells more efficiently in the vicinity of 25 $\mu$ m when presented with a variety of sizes (1990).

The eastern equatorial Pacific is considered a High Nutrient Low Chlorophyll (HNLC) region because nutrients such as carbon and nitrogen are plentiful but the chlorophyll levels are generally subdued. This is believed to be because there is a lack of iron in the system which commonly is the limiting nutrient for the growth of large phytoplankton cells. Many iron enrichment experiments such as IronEx I and II have been done in the region surrounding the Galapagos Islands, which are located directly in the middle of the eastern equatorial Pacific. Rollwagen and Landry discuss how these experiments showed that mesozooplankton population growth rates increased to 1.0 d<sup>-1</sup> which was a direct result of the increase of phytoplankton growth (2000). Another iron

enrichment experiment conducted in the Southern Ocean (Bowie et al.) showed the largest growth of plankton-incorporated Fe was in the standing stock of plankton  $>5\mu\text{m}$  from 1.9 pM to 12.9 pM which can be seen in fig1. These two experiments show that iron-enriched systems tend to produce larger phytoplankton and in turn large zooplankton.

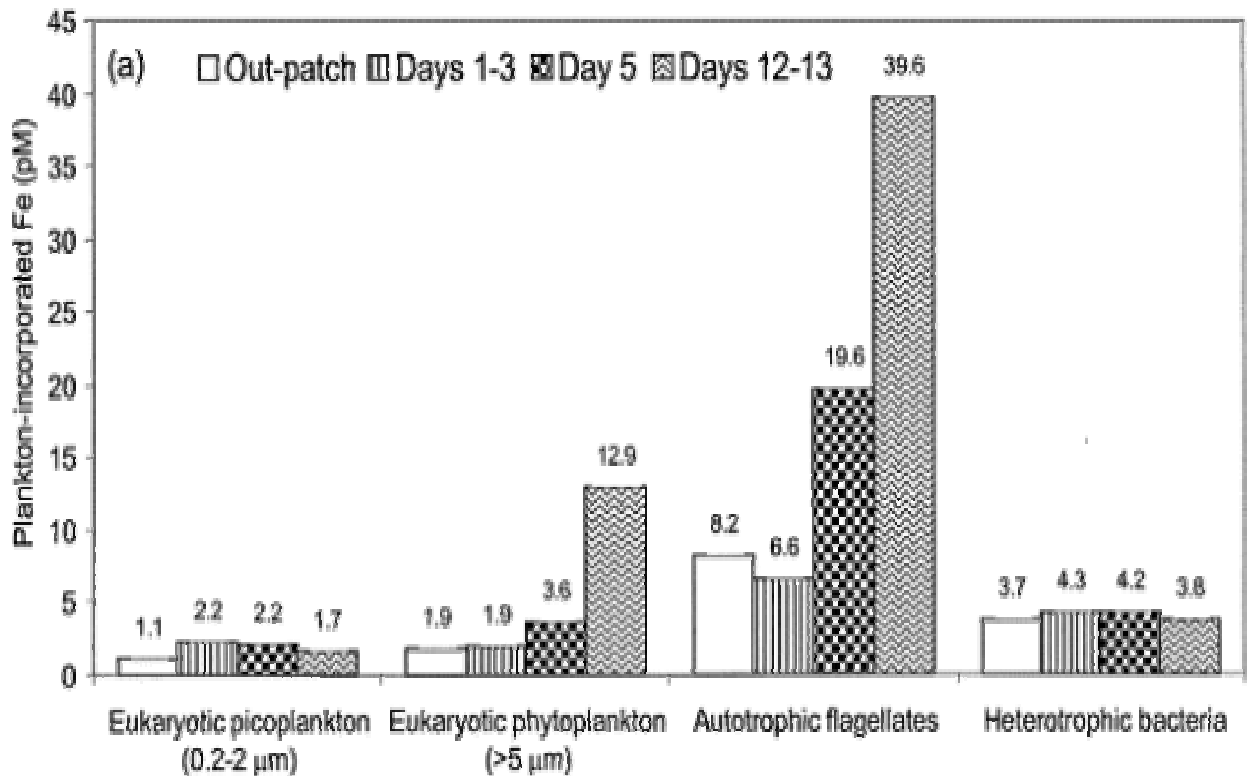


Fig 1. Bowie et al

Academy Bay, on the southern side of Santa Cruz Island, is located in an HNLC region. It however does not have the characteristics of one because there is iron input in the runoff from the surrounding land. Therefore, it could have similar conditions to those found in the iron-enrichments experiments mentioned previous. Figueroa and Hoeffel

report that the population breakdown of zooplankton in Academy Bay is over 80% Acartia (Not yet published). That observation coincides with what would be expected in an iron enriched bay already high in nutrients. Large phytoplankton would thrive leading to a high population of grazers which would graze size-selectively on larger phytoplankton because they would be in abundance.

I expect that the Acartia collected in Academy Bay will size-selectively graze on phytoplankton  $>10\mu\text{m}$  until those become limited, in which they will turn to the phytoplankton  $>2\mu\text{m}$ , but  $<10\mu\text{m}$ . If I am correct and the Acartia behave as expected it will be additional evidence that Acartia in tropical waters behave similarly to their colder water brethren and that they thrive in Academy Bay because the iron enrichment of the system helps foster a large algal cell population of phytoplankton. However, if I am wrong and the Acartia tend towards the smaller phytoplankton then the correlation between larger size and preferred prey will no longer be credible.

### Proposed Research

To begin to come to a conclusion on what size of prey the Acartia in Santa Cruz's Academy Bay prefer, incubations will be conducted which will then be size-fractionated and tested for chlorophyll. An oceanographic cruise is planned for January 12-20, 2006 in Ecuador's Galapagos Islands. The cruise begins in Academy Bay which is located on the Southern end of Santa Cruz Island at  $0^{\circ} 46.00' \text{ S}$  and  $90^{\circ} 17.50' \text{ W}$ . The sample

collecting for this experiment will be taken off the R/V Thomas G. Thompson while at the dock in Academy Bay. A 0.6-m-diameter net with 200 $\mu$ m mesh will be deployed to collect the Acartia samples. The depth of the net will depend on the time of day that the collecting occurs. Acartia move vertically in the water column, towards the surface in the early evening and to depth in the early morning to avoid predation. To assure that enough Acartia are collected the net tow could begin at depth ~30m and be brought to the surface. The YSI will be used to measure the water temperature which ideally will be what all of the incubations will be done at.

Next, 25 L of water at 5m will be collected and immediately brought inside to avoid further photosynthesis. All but 5L of this water will then be strained through a screen with a mesh size of 100 $\mu$ m to remove any larger organisms, ideally zooplankton. Once strained, the water will be divided into 12, 1-L dark bottles in which the incubations will occur. To 9 of the bottles a yet still undetermined number of Acartia will be added. The additions will be the same for each bottle. (To arrive at that number I have to hear back from Diego Figueroa and make some calculations.) To attain the Acartia samples from the plankton tow I will have to place some of the water in a Petri dish and use a dissecting microscope to identify and then individually remove using a small turkey baster. The bottles will sit in the back of the lab to incubate hopefully at a temperature that is similar to that of Academy Bay ~25°C. Every three hours these bottles would be stirred and uncapped to avoid particles from settling and for air circulation. While these bottles are incubating the remaining seawater will be used for two purposes. The unstrained 5L of the seawater will be frozen for later analysis of the natural population density of Acartia in Academy Bay. With the remaining water 3, 1L samples will be sent

through a 3-filter system to size fractionate the particles. The filters will be of a mesh of 10 $\mu$ m, 2 $\mu$ m, and 0.45 $\mu$ m in that order. Once the samples have been finished, a fluorometer will be used to measure chlorophyll of each size range.

From the samples that are incubated they divide into 3 groups: 3 bottles with Acartia incubate for 12 hrs, 3 with Acartia incubate for 24 hrs, and 6 incubate for 36 hrs. Of the 6, 3 have Acartia in them while the 3 others do not. All of the incubated samples are then sent through the same filter system and checked for chlorophyll. They are put through this process according to how long they need to be incubated for. The previously frozen 5L of seawater will be defrosted and examined to count the number of Acartia. (I know that this sample will not be actually frozen, I just know that I can kill it and count it when I am not time dependent) This will give me an idea of how dense the population is naturally so I have something to compare to the ratio that I am setting in the incubated bottles. Everything in the experiment will be recorded on a data sheet. The total time for this experiment will be 45 hrs.

## PROPOSED BUDGET

R/V Thompson - \$18,000

Lab fluorometer - \$6

Plankton Net - \$6

Surface thermometer - \$3

U of W bottles 1L - \$18

Turkey baster - \$2

U of W bottle 30L - \$6

Dissecting microscope - ?

Screens - ?

Filter setup - ?

## REFERNCES

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