

Zooplankton in a Thermohaline Staircase: Do fine-scale temperature and salinity gradients affect the distribution and abundance of zooplankton in the tropical N. Atlantic?

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Background

The objective of this project is to analyze previously collected zooplankton samples from a unique stratification regime in the thermocline of the tropical N. Atlantic. The site is within a large area of “thermohaline staircases” where temperature and salinity profiles display a remarkably regular staircase structure, with thin interfaces where temperature and salinity change rapidly alternating with well-mixed layers, 10-30 m thick, with uniform properties. These staircases are a permanent feature of the region, having been observed since the late 1960’s.

What were the primary questions you were trying to address with this research? (Or, if more appropriate, was there a hypothesis or theory that you were trying to prove or disprove?)

We are primarily interested to discover if zooplankton stratify along small scale temperature and salinity thermohaline staircase structures. In particular, deep-sea fish, species of krill (euphausiids) and sea butterflies (pteropods) were examined to test this theory. Larger taxonomic groups such as copepods, arrow worms, etc. were also considered.

What have you discovered or learned that you didn't know before you started this work?

Thus far, the samples from both the intensively sampled staircase and several other “control” samples collected in nearby areas have been counted, and they are currently being analyzed. A draft of a report has been started, but we are not yet in a position to make firm statements about how the zooplankton species relate to the physical structure of the staircases.

What is the significance of your findings for others working in this field of inquiry and for the broader scientific community?

Nothing to report yet.

What is the significance of this research for society?

Nothing to report yet.

What were the most unusual or unexpected results and opportunities in this investigation?

Nothing to report yet.

What were the greatest challenges and difficulties?

Taking a plankton tow within very small and precise depth ranges was very challenging. With 100’s of meters of wire out and the ship’s motion due to surface waves, it was particularly difficult to sample very thin 1 to 5 meter ‘treads’..

When and where was this investigation conducted? (For instance, did you conduct new field research, or was this a new analysis of existing data?)

The samples were collected in April 2006 in the Sargasso Sea in within a large area of "thermohaline staircases" where temperature and salinity profiles display a remarkably regular staircase structure 200 to 400 meters below the sea surface. Thin interfaces where temperature and salinity change rapidly alternate with well-mixed layers, 10-30 m thick, with uniform properties. They are maintained by salt finger convection in the high gradient interfaces and are characterized by enhanced vertical mixing.

What were the key tools or instruments you used to conduct this research?

The Multiple Opening and Closing Net and Environmental Sensing System (MOCNESS) was used to collect precisely located plankton samples from either the step or rise of the staircase structure. Once collected, the plankton was imaged using silhouette photography, the photographs were scanned and the groups of zooplankton were identified and measured with WHOI Digitizer software, a matlab-based program. Some groups, such as krill, and sea butterflies, were identified using a microscope.

Is this research part of a larger project or program?

This research was part of the Census of Marine Zooplankton, a part of the Census of Marine Life program.

What are your next steps?

As indicated above, we are analyzing the zooplankton and the physical data, and have started a report of the work. If the results prove that some zooplankton species do show a pattern strongly related to the staircase structure, a manuscript will be prepared for submission to a peer reviewed journal. We also anticipate using the information in a proposal to do a more extensive examination of the biological patterns in the staircase region.

Have you published findings or web pages related to this research? *Not Yet.* Please provide a citation, reprint, and web link (when available).

Please provide photographs, illustrations, tables/charts, and web links that can help illustrate your research.