ECOHAB: *Karenia*

RECENT FINDINGS:
VERTICAL MIGRATION COLUMN

Vertical Migration

Karenia brevis is a microscopic marine plant that obtains its carbon from photosynthesis. Like many other dinoflagellates, *K. brevis* is motile. It has two flagella (whip-like appendages) that allow it to move through seawater at speeds of more than 3 feet per hour.

Cells also are able to direct and orient their swimming motion. *K. brevis* is positively phototactic (cells move toward a light source) and negatively geotactic (cells can orient away from gravity). Such orientation abilities allow dinoflagellates to move to the surface during daylight hours and away from the surface at night. Large, visible surface aggregations of cells are often observed during daylight hours.

Aggregation of *Karenia brevis* in surface patches; note the difference in water color, which indicates different concentrations of *K. brevis*

Much is known about the biological, chemical, and physical factors that influence *K. brevis* movements, but many questions remain, including the following:

1. Does *K. brevis* swim downward at night? Under what conditions?

2. How do thermoclines (abrupt changes in water temperature) influence *K. brevis* migration?

3. How do nutrient concentrations affect cell movement?

These questions are being addressed in the laboratory by experiments with vertical migration columns.

Experimental Column Design

Experimental column to study vertical migration of *Karenia brevis*

To control environmental conditions, vertical migration is studied in the laboratory using experimental columns. A 7-foot-tall plastic (polyvinyl chloride, or PVC) tube is capped at one end, and the other end is left open. The lower half of the tube, or column, is filled with water and is wrapped with insulation to block light (except at the top) and to keep the water at a desired temperature.

Experimental column wrapped in water-filled tubing attached to a chiller

To examine how temperature influences cell movement, the lower half of the column is wrapped in water-filled tubing attached to a chiller, or refrigerant unit. The chiller can be set to a range of temperatures, and once the water in the tubing and the water in the lower half of the column have equilibrated to the desired temperature, an artificial thermocline (area of change in temperature) is created within the column.

At this point, a *K. brevis* culture can be added to the column to inoculate the water at a variety of depths for experiments. The behavior of this *K. brevis* population is then followed over time. Water samples can be retrieved from desired depths by lowering a sample line fitted with a themistor probe (similar to a thermometer) into the column. The *K. brevis* cells in the sampled water are counted, and the density of the cells can be calculated and tracked throughout the column over time or by environmental condition.