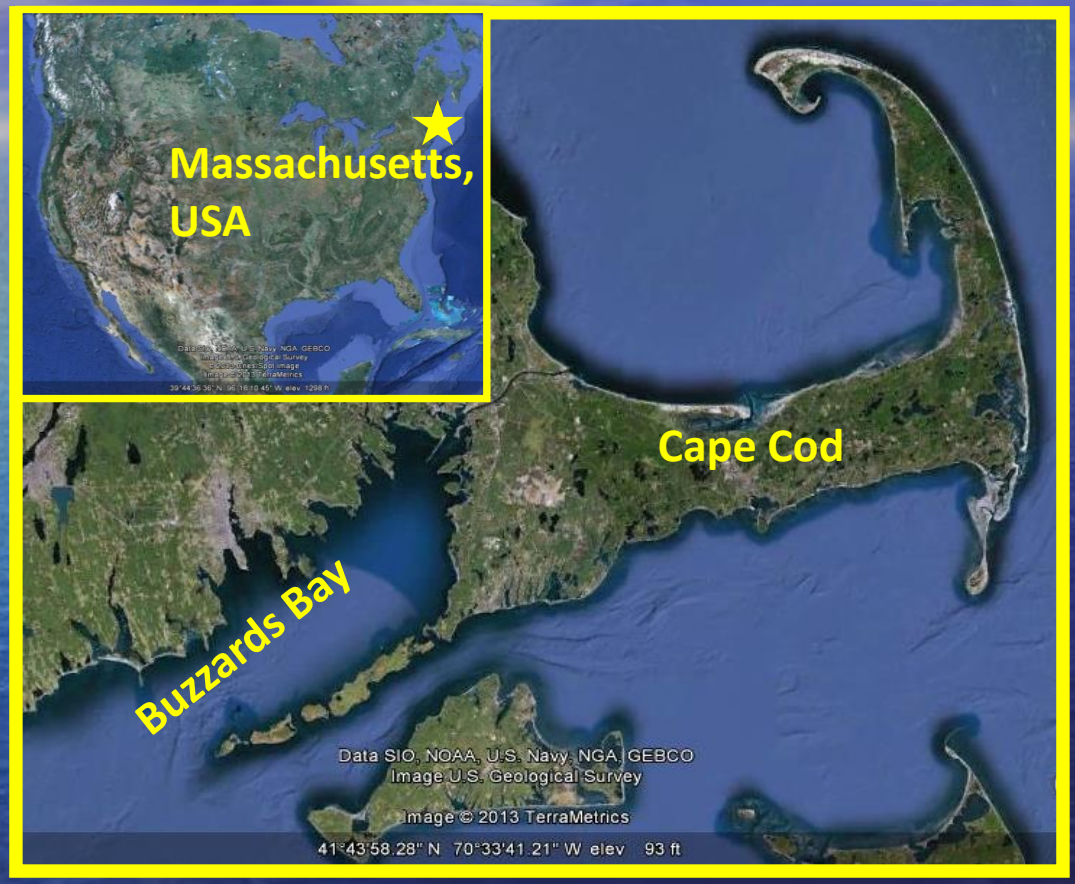
A Quarter-century of Environmental Monitoring in Buzzards Bay, Massachusetts, USA (1987-2015)

Jefferson T. Turner and Christian M. Petitpas



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GAEA

Global Awareness Education and Action Summit December 3-4, 2015

UMass scientists conduct research marathon on Buzzards Bay

By MARY CHAFFEE
CONTRIBUTING WRITER

Editor's note: Mary Chafee is a graduate student at UMass Dartmouth interning in the Office of Public Affairs for the university.

Dr. Jeff Turner prepares to collect water samples in Buzzards Bay on a trip aboard the Lucky Lady.

PHOTOS COURTESY UMASS DARTMOUTH

UMass Dartmouth doctoral student Chrissy Petitpas preserves samples aboard Lucky Lady during a Buzzards Bay trip.

From October 1987 through November 2015, monthly (every calendar month; 346 Cruises) measurements of inorganic nutrients, chlorophyll *a,* phytoplankton, zooplankton, bacterioplankton, temperature, water clarity and dissolved oxygen have been monitored at 8 stations in Buzzards Bay

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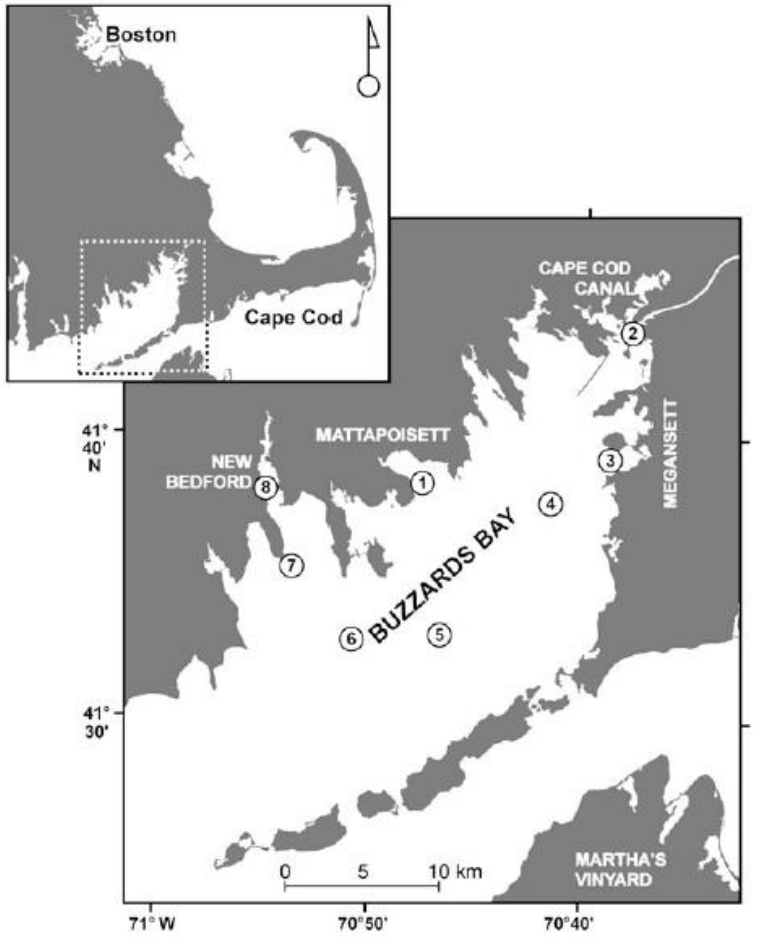
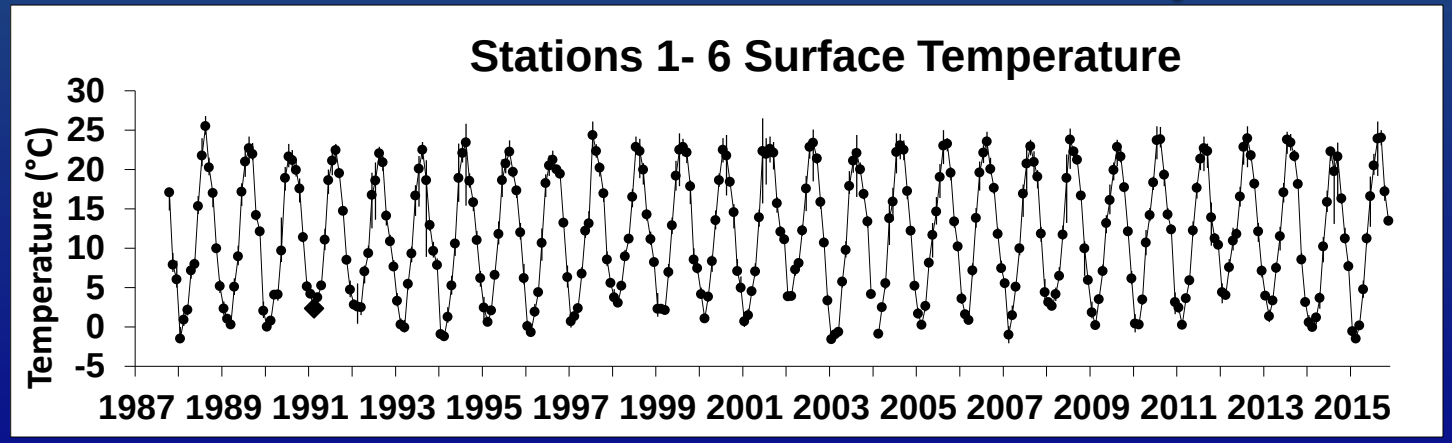
Plankton studies in Buzzards Bay, Massachusetts, USA. VI. Phytoplankton and water quality, 1987 to 1998

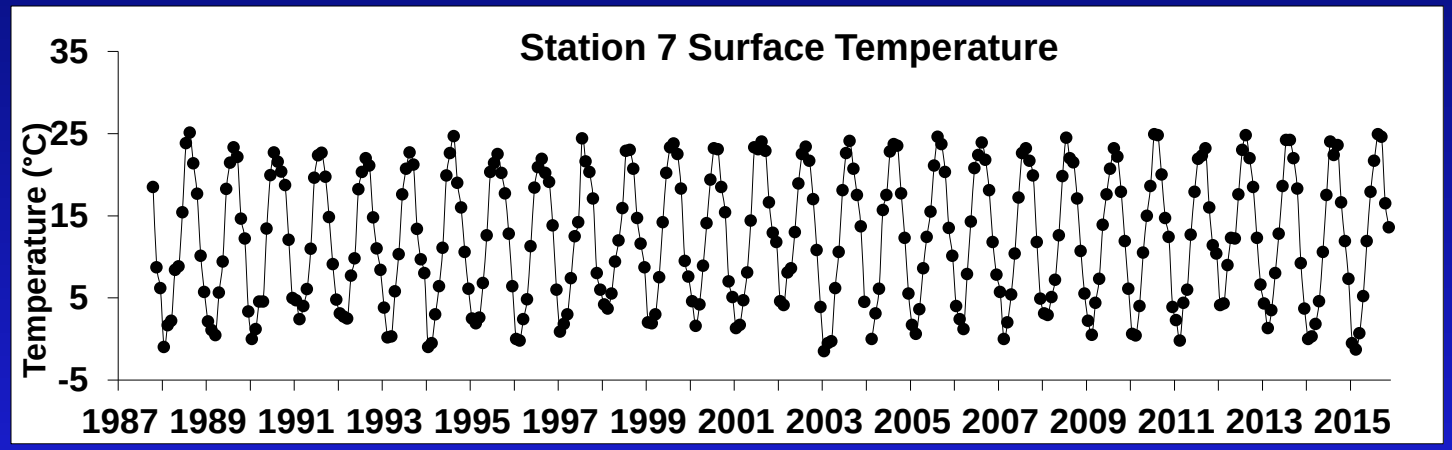
Jefferson T. Turner*, David G. Borkman, Jean A. Lincoln, David A. Gauthier, Christian M. Petitpas

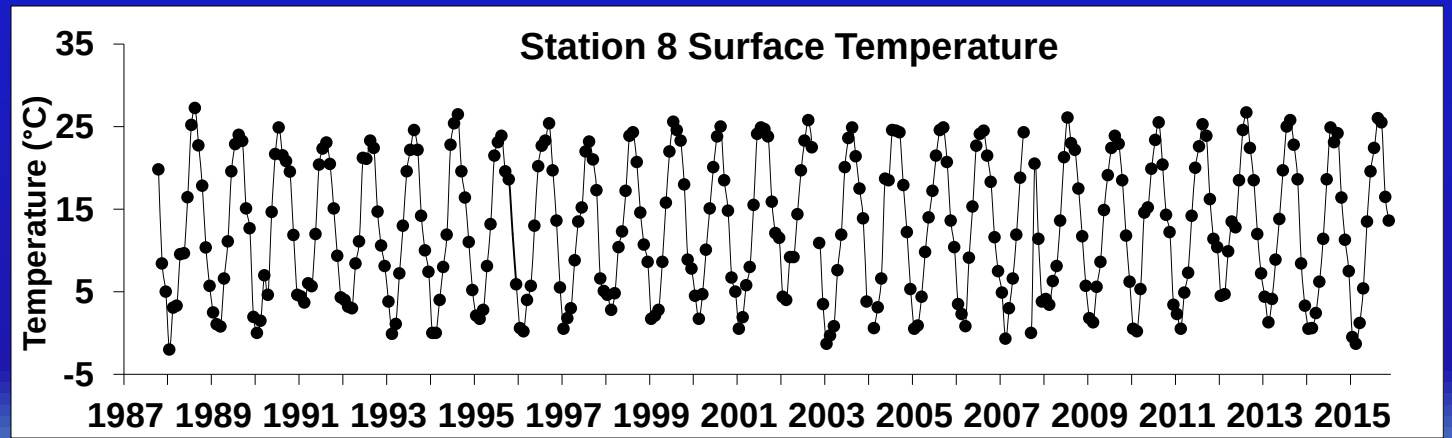
School for Marine Science and Technology, University of Massachusetts Dartmouth, 706 South Rodney French Boulevard, New Bedford, Massachusetts 02744, USA



Sea Surface Temperature



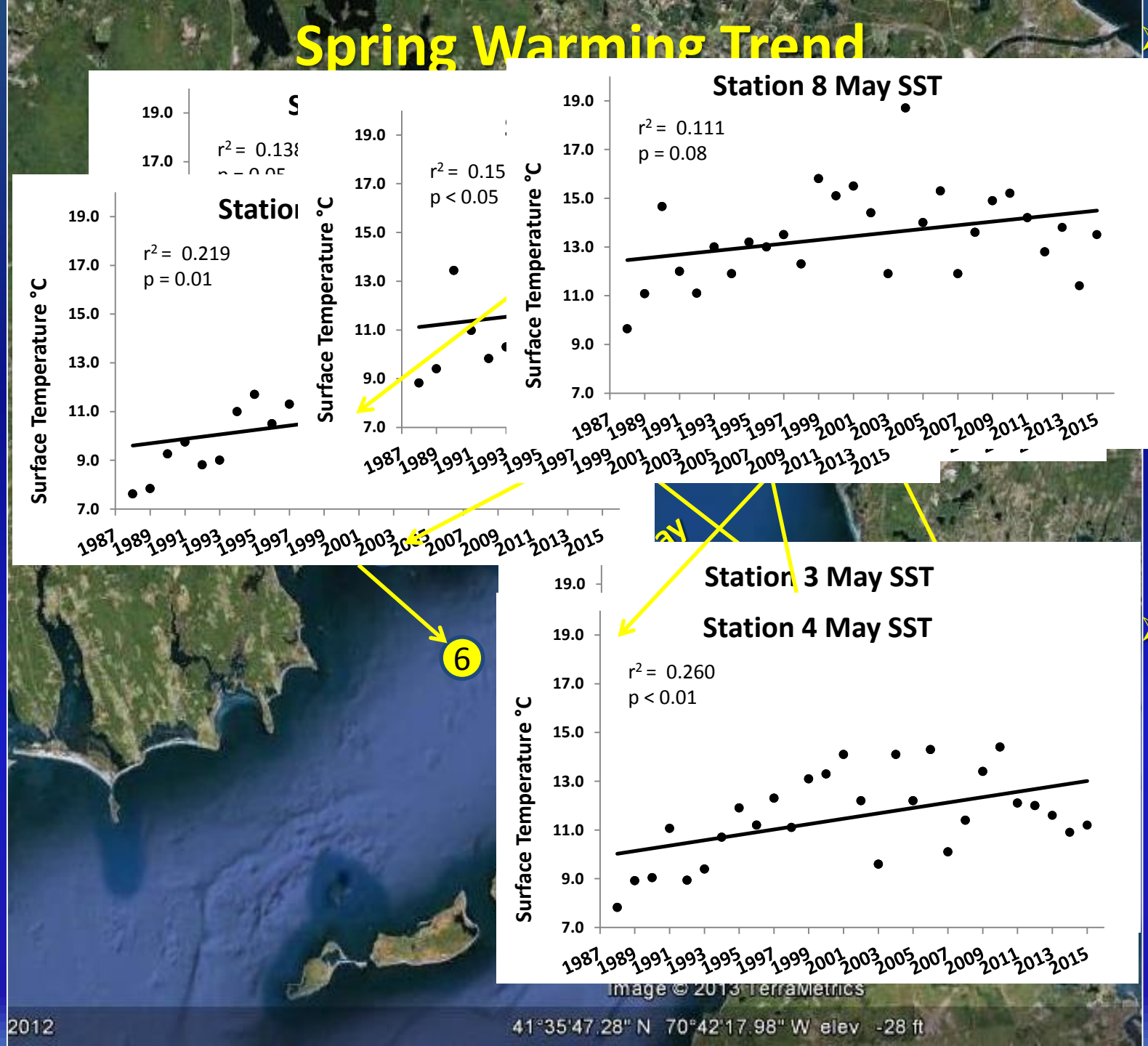




Clear seasonality, but NO apparent change in SST annual cycles

However...

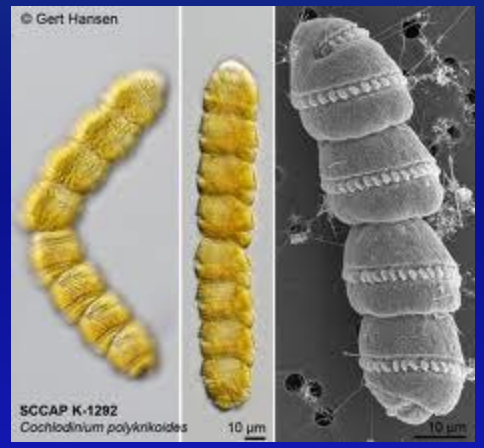
Spring Warming Trend



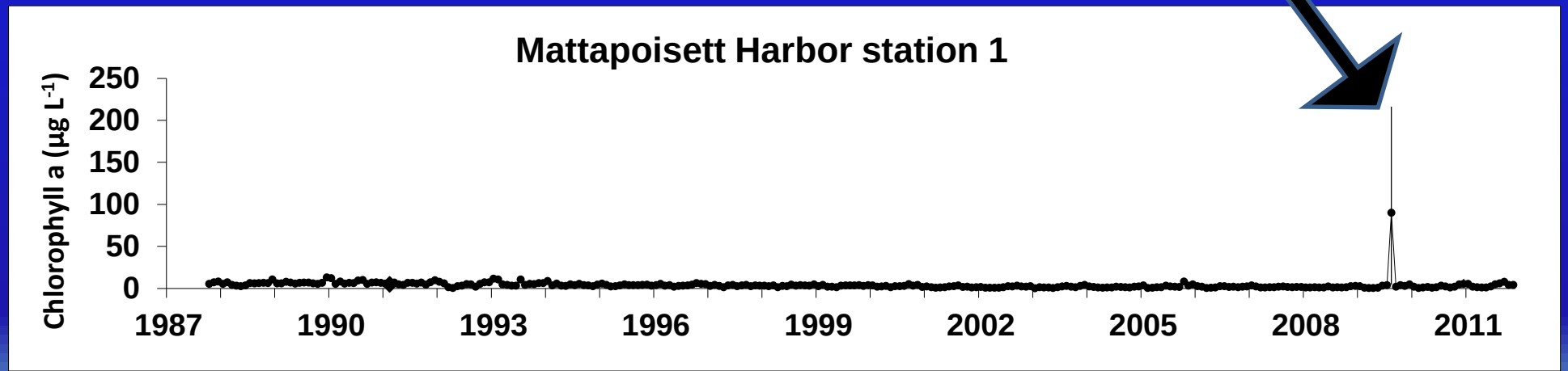
- May surface temperatures have increased significantly
- April to May surface temperatures increase an average of 4.9°C, but can increase as much as 12 °C
- Surface temperatures for winter and spring 2012 were 2-3 °C warmer than average temperatures across this data set

Captured major bloom of harmful microalgae *Cochlodinium polykrikoides* (3.4 million cells l^{-1}) in Mattapoisett Harbor (Station 1) in September 2009. Water was visibly discolored.

A boater's view of the "rust colored" water observed off North Falmouth in September 2005 caused by *Cochlodinium*. Photo taken by Larry Soule, Baywatcher for the Buzzards Bay Coalition.



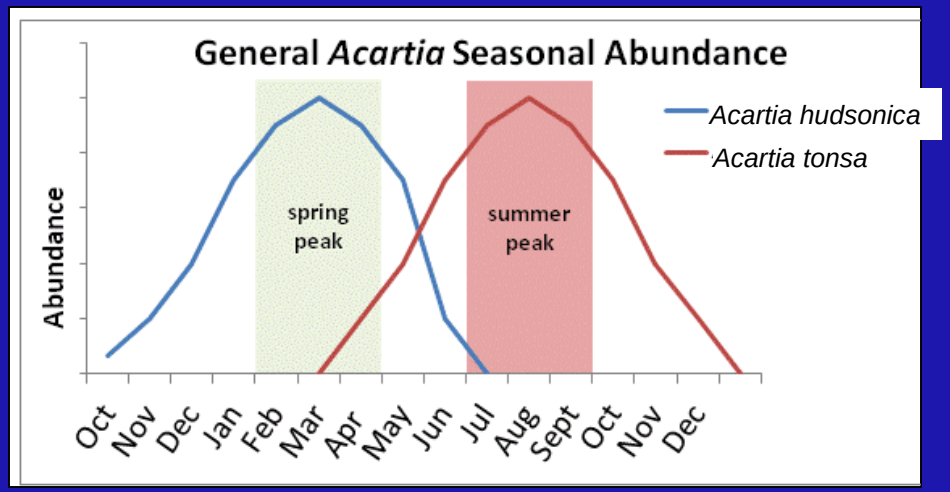
Chlorophyll *a* concentration >216 µg l^{-1} was much higher than baseline concentrations which are generally below 16 µg l^{-1}



Copepod Phenology

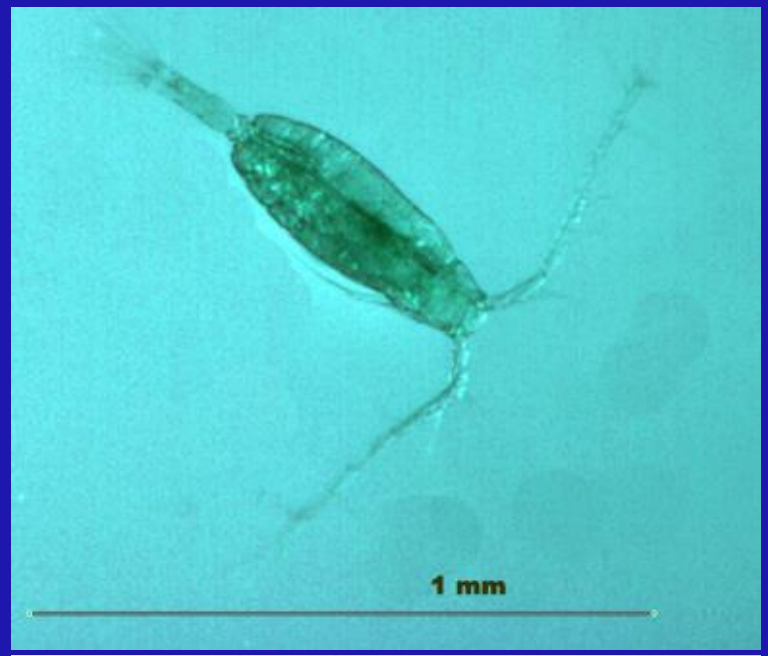
Acartia hudsonica

- Present in cold water



Acartia tonsa

- Present in warm water



Summary

Buzzards Bay was surveyed monthly for 28 yrs (346 Cruises) from October 1987-November 2015.

While there was no observed change or long-term trend in the seasonal range in temperatures, we are seeing warming earlier in the year.

There was a significant increase in May sea surface temperatures which suggests an earlier transition to summer temperatures.

Observed changes in the local plankton community suggest potential impacts from warmer water temperatures.

Acknowledgements

We thank the Massachusetts Department of Environmental Protection and NOAA National Marine Fisheries Service for funding portions of this monitoring program, and the University of Massachusetts Dartmouth for funding research vessel operations during periods of no external funding.

We thank the hundreds of student volunteers (many of whom are now middle-aged) who participated in this monitoring program.