Imaging Plankton and Jellyfish in the Chesapeake

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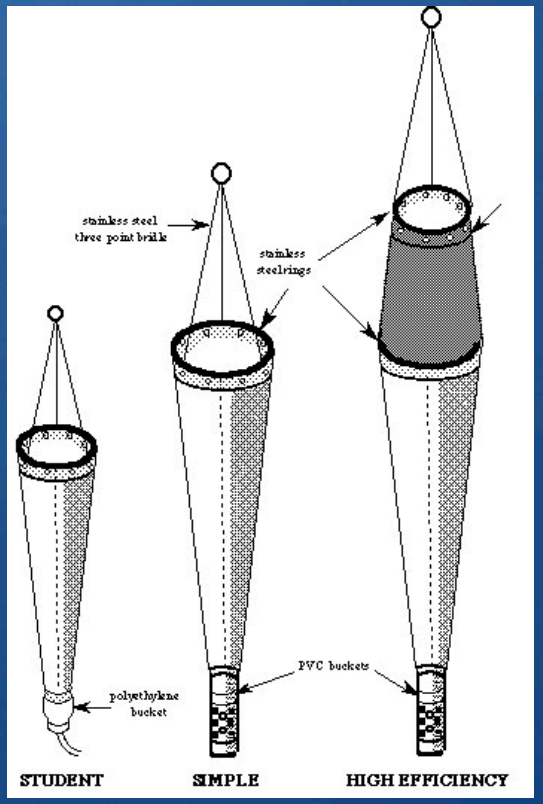
Why do we need imaging system

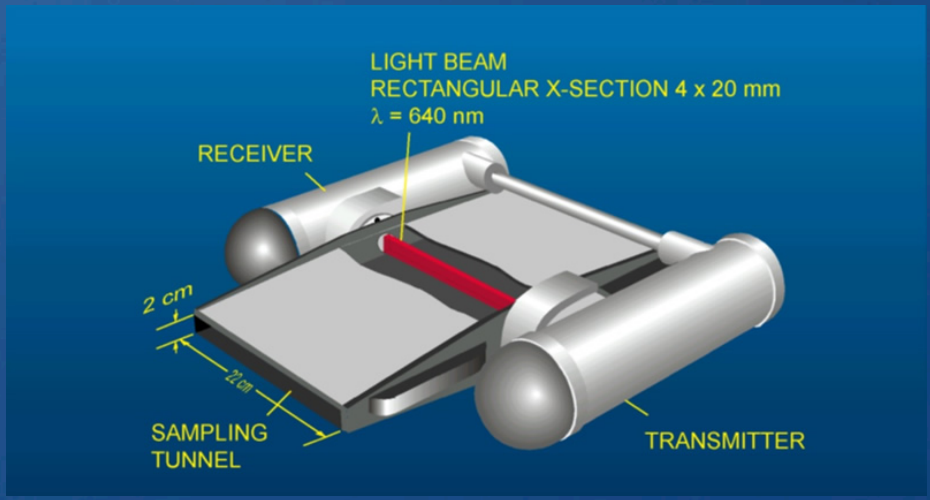
- Traditional sampling gears
  - Different nets for different organisms



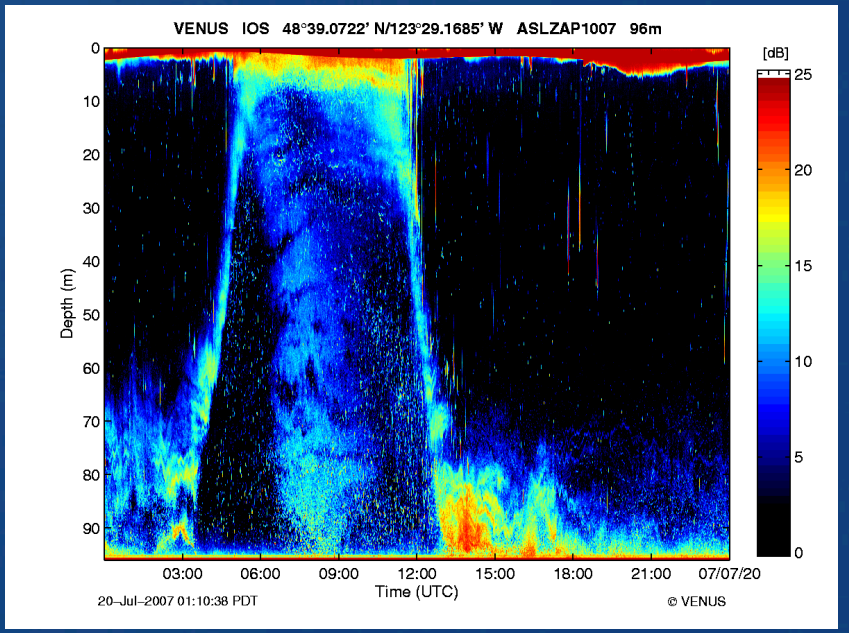
Source: http://www.gulfofmaine-census.org

Newer technologies

- Acoustics: backscatter
- Optical Plankton Counter



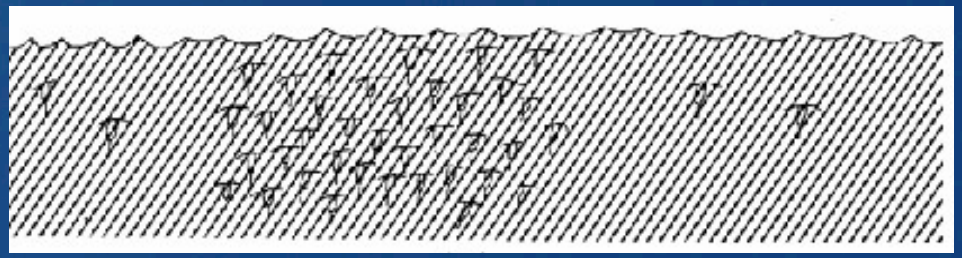
Source: http://www.gulfofmaine-census.org



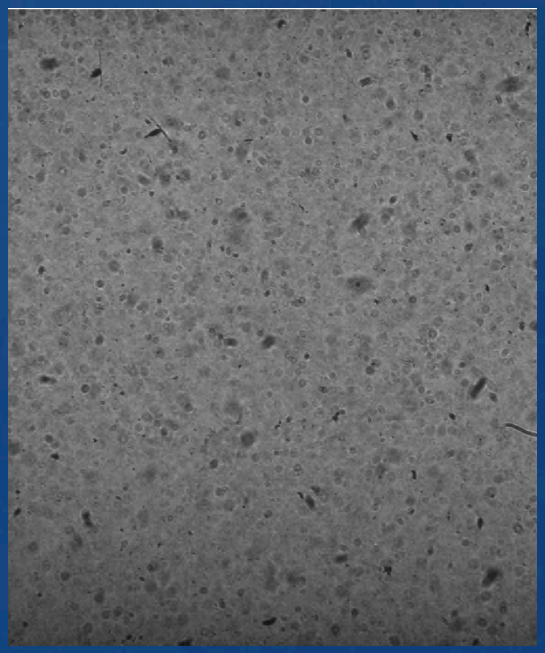
Source: Canada Ocean network

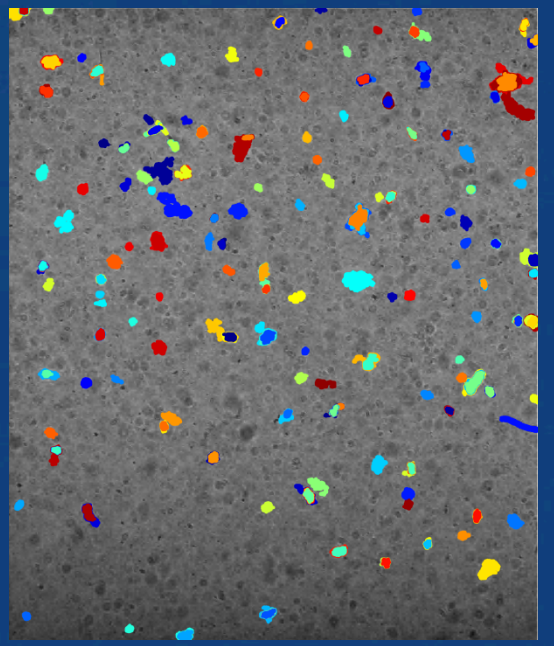
Problems

- Nets can not resolve fine scale distribution



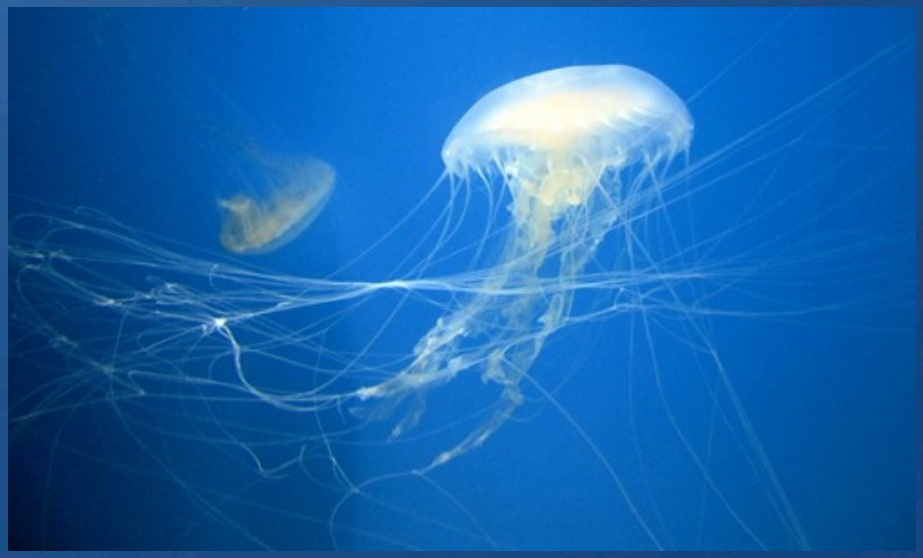
- Acoustic and OPC no taxonomic information
  - Too many particulates
    < 5% are organisms





Other issues and imaging systems

- Gelatinous zooplankton are fragile and hard to preserve



Chesapeakebay.net

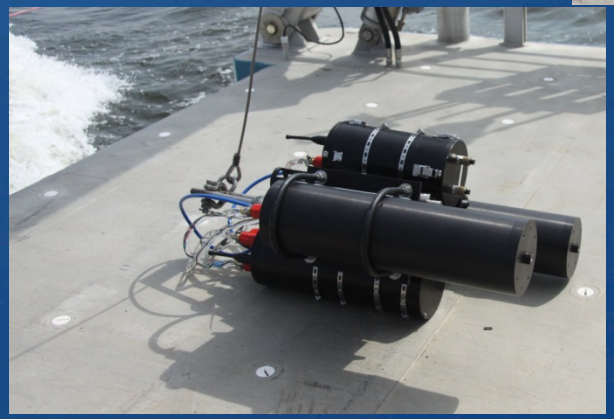
www.vims.edu

Imaging systems

- Imaging systems for > two decades
  - Video Plankton Recorder (VPR):
    - scattered light: turbidity
    - small sampling volume: only small organisms
  - Underwater Video Profiler (UVP)
    - profiling
  - Shadowed Image Particle Profiling Evaluation Recorder (SIPPER)
    - Not available
  - In Situ Ichthyoplankton Imaging System (ISIIS)
    - Large sampling volume
    - Require fiber optic winch

Zooplankton Visualization System

- Designed by Dr. Mark Benfield and tested in Chesapeake Bay

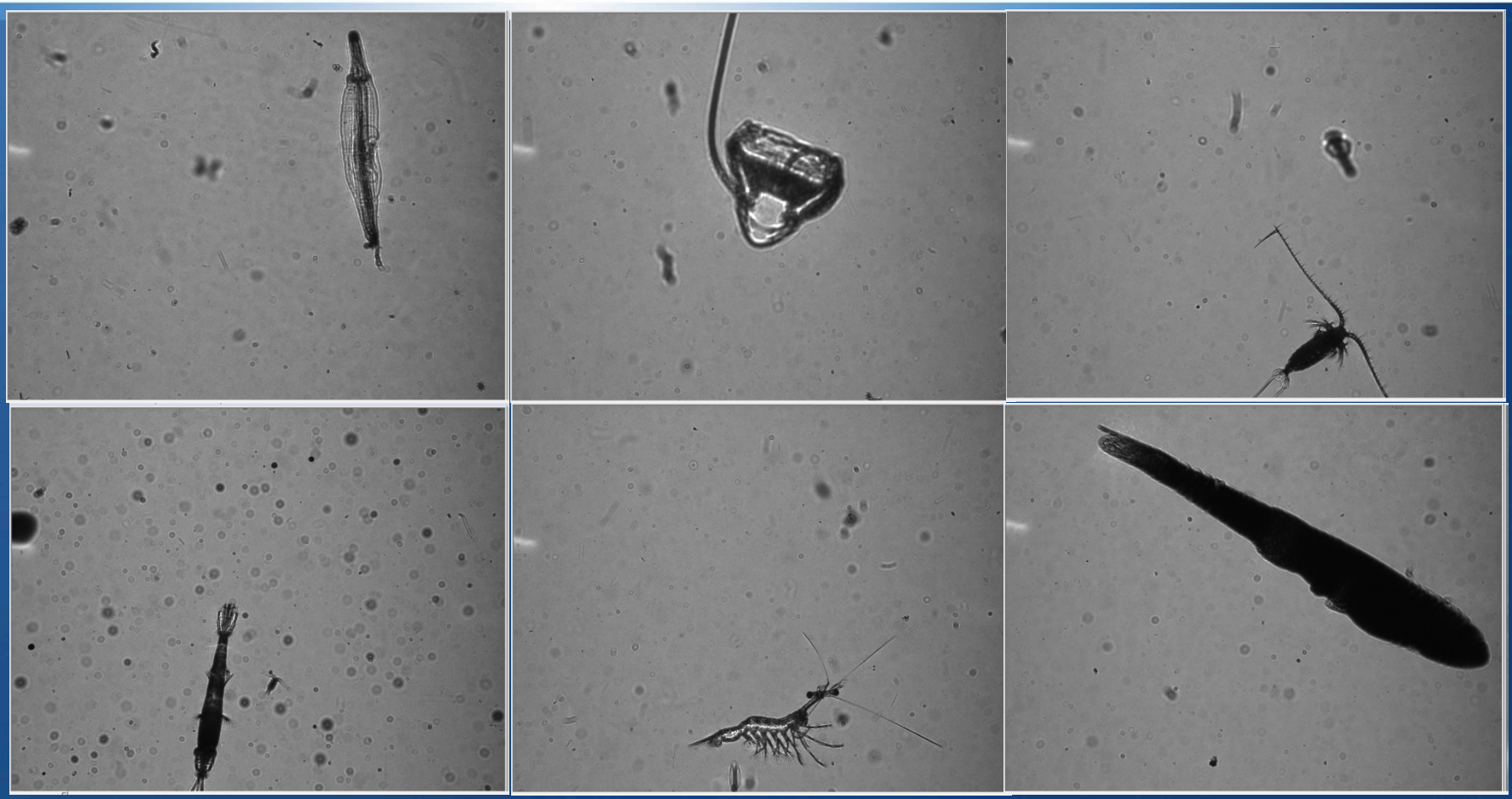


Zooplankton Visualization System

1. Red light
2. Shadowgraph imaging technique
3. 15 images per second
4. ~360L per minute
5. Pixel resolution 12 µm
6. From 50µm up to ~3cm
7. Two Lithium-ion battery: for ~6 hours deployment
8. Two internal hard drives: 500,000 images, 8 hours
9. Operating system in compact flash card

Bi et al. 2013 JPR

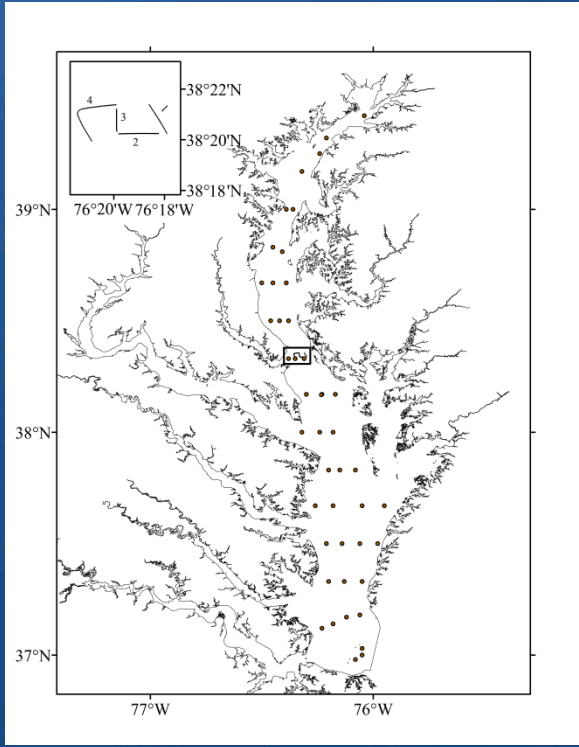
Images from the Gulf of Mexico

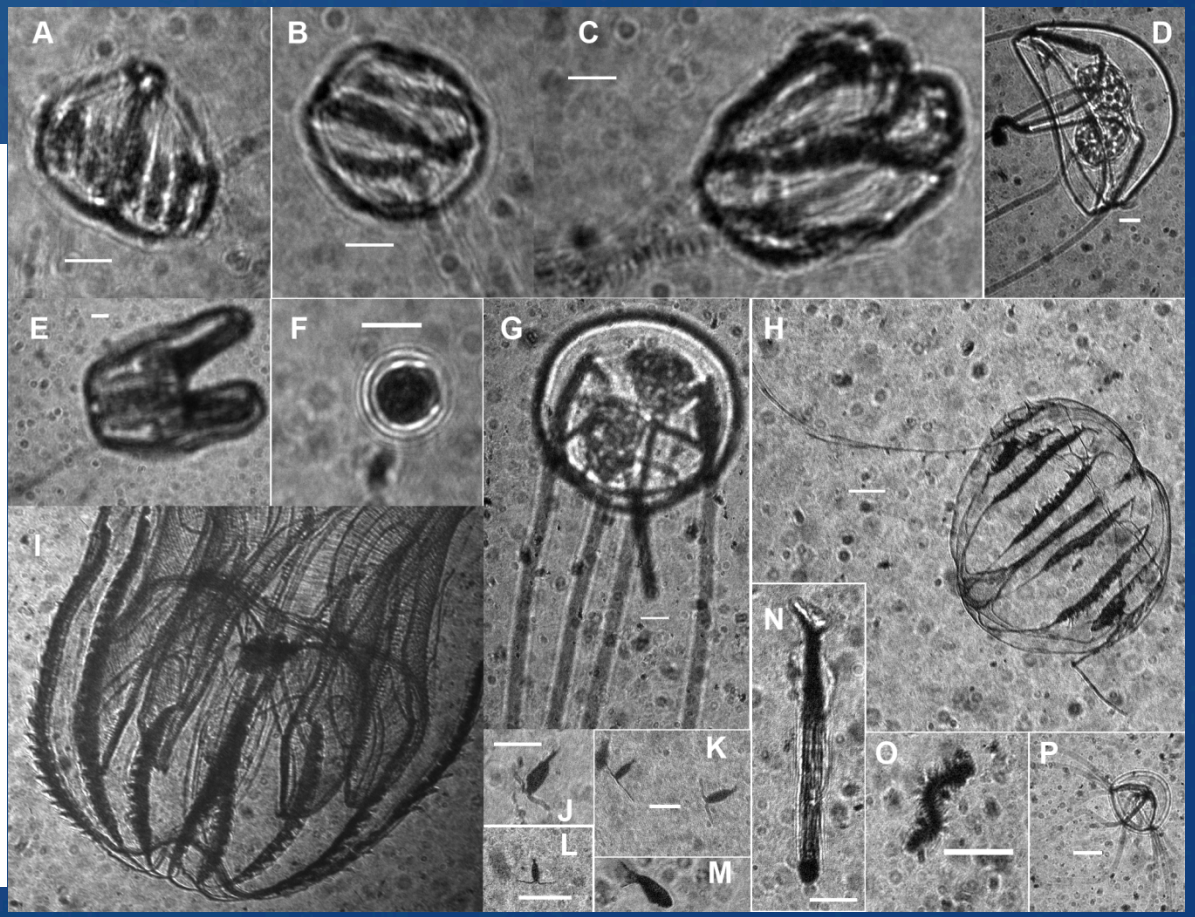


Courtesy of Dr. Benfield

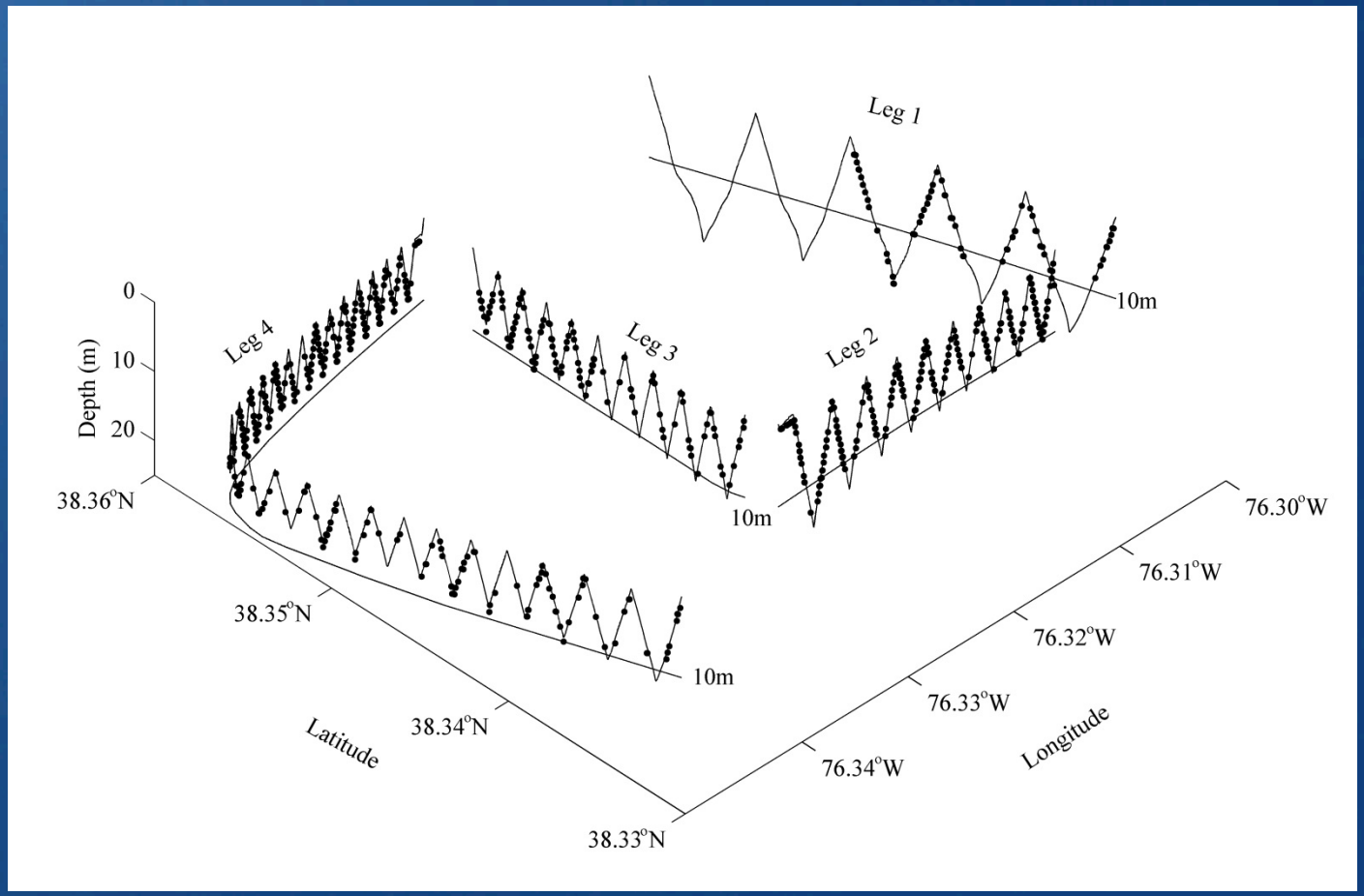
Deployments in Chesapeake Bay

- May, July, October 2011
- November 2012 (after the superstorm Sandy)
- May 2013

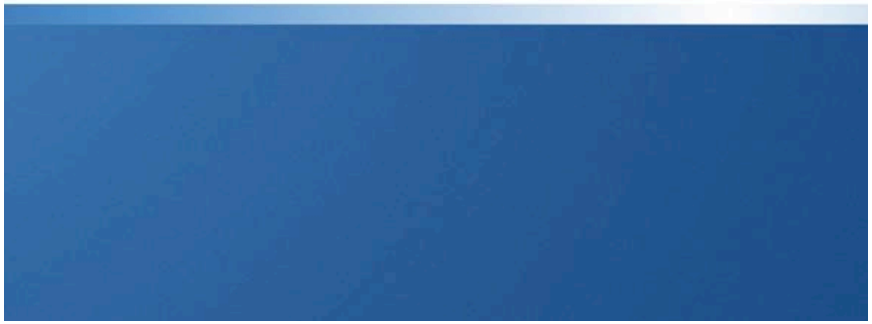


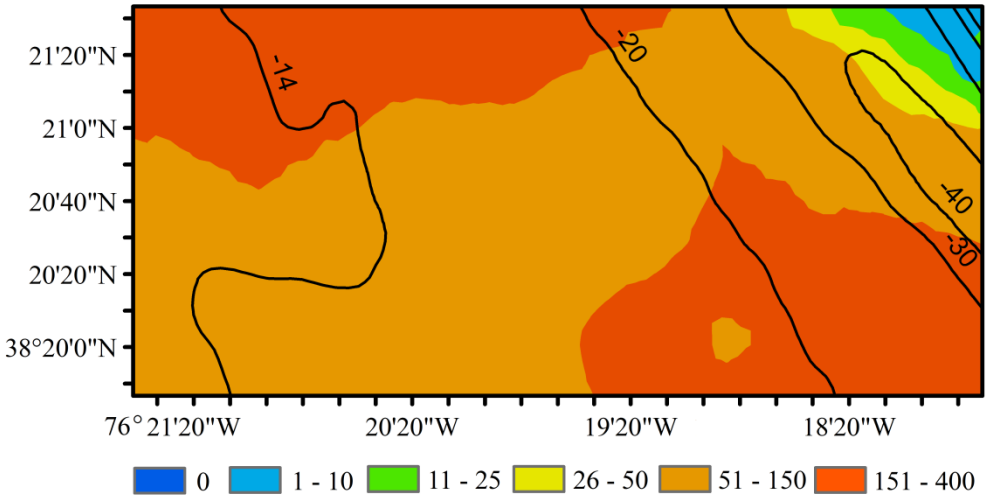


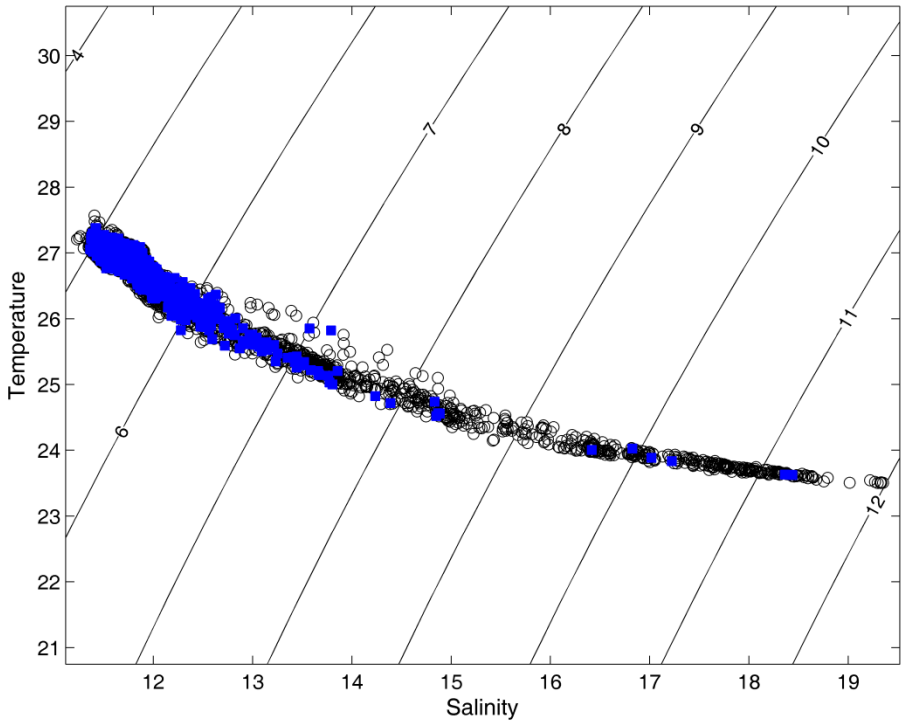
Fine scale spatial distribution: *M. leidyi*



M. leidyi

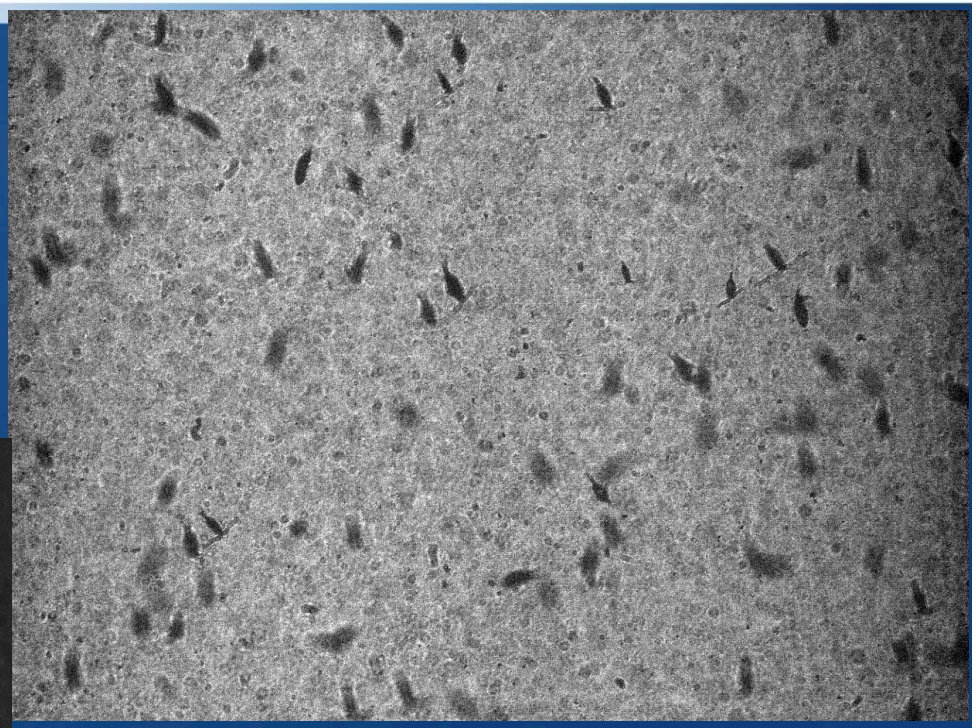


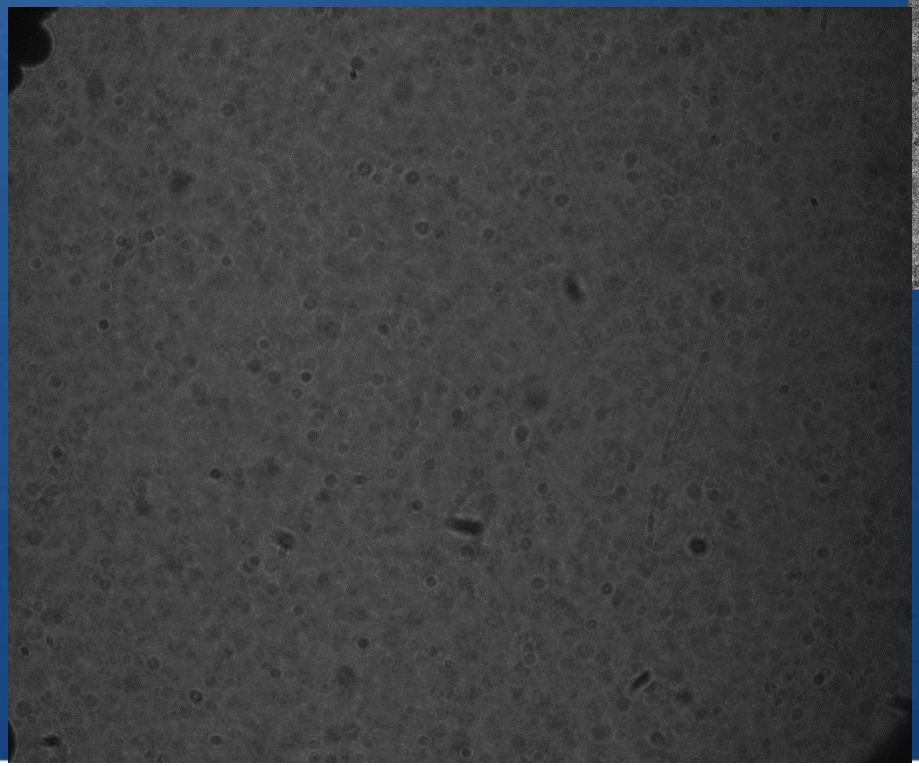




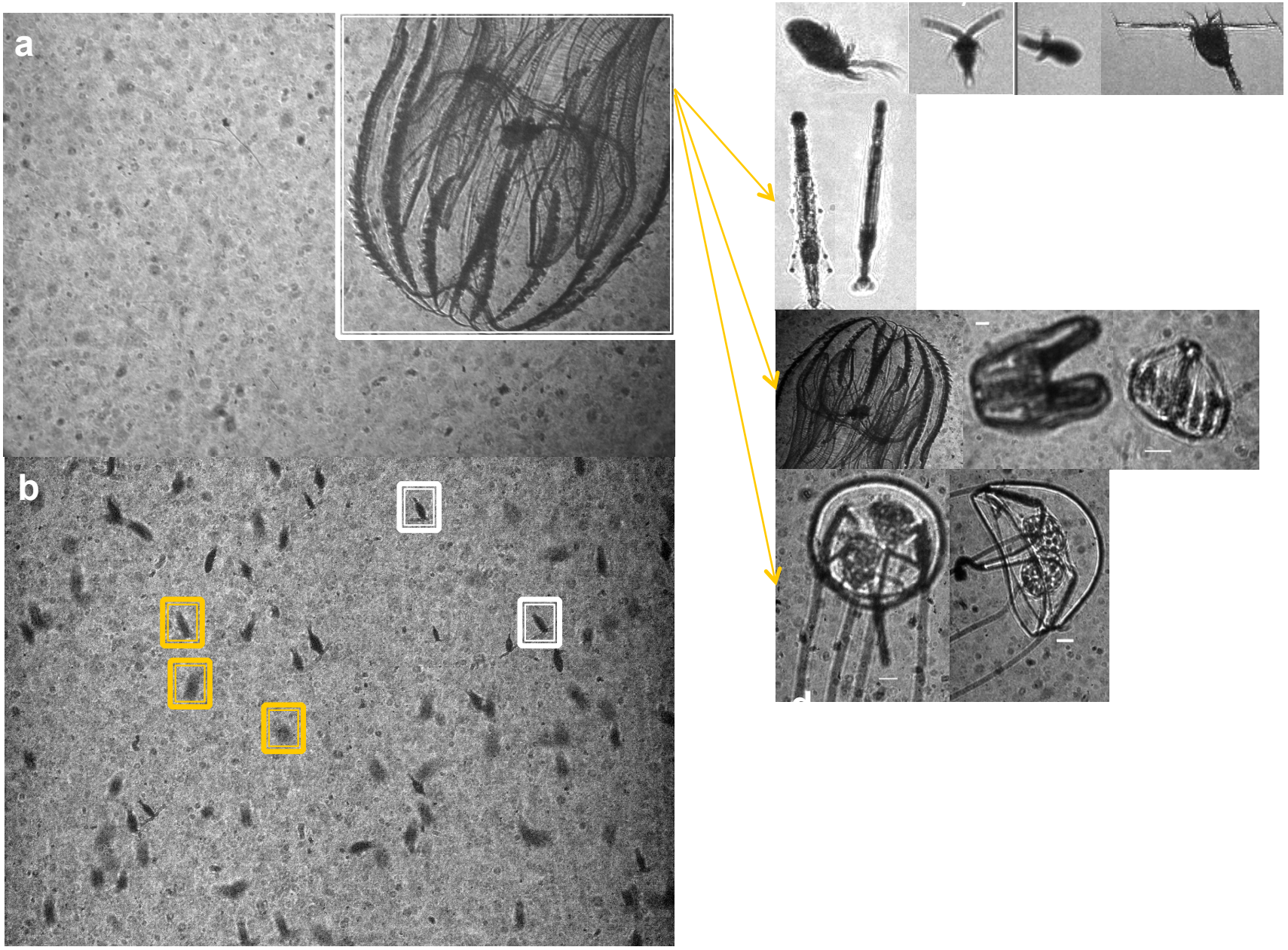
1. Temperature range
2. Salinity range
3. Vertical distribution
4. Horizontal distribution

Copepod patchiness

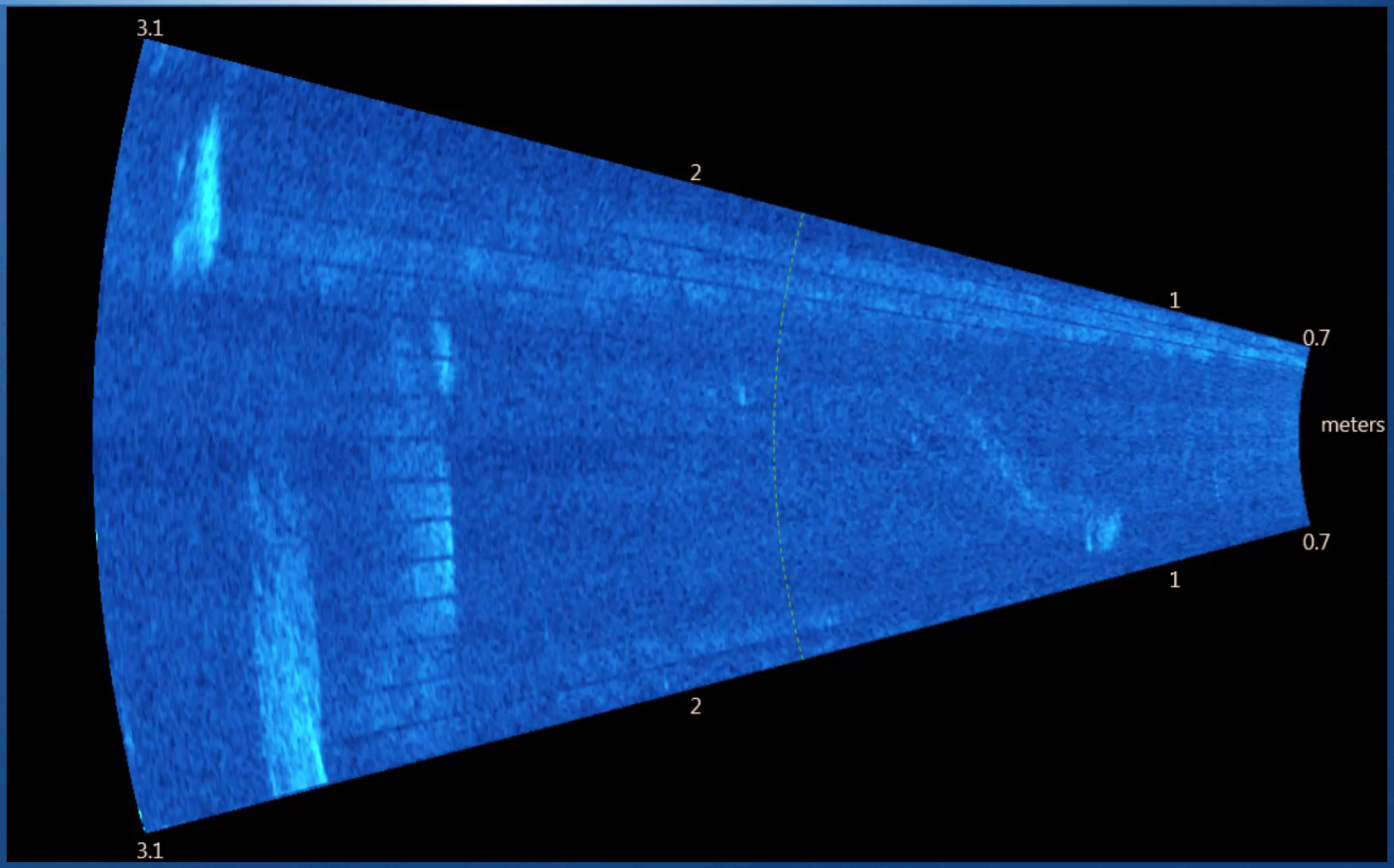




1. Quantify copepod distribution
2. Spatial overlap with predators
3. Response to physical processes: e.g., hypoxic event

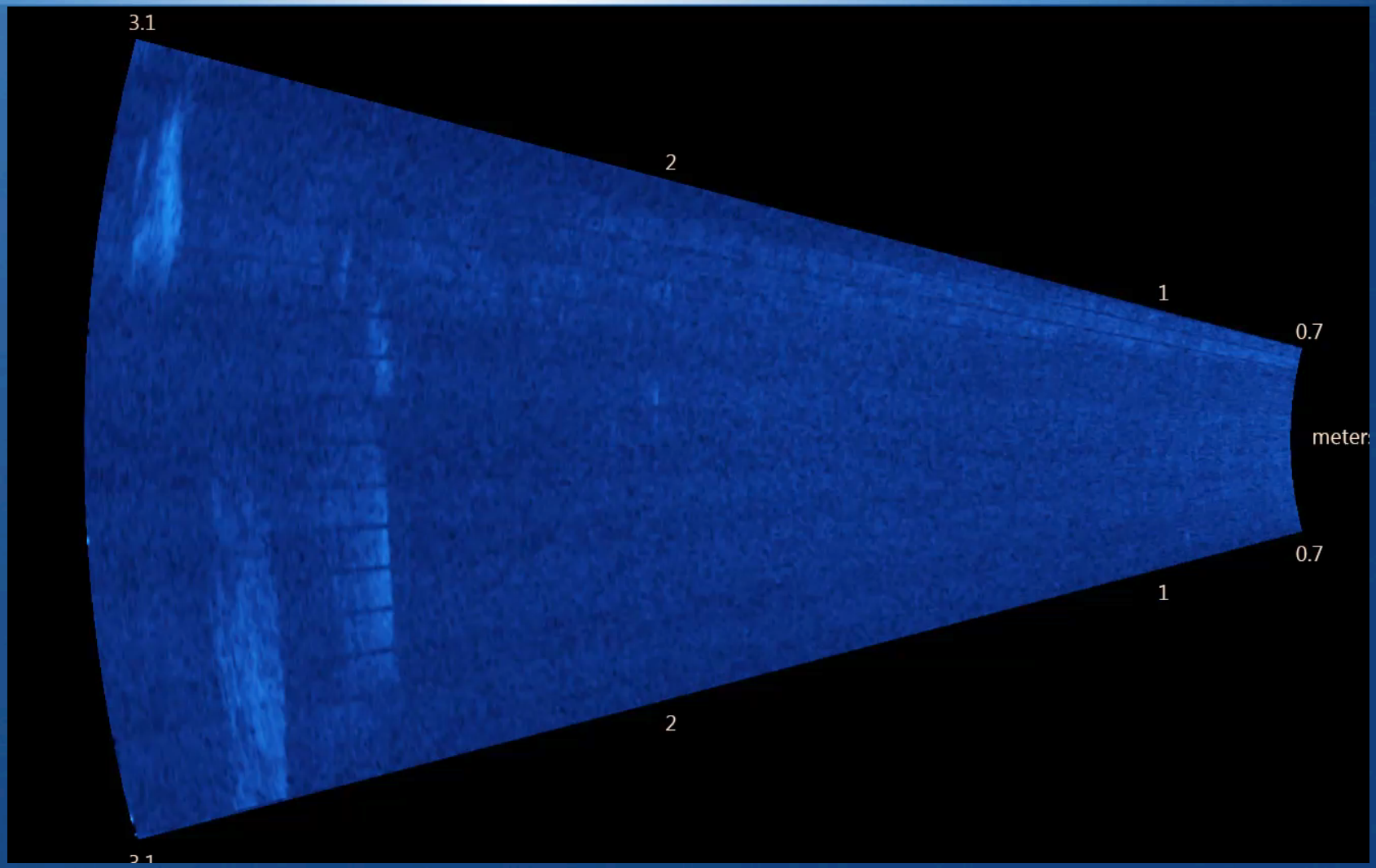

a
b

Sonar imaging system: sea nettle



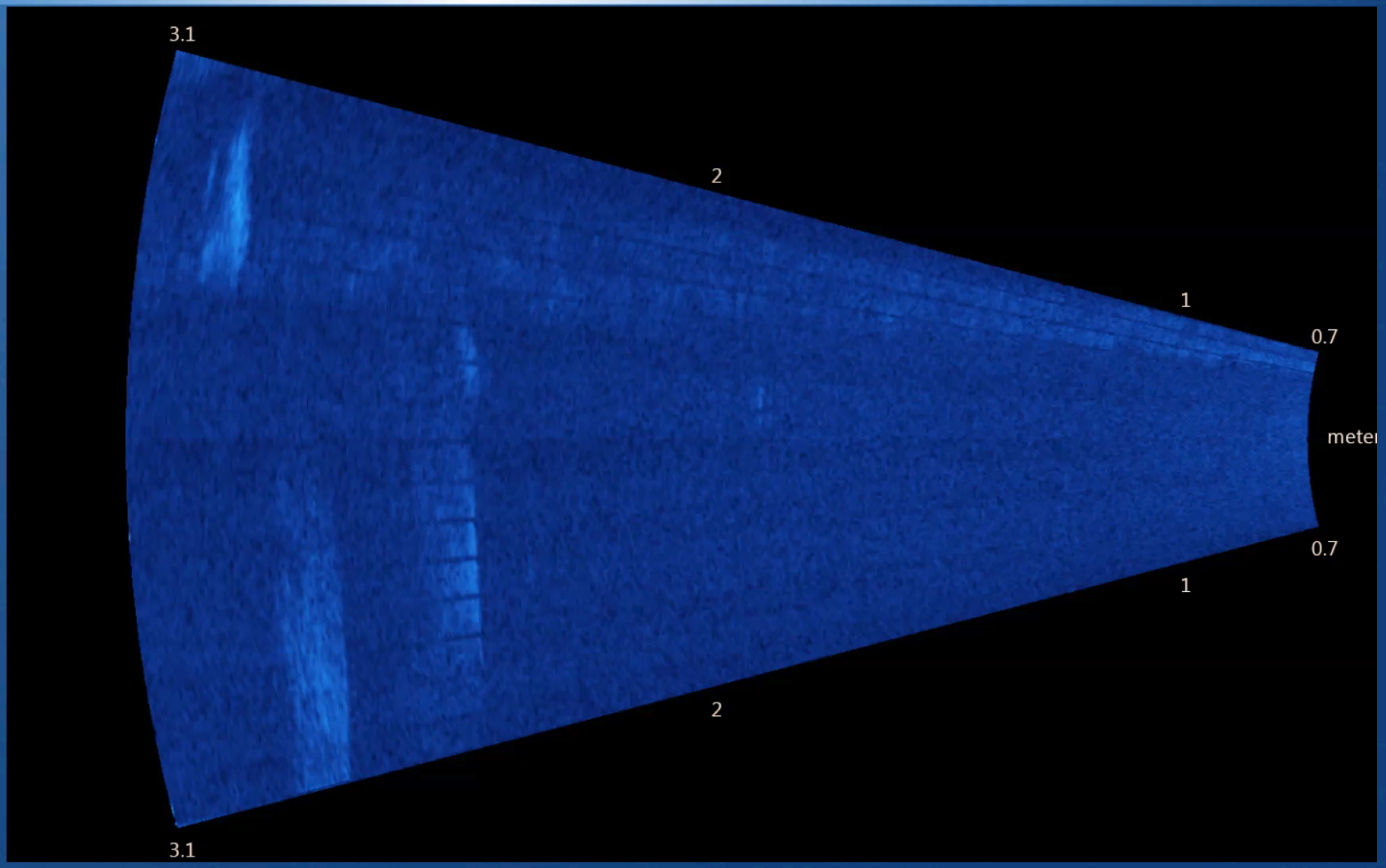
This video can be viewed online at: http://youtu.be/hQXC1sU7ynE

Sonar imaging system: striped bass



This video can be viewed online at: http://youtu.be/d0QuE1uzT-o

Sonar imaging system: silverside



This video can be viewed online at: http://youtu.be/CCoBgiaag3I

Acknowledgements

- Funds from Univ. of MD and Sea Grant
- Design of the system by Dr. Benfield
- CBL: Hao Yu, Ed Houde, Tom Miller
- NOAA: Michael Ford
- SERC: Denise Breitburg