POLAR TREC

TEACHERS AND RESEARCHERS EXPLORING AND COLLABORATING

Welcome to *PolarConnect*



Southern Ocean Diatoms

With PolarTREC Teacher Cara Pekarcik & Antarctic Researchers

Drs. Bethany Jenkins, Kristen Buck & Dreux Chappell

3 October 2016

Getting to Know Adobe Connect

Slides will be shown here

Exit presentation

Mute your speakers

Raise your hand

List of all participants

Follow the chat

Find out more about the presentation

Chat here

Participant Introductions

In the Chat box, please introduce yourself by typing in your:

- ✓ Name
- ✓ School or Institution
- ✓ The number of students and adults participating with you in the same location

What is PolarTREC?

- Since 2004, the Arctic Research Consortium of the United States (ARCUS), a non-profit organization, has been administrating the PolarTREC Program.
- PolarTREC is professional development for K-12 teachers. They are paired with researchers for 2-6 week research experiences in the polar regions.
- Over 150 teachers from around the United States have joined scientists in the Arctic and Antarctica to learn about science, the polar regions, and to share what they have learned with their students and communities.

ARCUS
ARCTIC RESEARCH CONSORTIUM OF THE UNITED STATES

25 Years of Connecting Arctic Research
www.arcus.org

Questions

During the Presentation:

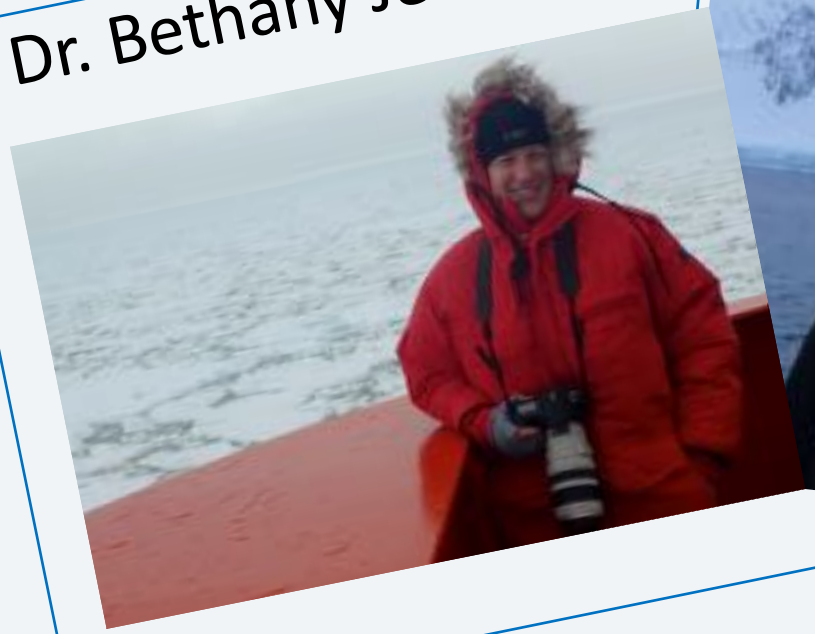
- Type your question in the text chat box

At the End of the Presentation:

- Raise your hand with the "hand button".
- PolarTREC staff will call on you and activate your microphone.
- Speak loud and clear, directly into the computer microphone or the phone to ask your question.

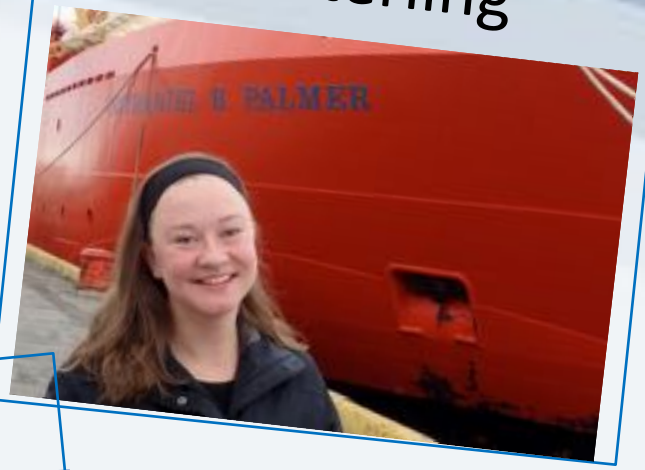
Research Team – University of Rhode Island

- Dr. Bethany Jenkins

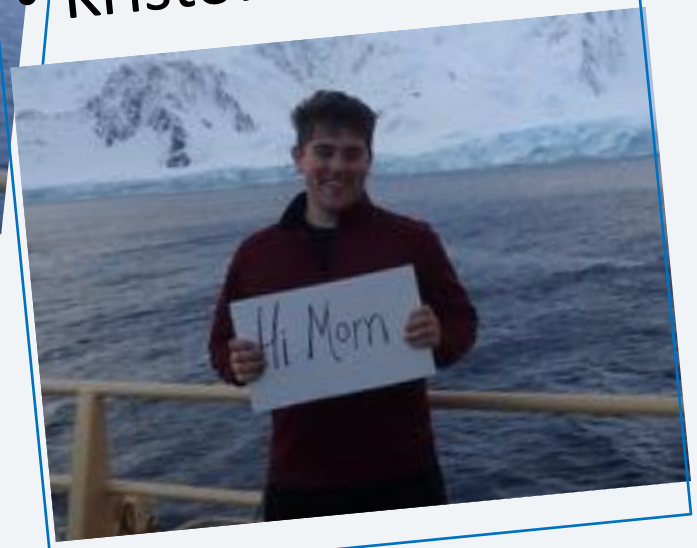


- Laura Filliger

- Alexa Sterling



- Kristofer Gomes



Research Team– Old Dominion University

- Dr. P. Dreux Chappell

- Kim Powell

- Zuzanna Abdala

- Sveinn Einarsson

Research Team– University of South Florida

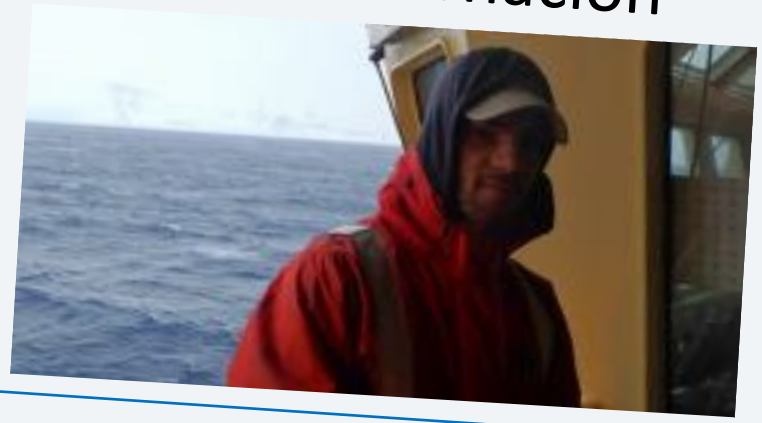
- Dr. Kristen Buck

- William Abbott

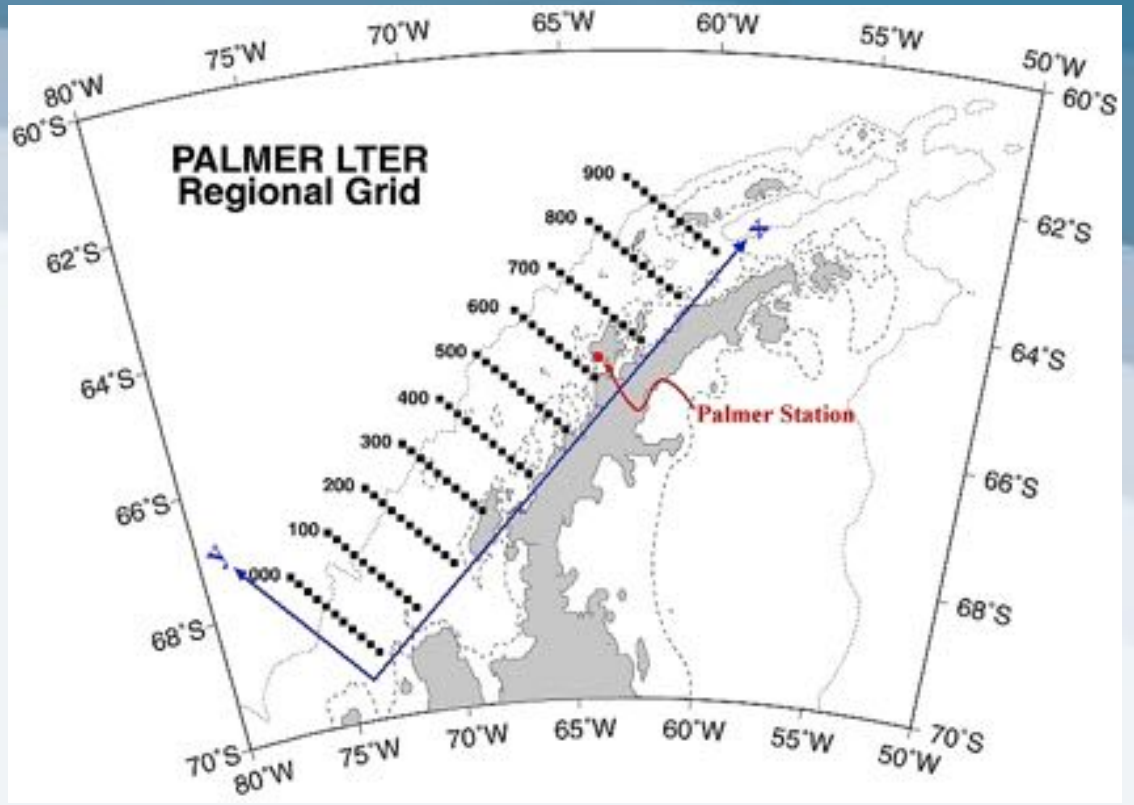
- Travis Mellett

- Dr. Randie Bundy

- Noahie Encarnacion



Region for research cruise:
Southern Ocean and
Western Antarctic Peninsula



Site of Long Term Ecological Research (LTER) sampling—from 1990 -present

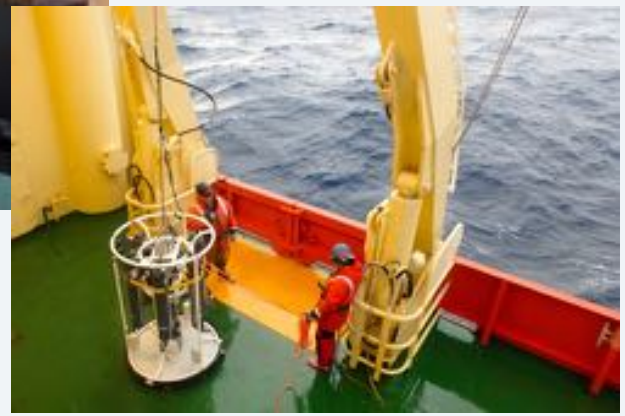
http://pal.lternet.edu/

Sampling strategy summarized in K.J. Waters and R. C. Smith (Palmer LTER: A sampling grid for the Palmer LTER program, Antarctic Journal of the United States, 27(5), 236-239, 1992).

RVIB Nathaniel B. Palmer

- Built in 1992
- Owned by Edison Chouest Offshore (ECO)
- Named after merchant marine and ship builder Nathaniel Brown Palmer
- Length: 94m/308ft
- Beam: 60 feet
- Draft: 22.5 feet
- Engines: 4 Caterpillar diesels @ 3,300 BHP each
- Accommodates 22 crew and 37 scientists
- Ice-classed ABS-A2: capable of breaking ice 3 ft. thick at 3 knots

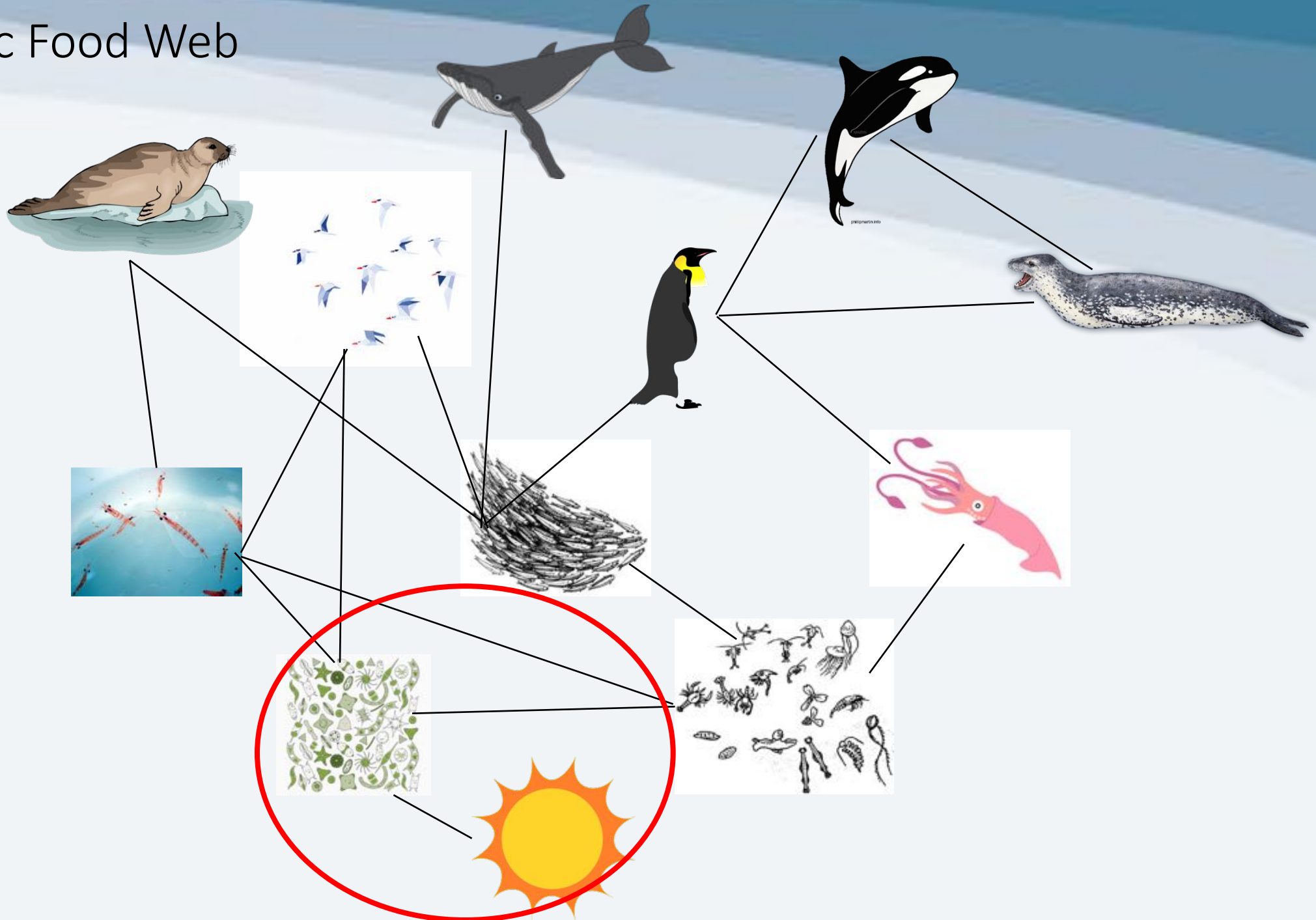
Photo by Katie Pena (PolarTREC 2008/2009), Courtesy of ARCUS

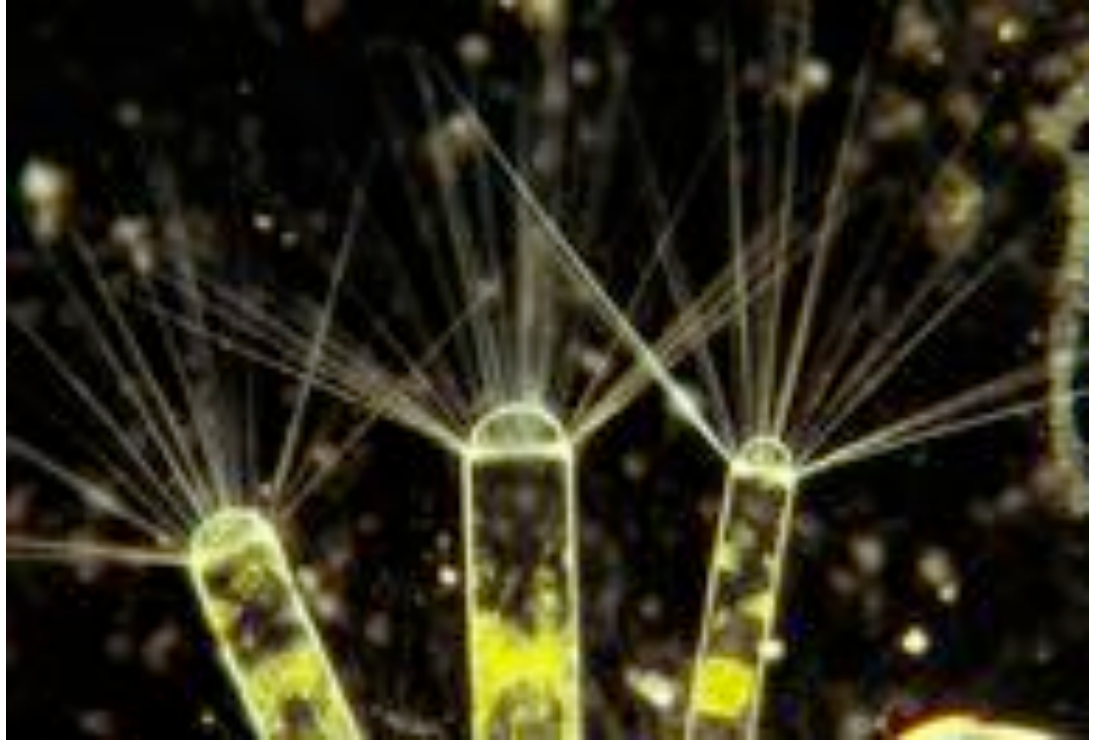


Info courtesy: US Antarctic Program at http://www.usap.gov/vesselScienceAndOperations/contentHandler.cfm?id=1561

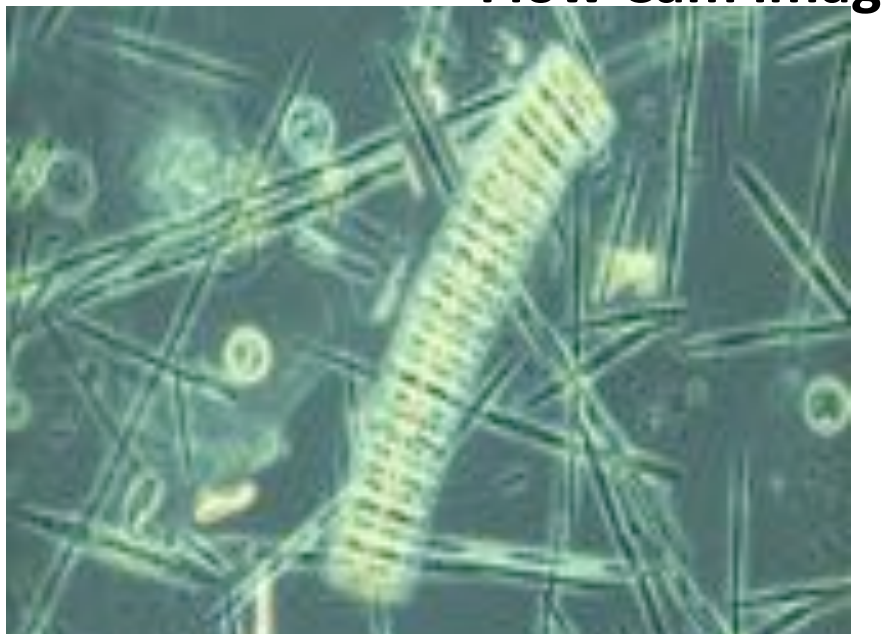
RVIB Palmer underway

Antarctic Food Web





Flow Cam imaging of primary producers

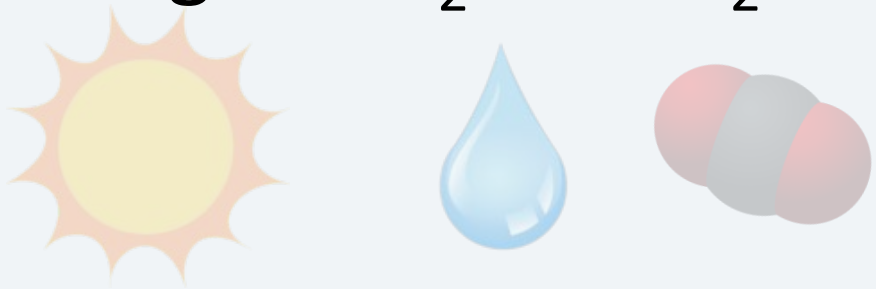


Photos courtesy Dr. Bethany Jenkins, URI

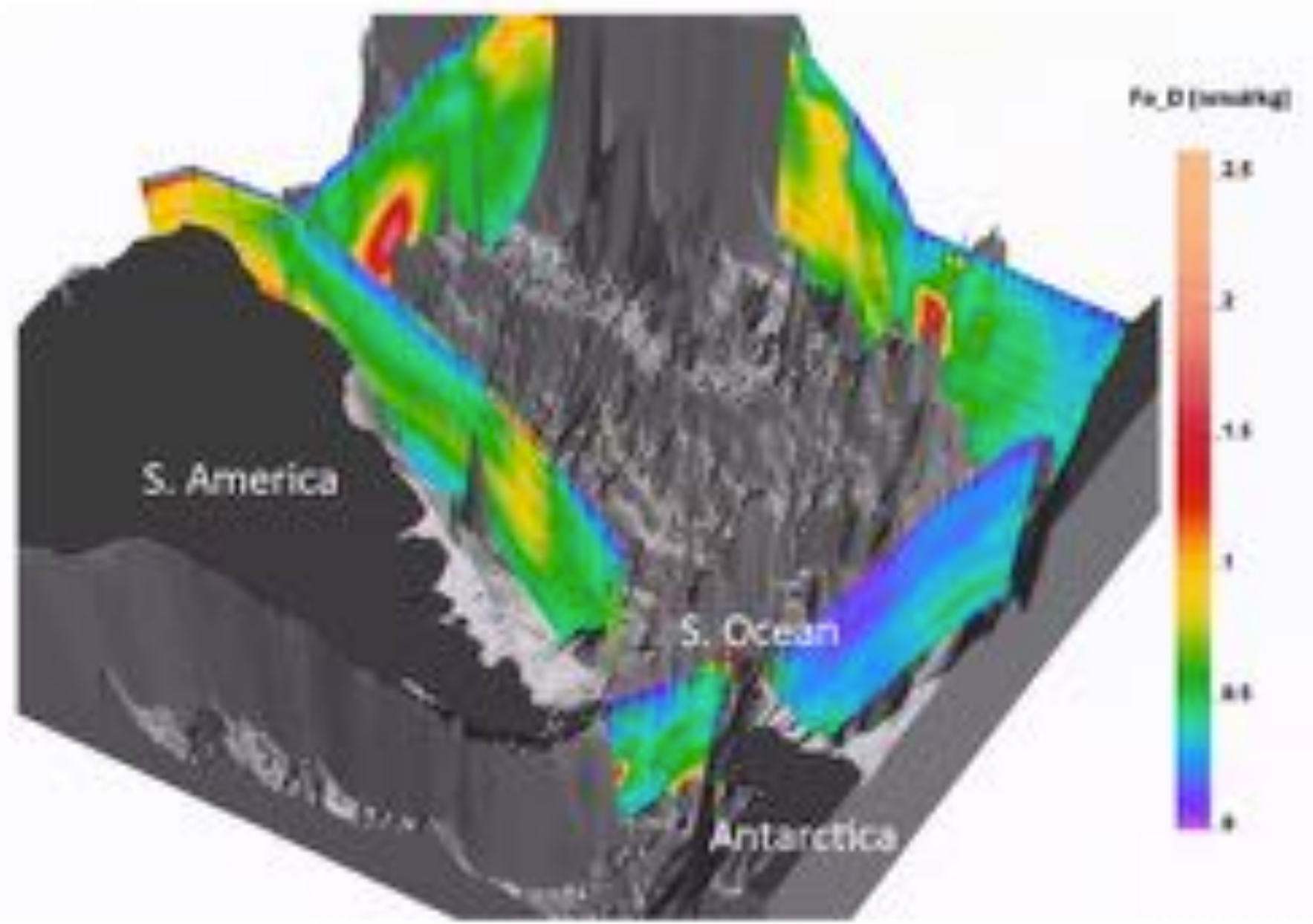
Photosynthesis – an overview

Reactants **Products**

Sunlight + H_2O + CO_2 + Nutrients → "CH_2O" + O_2



Nitrates NO_3
Phosphate PO_4
Iron
Silica



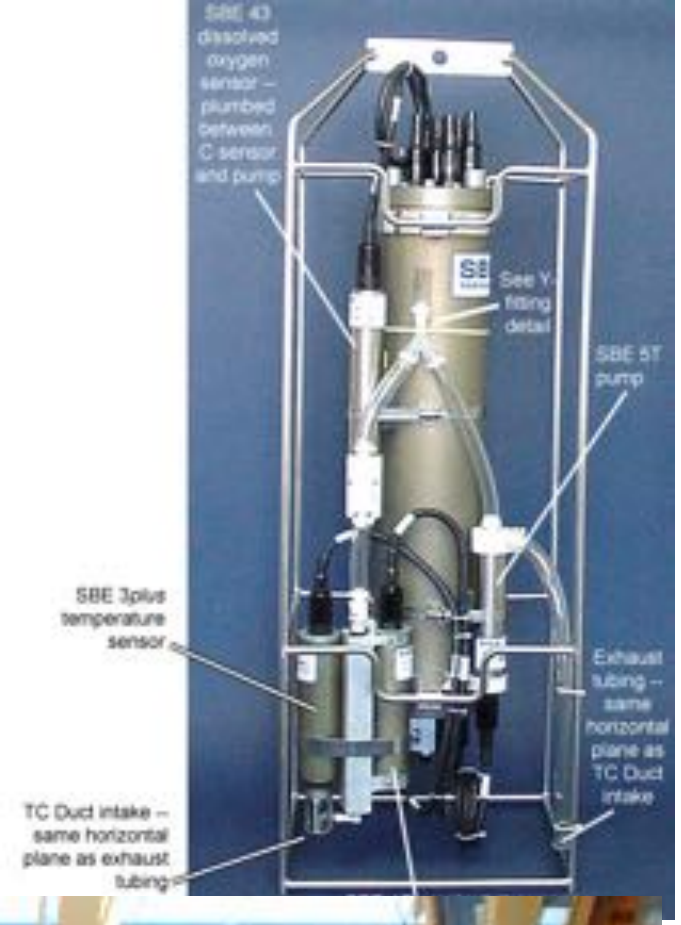
Schlitzer, R., *eGEOTRACES* - Electronic Atlas of GEOTRACES Sections and Animated 3D Scenes, http://www.egeotraces.org, 2015.

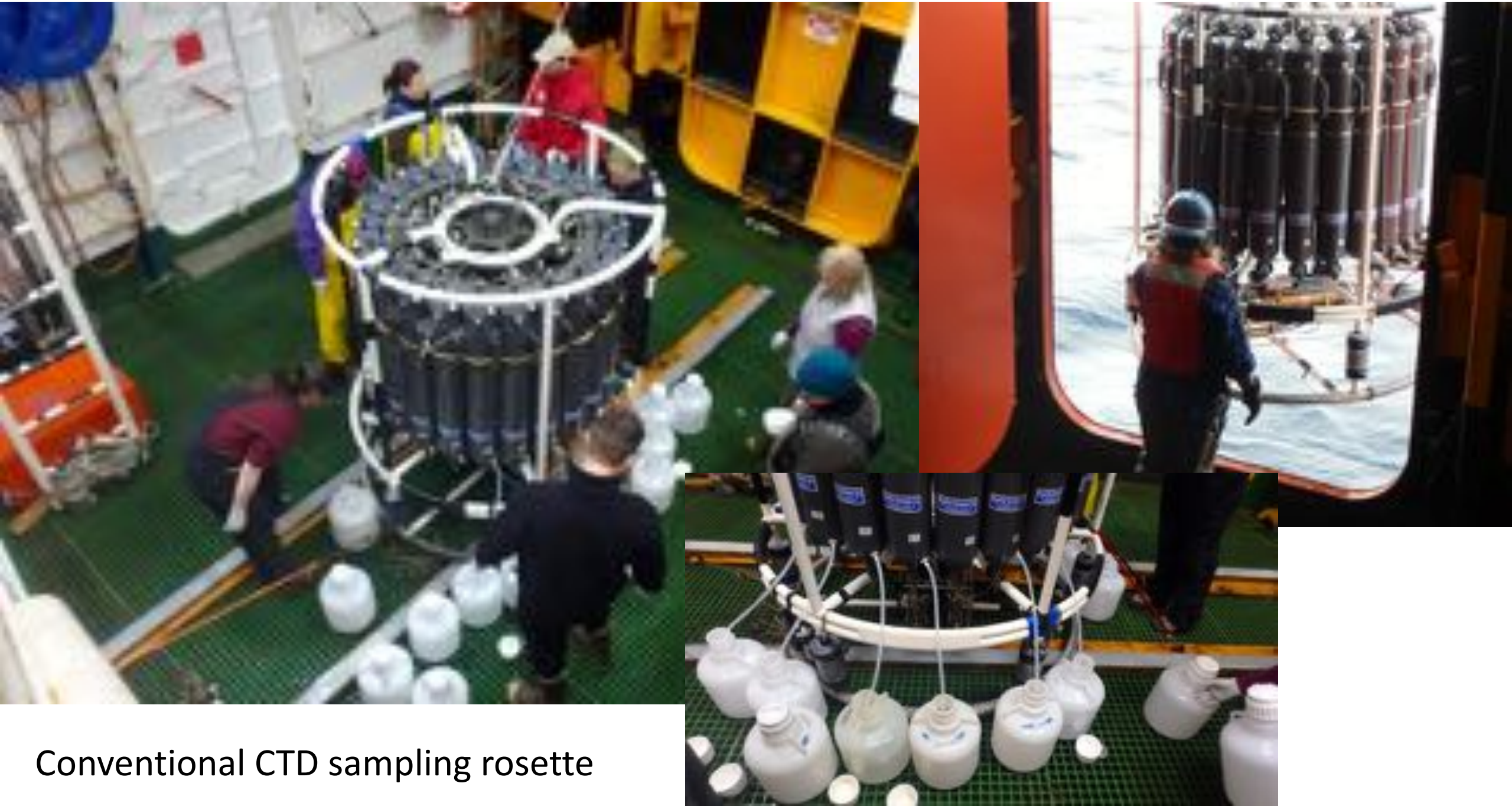
Research Objective:

- Combines trace metal biogeochemistry, phytoplankton cultivation and molecular biology to address questions regarding the production of iron-binding compounds and the role of diatom-bacteria interactions in iron-limited regions
  - Identify diatom species and measure oceanographic characteristics in the Southern Ocean
  - Exposing samples to different ranges in micronutrients (incubation sampling) to measure changes in ligand characteristics.
  - Evaluating Fe limitations in diatoms using physiological and genetic markers
  - Collecting and evaluating diatoms, diatom-associated bacteria and free-living bacterial communities (cell isolations and cultures, DNA analysis, gene expression comparison)

HOW? SEAWATER SAMPLING

CTD and Niskin bottles on trace metal sampling rosette





Conventional CTD sampling rosette

CTD data window on RVIB Palmer

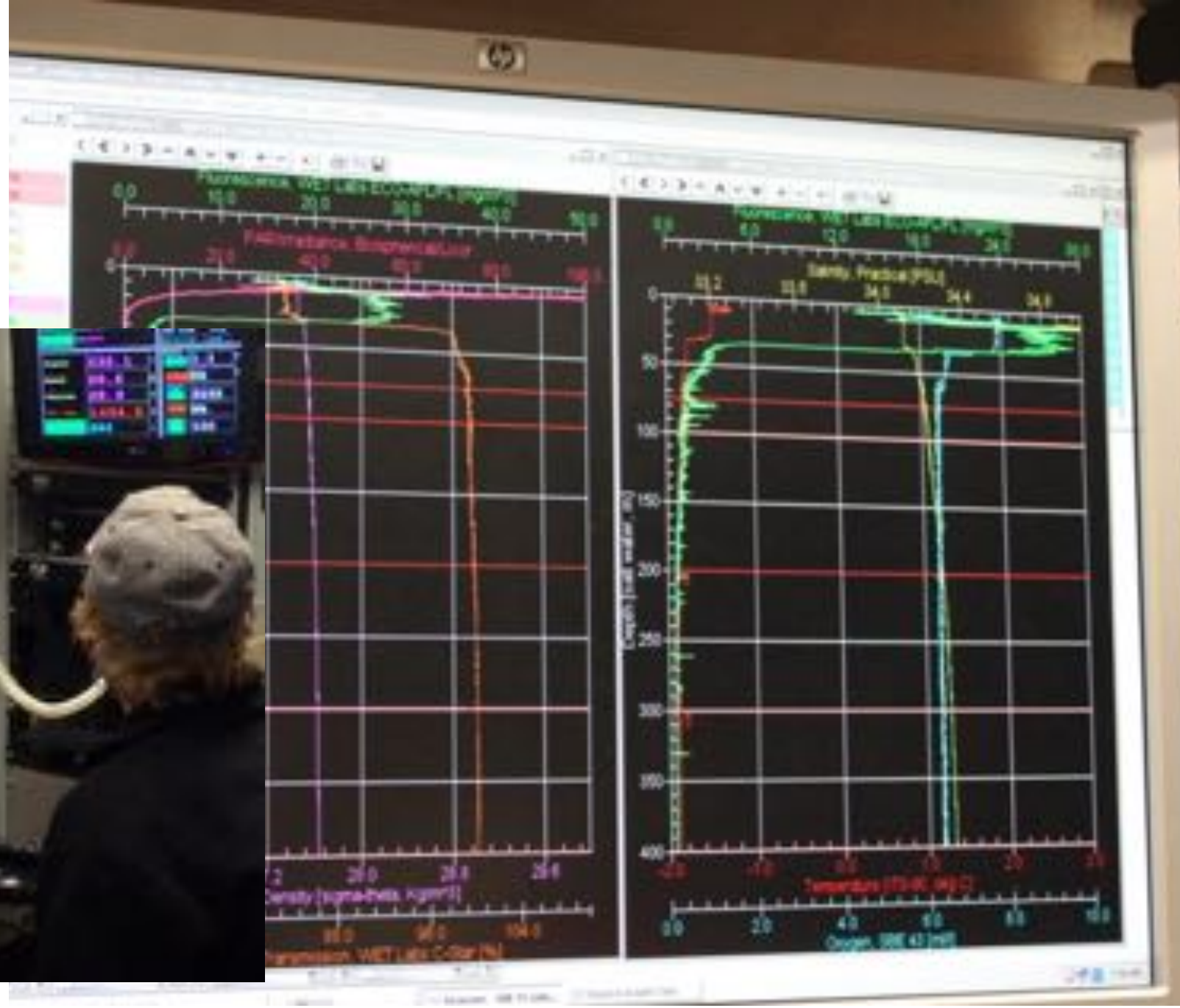
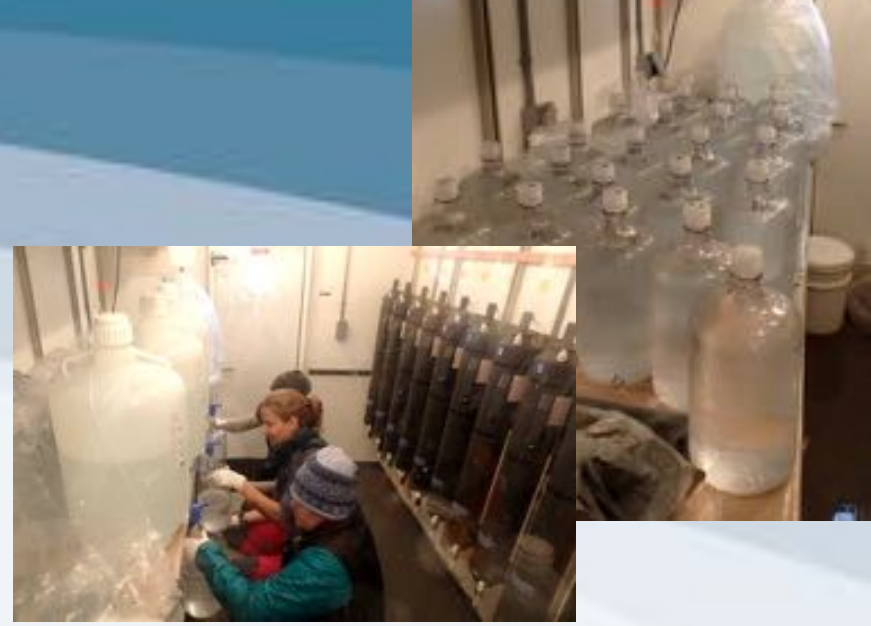


Photo courtesy Dr. Bethany Jenkins, URI

Incubation Experiments

Inside TM Clean Van

50 L Carboy
x3



TM Niskin
x12

Each incubation bottle
filled 1/3 from each carboy

Incubation bottles are ‘spiked’ with a nutrient or a nutrient combination. Bottles are spiked in triplicate.

Transferred to incubation van

Slide courtesy Dr. Dreux Chappell, ODU

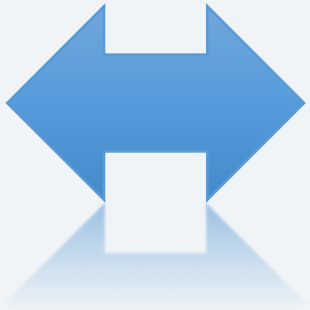
Bottles are stored in the 4C/39F incubation van throughout the 12-day incubation period. Samples are collected from bottles on the first day of sampling as well as days 1, 3, 5, 7, 9 and 12.

Samples are also stored in on-deck flow-through incubators that provide ambient light and temperature to the samples.

Sample Distribution

Chemical

Nutrients
Iron Speciation
Dissolved trace metals
Fe (II)

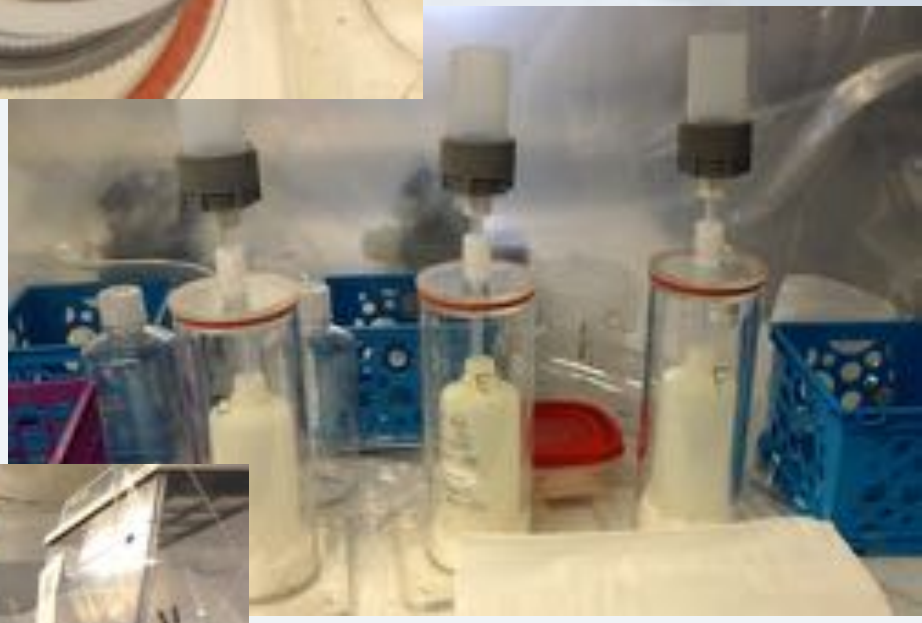


Biological

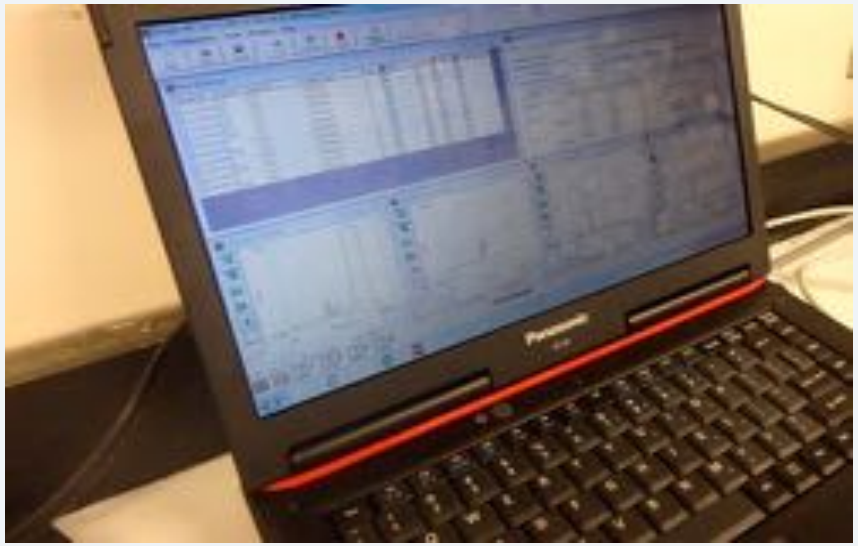
DNA
RNA
Chlorophyll
Florescence Induction Relaxation (FIRe)
Flow Cytometry (FloCyt)
FlowCam
Metatranscriptome

Trace Metal Sampling

- Determine the concentrations and chemical forms of iron and other trace elements
- How water chemistry influences the biology communities and vise versa
- Study how chemistry and biology govern the carbon cycle of water.



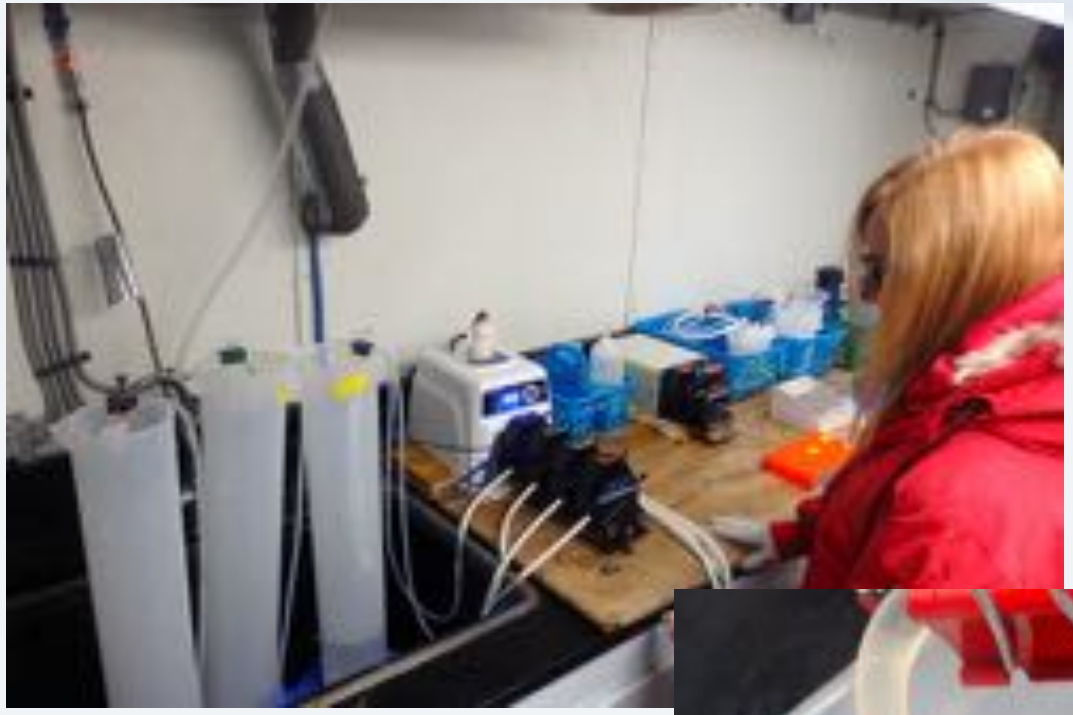
Nutrient Sampling

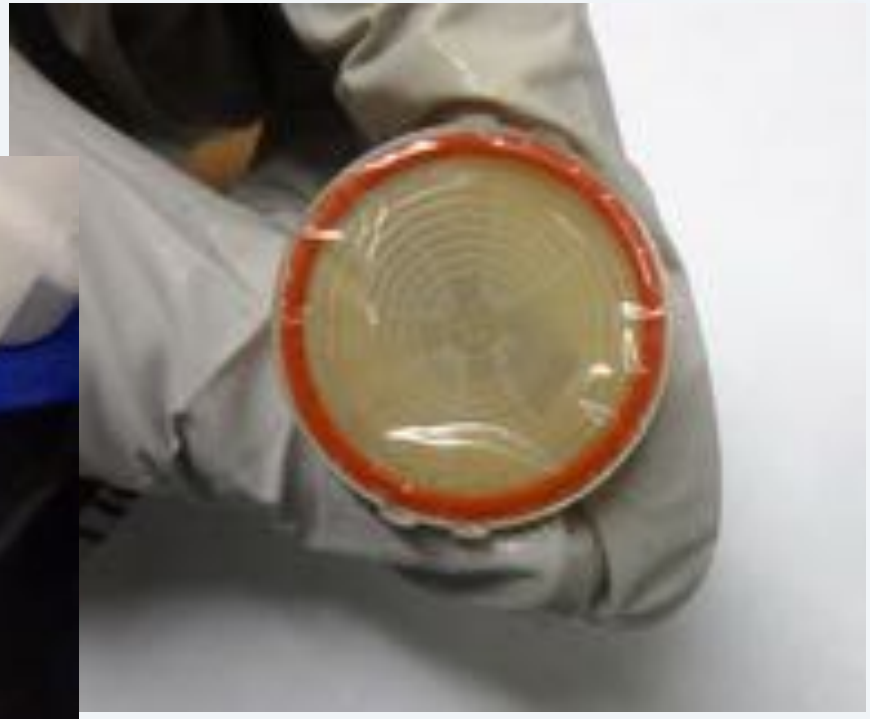


- Testing for concentrations of nitrate, nitrite, ammonium, silicate and phosphate in seawater samples
- Uses a flow injection analyzer (FIA)
- Analyses are done on underway samples and incubation samples

DNA/RNA Sampling

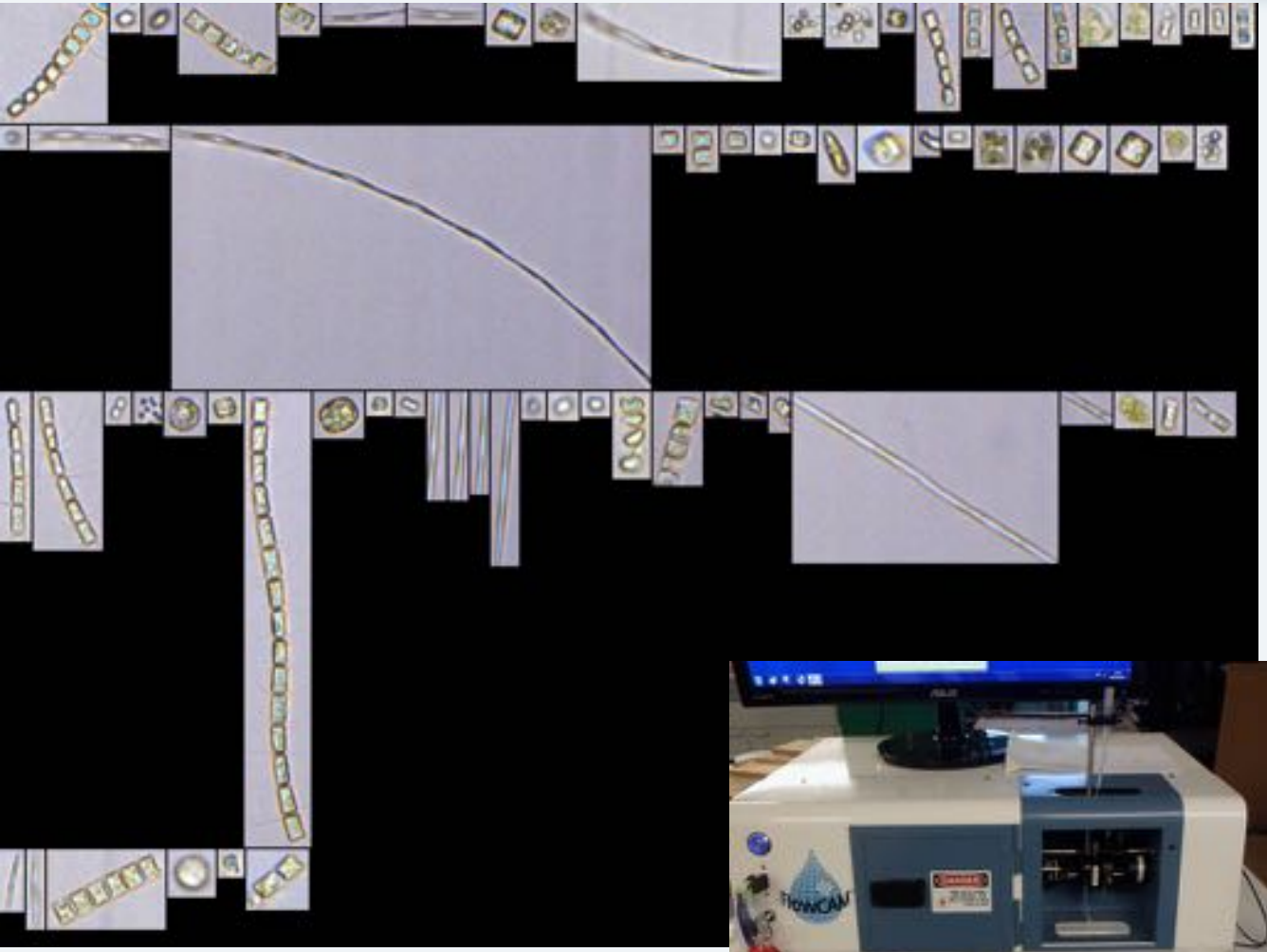
- Uses peristalsis pumps and a filter rig to collect samples of microorganisms
- Filters range in size from .2, 2.2 and 3 microns
- Filters are stored and flash frozen for DNA/RNA analysis after the cruise
- RNA sampling takes place in a cold room called Big Antarctica (4C)

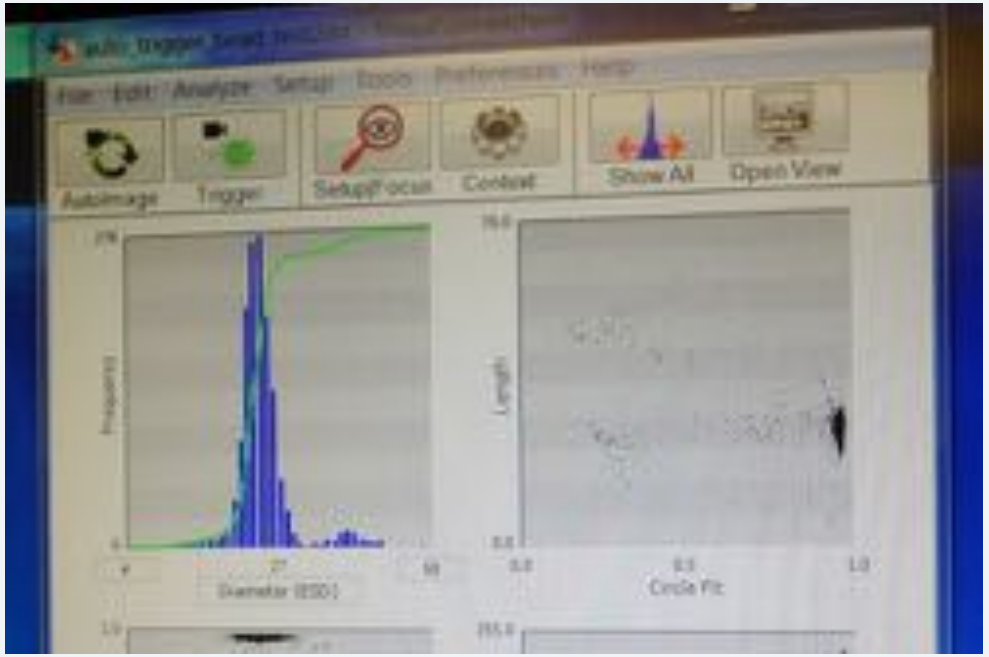




FlowCam Sampling

- Records photographs of microorganisms within a given volume of liquid
- Utilizes different magnifications
- Can help to determine the number of microorganisms in a given sample (compare for growth) and the health of the microorganisms.

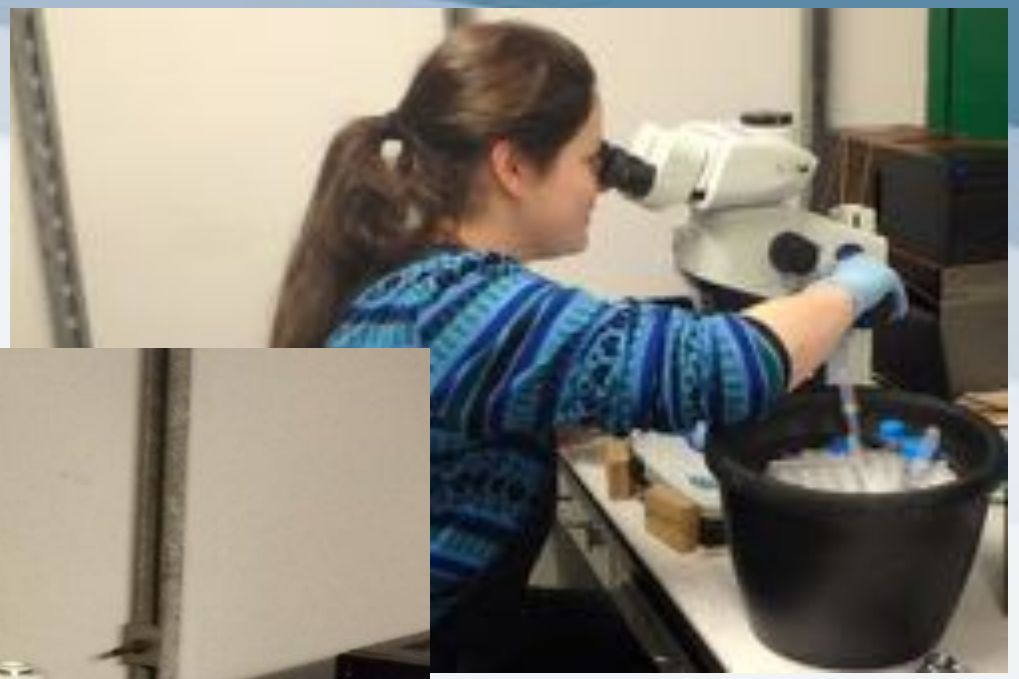


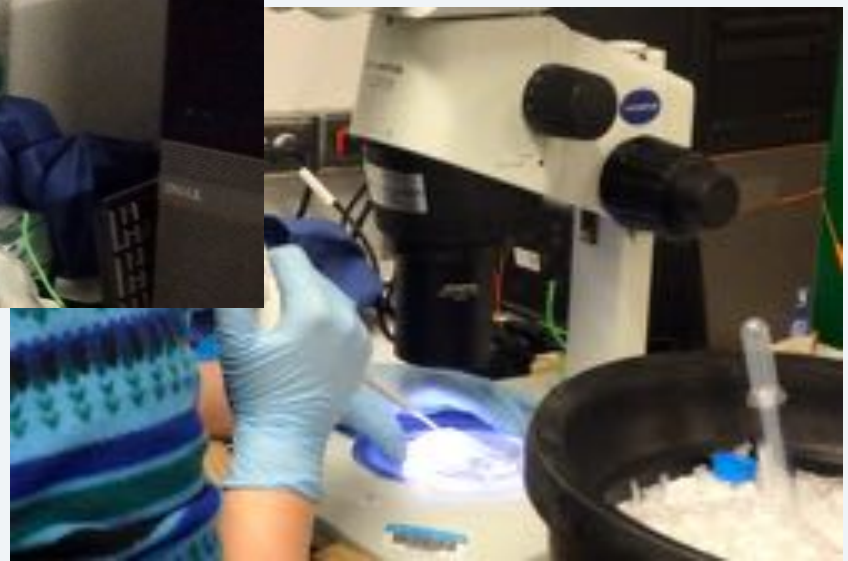


Images courtesy Kris Gomes, URI

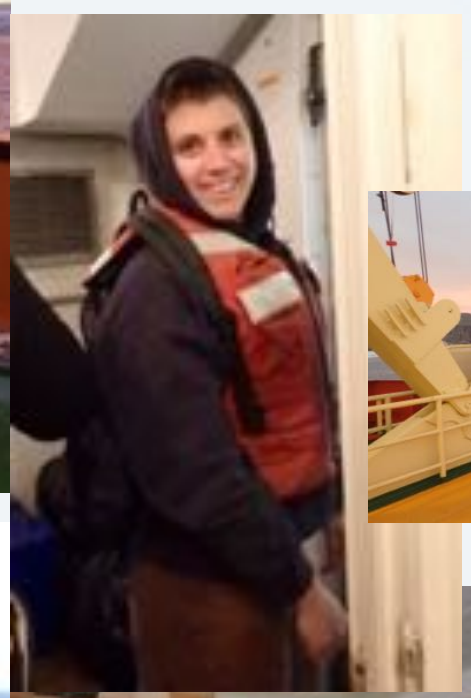
Cell Isolation and Cultures

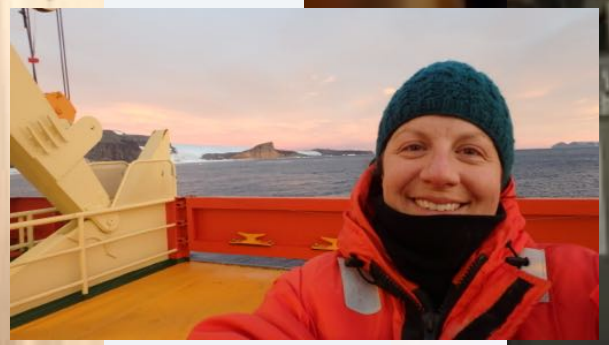
- Used to grow representatives from the Southern Ocean for additional experiments
- Collect representatives from the incubation communities





It’s not all about science….





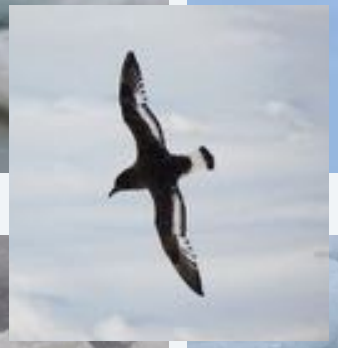


Photo by Zuzanna Abdala, ODU

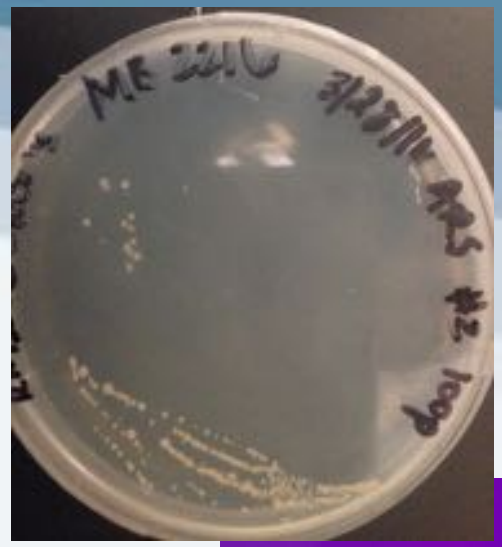
Photo by Zuzanna Abdala, ODU

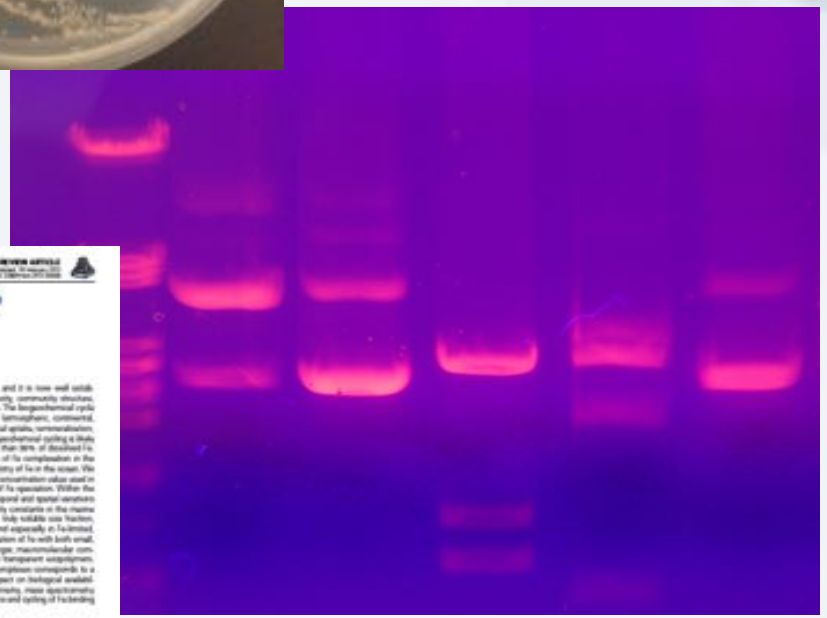
Wildlife list:

-Adelie penguins
-Gentoo penguins
-Leopard seals
-Weddell seals
-Crabeater seals
-Antarctic fur seals
-Minke whale
-Southern fulmar
-Greater shearwater
-Cape petrel
-Antarctic petrel
-Snow petrel
-Southern Giant-petrel
-Antarctic shag
-Wandering albatross
-Kelp gull
-South polar skua
-Slender-billed prions
-Antarctic krill

Post-cruise activities

- Education and community outreach
  - Lesson plans
    - Cell growth & cell isolation
    - Data visualization
    - Composition of phytoplankton communities
    - DNA bar coding (microbiology techniques)
    - Photosynthesis
  - Local presentations
  - NQ student visits to URI
- Scientific
  - Molecular biology analysis
  - Trace metal analysis
  - Cell isolation and culturing
  - Data analysis
  - Publications





Frontiers in MICROBIOLOGY

REVIEW ARTICLE

The organic complexation of iron in the marine environment: a review

THANK YOU!

- National Science Foundation
- ARCUS/PolarTREC
- Quincy Public Schools/North Quincy High School
- University of Rhode Island
- Old Dominion University
- University of South Florida
- USAP, DAMCO, ASC, ECO

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- **Join the Polar Education Email List**
- **Check out the great resources**
- **Become a PolarTREC Teacher or Researcher**
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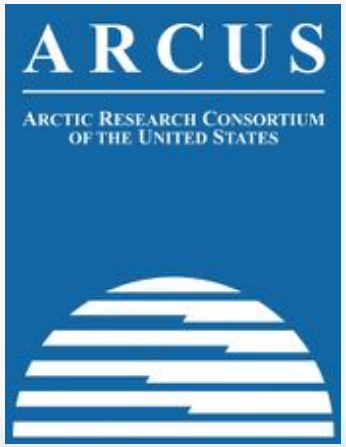
Thank You!

An archive of the event will be available shortly.

http://www.polartrec.com/polar-connect/archive



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