

# **MONITORING UPDATES:**

## **Water Quality**

### **Summer Temperatures**

### **Clam Health**

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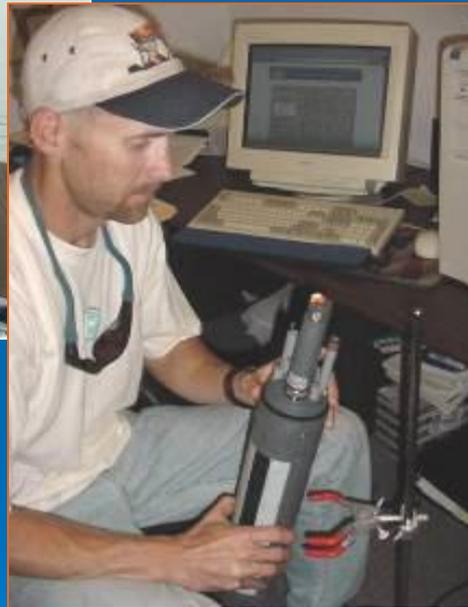
# Water Quality Monitoring Decision Support Tool for Clam Producers

- Collaborative project
  - University of Florida
  - FL Department of Agriculture and Consumer Services
- Partnership with USDA
  - Risk Management Agency
  - Funding renewed for 2010-12
- Allows for continued operation of remote sensing technologies in open-water clam farming

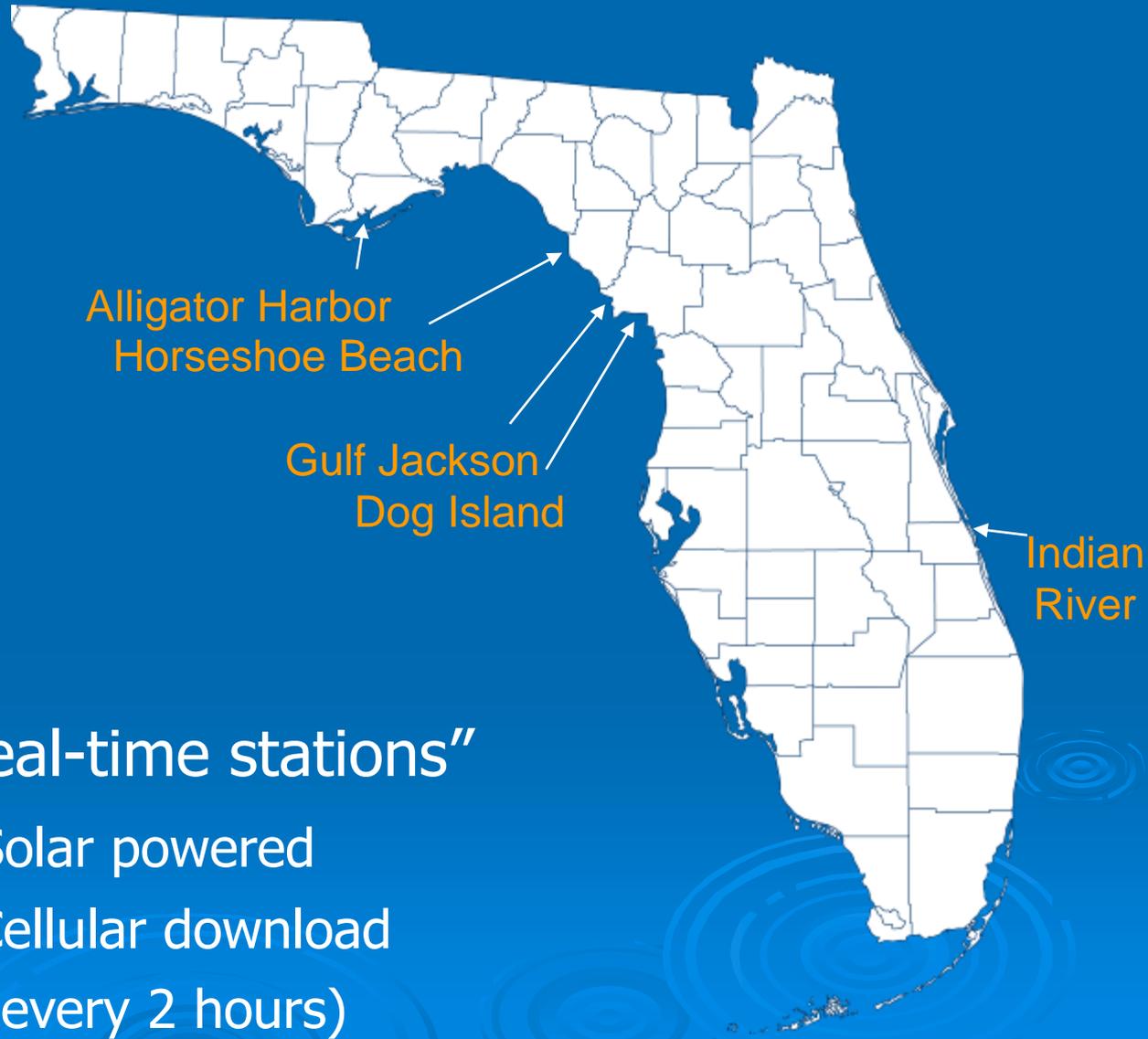


# Monitoring Equipment

- Campbell Scientific Weather Stations
- YSI, Inc. Sondes 6600
- Continuous recording (every 30 minutes)
  - Water temperature
  - Salinity
  - Dissolved oxygen
  - Turbidity and depth
  - Air temperature
  - Wind speed and direction



# Station Locations



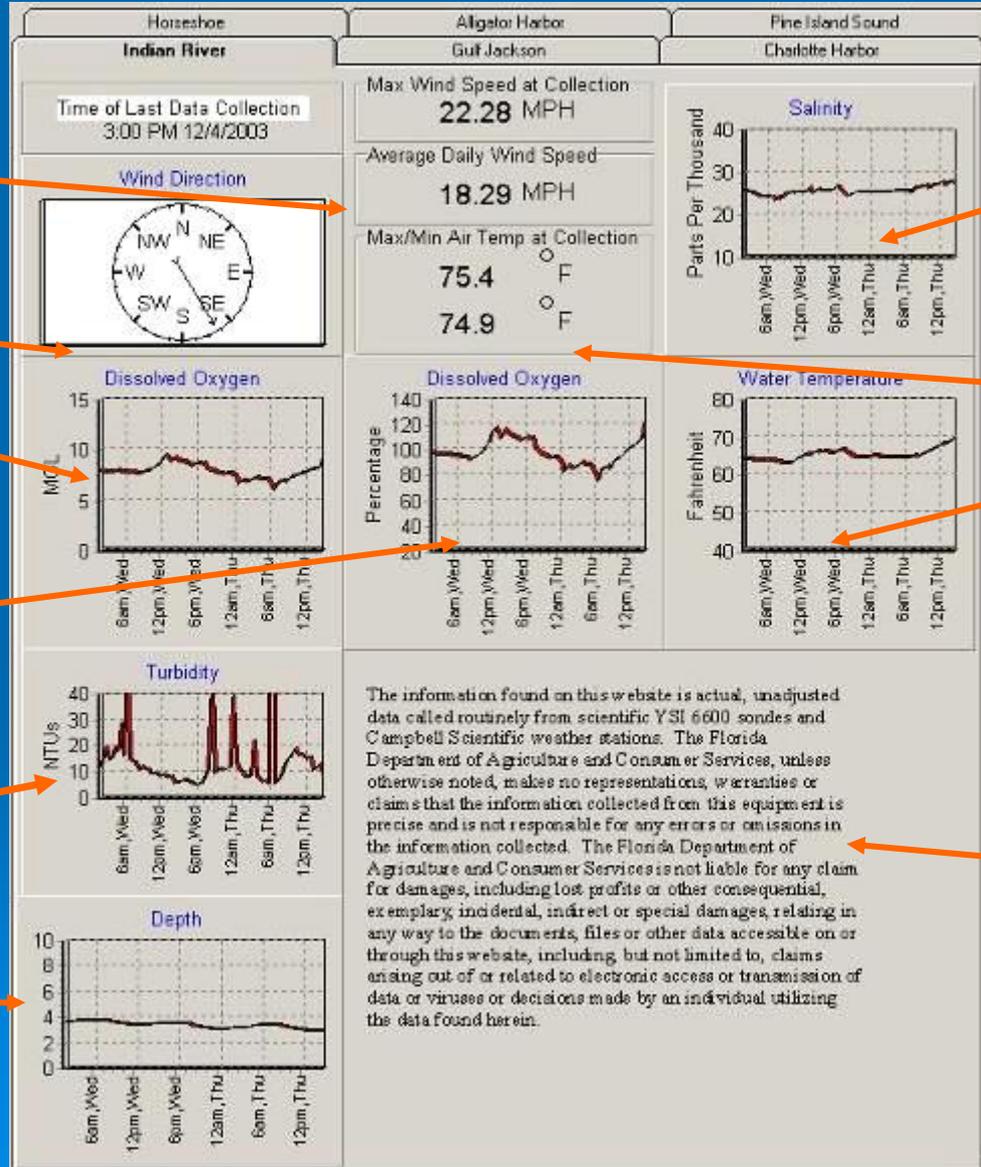
## ➤ “Real-time stations”

- Solar powered
- Cellular download  
(every 2 hours)



# Uncorrected real-time data posted immediately

## www.FloridaAquaculture.com



Wind speed

Wind direction

Dissolved O<sub>2</sub> (mg/L)

% Dissolved O<sub>2</sub>

Turbidity (NTUs)

Depth (feet)

Salinity (ppt)

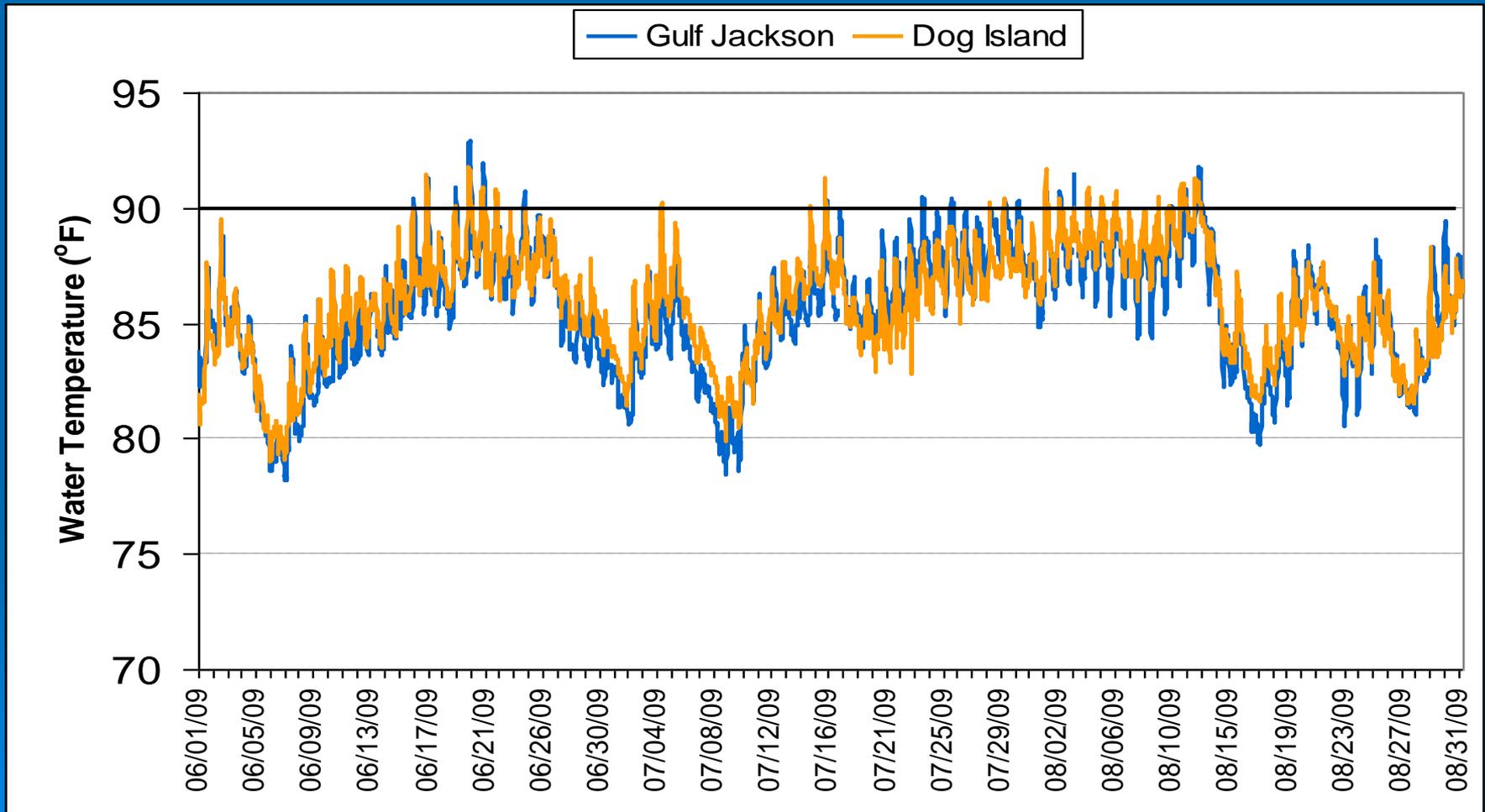
Air temperature

Water temperature (°F)

Disclaimer

# Continuous water quality database

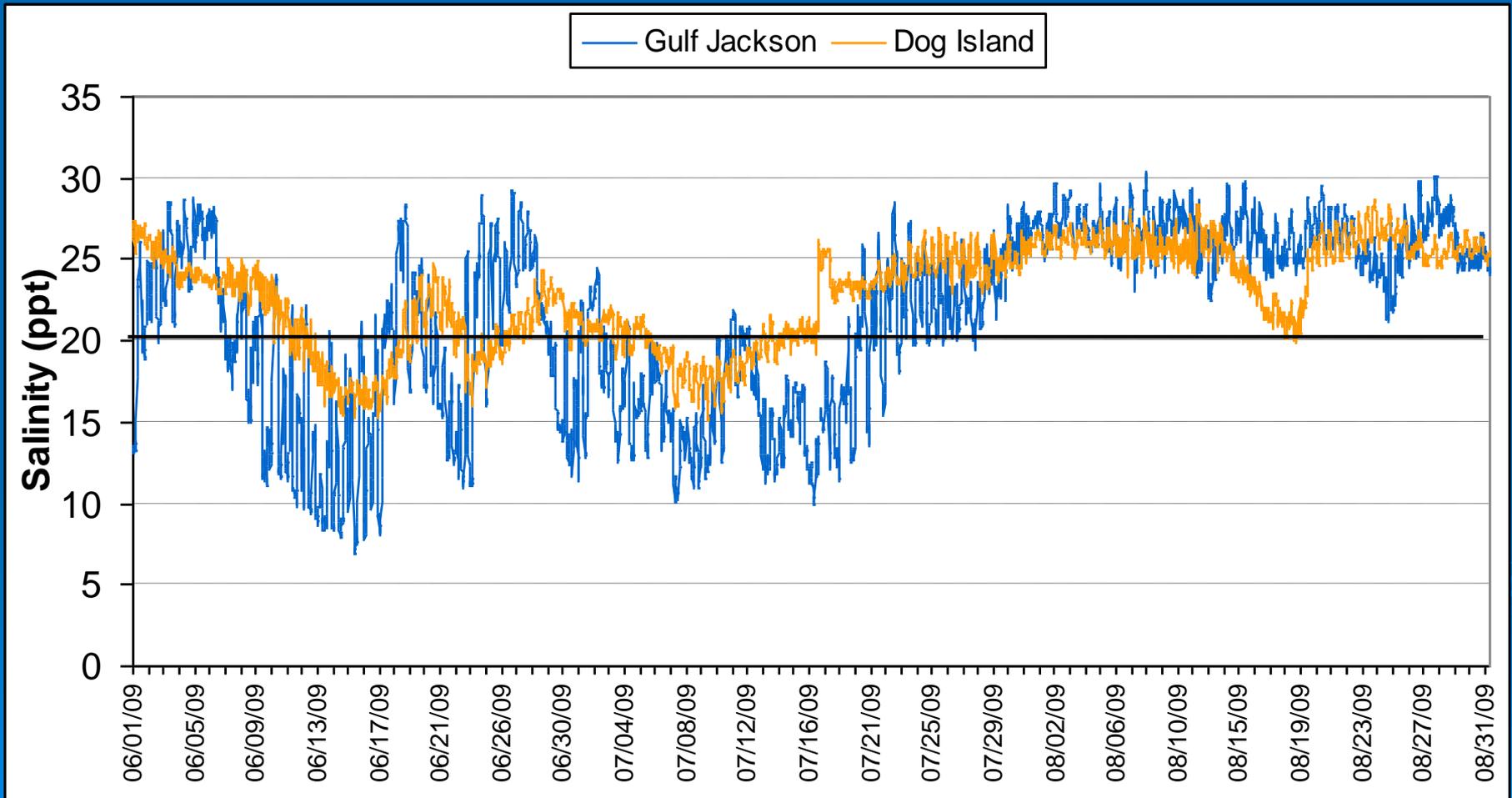
- Archived data provided in “farmer friendly” monthly and annual graphs
  - Details of temporal variability revealed



*Gulf Jackson and Dog Island Lease Areas (Levy County)  
June - August 2009*

# Continuous water quality database

- Trends in environmental conditions in relation to clam production emerging
  - Long-term data set is being developed



*Gulf Jackson and Dog Island Lease Areas (Levy County)  
June - August 2009*

# Water quality fact sheets

available at website: <http://edis.ifas.ufl.edu>  
 FA151, FA152, CIR1500

UNIVERSITY of FLORIDA IFAS Extension edis FA151

## The Role of Water Temperature in Hard Clam Aquaculture<sup>1</sup>

Kerry Weber, Leslie Sturmer, Elise Hoover

### Introduction

This document describes the effects associated with hard clam production in a diversity of terms associated with the culture.

**What is water temperature?**

Temperature is the measurement of thermal energy, and is related to the motion of molecules that make up the material. Many physical properties of materials depend on temperature, and most (liquid or gas), density, and volume. Temperature is one of the many aspects reflected with water quality data because conductivity, pH, and dissolved oxygen concentrations are dependent upon water temperature.

Temperature also plays an important biological role by determining the rate of biochemical reactions. Aquatic organisms have a narrow temperature range in which they function best. Outside this range, organisms do not function as

UNIVERSITY of FLORIDA IFAS Extension edis CIR1500

## The Role of Salinity in Hard Clam Aquaculture<sup>1</sup>

Shirley Baker, Elise Hoover, and Leslie Sturmer<sup>2</sup>

### What is salinity?

Salinity is defined as the total concentration of dissolved salts in a given amount of water. Salinity is expressed in grams per liter or parts per thousand (ppt). Seawater contains about 35 ppt, which is mostly sodium chloride, but about 55% of the ions in seawater are sodium chloride, or ordinary table salt. The other major dissolved ions include sulfate, magnesium, calcium, potassium, and bicarbonate (Table 1). The proportions of the major ions in seawater are nearly constant across geographic regions.

**Table 1. Dissolved ions in seawater**

| ion         | g/L  | % of salinity |
|-------------|------|---------------|
| Chloride    | 19.4 | 56.2          |
| Sulfate     | 10.8 | 30.7          |
| Sodium      | 2.7  | 7.7           |
| Magnesium   | 1.3  | 3.7           |
| Calcium     | 0.4  | 1.1           |
| Potassium   | 0.4  | 1.1           |
| Bicarbonate | 0.1  | 0.3           |

**What is dissolved oxygen?**

Oxygen is a chemical element and a major component (21%) of the air we breathe. This gas is released to the atmosphere by plants during photosynthesis, the process by which light energy and carbon dioxide are converted to food and oxygen (Equation 1). Oxygen is necessary for aerobic respiration in animals, in which energy is released by oxidation of food molecules for use in body maintenance, growth, reproduction, and other activities (Equation 2).

**Equation 1: Photosynthesis**  
 carbon dioxide + water + light → food + oxygen + water

**Equation 2: Aerobic respiration**  
 food + oxygen → water + carbon dioxide + energy

Oxygen is also present in water, where it is called dissolved oxygen. Most aquatic plants produce oxygen, just as most land plants do; most aquatic animals require oxygen, just as most land animals do.

UNIVERSITY of FLORIDA IFAS Extension edis FA152

## The Role of Dissolved Oxygen in Hard Clam Aquaculture<sup>1</sup>

Kerry Weber, Elise Hoover, Leslie Sturmer, and Shirley Baker<sup>2</sup>

### What is Dissolved Oxygen?

Oxygen is a chemical element and a major component (21%) of the air we breathe. This gas is released to the atmosphere by plants during photosynthesis, the process by which light energy and carbon dioxide are converted to food and oxygen (Equation 1). Oxygen is necessary for aerobic respiration in animals, in which energy is released by oxidation of food molecules for use in body maintenance, growth, reproduction, and other activities (Equation 2).

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**How is Dissolved Oxygen Measured?**

Dissolved oxygen can be measured by several methods. Unfortunately, measurement of dissolved oxygen requires special, often expensive, equipment. Winkler titration is the most inexpensive method to determine the amount of dissolved oxygen in water, but it is also the least accurate and most labor intensive. Oxygen electrodes and oxygen optodes (different types of oxygen sensors) are fast and accurate, but they can be expensive.

**Winkler titration**

A water sample is removed from the water body and preserved with chemicals that form a brown precipitate; the amount of precipitate is directly proportional to the volume of dissolved oxygen present. In the next step, a strong acid is used to convert the precipitate to dissolved iodine. Finally, a thiom solution is slowly added until the brown-black iodine color disappears. The concentration of dissolved oxygen can be calculated from the volume of thiom necessary to make all the color disappear.

- How measured
- Why variable
- How affects clam physiology
- What are signs of stress
- How affects clams
- How to manage crop in response to
  - Water temperature
  - Salinity
  - Dissolved oxygen

# Water Temperature Monitoring



- Need to better understand water temperature during summer months and their affect on clam production
- Inexpensive data loggers distributed to participating growers provides detailed and broad coverage

# Water Temperature Monitoring

- Deployed by growers inside bags
  - 17 leases in 2007, 8% coverage
  - 29 leases in 2008, 14% coverage
- Beginning to adequately describe temperature variability within and among high-density lease areas
  - Water depth
  - Bottom configuration
  - Substrate characteristics
  - Tidal and wind current
  - Other parameters
- Develop site-specific planting and harvesting strategies

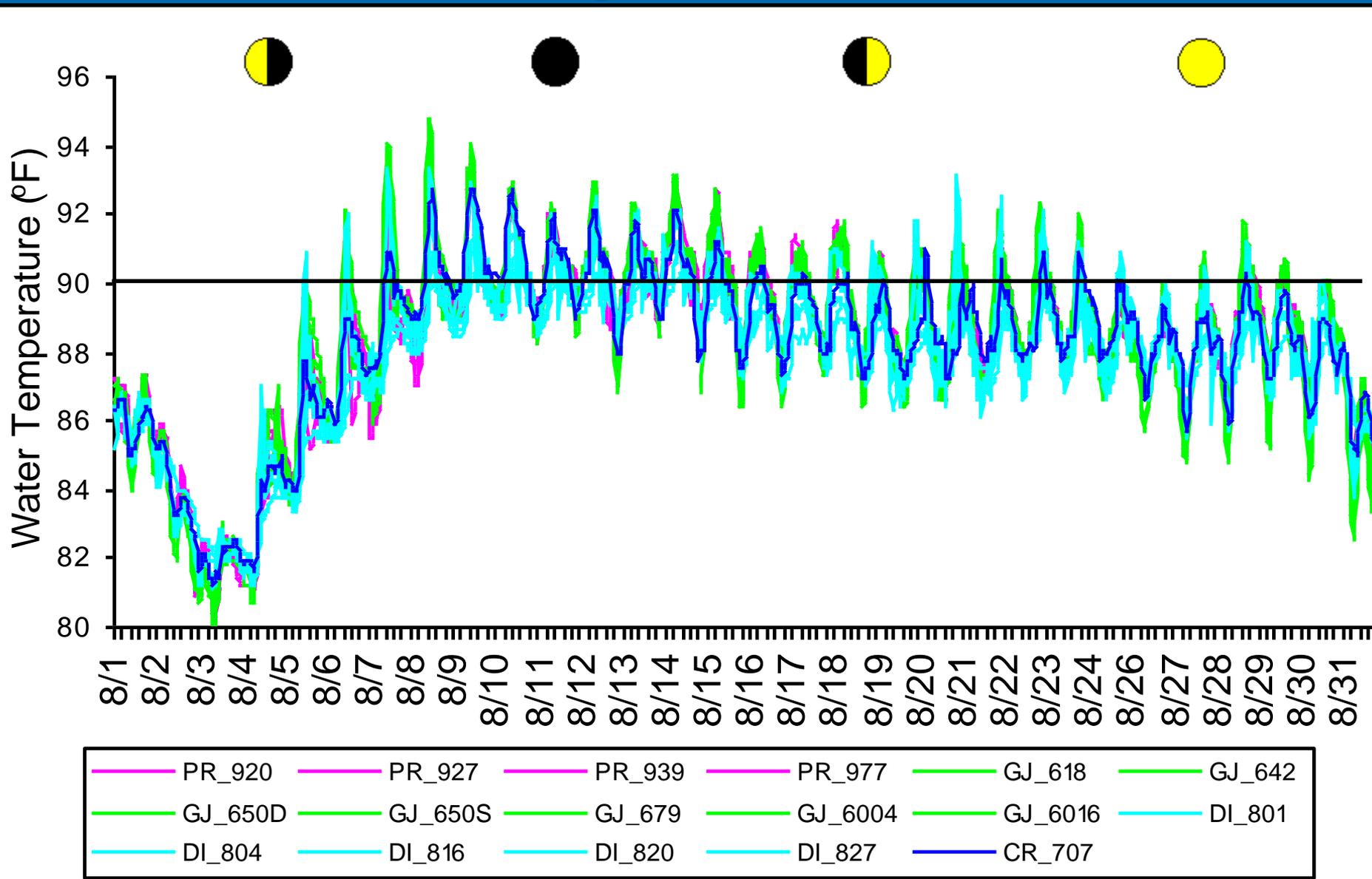


*HOBO® Pendant  
Temperature Data Logger  
(2.3 x 1.3 x 0.9 inches)*



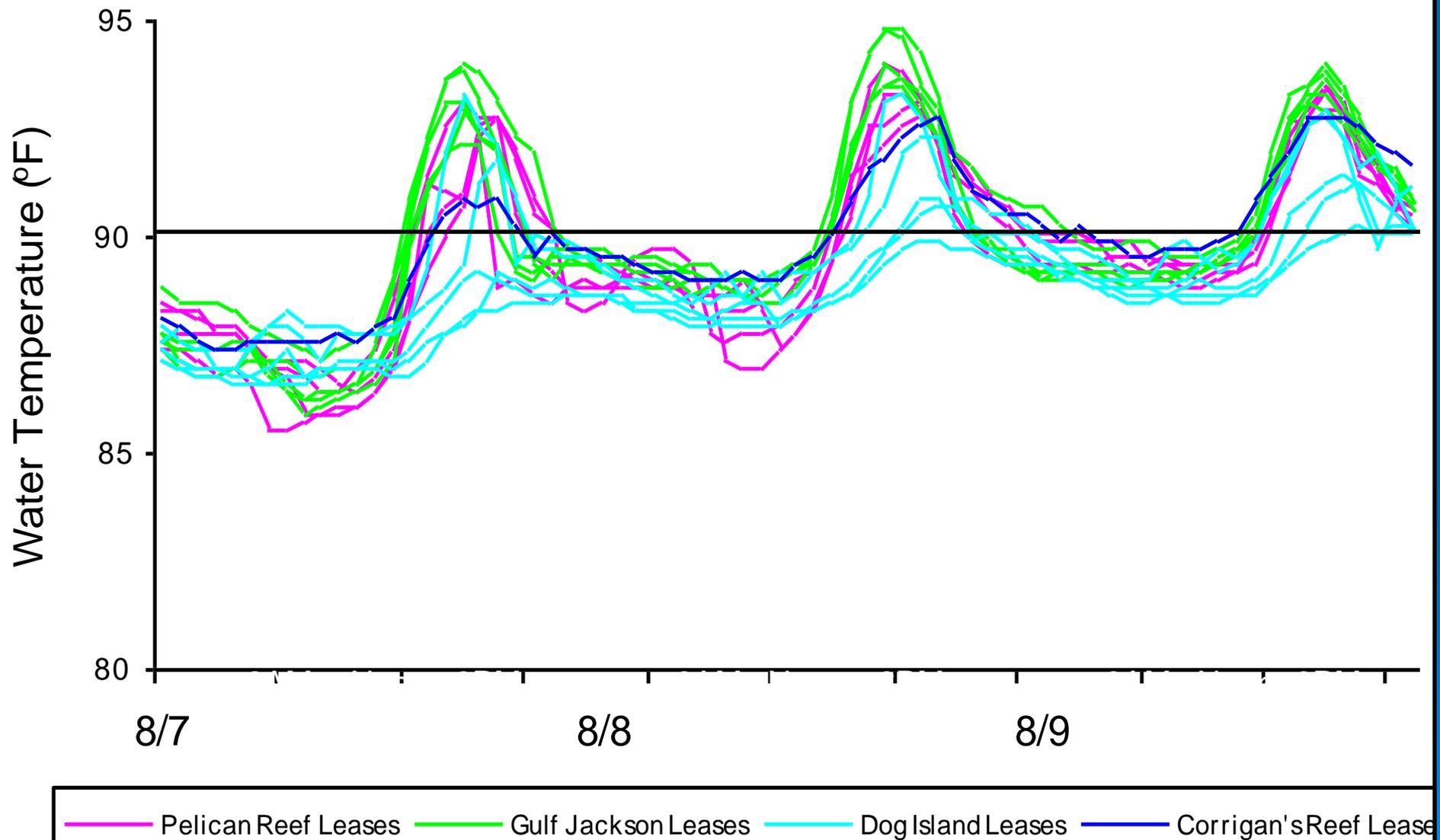


# Cedar Key Leases (n=17) August 2007



# Cedar Key Leases (n=17)

## August 7-9, 2007



# What's going on in 2009-10?

- 39 data loggers deployed in 2009
- Temperature monitoring from May through October 2009 – **RETURN LOGGERS SOON**
- Chlorophyll mapping at selected leases in 2010
  - Provide indication of food quantity
- Hydrogen sulfide monitoring at selected leases in 2010
  - Provide indication of sediment quality

# Clam Health Monitoring

- Program initiated in 2007-8 to examine harvest-size clams during summer at Cedar Key lease areas
- In 2009 samples submitted to UF FAS Diagnostic Lab in response to specific events in June and September
  - Clams examined for obvious lesions
  - Gill biopsy examined under light microscope
  - Two sections of body prepared for routine histologic slides

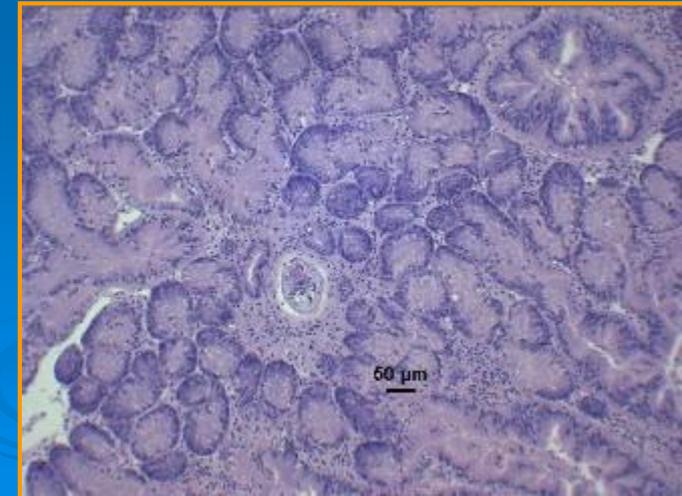
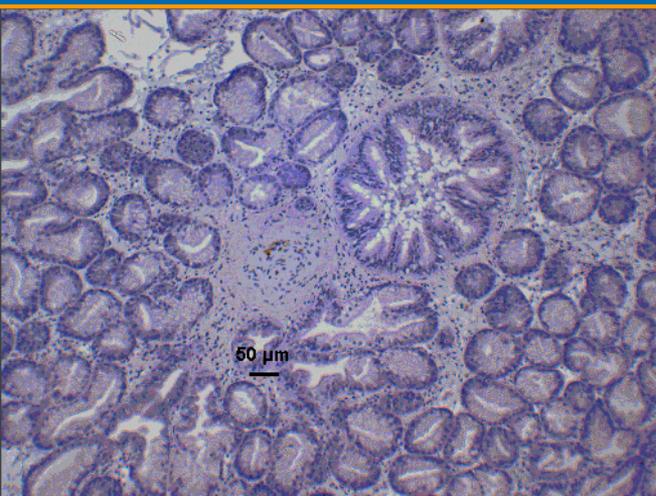


*Dr. Denise Petty, DVM*

# Health Results

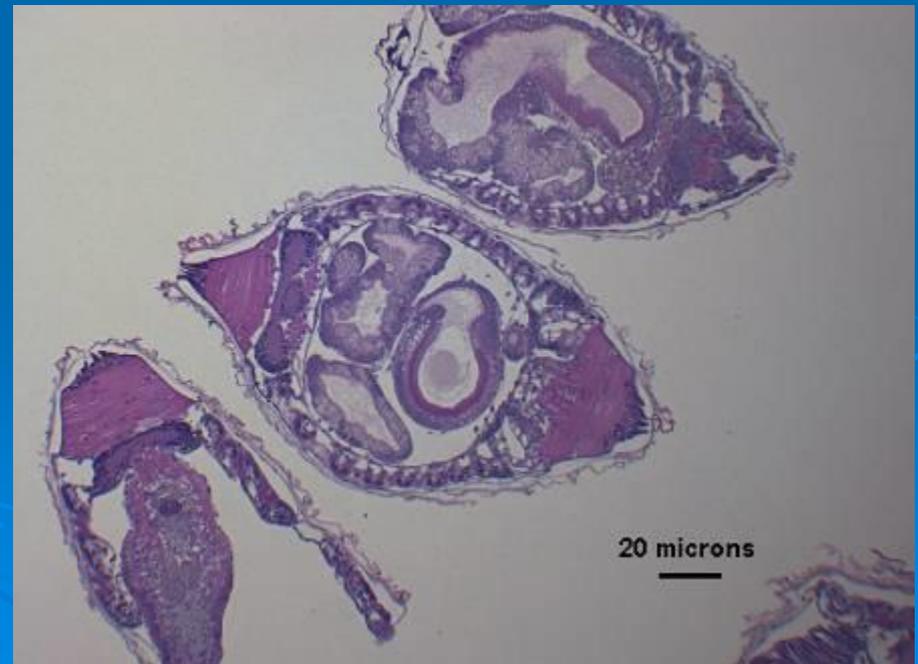
- Copepods observed within mantle cavity
- Gill biopsies – within normal limits
- Histologic results still pending
- So far, no pathogens observed, i.e., QPX
- No problems observed in market size clams examined
- Baseline established

*Leptinogaster major*



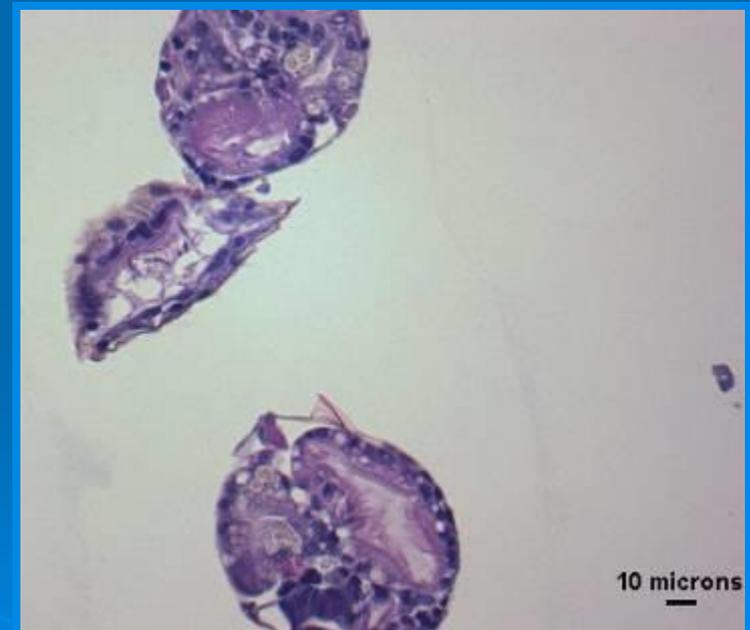
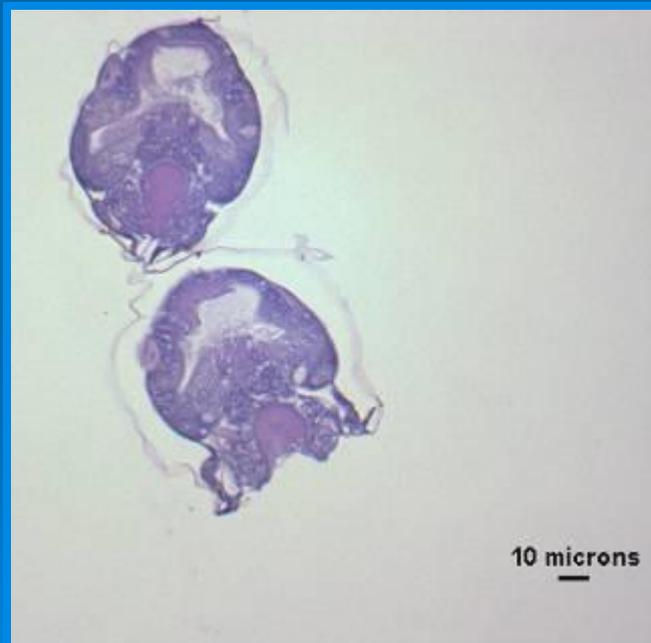
# Clam Seed Health

- Program initiated in 2007-8 to visit Florida hatcheries
- In fall of 2008 “hands-on” laboratory sessions conducted
- Hatchery personnel instructed in
  - Bacterial cultures of algal stocks and seed clams
  - Normal anatomy of seed clams
  - Water quality monitoring
- In 2009 specimens voluntarily submitted for histologic examination and bacterial culture
  - Broodstock
  - Larvae and Seed
  - Algal cultures
  - Source water



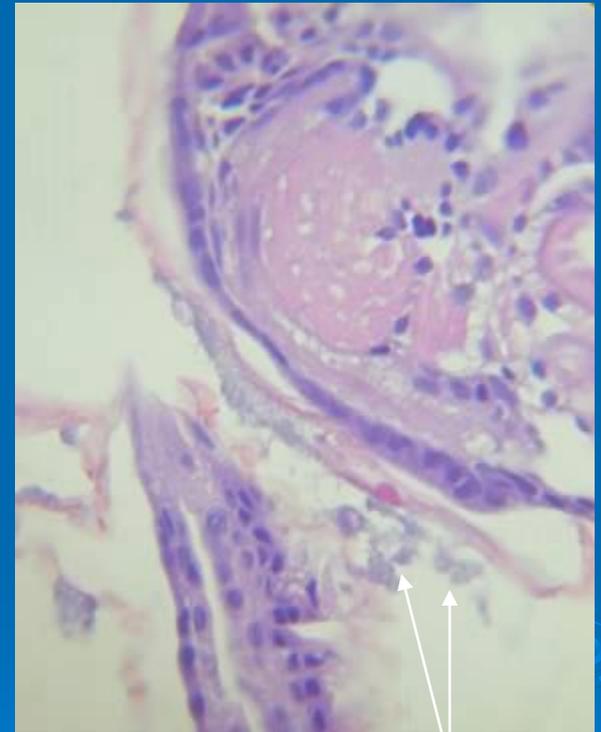
# Hatchery Results

- Most common issue, if any:
  - Bacterial infections of larvae
  - Bacterial and/or ciliate contamination of algal cultures



# Diagnostic Testing

- Testing includes:
  - Water quality parameter analysis
  - Bacterial cultures of algal stocks, water, and larvae
  - Histology of larvae and adult stocks
  - Identification of phytoplankton (Susan Badylak or Mary Cichra)



Bacteria

# Act quickly when mortalities occur!

- Animals should be collected for diagnostic testing as soon as mortality is observed.

Timing is critical!

- The primary problem may resolve before a sample of animals is collected. Often, these animals are the survivors and tests will be negative.
- Many larvae are required to run a variety of tests; be generous.



# Clam health fact sheet

available at <http://edis.ifas.ufl.edu>, FA125

## Introduction to Infectious Diseases in Hard Clams<sup>1</sup>

Shirley Baker, Denise Petty, Ruth Francis-Floyd, Roy Yanong, Leslie Stumer<sup>2</sup>

### Introduction

The aquaculture of hard clams (*Mercenaria mercenaria*) in Florida is a relatively young industry that has grown very rapidly over the past several years. Hard clams have notably few infectious diseases, compared to other bivalve molluscs, and to date no significant problems due to infectious diseases have been observed in cultured clams from Florida waters. There is a growing concern, however, that disease-causing agents may appear as production densities increase. Information provided in this document is intended to familiarize clam growers with common clam diseases.

### Gross Signs of Disease in Hard Clams

Gross signs of infectious disease in juvenile or adult hard clams may go unnoticed because clams are infanual; that is, living buried in the sediment. However, most diseased or stressed individuals will rise to the sediment surface. Additional signs of infectious disease in clams may include: gaping (inability to hold the valves closed); shell deformities or chipping of the shell margin; deposits or blisters

on the inner surfaces of shells; excess mucus production; watery meats; dark, pale, or discolored meats; lesions or ulcers of the mantle, adductor muscle, or foot; or retracted and/or swollen mantle edges. These signs are not necessarily indications of infectious disease; they may also be associated with noninfectious diseases and adverse environmental conditions.

### Types of Clam Diseases and Pests

Pathogens can potentially infect all life stages of hard clams. Organisms of particular concern include QPX (Quahog Parasite Unknown), which has caused significant mortality of cultured clams in northeastern states, and *Perkinsus* spp., an oyster disease which clams are known to carry, though they do not get sick. Other potential pathogens of *M. mercenaria* include common bacteria in the environment, such as *Chlamydiales* and *Rickettsiales*. It should be noted that none of these diseases affect humans.

### QPX

QPX, short for Quahog Parasite Unknown, is the only significant pathogen of hard clams. Significant

- Gross signs of disease in clams
- Types of clam diseases and pests
  - QPX, a "slime-net" protist
  - *Perkinsus* spp. (Dermo)
  - Chlamydiales
  - Rickettsiales
  - Pest metazoans
  - Granulomas
- Significance in Florida