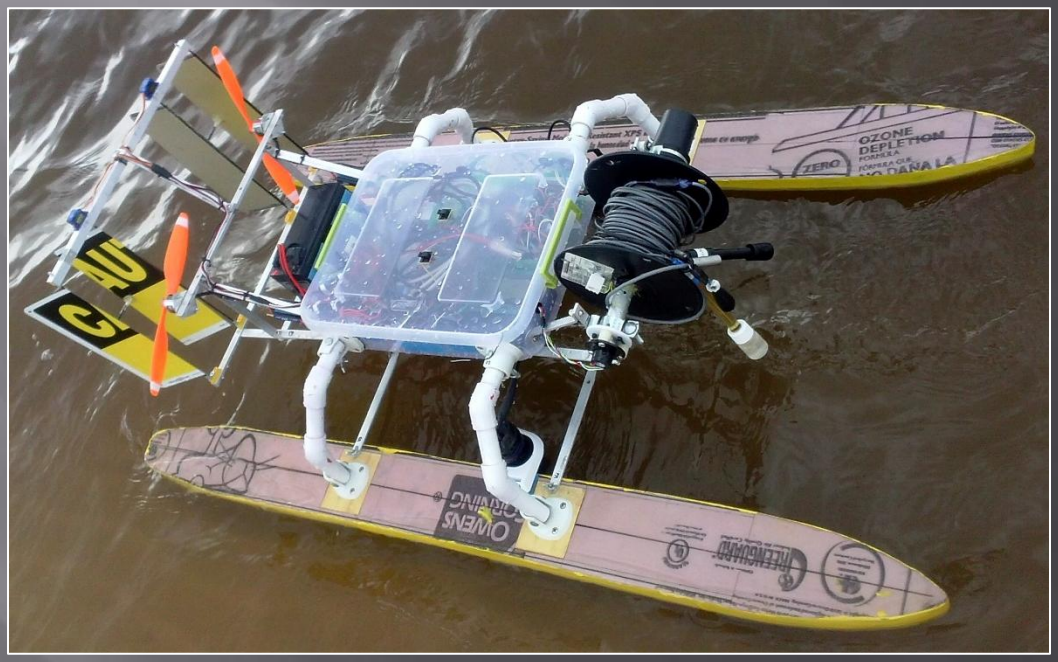
AIRSPACES:

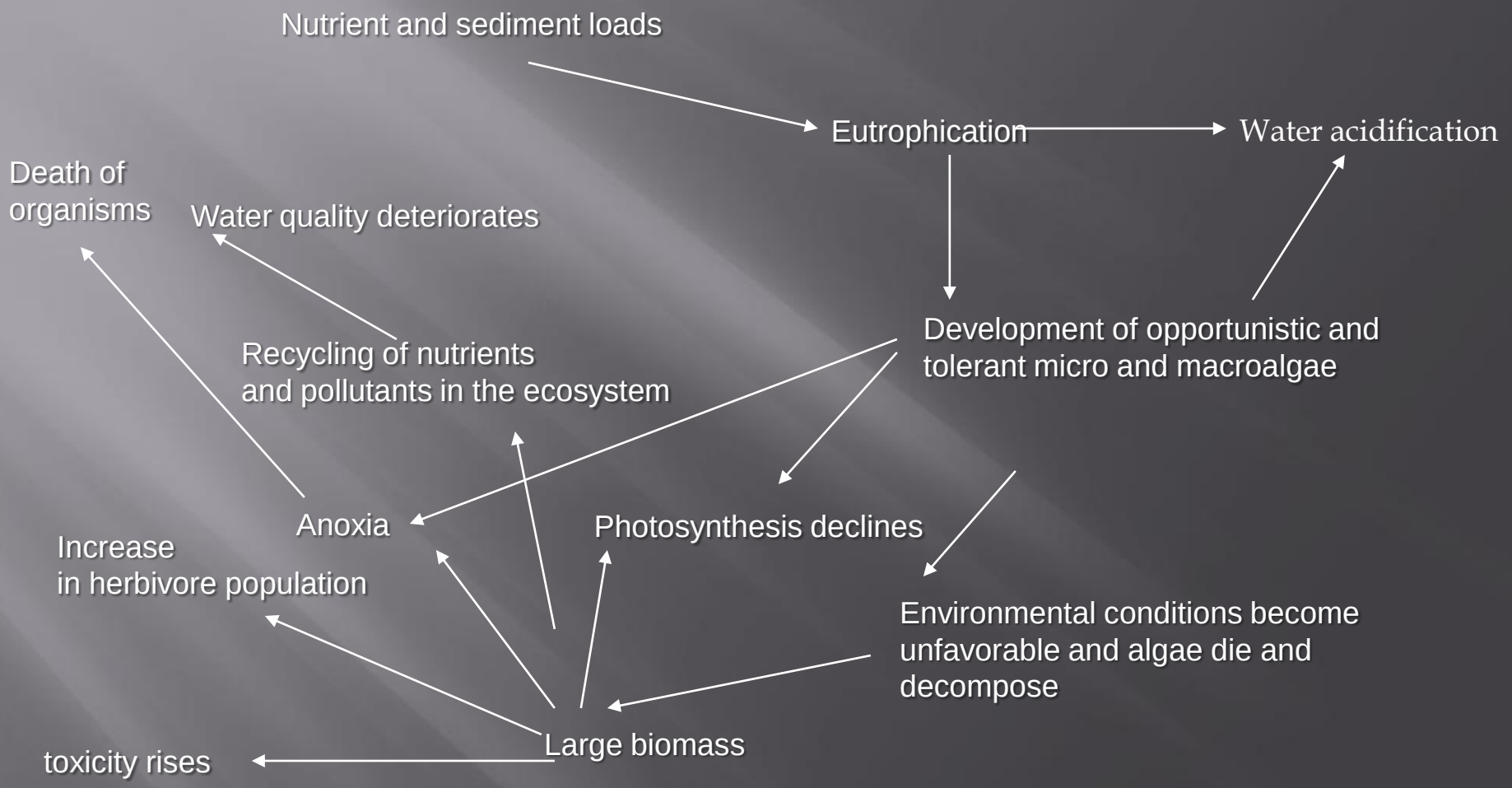
AIR-PROPELLED INSTRUMENTED ROBOTIC SENSORY PLATFORM FOR ASSATEAGUE COASTLINE ENVIRONMENTAL STUDIES



Presenter: Daniel Villalobos

Faculty Advisors: Dr. Mitra and Dr. Nagchaudhuri

THE ECOLOGICAL PROBLEM



Courtesy: Dr. Mitra

NUISANCE ALGAE SPECIES

Dead man's finger (green)
Codium fragile

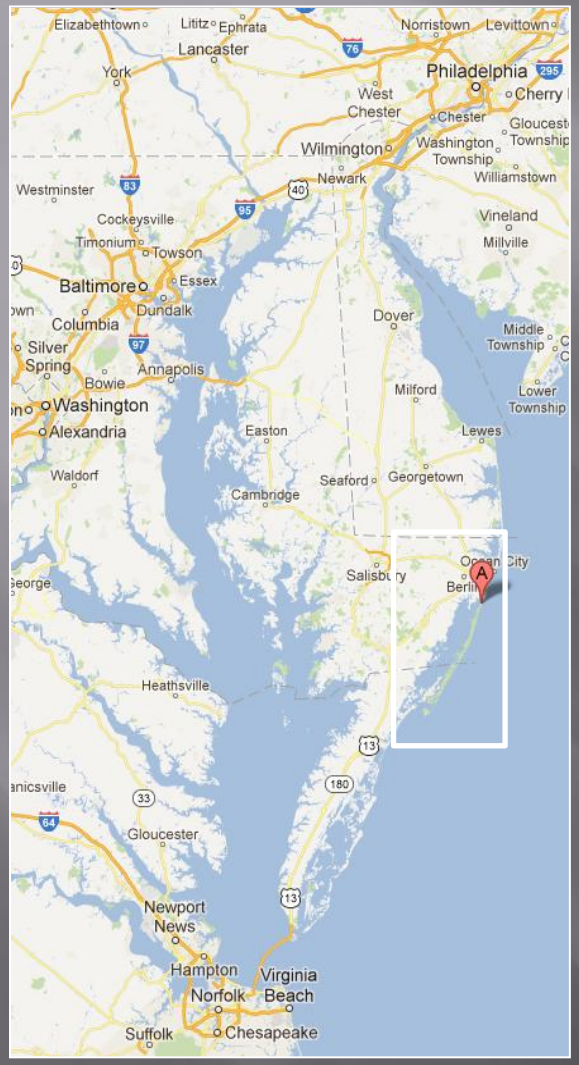
Sea Lettuce (green)
Ulva lactuca

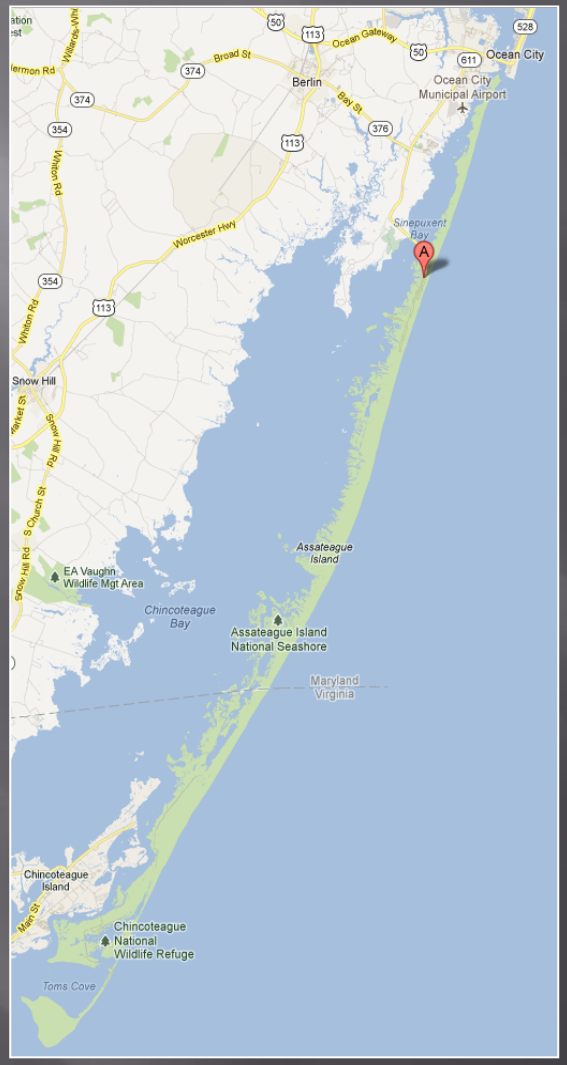
Gracilaria (red)
Gracilaria tikvahiae

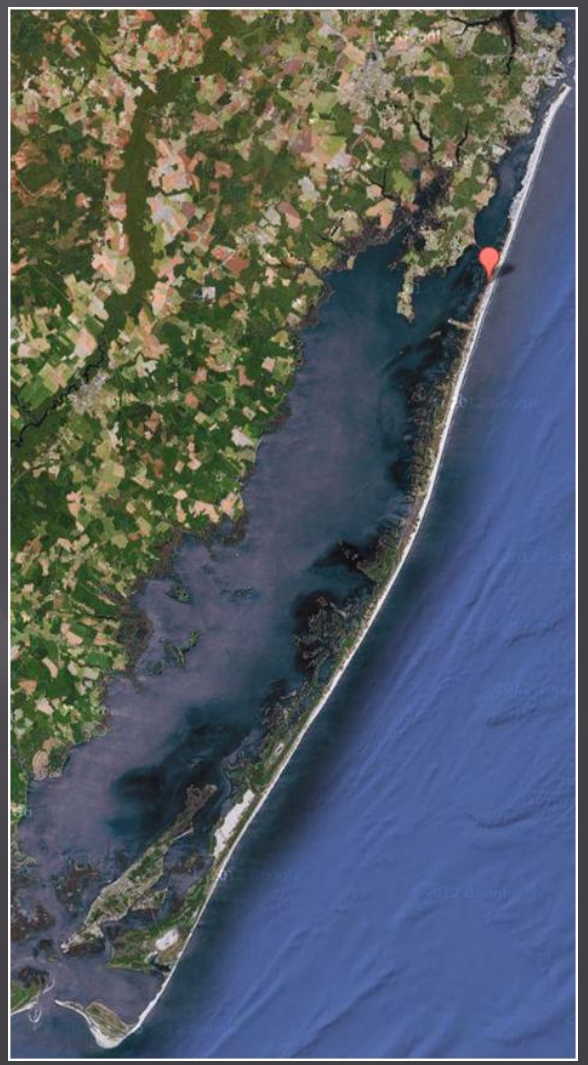
Fucus (brown)
Fucus vesiculosus

Photos: Dr. Mitra's Lab

ASSATEAGUE COASTAL BAY







ASSATEAGUE COASTAL BAY







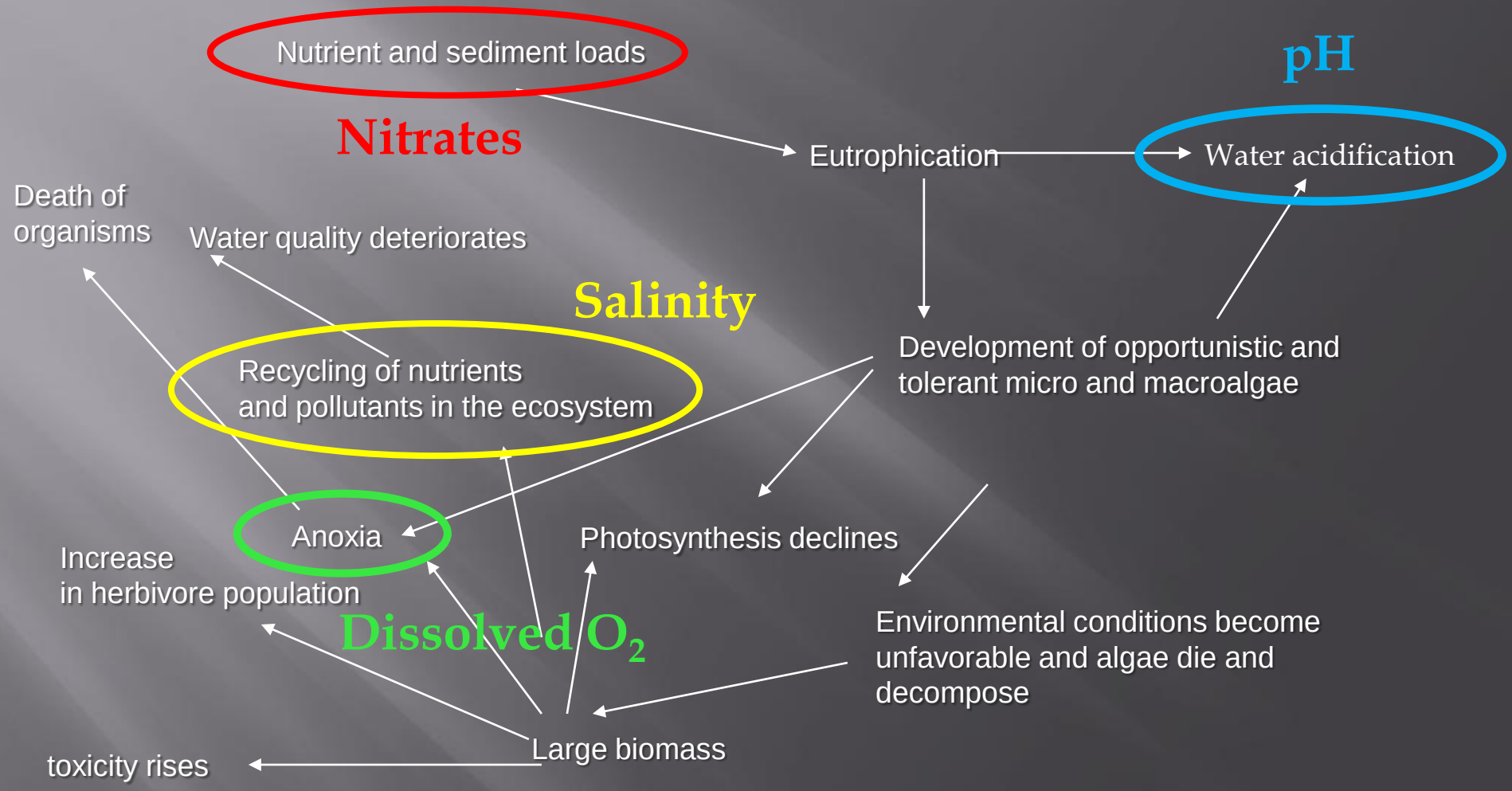


OBJECTIVES OF THE STUDY

- To design and implement an autonomous vehicle capable of recording data for further environmental study

- To implement in-situ water quality sensors on the platform for taking measurements from the Assateague Bay including:
  - pH
  - Salinity
  - Dissolved Oxygen
  - Nitrates

THE ECOLOGICAL PROBLEM



Courtesy: Dr. Mitra

CAUTION:

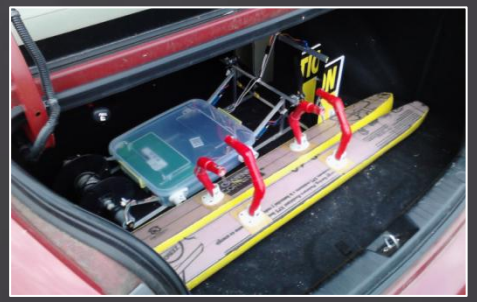
CATAMARAN-TYPE AUTONOMOUS UNDERWATER-SENSING TWIN-PROPPED INSTRUMENTED OCEAN NAVIGATOR

CAUTION
MECHANICAL PLATFORM

- Composite Fiberglass Reinforced Twin Hulls
  - Extruded PolyStyrene (Pink Foam)
  - Birch Plywood
- Metal "Caution" Sign Air Rudders
- Aluminum Flat Support Structure
- Plastic Tupperware Electronic housing
- Separable CPVC Pipe Support Arms

- Designed for portability & durability
  - Total operational weight: 18 lbs
  - Assembled Dimensions (lxwxh): 4′ x 2.2′ x 1.7′
  - Can support up to 30lbs of weight
  - Can quickly be assembled and broken down for transport

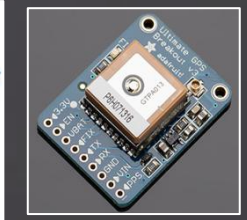
- Designed for use in multiple environments
  - Air Propelled
  - Replaceable Hulls

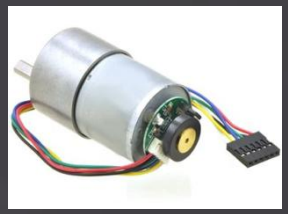


CAUTION
ELECTRICAL COMPONENTS

- Propulsion:
  - 2 Brushless Motors & reversible ESCs drive propellers
  - 2 Servos control air rudders
- Navigation/Control System:
  - Arduino Mega & Uno microcontrollers
  - GPS, compass, and microSD card shields
  - Turnigy 6-Channel 2.4 GHz Receiver & Transmitter
  - 3g/4g USB modem, Router, and Arduino Ethernet Shield
- Sensory System:
  - Water Quality: Nitrates, Salinity, Dissolved O2, and pH
  - Winch: NMEA Depth Transducer, DC motor with encoder
- Power System:
  - 1 12V 8Ah SLA Battery
  - 1 Battery Eliminator Circuit (BEC): 12V to 5V

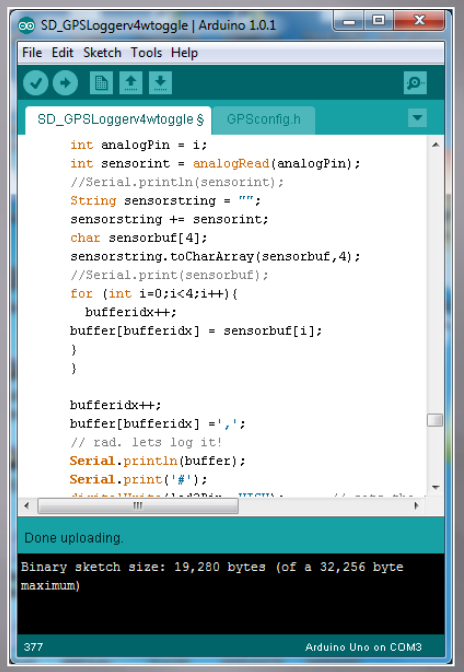






DATA COLLECTION

Arduino IDE



Real Time Feedback

Raw Arduino Data

Clipboard | Font | Paragraph | Insert | Editing

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Transducer: Depth & Temp.  Sensors 1, 2, 3        GPS: Date, time, Latitude, Longitude, Speed

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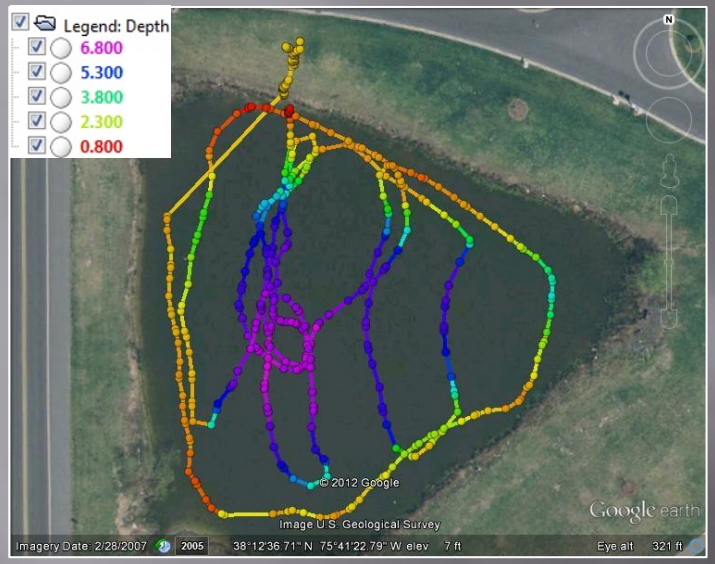
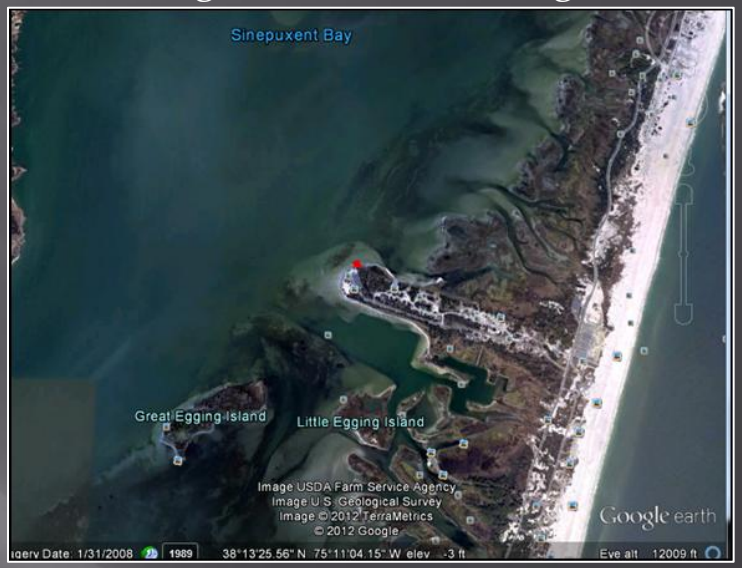
DATA COLLECTION

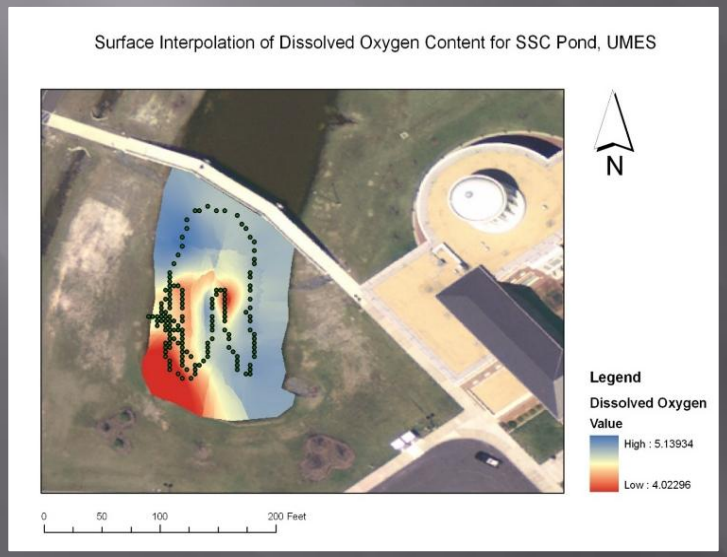
GPS & Depth Data – UMES Pond 1



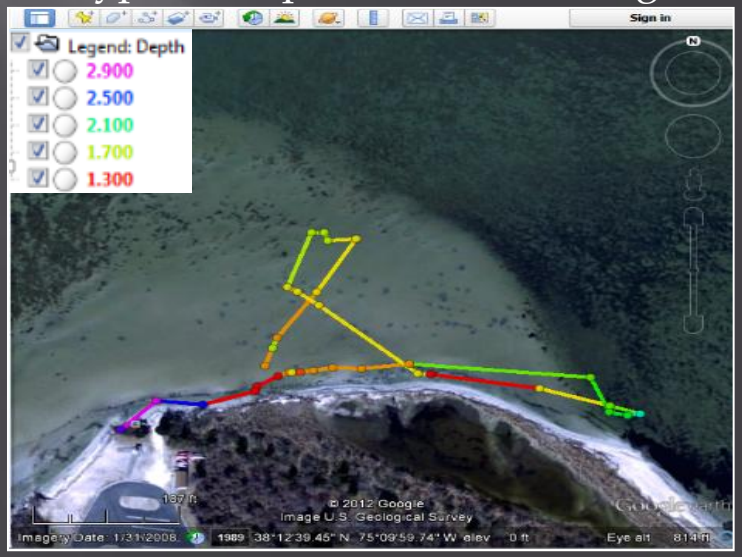
Google Earth – Assateague



Dissolved Oxygen – UMES Pond 2



Waypoint Depth Data – Assateague



WHY WE NEED CAUTION

- Manned boat not required
- Greater accessibility in the field
- Increased coverage area
- Potential cost savings
- Ease of use

Images: Stockton College MSEFS

- Supplemental uses:
  - Classroom Instruction for all age groups
  - Water quality measurement of other bays and water bodies
  - Assisting efforts by organizations such as the Assateague Coastal Trust which are involved in the protection of the waterways of the Delmarva Peninsula
  - Community awareness of the environmental state of the bay

ASSATEAGUE COASTAL TRUST
ACT FOR BAYS.ORG

Keep the bay fishable and swimmable!

ACKNOWLEDGEMENTS

Maryland Space Grant Consortium

UMES:

- Dr. Madhumi Mitra
- Dr. Abhijit Nagchaudhuri
- UMES Students

NASA Collaborators:

- Geoff Bland
- Ted Miles

UMCP:

- Dr. Mary Bowden
- Dr. David Akin

QUESTIONS

"Gone out for more data!"