

# Establishing A Baseline Map of Submerged Aquatic Vegetation for Coastal North Carolina

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and Habitat Research

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# Partnership History

- U.S. Fish & Wildlife Service Region 5 grant application (Summer 2001)
- First aerial surveys (Autumn 2003)
- APNEP coordinating lead (Summer 2004)
- Expansion of objectives (Winter 2006)
- SAV Memorandum of Understanding (Autumn 2006)

# SAV Partnership

- Federal: ACE, FWS, NOAA, NPS, NRCS
- Mixed: APNEP, NERR
- State: DCM, DMF, DWQ, DWR, EEP, WRC, DOT
- Academia: ECSU, ECU, NCSU, UNC-CSI, UNC-IMS, UNC-W, NC Sea Grant, DUMML, CW&M-VIMS
- NGOs: NCCF, TNC

# Partnership Objectives

- Monitoring and Mapping
- Assessment and Restoration
- Policy and Outreach

# Monitoring and Mapping Objective

Monitor and map the distribution and abundance of Submerged Aquatic Vegetation (SAV) in North Carolina's and southeastern Virginia's estuarine and coastal waters. The network will cover the waters from Back Bay, VA, to the NC/SC boundary.

# Initial Monitoring Strategy

- Monitor and map SAV's from Back Bay, VA /Currituck Sound, NC to Kitty Hawk Bay, NC
  - Task 1. Obtain color aerial photography at 1" = 2000' scale (1:24,000) minimum with flight lines that have 60% forward and 30% side overlap
  - Task 2. Interpret aerial photography to delineate SAV's, includes ground truthing and identification of species present
  - Task 3. Produce digital maps of SAV for the Phase 1 Area, make available (web based) to all cooperators, and other users
- Develop a schedule for implementing SAV monitoring in the remaining areas.

# Monitoring Strategy II

- The initial objective is to monitor any portion of the region no less frequently than every four years, a shorter cycle when funding allows.
  - Task 1. Delineate flight lines needed to cover the remaining areas and associated costs for aerial photography
  - Task 2. Delineate the next regions (phases) to be monitored for SAV
  - Task 3. Obtain additional partners to support and use the collected information
  - Task 4. Obtain funds and develop an implementation schedule for monitoring

# Monitoring Strategies III & IV

- “Institutionalize” SAV monitoring within State Government to insure it becomes an adequately funded, long-term, operational monitoring program
- Plan and implement strategically placed ground truth areas to be monitored yearly throughout the network
  - Develop a program to certify local individuals (or groups) to gather qualitative data yearly at the ground truth stations



# Pre-2007 Aerial Monitoring Activities

- Back Bay & Currituck Sound (Phase I)
  - Monitored October 2003
  - Mapped 2006
- Pea Island NWR
  - Monitored June 2004
  - Mapped 2007-2008?
- Southeastern Albemarle Sound
  - Monitored July 2005
  - Mapped 2006
- Bogue & Core Sounds
  - Monitored June 2006 (70%)
  - Mapped 2008?

# 2007 Monitoring Activities

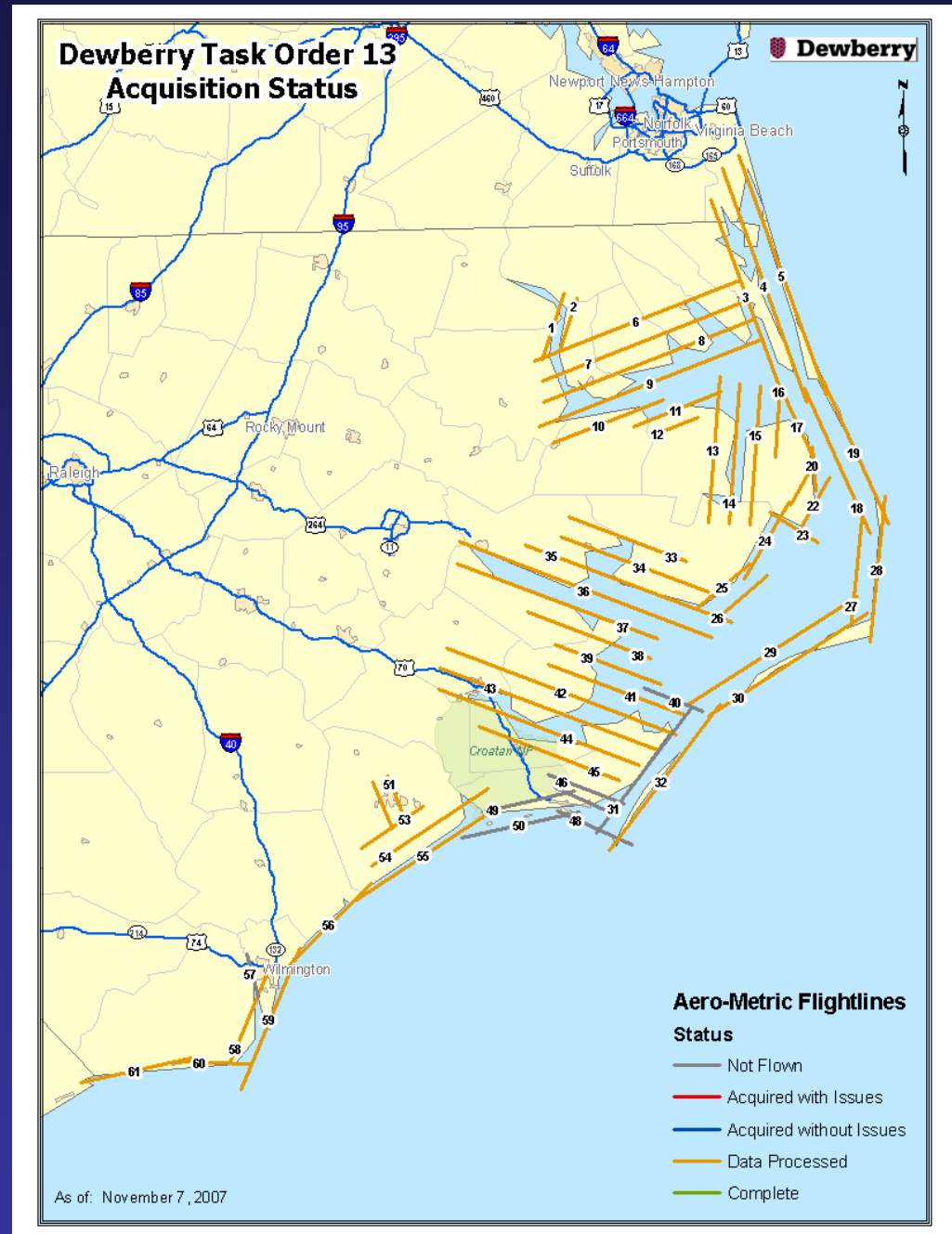
- Resources: APNEP, FWS, DMF
  - NOAA IDIQ Contract Mechanism
- Flights: Aerometric, Dewberry
- Water Clarity Volunteer Network
  - 25 citizens: secchi depth
- Ground Truth Network

# Aerial Monitoring Phases

- Image acquisition: Zeiss Digital Mapping Camera System
  - 24K feet above mean terrain (1" = 5,080')
  - Sub-meter raw native pixel resolution
  - Sun angle 25-45, wind < 10 mph, low tide (polyhaline)
- Photogrammetric control coordination: airborne GPS + ground-based GPS receivers
- Softcopy aero-triangulation
- Digital imagery orthorectification using DEMs

# Autumn 2007 Aerial Monitoring

- 1,795.45 flight line miles targeted
- Oligohaline waters priority
- 1,637.71 flight line miles captured (91.2%)



# Ground Truth Network: Autumn 2007

- 98% of 1,494 field points ground-truthed
  - 650 polyhaline/mesohaline points
  - 85 mesohaline points
  - 759 oligohaline points
- Field points allocated into 67 areas
  - 82% of areas monitored by DMF staff
  - 6% of areas monitored by ECU staff
  - 4.5% of areas monitored by DWQ Rapid Response staff
  - 3% of areas monitored by DOT Biological staff
  - NERR, WRC-Edenton, FWS-Back Bay, DCM one area each

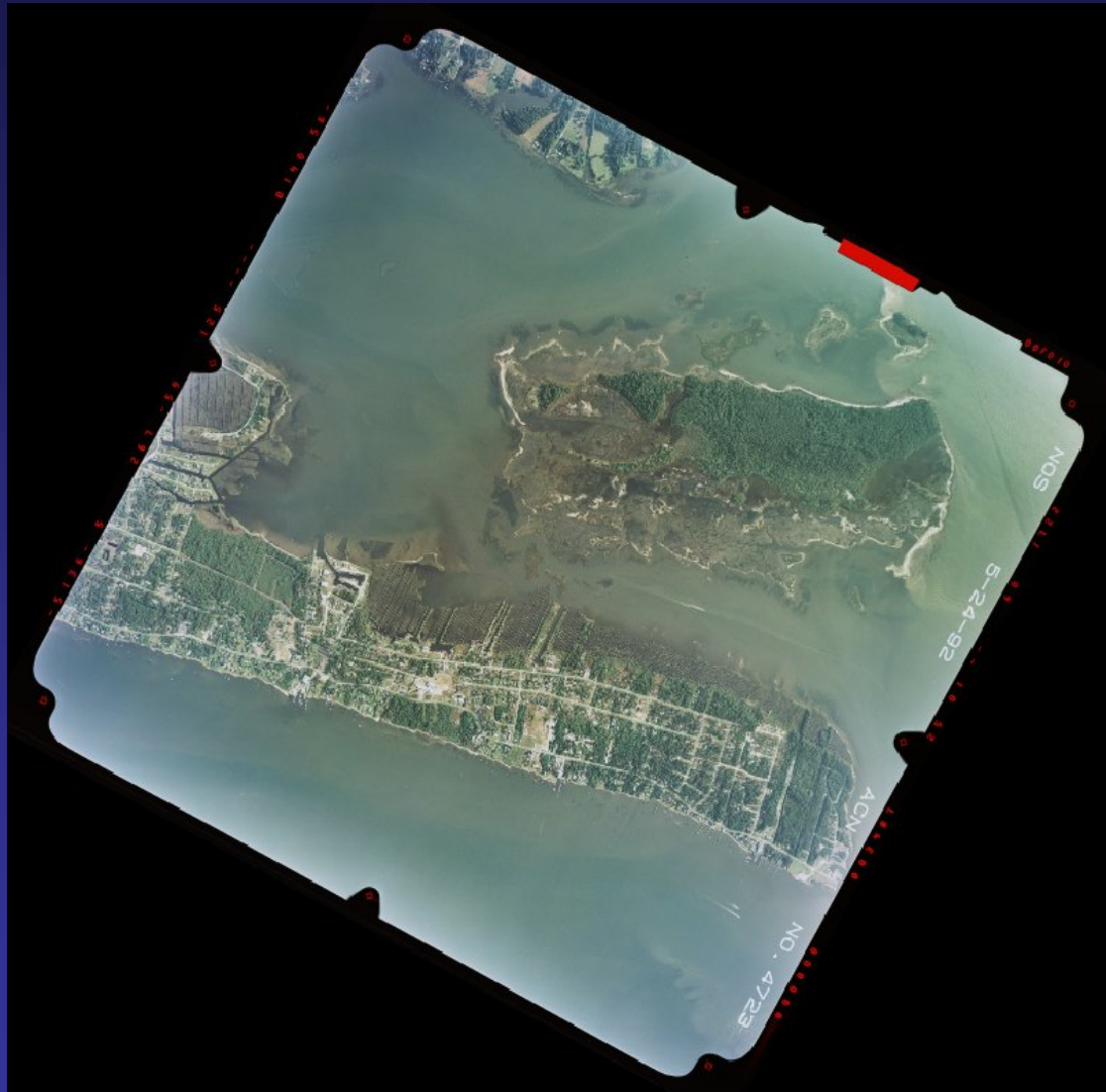
# Ground Truth Parameters: Autumn 2007

- Position
- Water Clarity
- Temperature
- Salinity
- Depth
- Species Identification
- SAV Density

# Environmental Parameters for Submerged Habitat Mapping

- Winds low – preferably 5 mph or less
- Sun Angle 20 – 45 degrees to reduce glint
- Low tide
- Turbidity low
- No clouds or haze
- Adequate biomass of target

# Remote Sensing Basics



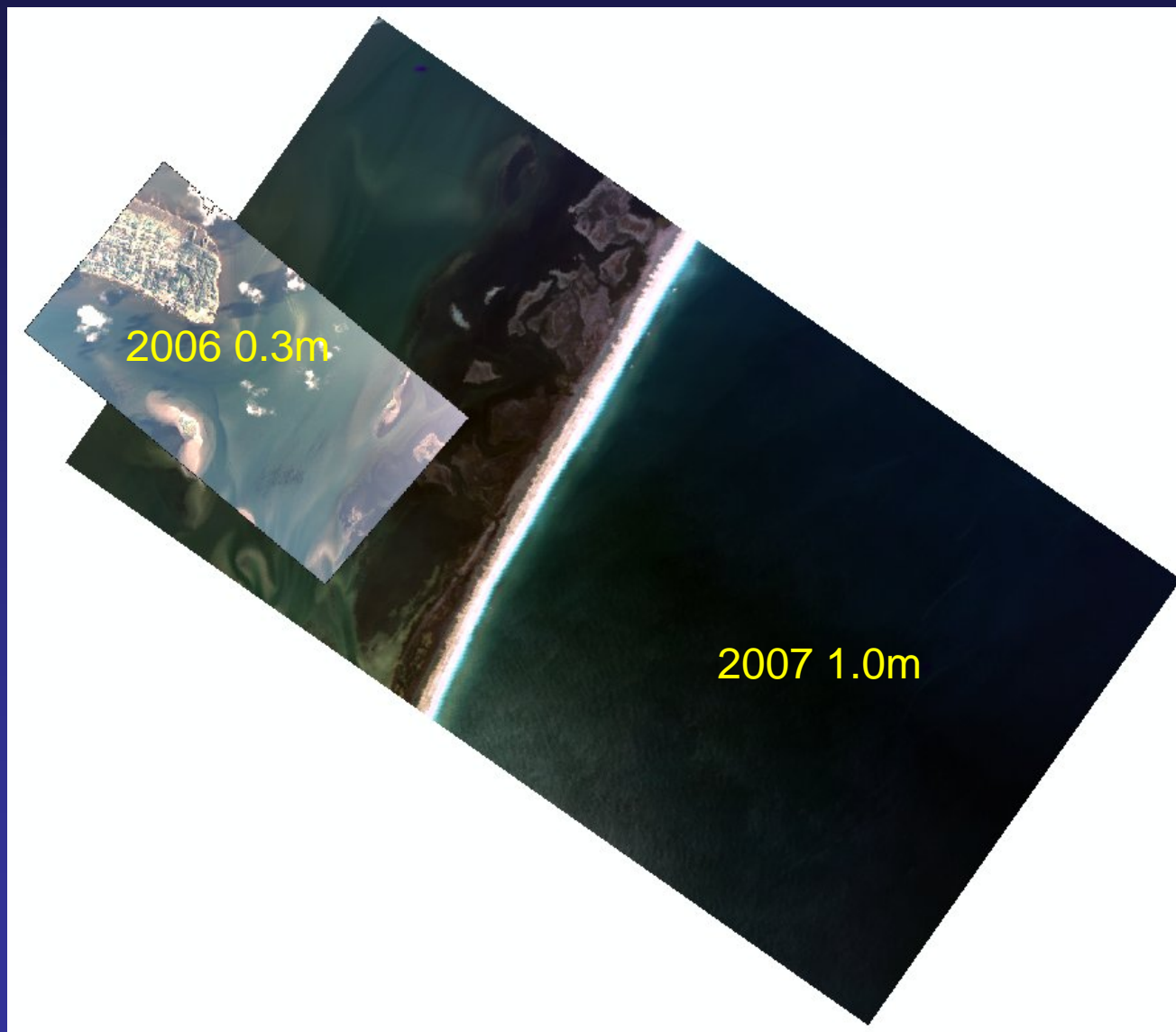
1:24,000 Scale Air Photo - 1992 – East Harkers Island



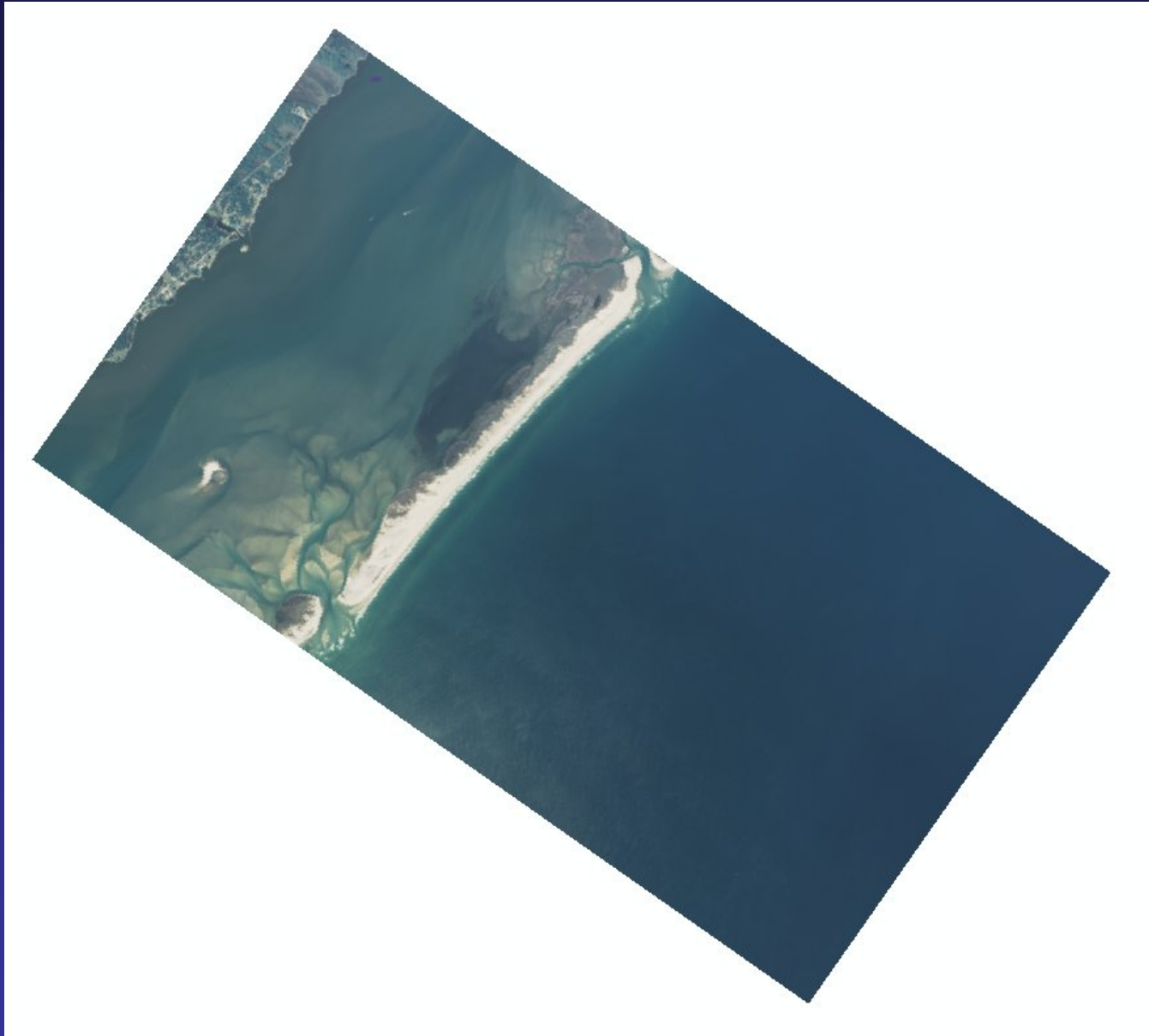
# DMC Camera



# 2006 0.3 m vs. 2007 1 m DMC imagery



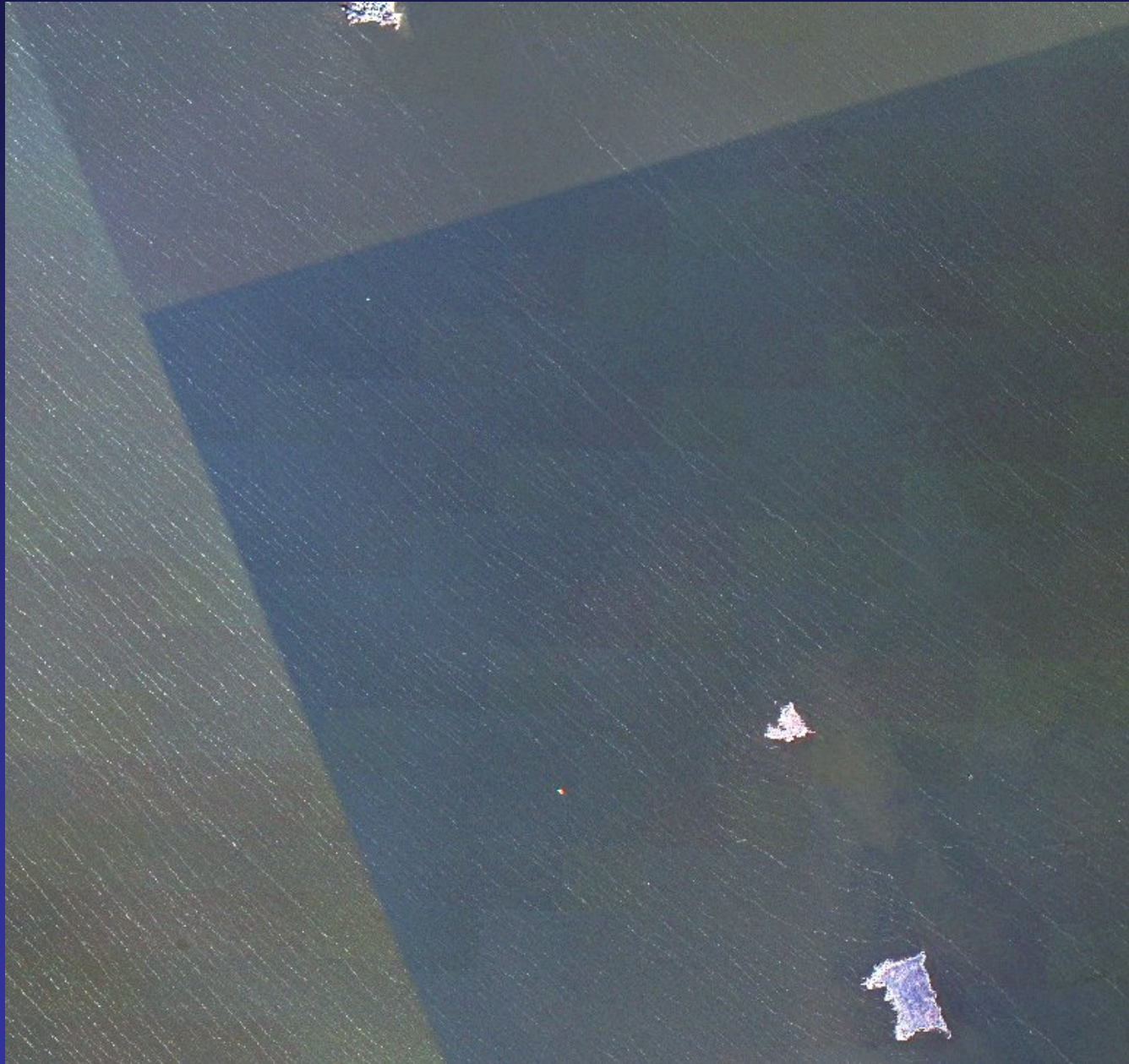
# 2007 1 m DMC imagery – Drum Inlet, NC



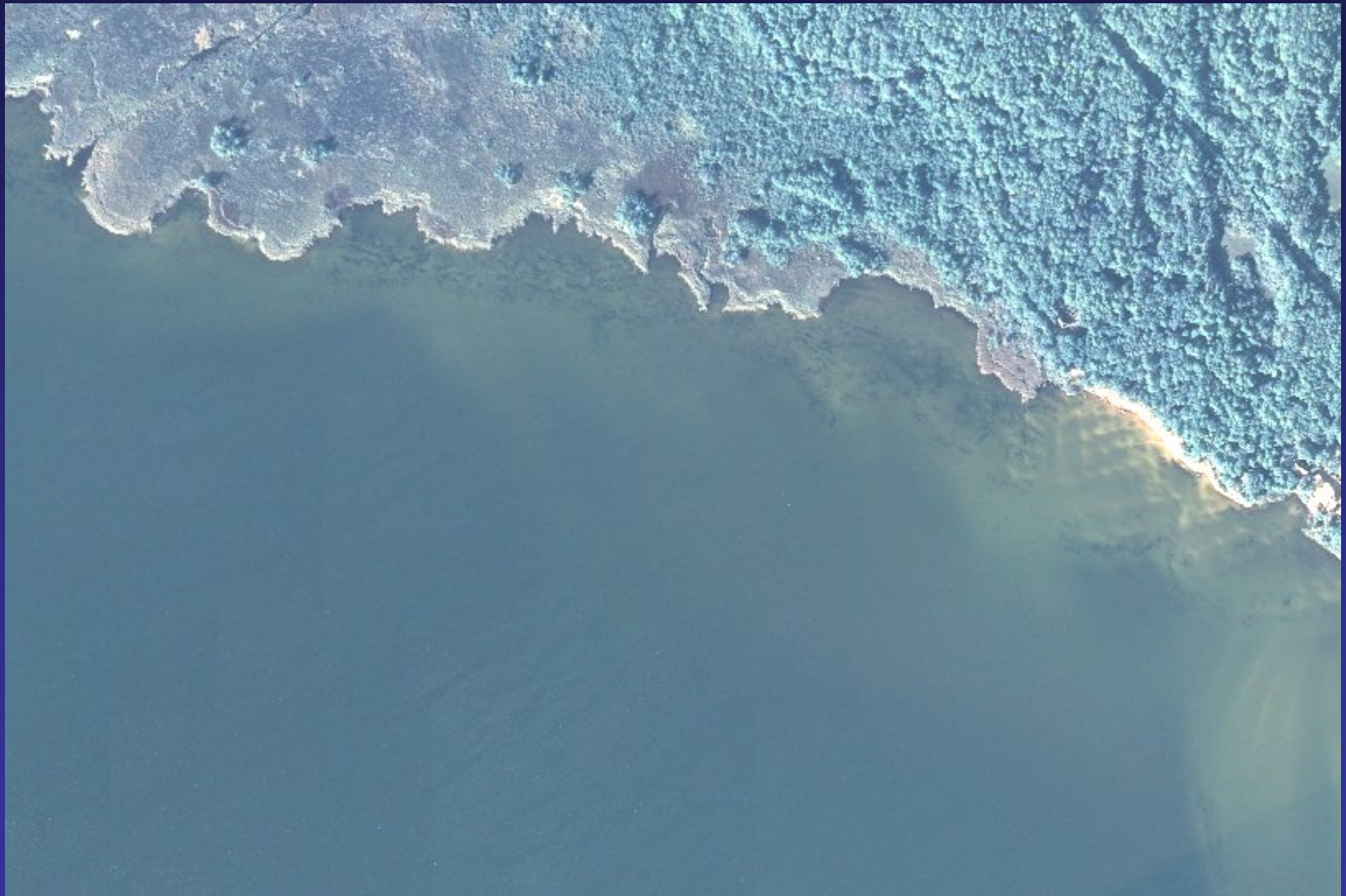
# 2007 1 m DMC imagery – Drum Inlet, NC



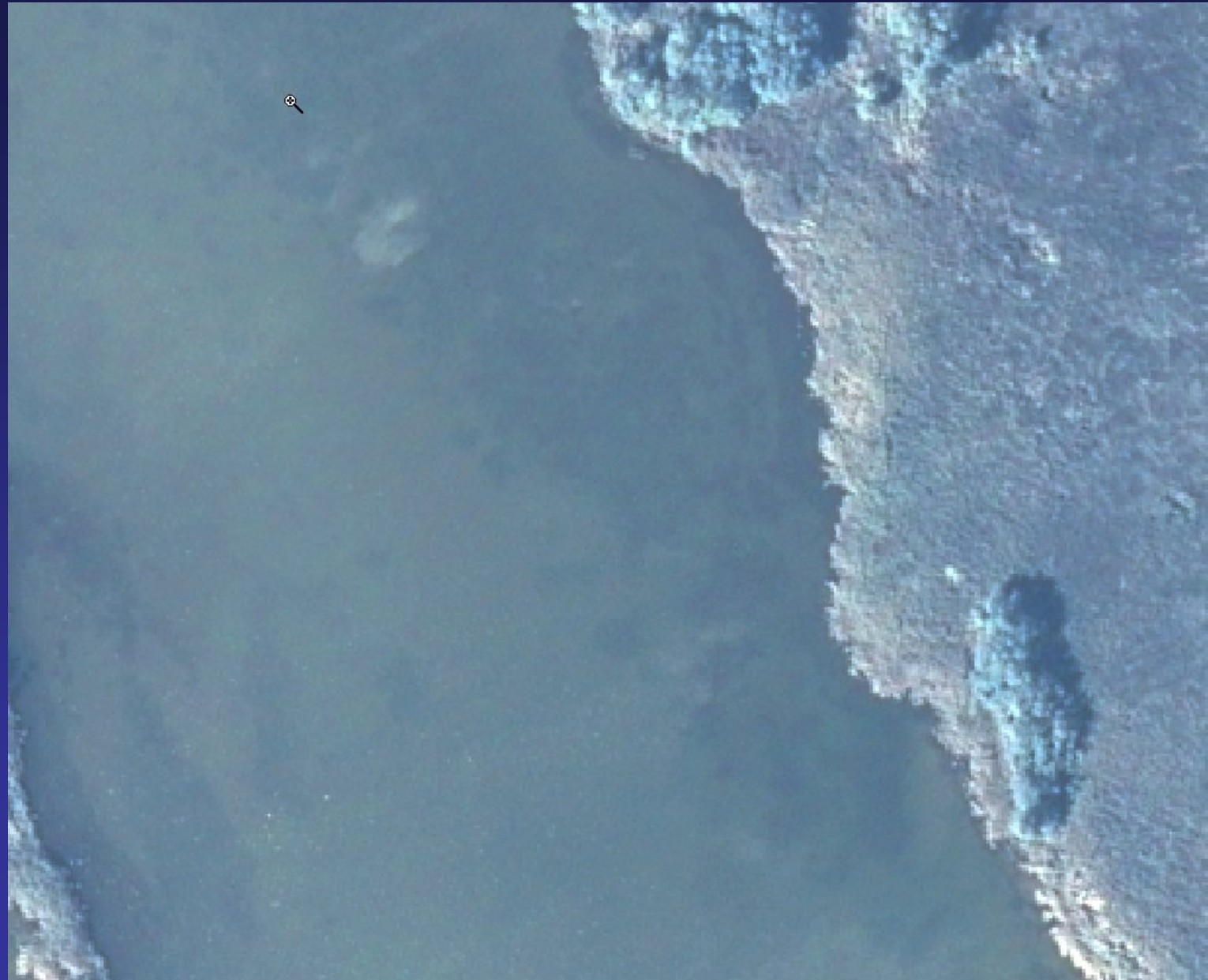
# 2007 1 m DMC imagery – Currituck Sound, NC



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# 2007 1 m DMC imagery – Currituck Sound, NC

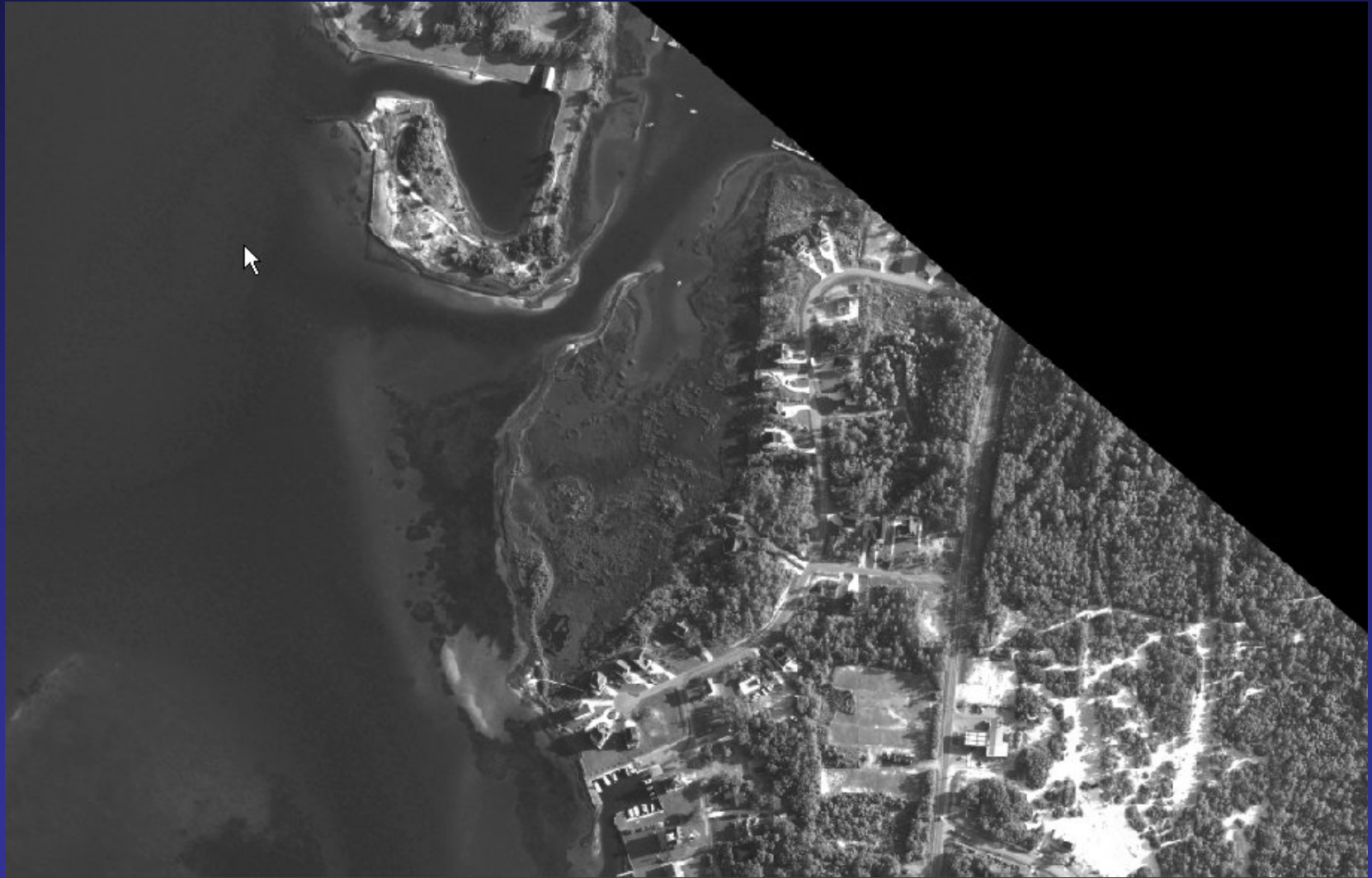


# 2007 1 m DMC imagery – A-P Sound, NC





# 2006 DMC Data – 0.3 m – Harkers Island, NC



Band 1 - Blue

# 2006 DMC Data – 0.3 m – Harkers Island, NC



Band 2 - Green

# 2006 DMC Data – 0.3 m – Harkers Island, NC



Band 3 - Red

# 2006 DMC Data – 0.3 m – Harkers Island, NC

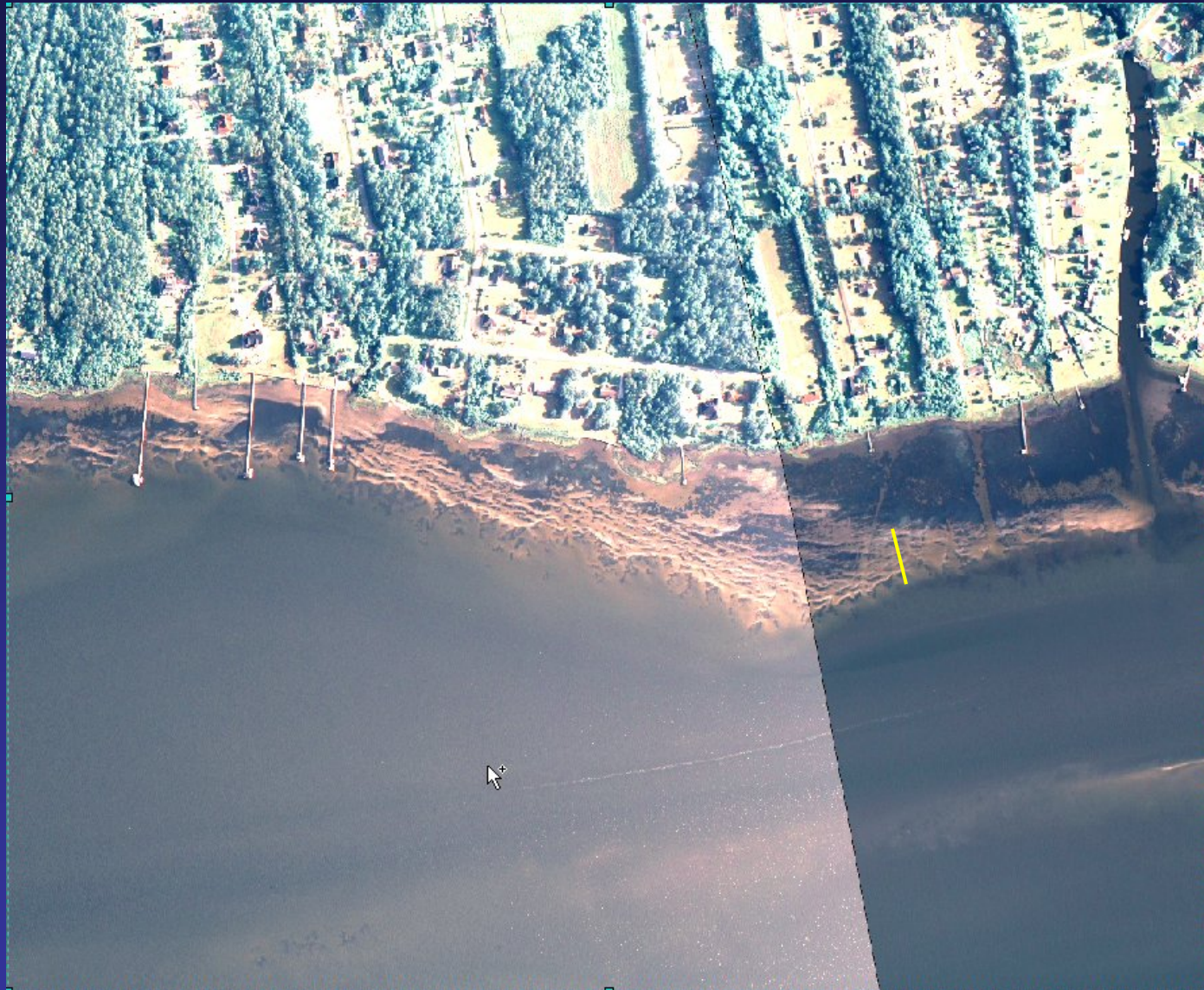


Band 4 – Near Infrared

# 1992 Air Photo – Bogue Sound



# 2006 DMC Data – Bogue Sound



Dense SAV to Patchy SAV – Yellow Line = 70 m

# 1992 Air Photo – Bogue Sound



# 2006 DMC Data – Bogue Sound



Dense SAV to Patchy SAV – Yellow Line = 60 m



# 1992 Air Photo – Harkers Island



# 2006 DMC Data – Harkers Island



# 1992 Air Photos – Harkers Island



# 2006 DMC Data – Harkers Island



# 1992 Air Photo – Bogue Sound



# 2006 DMC Data – Bogue Sound



# Monitoring & Mapping Activities 2008

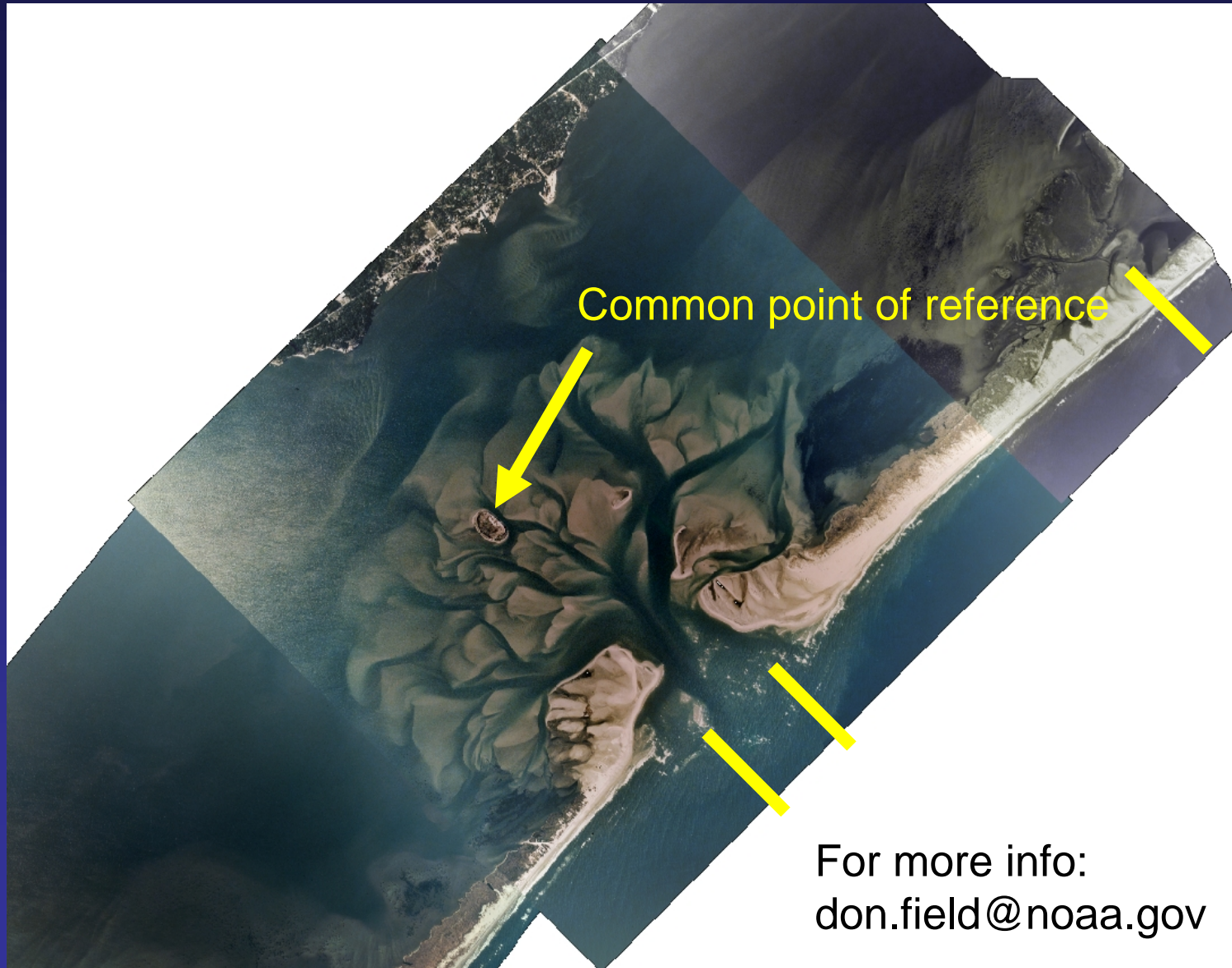
- Spring Monitoring
  - 157.77 flight line miles
- Mapping
- Field Monitoring Planning
- Resources for 2009
- SAV Partnership Web Site
  - [www.apnep.org/pages/sav.html](http://www.apnep.org/pages/sav.html)

# Monitoring & Mapping: Why We Need Both

- Turbidity – Even on the BEST days to fly – SAV resources may be hard to visualize – i.e. turbidity caused by boat wakes
- Biomass – can be large differences in biomass for many reasons
- Change detection with monitoring can improve habitat classification over time

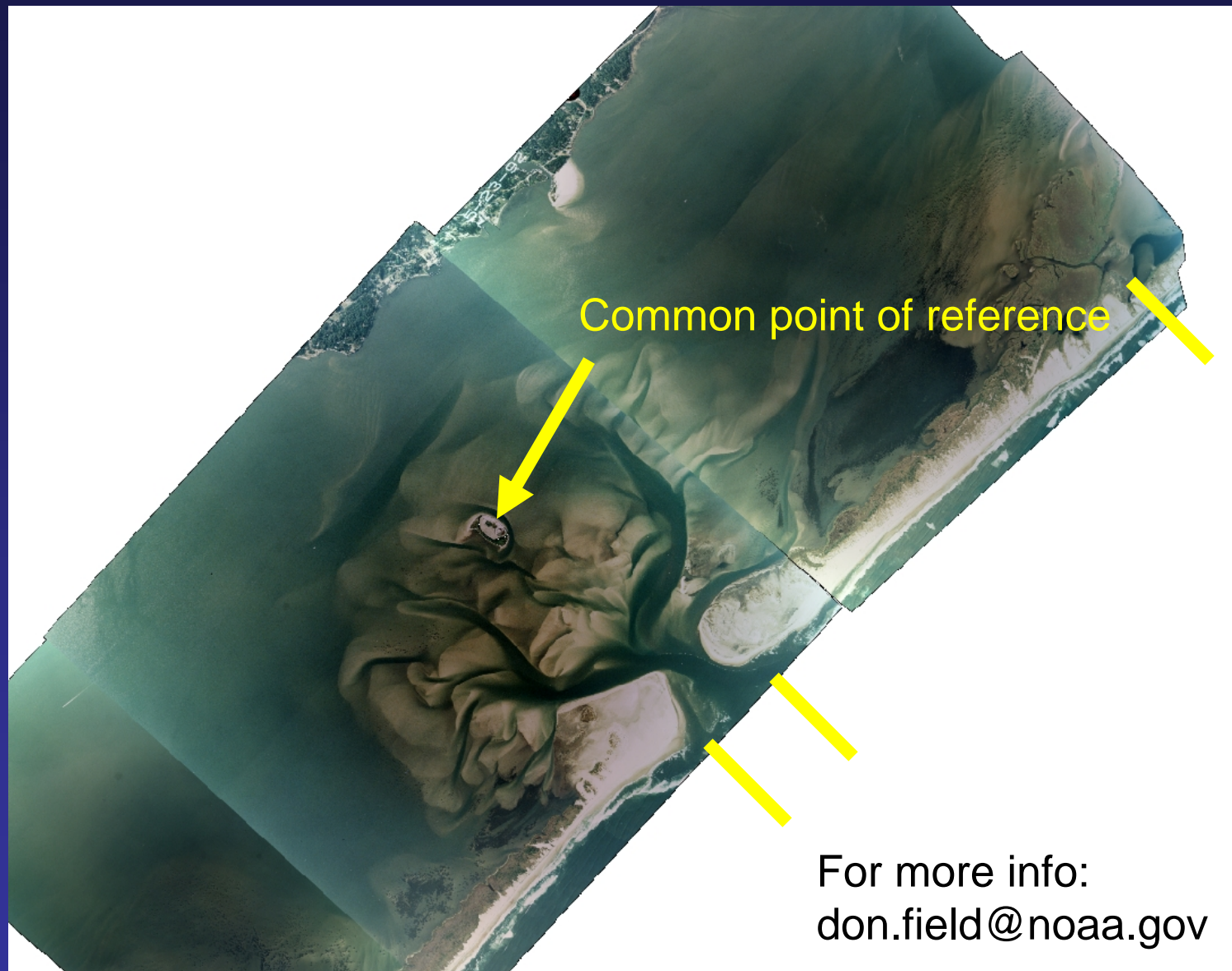


# Remote Sensing to Monitor Coastal Habitats



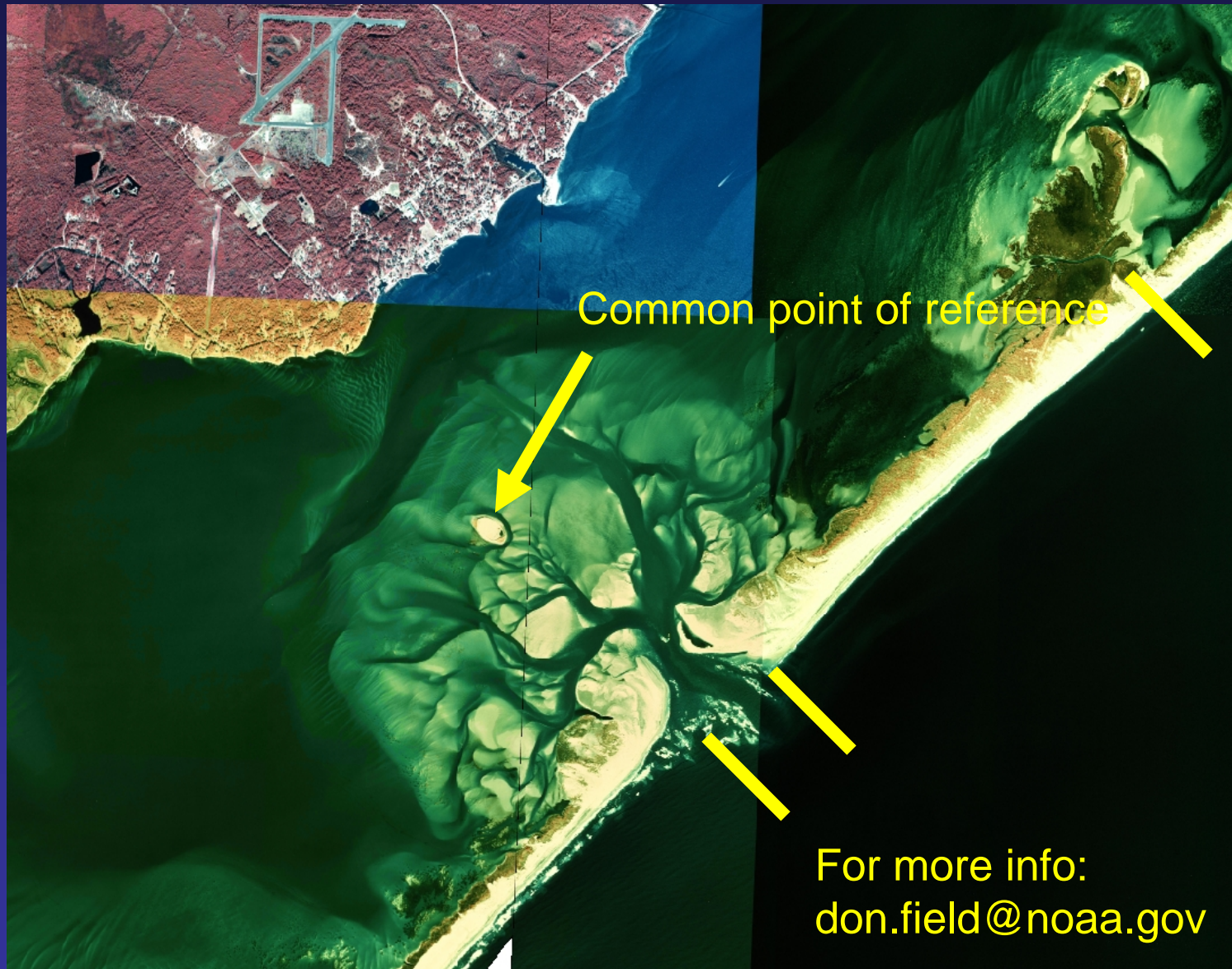
Drum Inlet – 1988 – Air Photos Scanned to 1 m

# Remote Sensing to Monitor Coastal Habitats



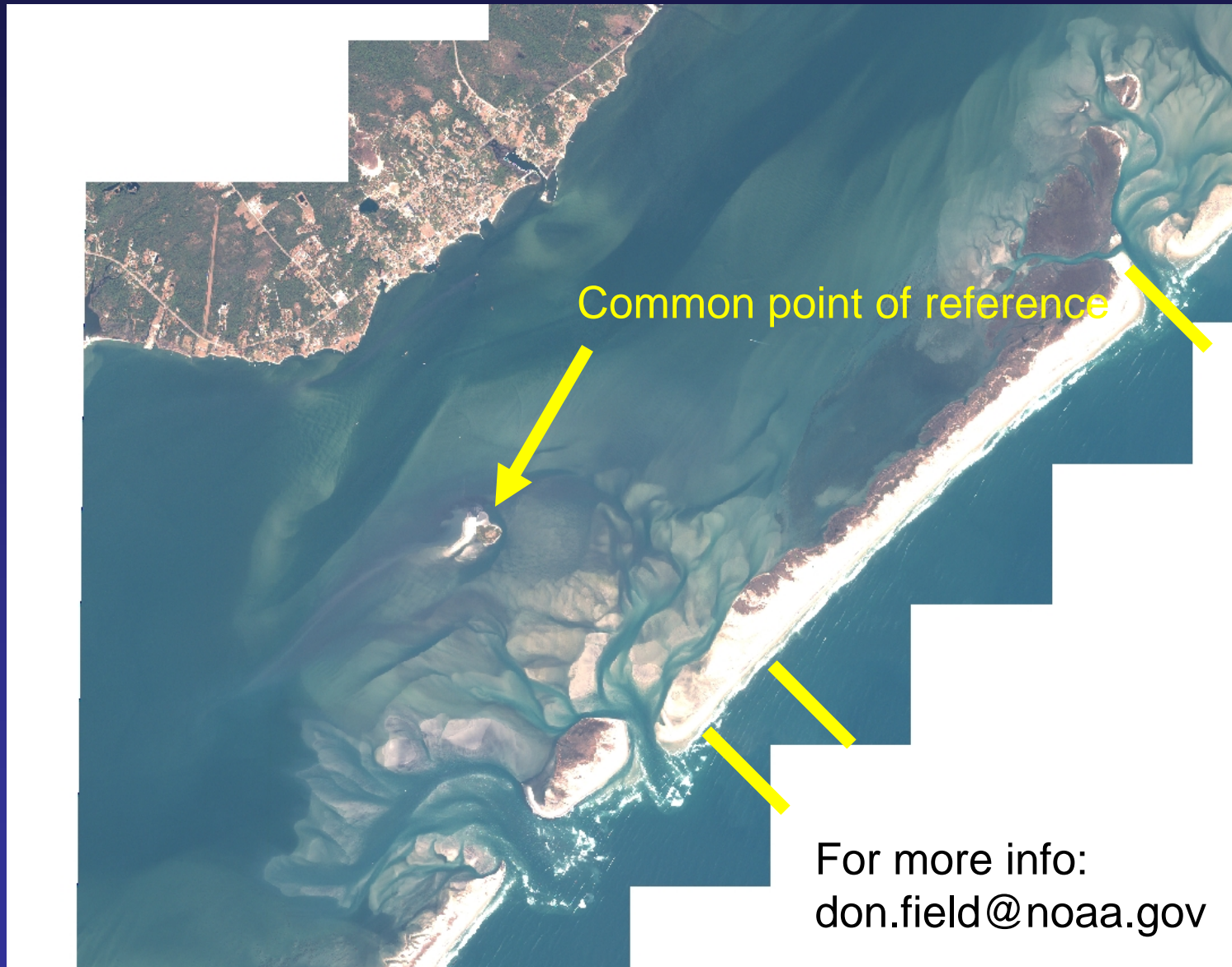
Drum Inlet – 1992 – Air Photos Scanned to 1 m

# Remote Sensing to Monitor Coastal Habitats



Drum Inlet – 1998 – Air Photos Scanned to 1 m (from NCDOT)

# Remote Sensing to Monitor Coastal Habitats



Drum Inlet – 2007 – IKONOS Satellite Image – 4 m Pixel Size

# Essential Fish Habitat

