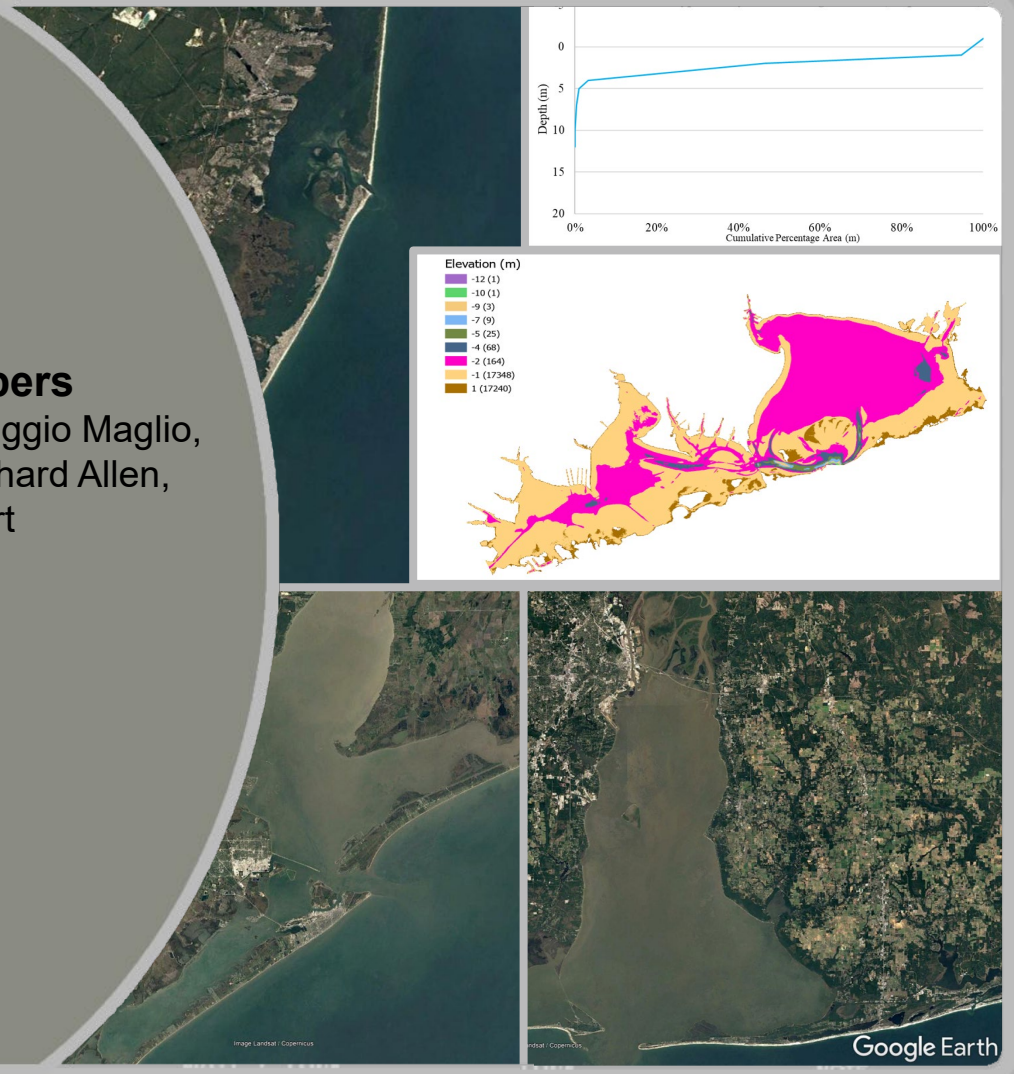
IMPACTS OF WETLAND NOURISHMENT ON COASTAL INLET PROCESSES



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COASTAL INLETS RESEARCH PROGRAM

FY21 IN PROGRESS REVIEW

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Problem Statement

- Strategic dredged sediment placements in tidally-affected bays and rivers are becoming more common, and are an important part of ambitious beneficial use goals.
- They often serve many important sediment management, storm risk reduction, habitat restoration and resilience functions.
- Planning for long-term sediment transport and coastal navigation impacts can be difficult.
- Medium to long-term impacts of cyclic nourishments on tidal inlet and navigation channel hydrodynamics and sediment transport are under-addressed in the literature.

Statements of Need

- FY19 1356 (Long-term Modeling of Barrier Island Tidal Inlets)
- FY20 1411 (Sustainable Dredged Sediment Management Practices to Support Wetlands)
- FY20 1322 (Near-shore Placement for Wetland Nourishment)
- FY19 1370 (Testing and Evaluation of USACE Coastal Numerical Models)

Capability and Strategic Impact Statement

- **A variety of embayment modifications have been linked to large, unintended impacts, but can these observations be extrapolated to wetland placement?**
- **Developing a systematic understanding of in-bay sediment placement impacts, including:**
  - the spatial scale of hydrodynamic response to placement,
  - the relationship between wetland placement and subsequent shoaling, and
  - the long-term ramifications of in-bay placement for navigation

  could provide a useful conceptual framework for avoiding unintended outcomes following wetland construction.

Overall Goals

- **Develop generalized guidance concerning the medium- to long-term impacts of strategic sediment placement in tidally-influenced bays and rivers, with an emphasis on:**
  - Impacts on sediment transport
  - Impacts on tidal inlet morphodynamics
  - Impacts to navigation.

Literature Review Conclusions

- **The hydrodynamic response to embayment engineering is a complex topic, and it has been under-studied in a wetland placement context.**

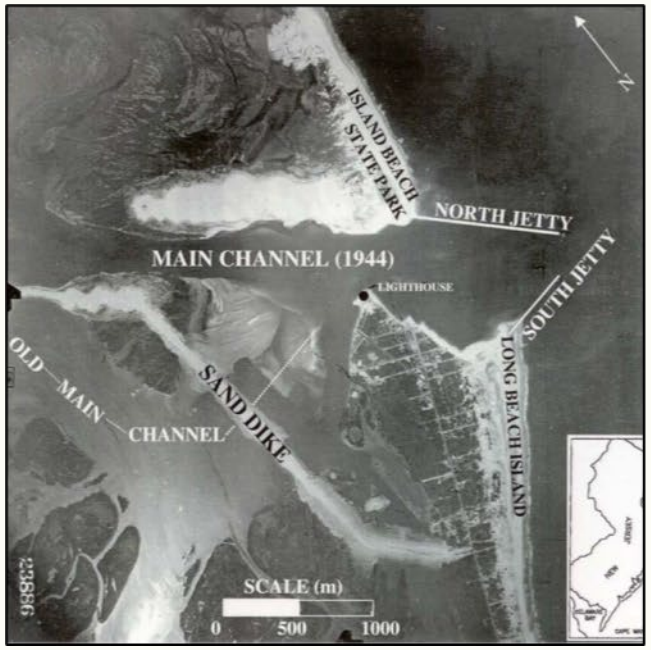
- **Certain site-specific responses to large-scale embayment modification may be relevant to wetland nourishment in some systems.**
  - ***Tidal amplitude:*** narrowing & reducing friction amplifies tides; adding intertidal area may damp tides.
  - ***Tidal prism reduction:*** adding sediment within the tidal frame can reduce tidal prism.
  - ***Tidal prism capture:*** altering one side of a multichannel system can redirect more flow through one of the channels.
  - ***Tidal asymmetry:*** intertidal area makes systems more ebb dominant, particularly at elevations slightly above MWL. Elevations near MLW may contribute to flood dominance.

- **Complicating factors**
  - Individual modifications are often not in isolation, and responses may occur gradually over years
  - The relationship between modification scope and embayment response is not clear
  - Applicability across the full spectrum of embayments is unclear.

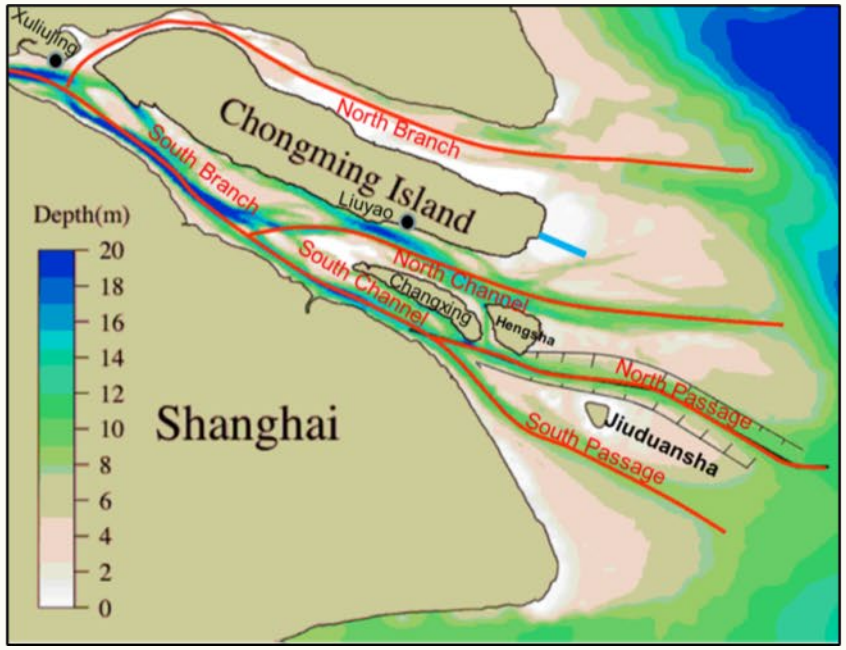
- ***Collaboration opportunities welcome!***

Site Specific Response Example

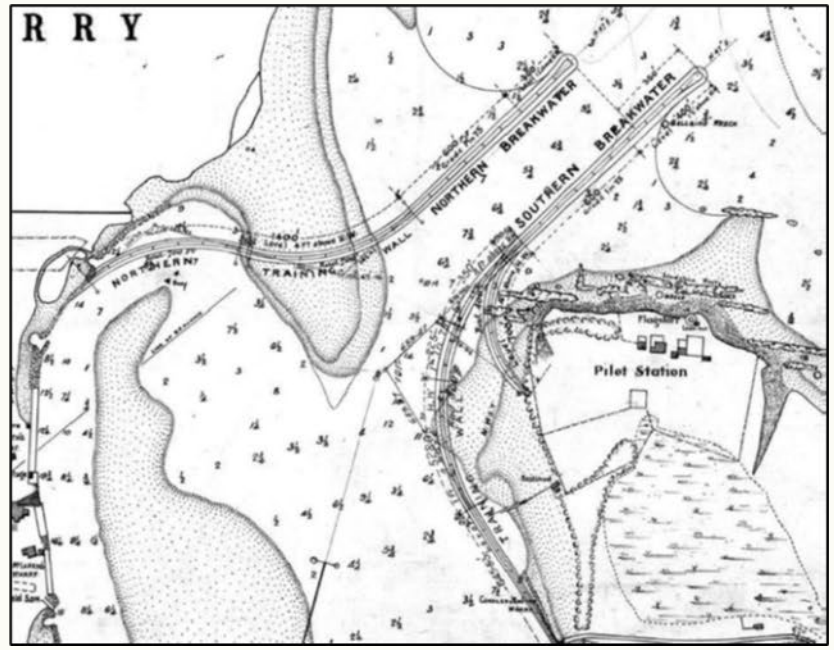
- Embayment response to modifications can often be grouped into general trends
- Site-specific parameters frequently modulate these impacts
- Somewhat similar modifications can cause opposing responses
- Tidal prism decrease in Barnegat and the North Passage of the Yangtze vs. tidal prism increase at Wallis Lake, Lake Wagonga, and Lake Macquarie following jetty or training structure addition
- Distinction could be related to increasing vs. decreasing friction or flow path length



1944 aerial photograph of Barnegat Inlet and 1943 sand dike constructed from Seabergh et al. (2003)



Yangzte estuary and training bund construction along the North Passage from Wang et al. (2015)



Wallis Lake Inlet and jetty construction from Nielsen and Gordon (2017)

Summary

FY21 Major Advances in Capability

- Literature review documents and synthesizes findings on anthropogenic modifications and altered tidal embayment hydrodynamics and sediment transport
- Knowledge gaps identified/confirmed
- Groundwork for data analysis at Barnegat Inlet

FY21 Major Products & Collaborations

- Special Report
- PDT meeting (11/10/20)
- Tech Discussion (8/10/21)
- Virtual Poster presentation at the CHL symposium

FY22 & FY23 Products/Advances

- Current plans involve detailed analysis at a small number of test case sites, beginning with Barnegat Inlet, to investigate relationships between placement strategies and shoaling rates
- Progress into FY23 may include expansion to larger number of sites, but the team is in the process of refining the format and scope of additional FY22 and FY23 deliverables
- Suggestions Welcome!