

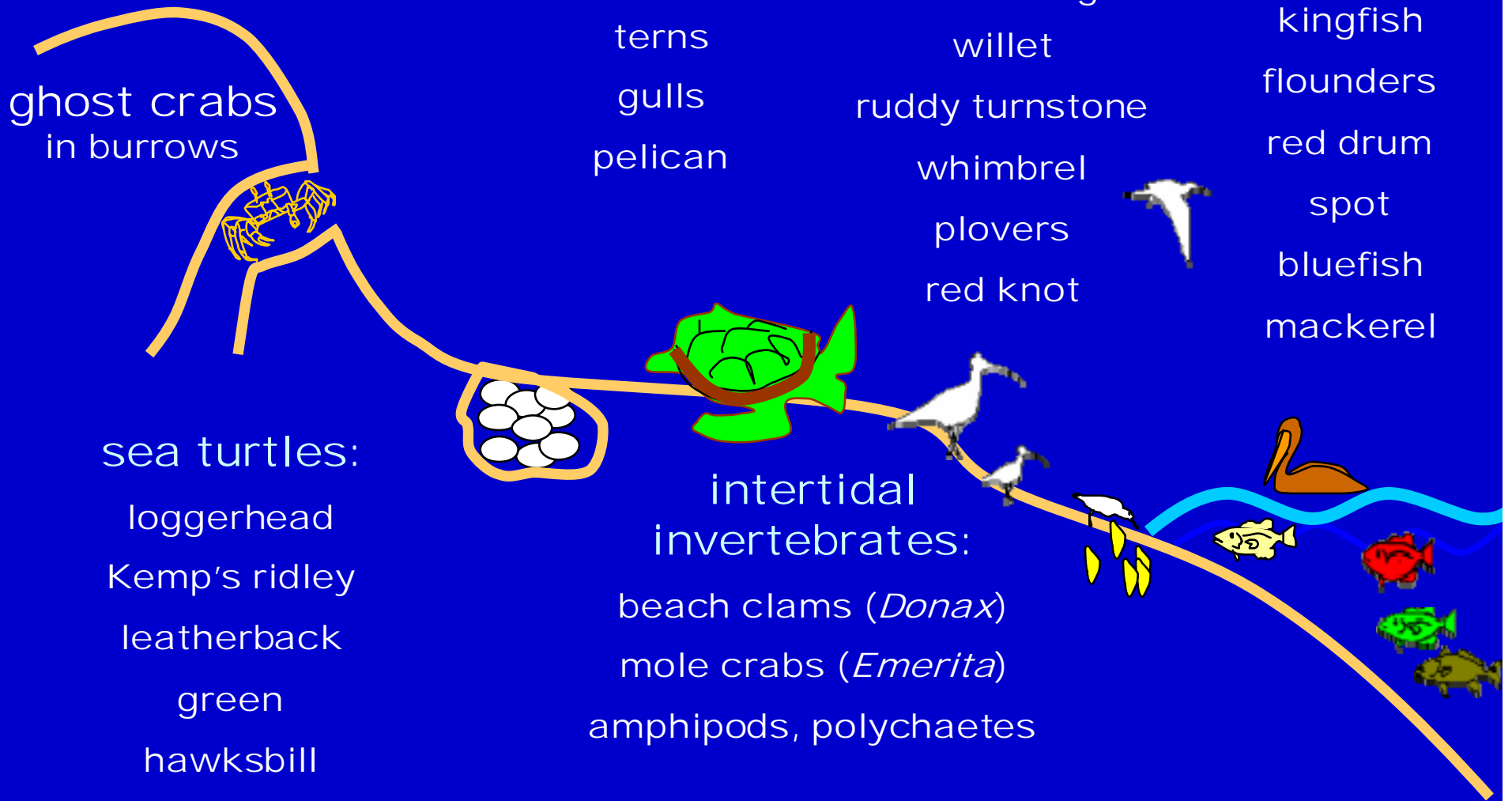
The Effects of Beach Nourishment Projects on Coastal Ecosystems

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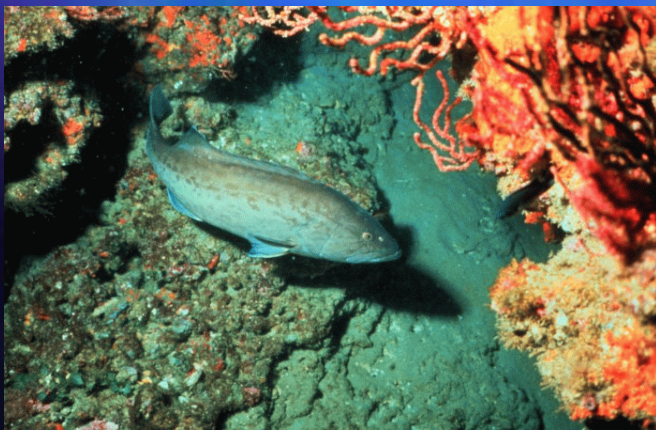
² Institute of Marine Sciences, UNC Chapel Hill, Morehead City, NC

Beach Ecology



AVOID -- Minimize -- Mitigate

- AVOID peak biological seasons
- AVOID biologically sensitive habitats
- AVOID using hopper dredges
- AVOID incompatible fill material



Gag grouper (NOAA)



Least tern (P. Meyer)



GREEN SEA TURTLE
U.S. Fish and Wildlife Service/David Vogel



Green sea turtle (USFWS)

AVOID -- Minimize -- Mitigate

- AVOID fill material significantly **coarser** than native beach sediments
- Impacts to fauna may last indefinitely

Emerald Isle, NC 2003



Oak Island, NC 2004



Photos courtesy of Duke University

AVOID -- Minimize -- Mitigate

- AVOID fill material significantly **finer** than native beach sediments
- Significant impacts to fish, invertebrates

Atlantic Beach, NC 2005



Turbidity
mixing zone



Holden Beach, NC 2002

AVOID -- Minimize -- Mitigate

- AVOID fill material without the same color and mineralogy as the native beach sediments

Bogue Banks, NC 2002



Holden Beach, NC 2002



Avoid -- **MINIMIZE** -- Mitigate

- Incorporate natural design features like overwash gaps
- Incorporate undisturbed refugia
- Construct shallower pits on the seafloor
- Use sand fencing for dunes
- Plant native vegetation



Black Skimmer Colony (W. Golder)



Ocean City, MD

Avoid -- **MINIMIZE** -- Mitigate

- Monitor sediment compatibility during construction
- Include provisions for moving mining operations to better locations if problems detected



Avoid -- **MINIMIZE** -- Mitigate

■ MINIMIZE habitat modifications

- Levee-dune construction
- Escarpments
- Morphological features like beach cusps and shoals
- Seafloor bathymetry



Ecological Monitoring

- Much of uncertainty about impacts is attributable to poor quality of monitoring studies
- Only 11% of studies controlled for both natural spatial and temporal variation
- 87% ended before recovery was demonstrated (ave. duration = 1.5 years)
- 56% of studies reached conclusions not adequately supported
- 49% failed to meet publication standards

Peterson and Bishop (2005)

Avoid -- Minimize -- **MITIGATE**

In-kind mitigation

- Introduce lab-raised bivalves and amphipods
- Protect undisturbed areas through land acquisition or easements
- Restore habitat by removing structures
- Enhance habitat through predator control, prohibiting ORV use
- Create overwash gaps

South Nags Head, NC 1998



Avoid -- Minimize -- **MITIGATE**

Out-of-kind mitigation

- Fund scientifically rigorous research of coastal ecosystems (including fish)
- Fund and create physical – biological predictive models
- Conduct cumulative impacts assessment

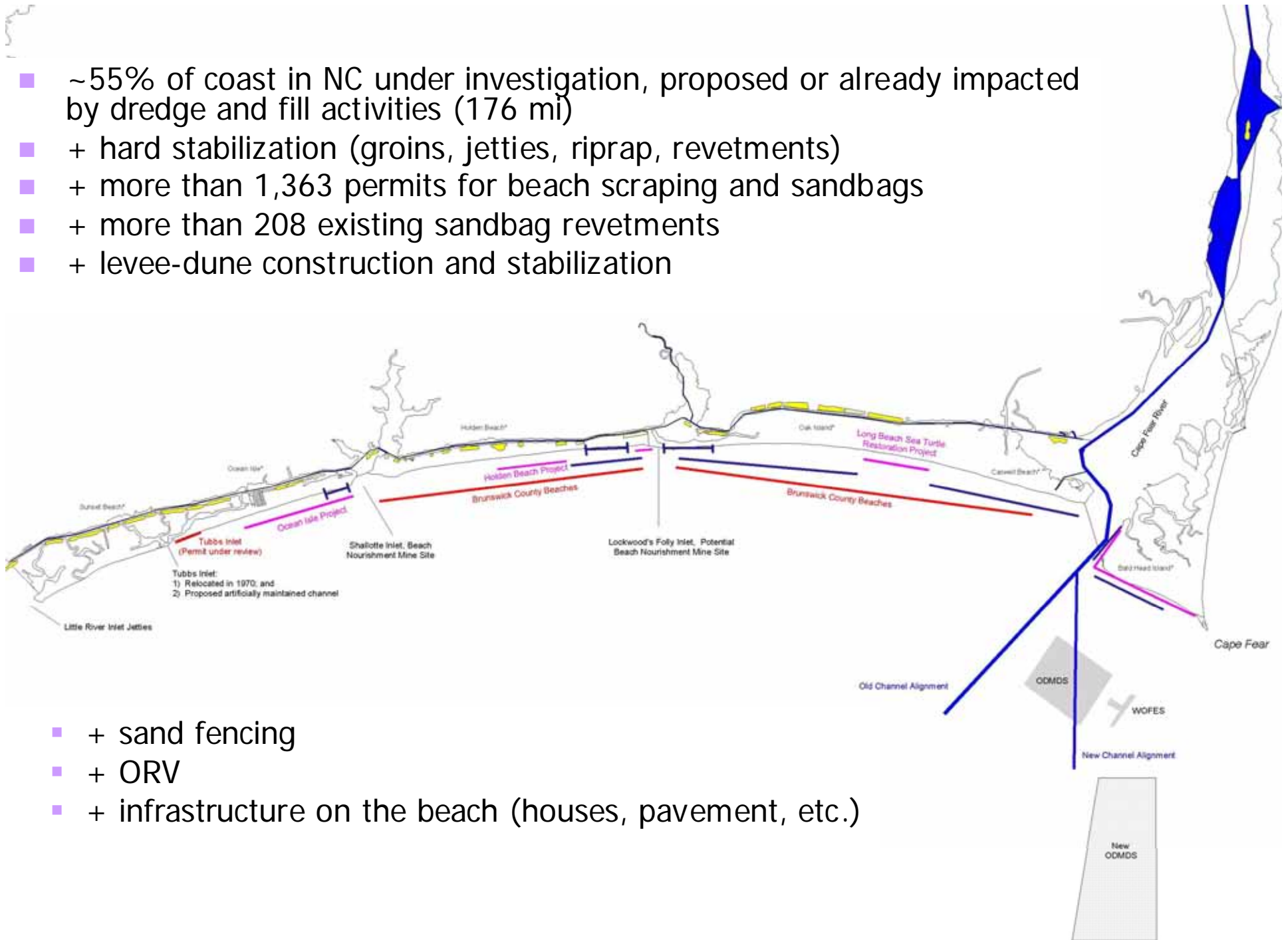


Cumulative Impacts

- Data are in decentralized locations
 - Academic sources (Duke, VIMS, ECU, UMass)
 - Federal sources (e.g., CIRP)
 - NEPA, FWCA and ESA documents
- Assessment methodology available
 - Scientific / planning literature
 - CEQ
 - GIS and aerial photography



- ~55% of coast in NC under investigation, proposed or already impacted by dredge and fill activities (176 mi)
- + hard stabilization (groins, jetties, riprap, revetments)
- + more than 1,363 permits for beach scraping and sandbags
- + more than 208 existing sandbag revetments
- + levee-dune construction and stabilization





Questions?