

Seawall Habitats with Mangrove Reef Walls



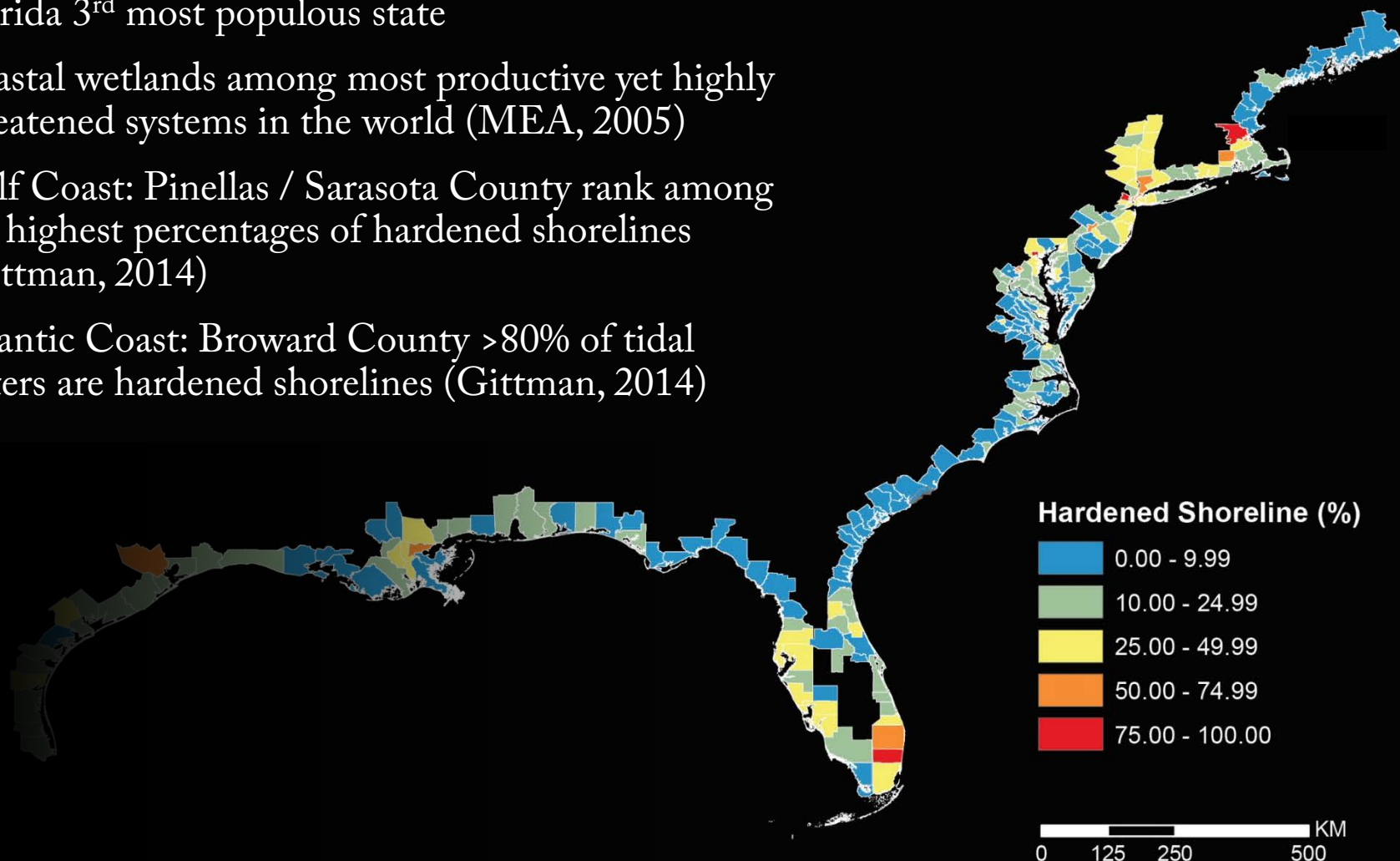
Keith Van de Riet, PhD, AIA

University of Kansas, School of Architecture and Design
kvdr@ku.edu



Loss of Wetlands Correlates to Population Density

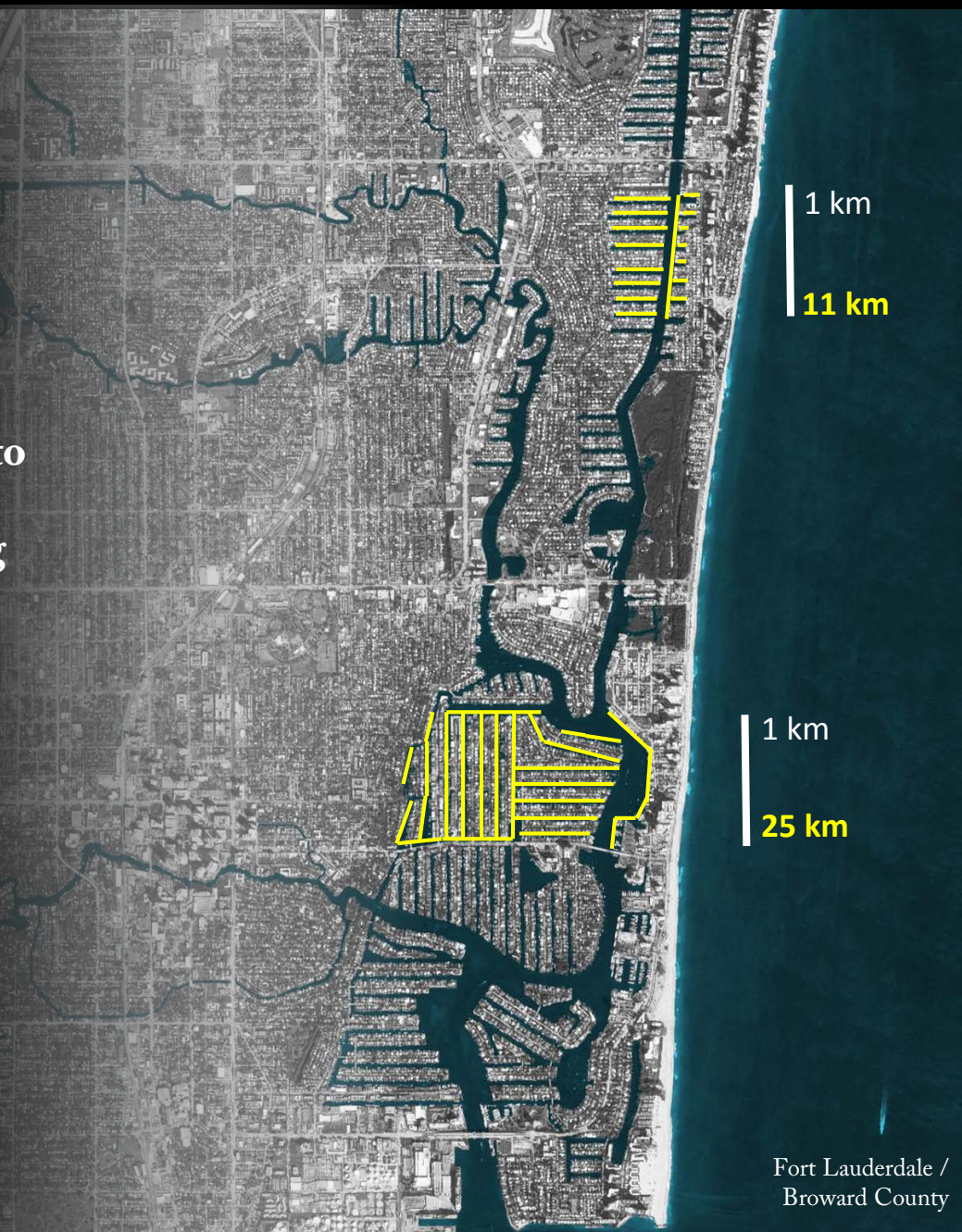
- Near half U.S. lives in coastal counties; Florida 3rd most populous state
- Coastal wetlands among most productive yet highly threatened systems in the world (MEA, 2005)
- Gulf Coast: Pinellas / Sarasota County rank among the highest percentages of hardened shorelines (Gittman, 2014)
- Atlantic Coast: Broward County >80% of tidal waters are hardened shorelines (Gittman, 2014)



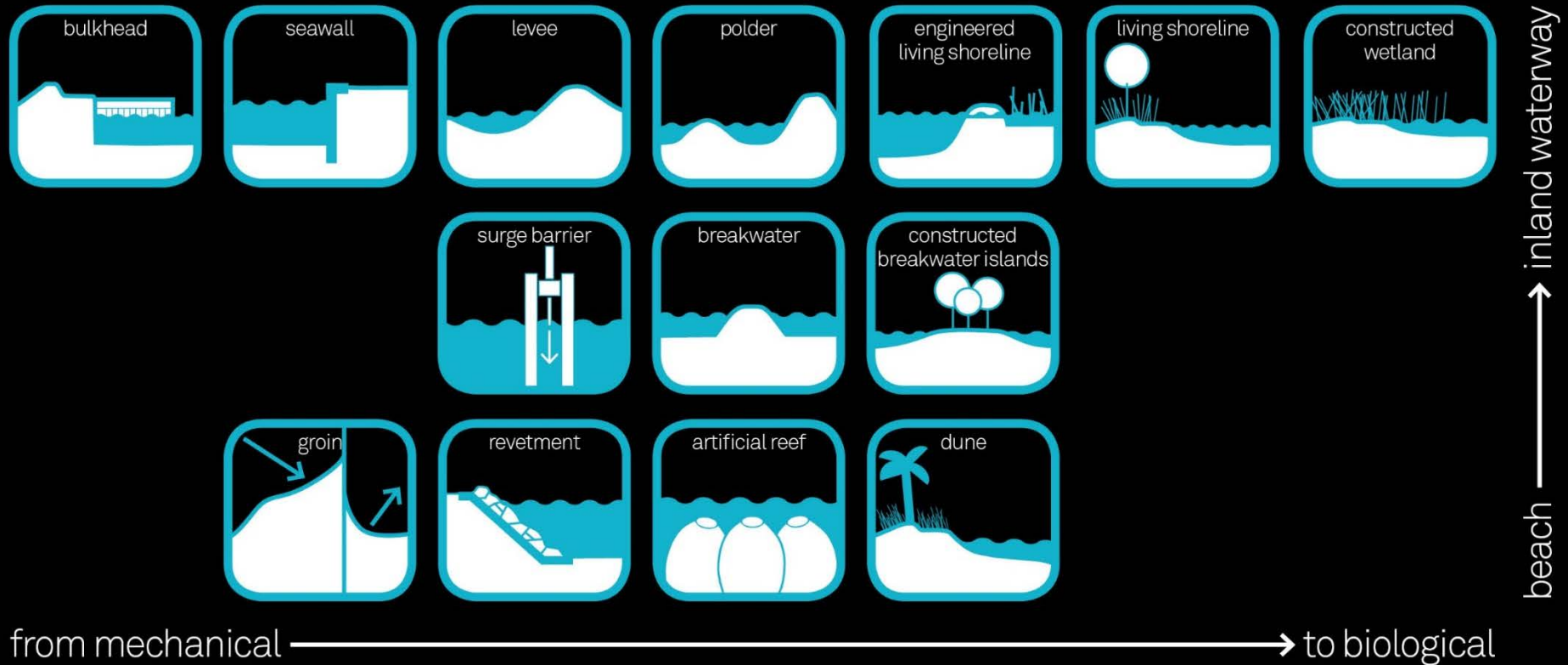
Graphic modified from Gittman, 2014

The Water's Edge

- >1/3 mangrove cover lost in U.S.;
Loss of habitat and filtration services
- Built environments have replicated and further articulated pre-existing shorelines
- **Human-made structures have potential to support diverse marine life and increase filtration capacity beyond that of existing natural edges (Layman et al. 2014)**

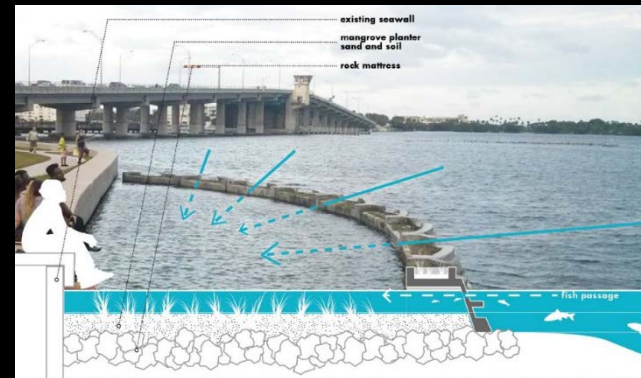
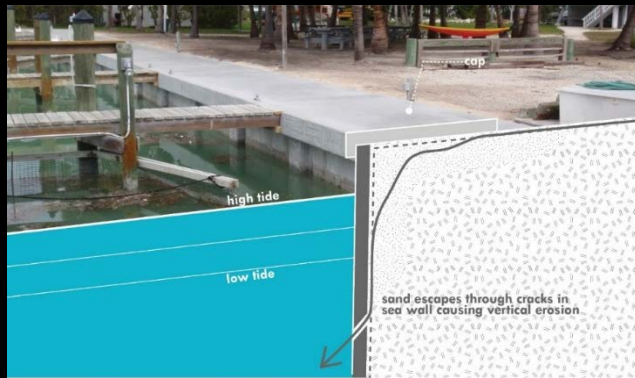
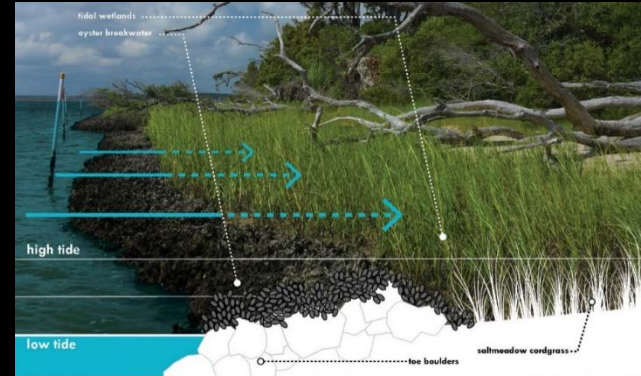
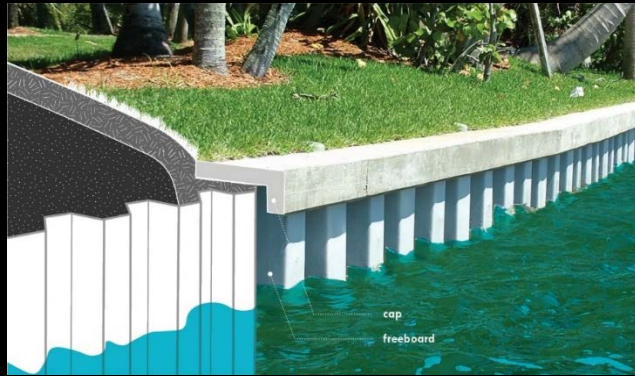


Shoreline Technology Summary



From "ADaPT: Adaptation, Design and Planning Tool, w/ Huber, et al. 2017

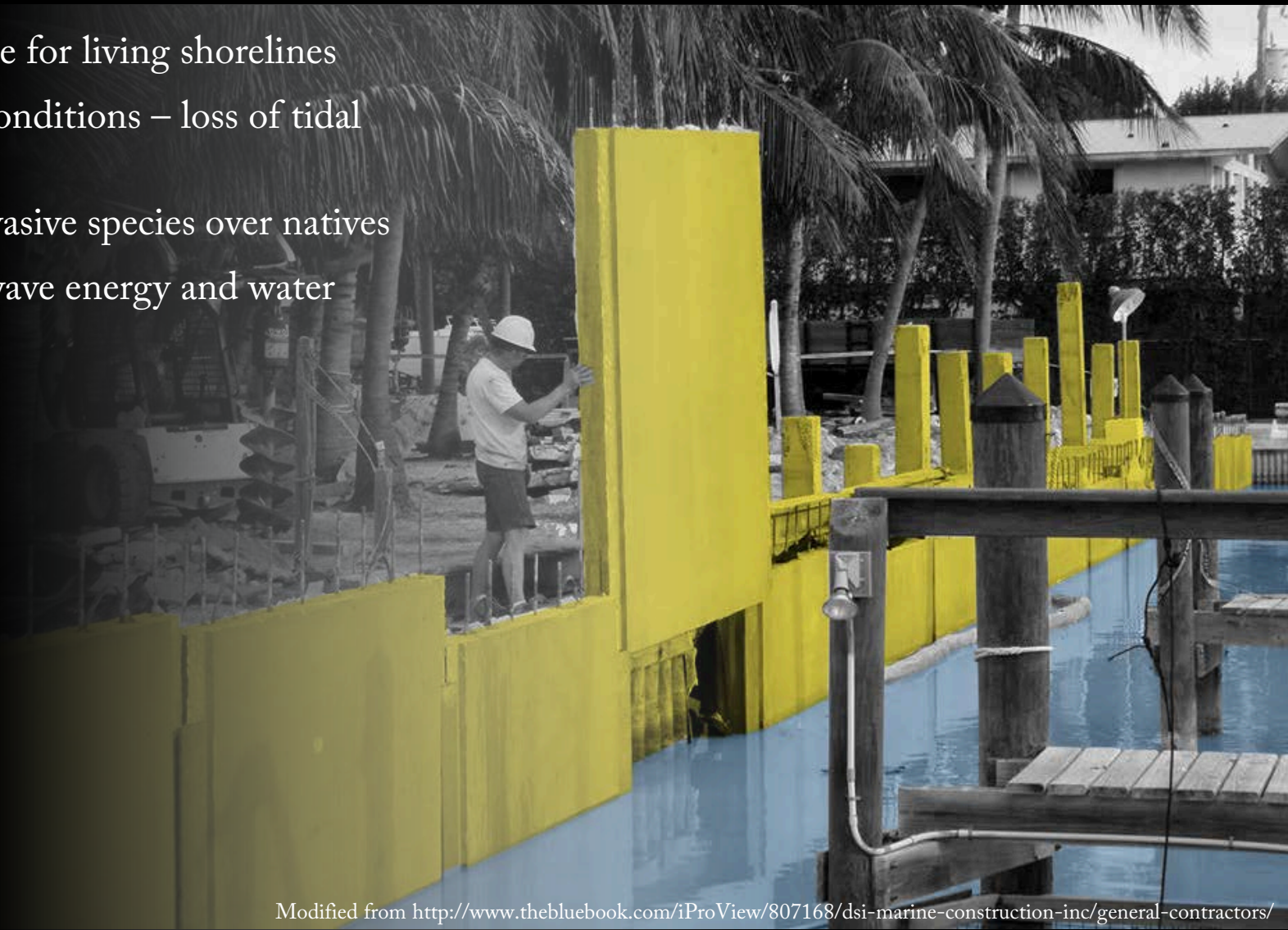
Urban Shorelines - Applicable Technologies



From "ADaPT: Adaptation, Design and Planning Tool, w/ Huber, et al. 2017

Florida's Canals are Narrow Navigation Channels

- Limited space for living shorelines
- Deepwater conditions – loss of tidal zone habitat
- Promotes invasive species over natives
- Exacerbate wave energy and water turbidity
- Unattractive



Modified from <http://www.thebluebook.com/iProView/807168/dsi-marine-construction-inc/general-contractors/>

Nature's Shorelines are Diverse in Habitat and Species

- Tidal structure as nursery and hunting grounds for diverse species
- Filtration of water / erosion control
- Ecologically productive
- Mangrove Trimming and Preservation Act – helpful or hurtful?



Mid-tide view of mangrove, tunicates, sponges and shellfish



Subsurface view of mangrove habitat



Oyster reef, SW Florida

“Grafted” Landscapes?



Mid-century dune planting



Colonized Reef Ball

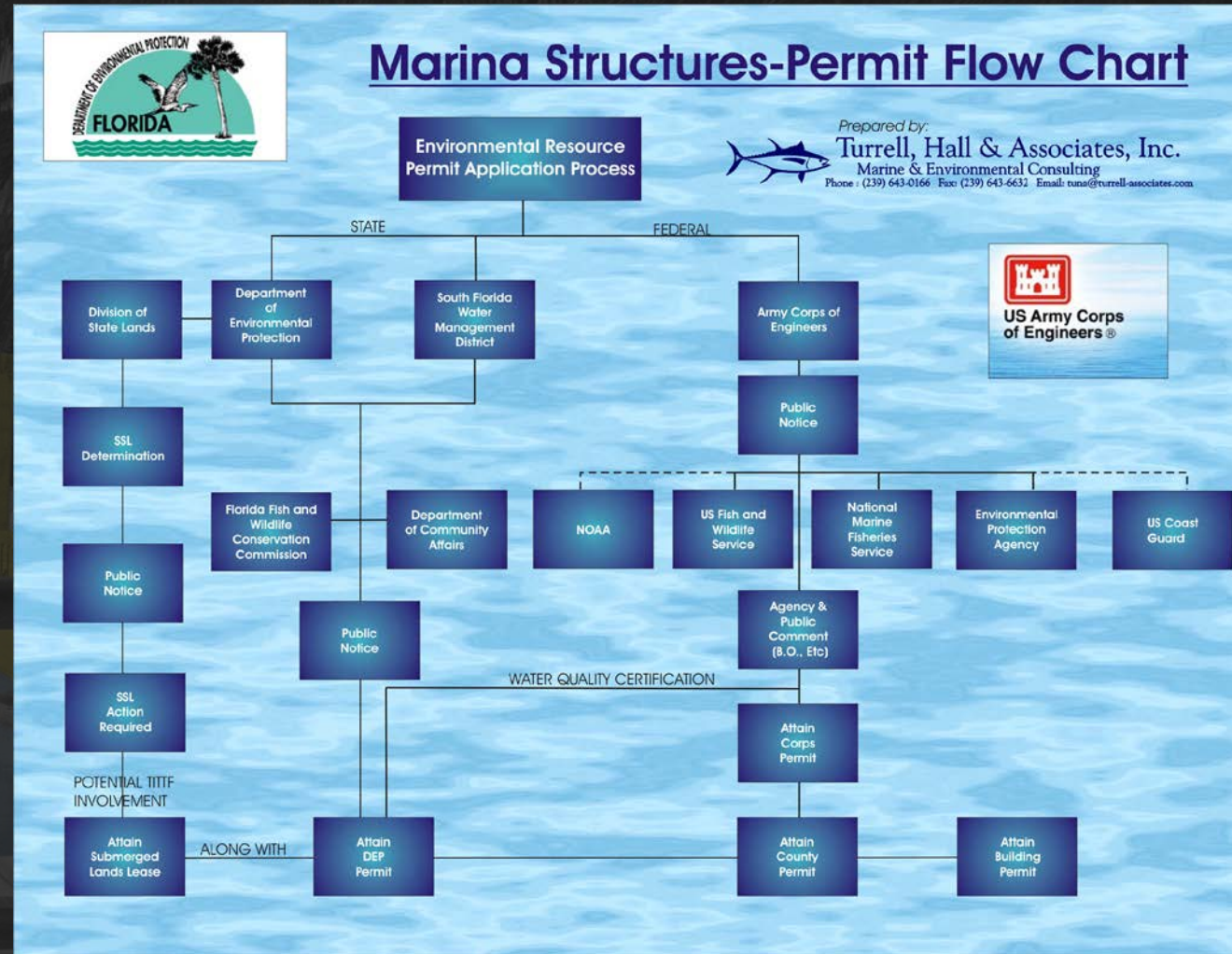
Camouflage?



Deceitful seawall to promote natural colonization

Wicked Permitting

- Complex / lengthy process is an understatement
- Local, Regional, State and Federal Reviews



Florida DEP Code – 62.330.050, Sect 12:

(12) Construction, Replacement, Restoration, **Enhancement**, and Repair of Seawall, Riprap, and Other Shoreline Stabilization –

(a) **Construction replacement, and repair of seawalls or riprap in artificial waters and residential canal systems that are exempt under Section 403.813(1)(i), F.S.,** including only that backfilling needed to level the land behind seawalls or riprap.

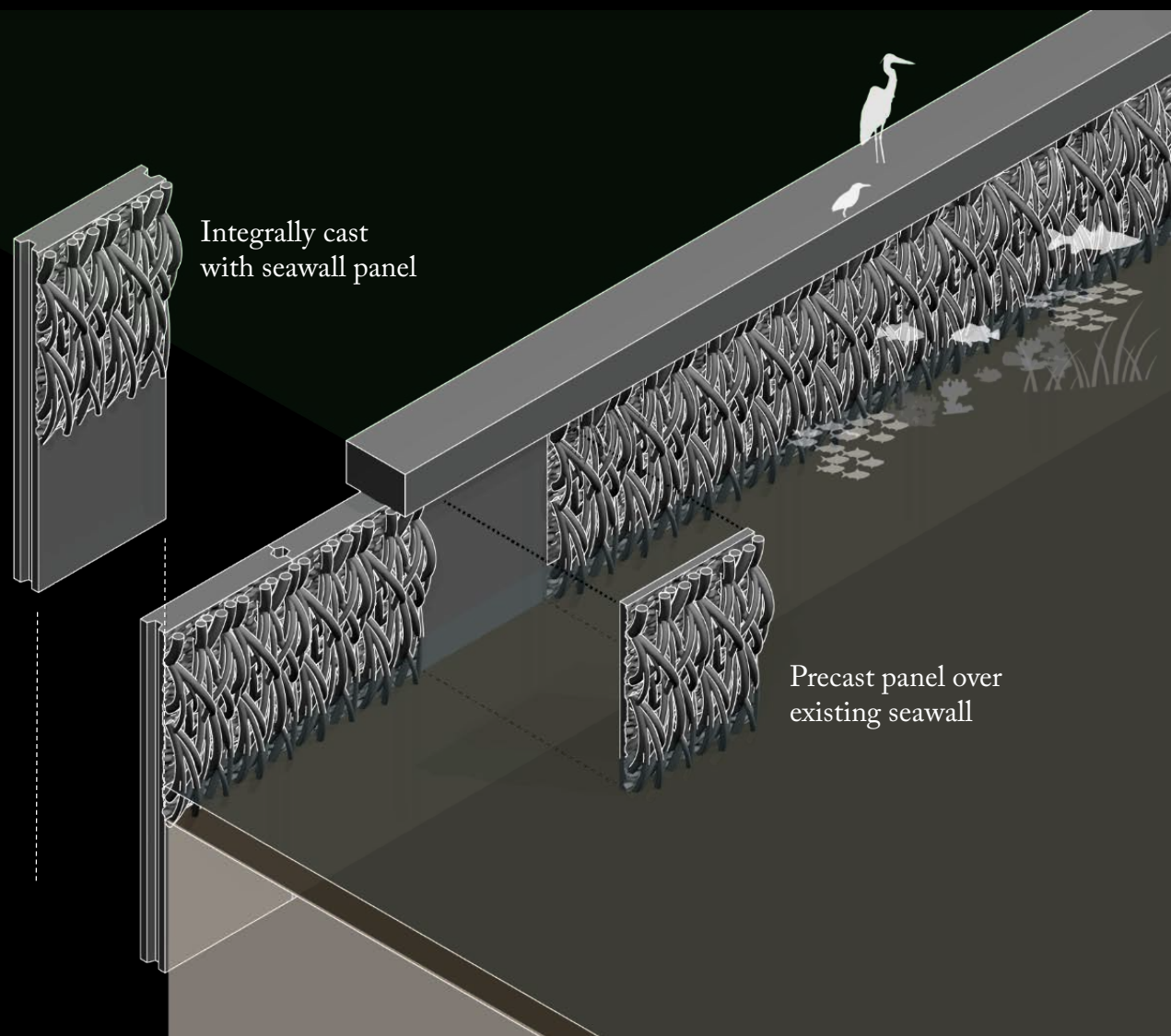
(b) The restoration of a seawall or riprap under Section 403.813(1)(e), F.S., where:

1. The seawall or riprap has been damaged or destroyed within the last year by a discrete event, such as a storm, flood, accident, or fire or where the seawall or rip rap restoration or repair involves only minimal backfilling to level the land directly associated with the restoration or repair and does not involve land reclamation as the primary project purpose, as further explained in section 3.2.4 of Volume I;

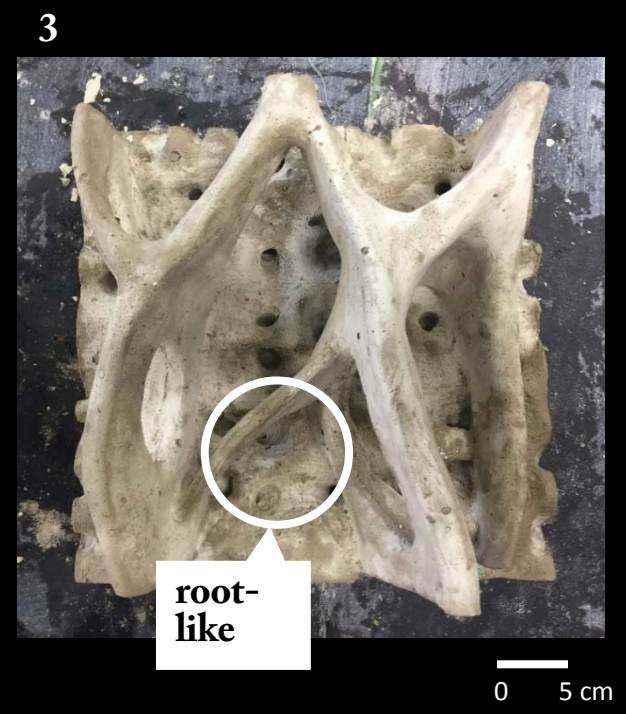
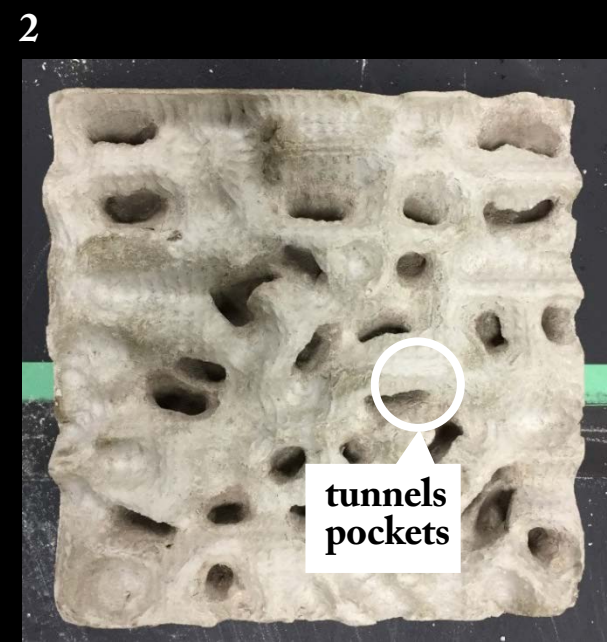
2. **Restoration shall be no more than 18 inches waterward of its previous location,** as measured from the waterward face of the existing seawall to the face of the restored seawall, or from the waterward slope of the existing riprap to the waterward slope of the restored riprap;

Reef Wall Design

- Maximize habitat within 18" of allowable space
- Integrate seawall panel or install over existing
- Wave energy dissipation, erosion control
- Improve water quality



Casting Organic Patterns



Precast Panels

- Greater flexibility in design: custom materials, complex habitat features
- Applicable to any seawall – flat concrete, corrugated composite, etc.
- High strength concrete – 9000psi
- Crushed oyster shell as aggregate
- Surface area increased 200-300%
- Oyster growth enhances structure



Photo credit: Jose Beltran



Seawall Habitats with Mangrove Reef Walls



Seawall Habitats with Mangrove Reef Walls

Pilot Study – Manasota Key in Englewood, FL



Lemon Bay Installation

- Panels vary in complexity
- Monitored bi-monthly for biological development



THE CURTIS AND EDITH
MUNSON FOUNDATION



The Gaia Institute



E.I.C.
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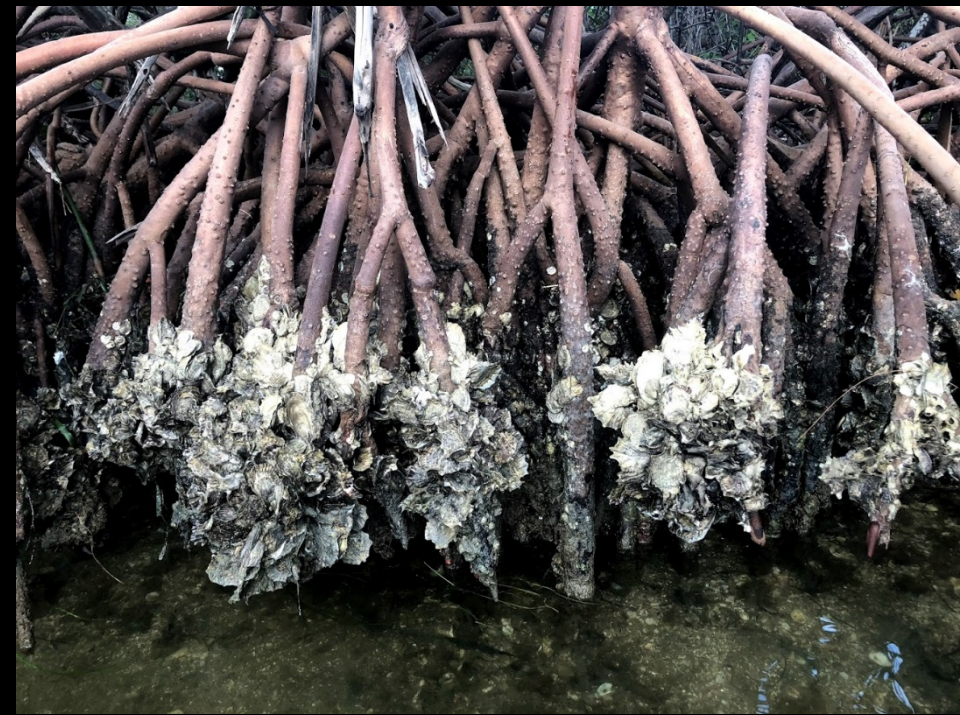


Image Credit: WGCU, Fort Myers



Seawall Habitats with Mangrove Reef Walls





Neighboring Shoreline



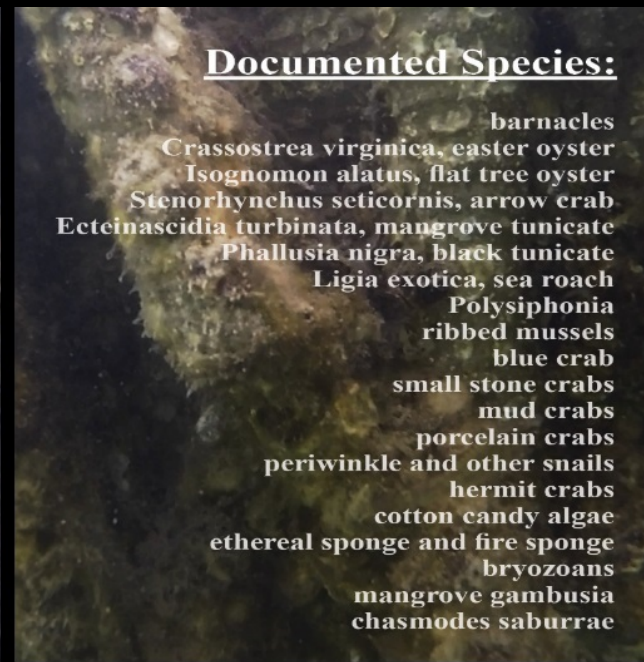
18 Month Growth

Generation II prototype at 16 weeks



Documented Species:

barnacles
Crassostrea virginica, eastern oyster
Isognomon alatus, flat tree oyster
Stenorhynchus seticornis, arrow crab
Ecteinascidia turbinata, mangrove tunicate
Phallusia nigra, black tunicate
Ligia exotica, sea roach
Polysiphonia
 ribbed mussels
 blue crab
 small stone crabs
 mud crabs
 porcelain crabs
 periwinkle and other snails
 hermit crabs
 cotton candy algae
 ethereal sponge and fire sponge
 bryozoans
 mangrove gambusia
Chasmodes saburrae



“Post-occupancy” Evaluation

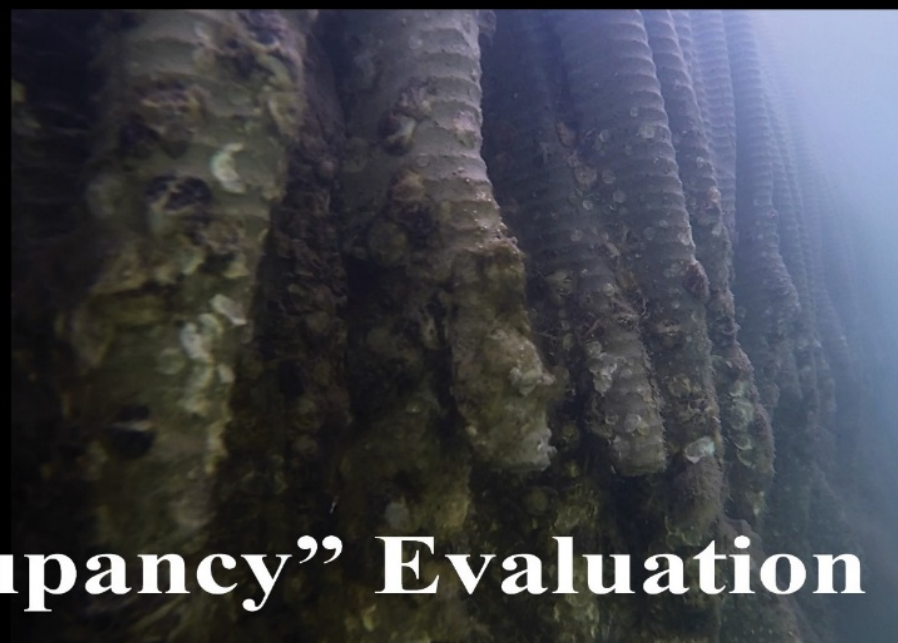


Image Credits: Jessene Aquino-Thomas

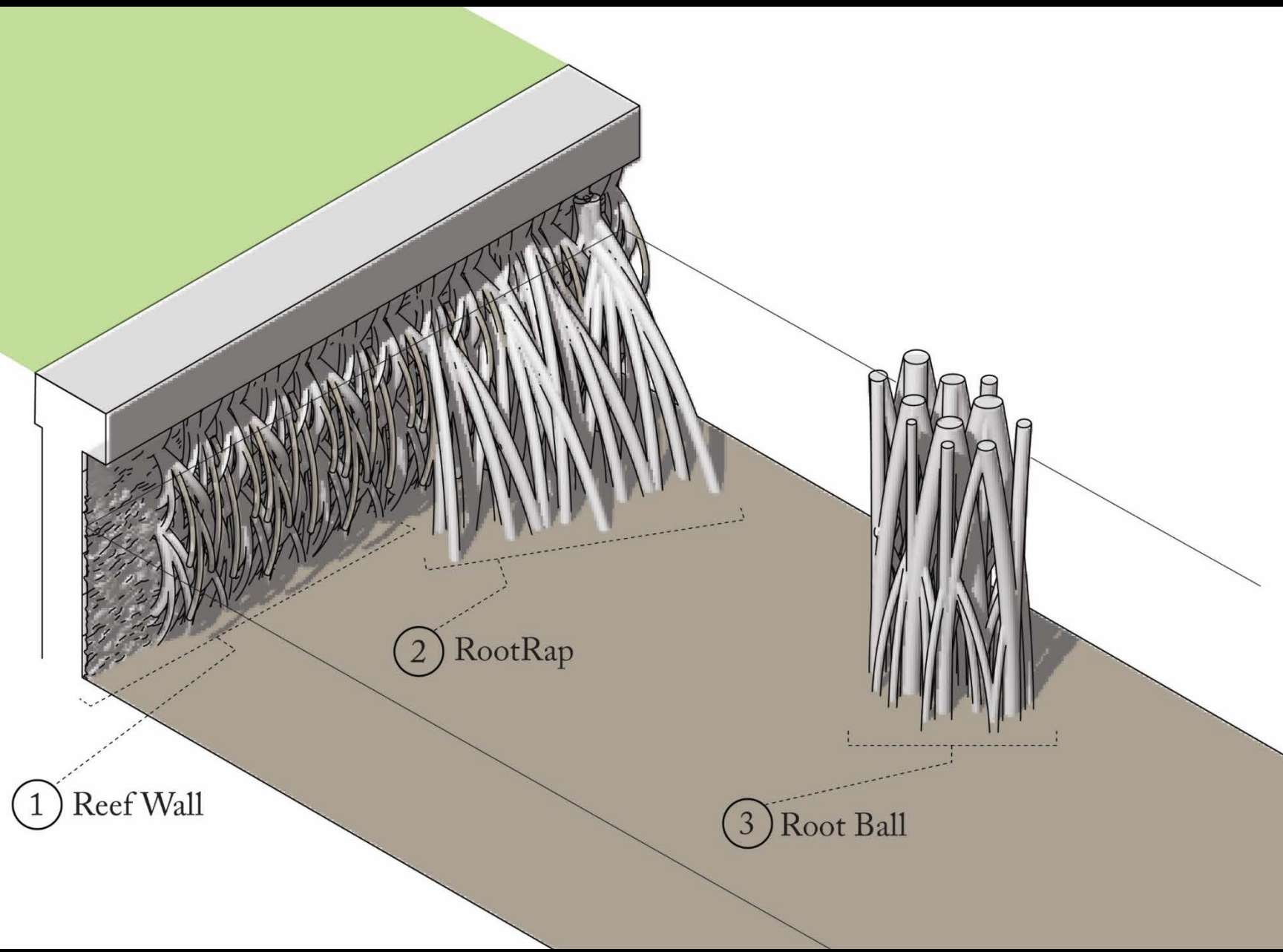
Fort Pierce Shoreline – 06.2018



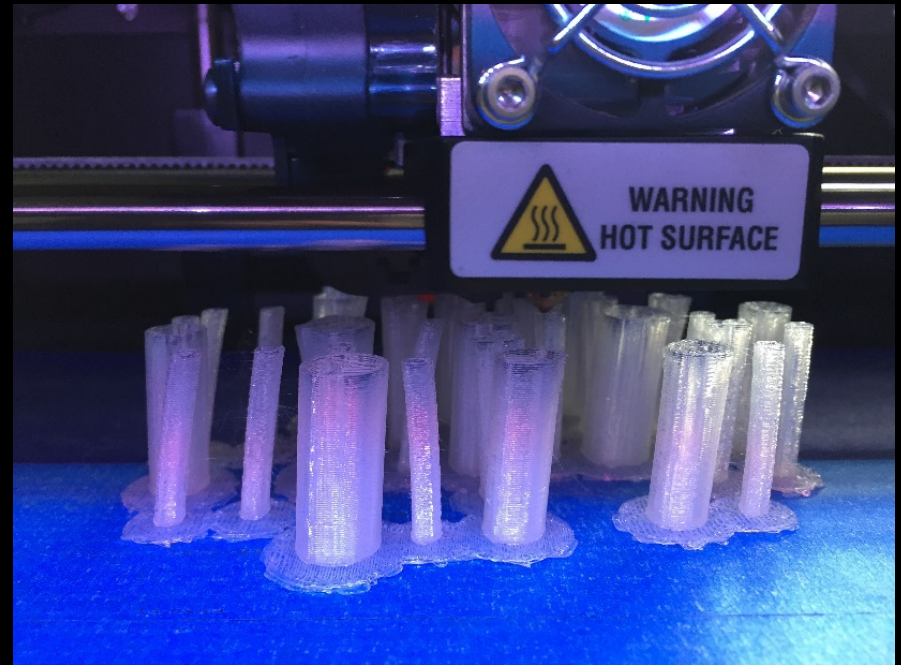
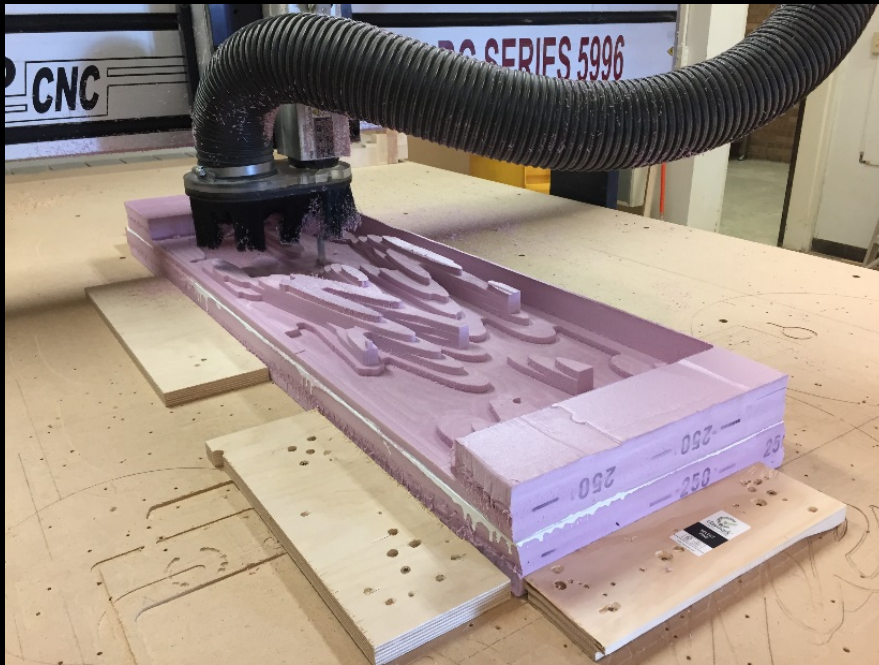
Diverse Substrates for Diverse Species





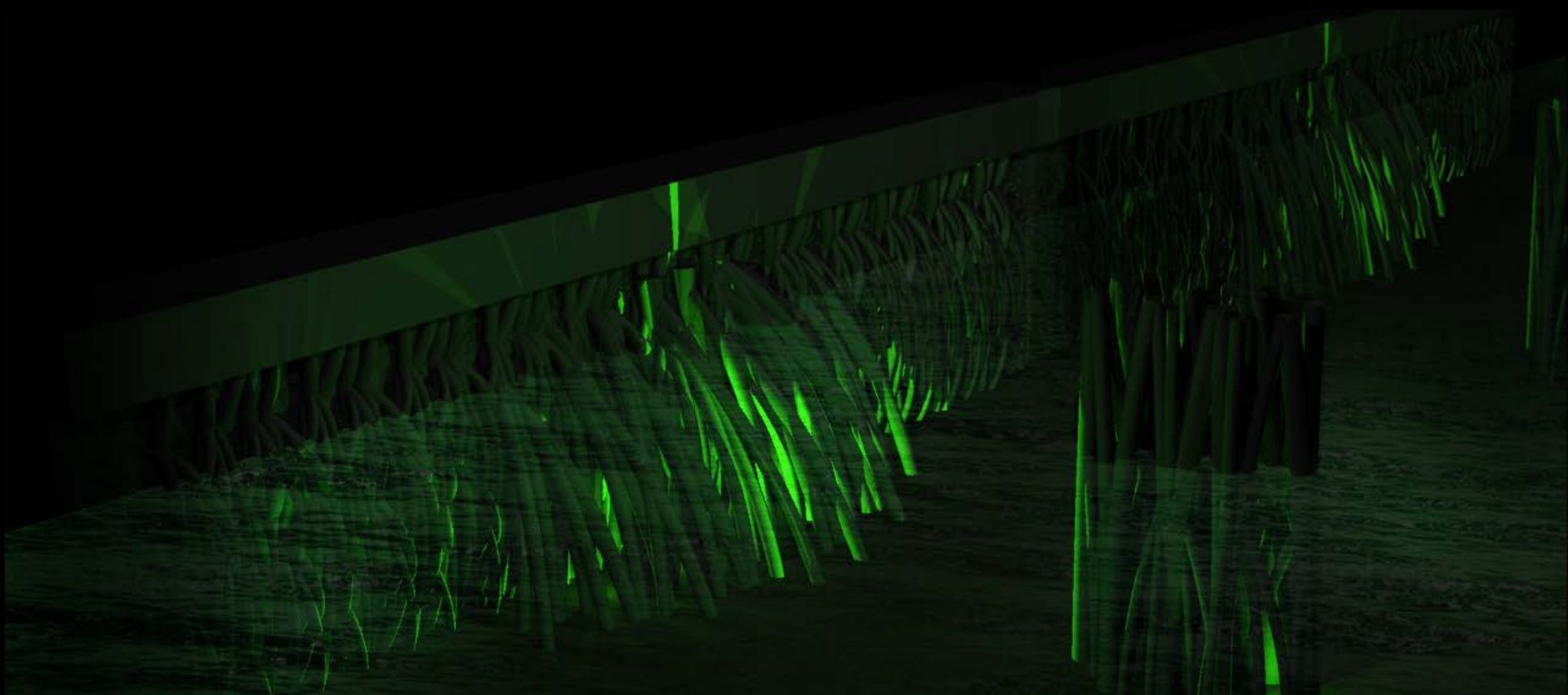


Subtractive + Additive Manufacturing



Current Projects

- Florida State Wildlife Grant with FWC
– 300' installation during 2019 for monitoring over two years
- Tampa Riverwalk (with Meg Whitmer, Ecosphere Restoration Institute)
- Pilot studies with multiple municipalities
- Wave energy and tidal flow analysis with Florida Atlantic University Ocean and Mechanical Engineering



Thank you

kvdr@ku.edu