Sebastian Inlet Channel Completion Project
Comprehensive Seagrass Mitigation Program
2009 Program Update

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A Project for
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Sebastian Inlet District
Sebastian Inlet, FL USA

• Brevard & Indian River Counties, Florida
• 1 of only 6 inlets to the IRL
• High tidal currents
• Expanding flood tidal shoal
• Productive seagrass mixed meadow
• Aquatic Preserve (Malabar to Vero Beach)
• NMFS Critical Habitat for *Halophila johnsonii*

Indian River Lagoon (IRL) Highlighted in Orange.
A Brief History

1924 – The Inlet was opened
1938 – Inlet officials request a connection to the Intracoastal Waterway; denied by War Department
1996 – State permit obtained; denied by ACOE over *Halophila johnsonii* concerns
2007 – State & Federal Permits obtained; dredging completed and markers installed
Seagrass Impacts

- 3,120 ft long, 10.7 acre channel extension
- 1.65 – 3.08 acres of seagrass impact

Halophila johnsonii
Syringodium filiforme
Halodule wrightii
Comprehensive Mitigation Program

- Transplantation of Channel Grasses
- Propscar Inventory / Repair
- Protective Signage
- Aerial Monitoring of Seagrass Expansion
- Stormwater Pollution Control Project (Vero Beach, FL)

Out-of-Kind
Transplantation of Channel Seagrasses

Goals
- Remove seagrasses from channel (*best effort*)
- Fill available propscars
- Demonstrate success transplanting *H. johnsonii*
Transplantation of Channel Seagrasses

**Method**

- Manual removal using pitch fork and shovel
- Produce plugs (PU) using 6” trowel and sod staples
- Plant on 1-ft centers
- Permanently mark repaired scars (DGPS)

Galvanized steel stake

Rubber ‘cow tag’

Planted March 28, 2007
Transplantation of Channel Seagrasses

- April 24-25 & May 15-16, 2007
- 459 PU (179 H. wrightii, 279 S. filiforme, 1 H. johnsonii)
- 41 scars planted

Results

Planted H. johnsonii as observed August 27, 2007

Halodule plug
Transplantation of Channel Seagrasses

Results

- September 2008
  - All locations = complete or near complete recovery
- August 2009
  - Complete recovery at all locations visited
Propscar Repair

- Completed May 2008
- In cooperation with Seagrass Recovery & Florida Tech

- Targeted Type III scarring, focusing on Zone E
- Deployed 2031 sediment tubes
- Dredged material from channel used to fill prop scars
- Filled 32 features (10 scars and 22 blowouts)
- Recorded DGPS positions and physical measurements of repaired features
Aerial Monitoring (2007)

- Digital Orthophotography
- 500 acre region of shoal
- Images taken at low tide in June 2007
- Absolute resolution of 1: 2,400
- 0.25-ft ground pixel resolution
Aerial Monitoring (2007)

- 110.26 acres of seagrass
  - 76% of mitigation area
Aerial Monitoring (2008)

- Color digital imagery
- 500 acre region of shoal
- Image taken at low tide on June 11, 2008
- Negative scale: 1:4,800
- 0.25-ft ground pixel resolution
- Target scale: 1"=50'
Aerial Monitoring (2008)

- 115.36 acres of seagrass
  - 79.56% of mitigation area
Aerial Monitoring
Change Analysis 2007-2008

- 7.69 acres lost
- 12.76 acres gained
- Net increase of 5.07 acres
- Majority of change in Zone C (GAIN)
- Every zone (except F) exhibited increases relative to 2007
- Dynamic system
Aerial Monitoring (2009)

- Color digital imagery
- 500 acre region of shoal
- Image taken during incoming tide on June 25, 2009
- Negative scale: 1:4,800
- 0.25-ft ground pixel resolution
- Target scale: 1"=50'

Ecological Sciences
Aerial Monitoring (2009)

- 110 acres of seagrass
  - 75.86% of mitigation area
Aerial Monitoring
Change Analysis 2008-2009

- 14.33 acres lost
- 8.97 acres gained
- Net decrease of 5.36 acres
- Majority of change in Zones A, D, E (LOSS)
- Every zone experienced decrease relative to 2008 (except Zone C)
Aerial Monitoring: Zone D

2008

2009
Aerial Monitoring
Change Analysis 2007-2009

- 14.80 acres lost
- 14.51 acres gained
- Net decrease of 0.29 acres
- Majority of change in Zone C (GAIN)
- Every zone, except Zones B and C, exhibited decreases relative to 2007
- Stability over two years
Groundtruthing (2007)

- Conducted August 2007
- Randomized point check by depth
  - 10 per depth strata (0-2.5 m, 0.5-m increments)
  - N=50
  - 30-100% accurate for seagrass beds <1.5 m depth (93.84% of mitigation zone)
  - 70-100% accuracy overall

Randomized patch perimeter check by size class
- 10 per size class (0-50 m, 10-m increments)
- N=50
- Tended to underestimate patch size (i.e., aerial coverage of SAV)
Groundtruthing (2008)

Species Distribution

- 818 of 904 positions provided seagrass species data
- Species-specific depth distribution data
  - *Halodule wrightii* occurring shallower than *Syringodium filiforme*
Propscar Inventory (2007)

- 661 potential scars identified
- 506 scars confirmed
- Cataloged according to Type: Type I, II, or III
- Type III scarring
  - Clustered in Zone E
Propscar Inventory (2008)

- 716 potential scars identified
- 431 scars confirmed
- Scars cataloged according to Type
- Type III scars
  - Clustered in Zones A, D and E
**Propscar Analysis 2007-2008**

- Net overall reduction in total number of scars
  - Largely due to drop in Type I scarring
- Areas of greatest change: Zones A, D and E
  - Increases in Type II scarring driving much of the overall pattern
Propscar Inventory (2009)

- 775 potential scars identified
- 188 scars confirmed
- Scars cataloged according to Type
Propscar Analysis 2008-2009

- Net overall reduction in total number of scars
  - Largely due to reduction in Type II and III scarring (Type I impacts stable)
  - Kendall's tau Correlation test performed
- Areas of greatest change: Zones A, D and E
  - Decreases in Type II scarring driving much of the overall pattern
Propscar Analysis
2007-2009

Areas of greatest change from 2007 to 2009: Zones C and E
– Decreases in Type I and III scarring driving much of the overall pattern
Stormwater Pollution Control Structure

Photographs courtesy of Indian River County

Estimated annual removal:
- total nitrogen = 46,800 lbs.
- total phosphorus = 11,500 lbs.
- total suspended solids = 906,000 lbs.
- approximately 300 cubic yards/year of fine sediment from sediment traps

Equating to the following reductions in the total estimated yearly pollutant loading from the Indian River Farms Water Control District into the Indian River Lagoon:
- total nitrogen = 12%
- total phosphorus = 17%
- total suspended solids = 15%

- Vortex technology and self-cleaning bar screens with traveling rakes
- Filters down to 600 microns
- Treats 304 million gallons/day before diversion to spillway structure
- Treats approximately 51,000 acres
- Operation and maintenance cost $42/screen/year
Stormwater Pollution Control Project

- Monitoring of fixed seagrass transects
- Vero Beach Main Relief Canal Outfall
- SJRWMD methods
- Data supplied to SJRWMD
- Sampling in Summer and Winter
- 3 baseline sampling events
  - May 2007
  - Feb 2008
  - July 2008
- 2 events after stormwater control structure turned on
  - February 2009
  - July 2009
Stormwater Pollution Control Project
Seagrass Distribution by Depth
All Species – All Transects – Total Visual Cover

- Halodule wrightii
- Halophila decipiens
- Halophila johnsonii

Data shows seasonal variation in seagrass cover across different depth ranges.
Stormwater Pollution Control Project
Seagrass Distribution by Distance from Shore

All Species – All Transects – Total Visual Cover

Graphs showing the percent cover of seagrass species by distance from shore, with data for Halodule wrightii and Halophila decipiens, comparing winter and summer conditions.
Summary

- **Aerial analysis**
  - 2007 to 2009 - overall stability in seagrass acreage within the analysis area

- **Propscar inventory**
  - Net reduction in verified propscars from 2007 to 2009

- **Transplanted scars**
  - Scars were not visible in August 2009

- **Active propscar repair (sediment tubes)**
  - All repaired propscars completely recovered
  - 10 of 22 repaired blow-outs = seagrass encroaching from edges
  - Remaining 12 blow-outs = no additional scour, void of seagrasses

- **Fixed transect monitoring (semiannual)**
  - Significant inverse relationship between edge of bed and distance from outfall
  - Further analyses pending
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