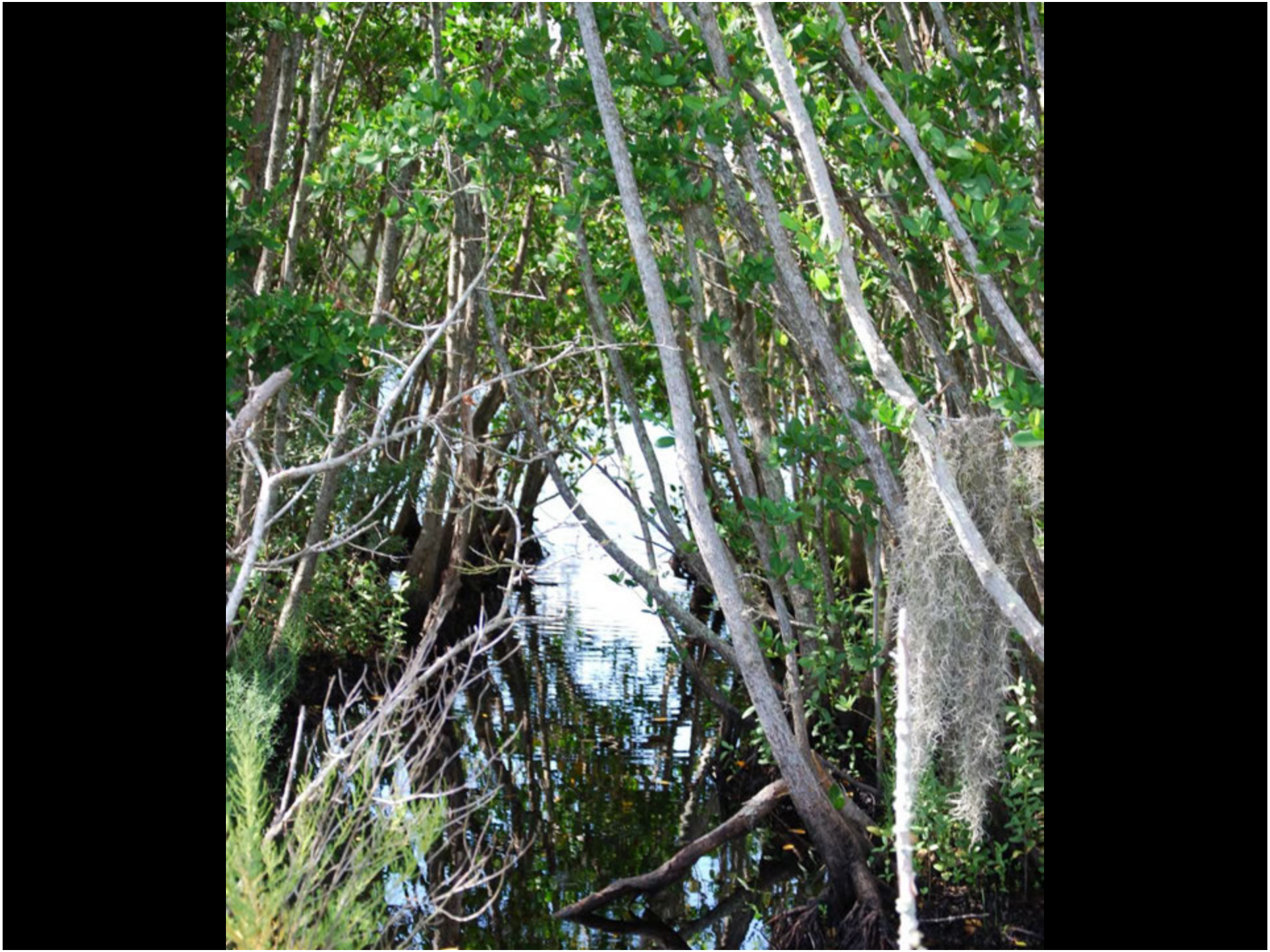
St. Johns River Water Management District

Collaborative Restoration of Coastal Wetlands: Salt Marshes and Mangroves

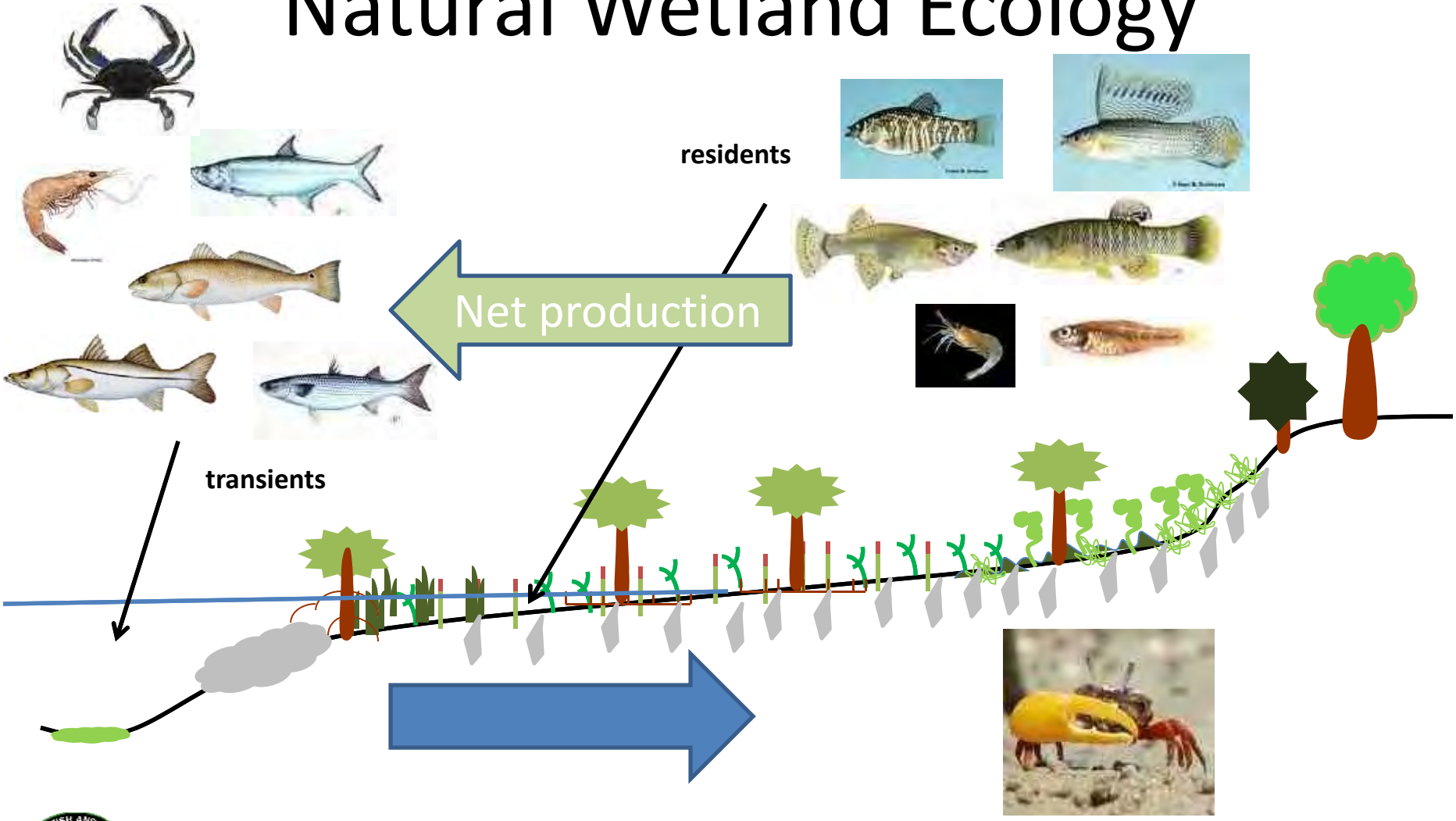
Ron Brockmeyer
Environmental Scientist

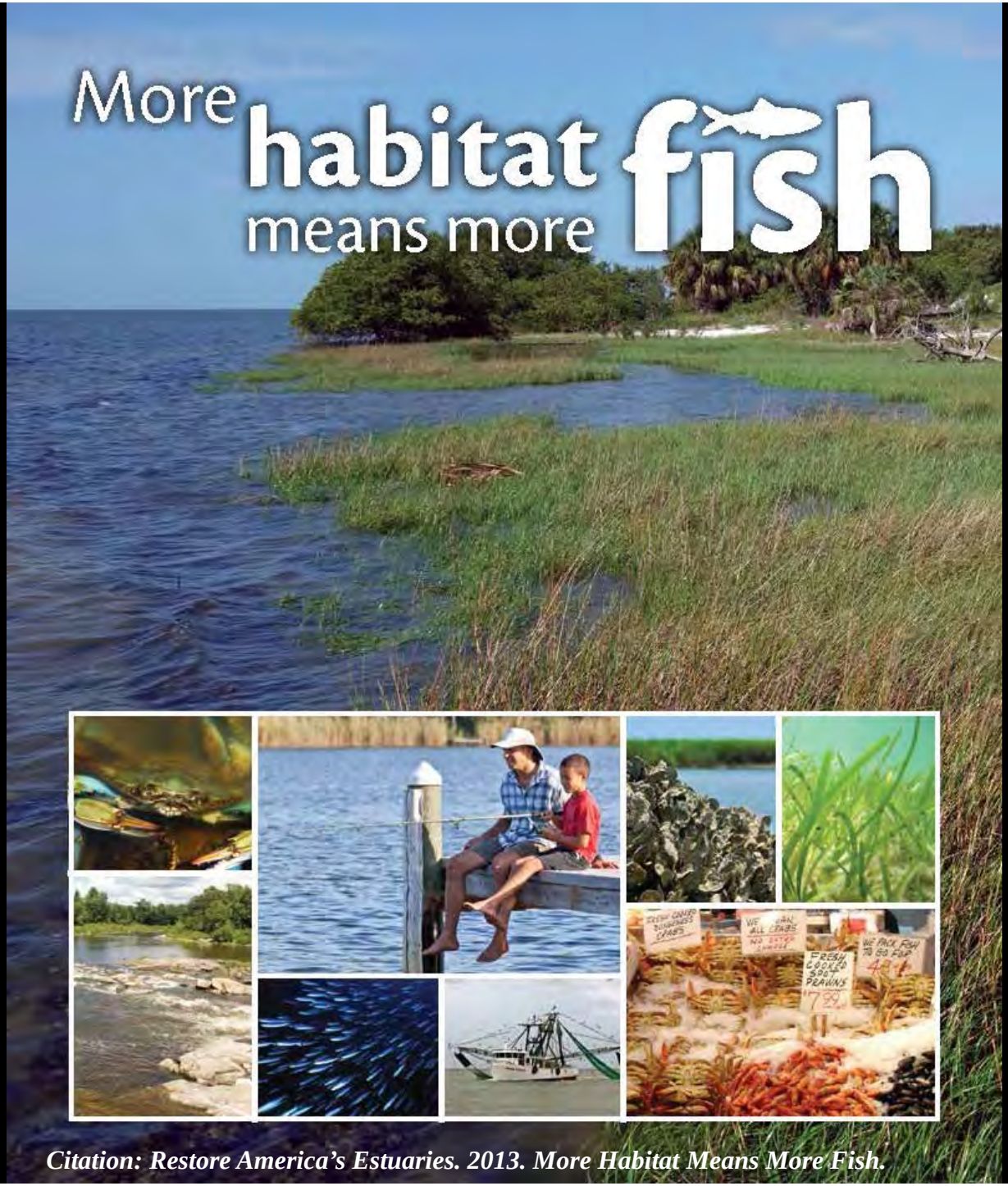
Outline

- **What are Coastal Wetlands?**
- **Why are they important?**
- **What have “we” done to them?**
- **How are “we” fixing them?**



Indian River Lagoon
Natural Wetland Ecology

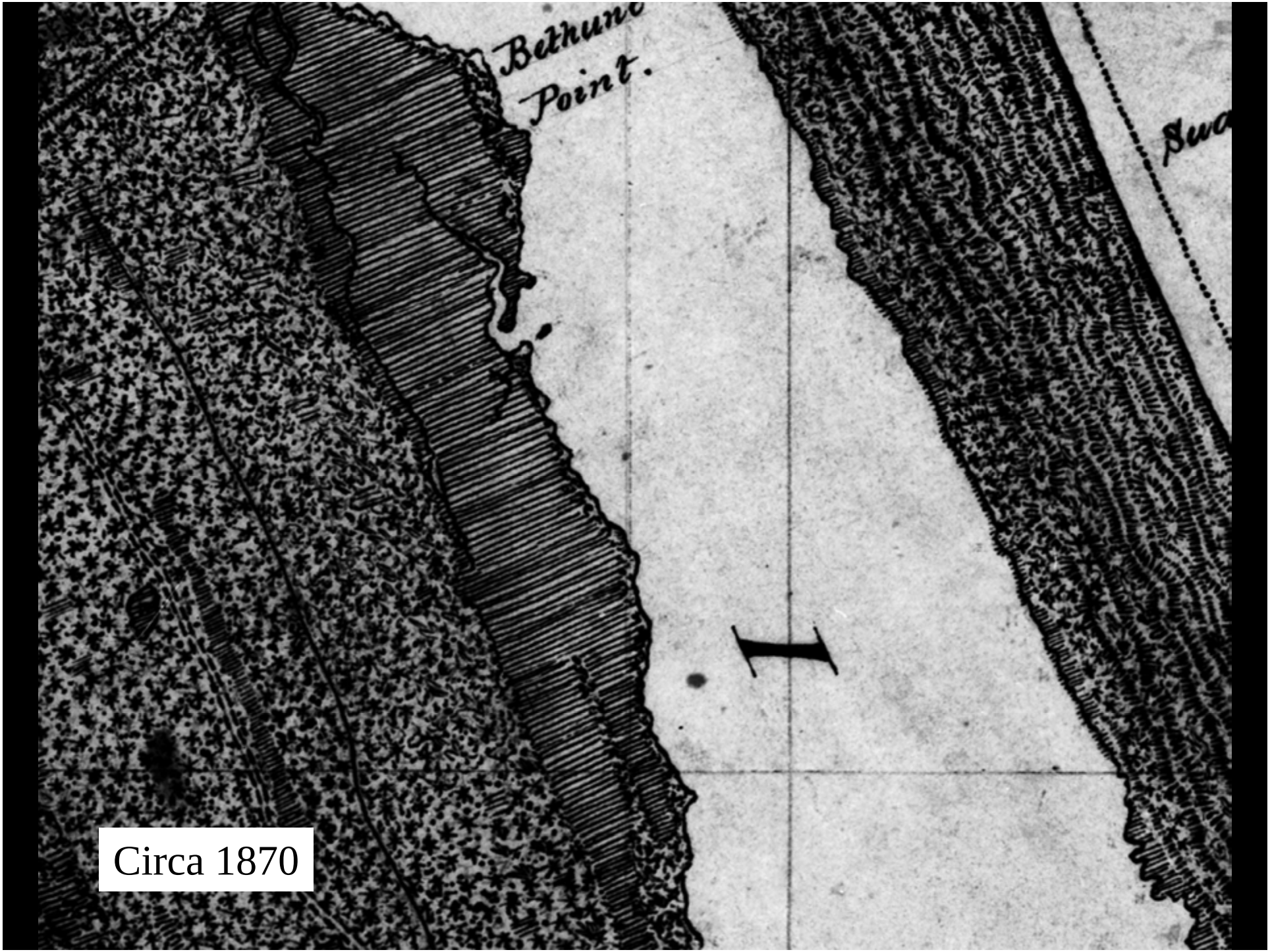




Citation: Restore America's Estuaries. 2013. More Habitat Means More Fish.

Coastal Wetland Impacts

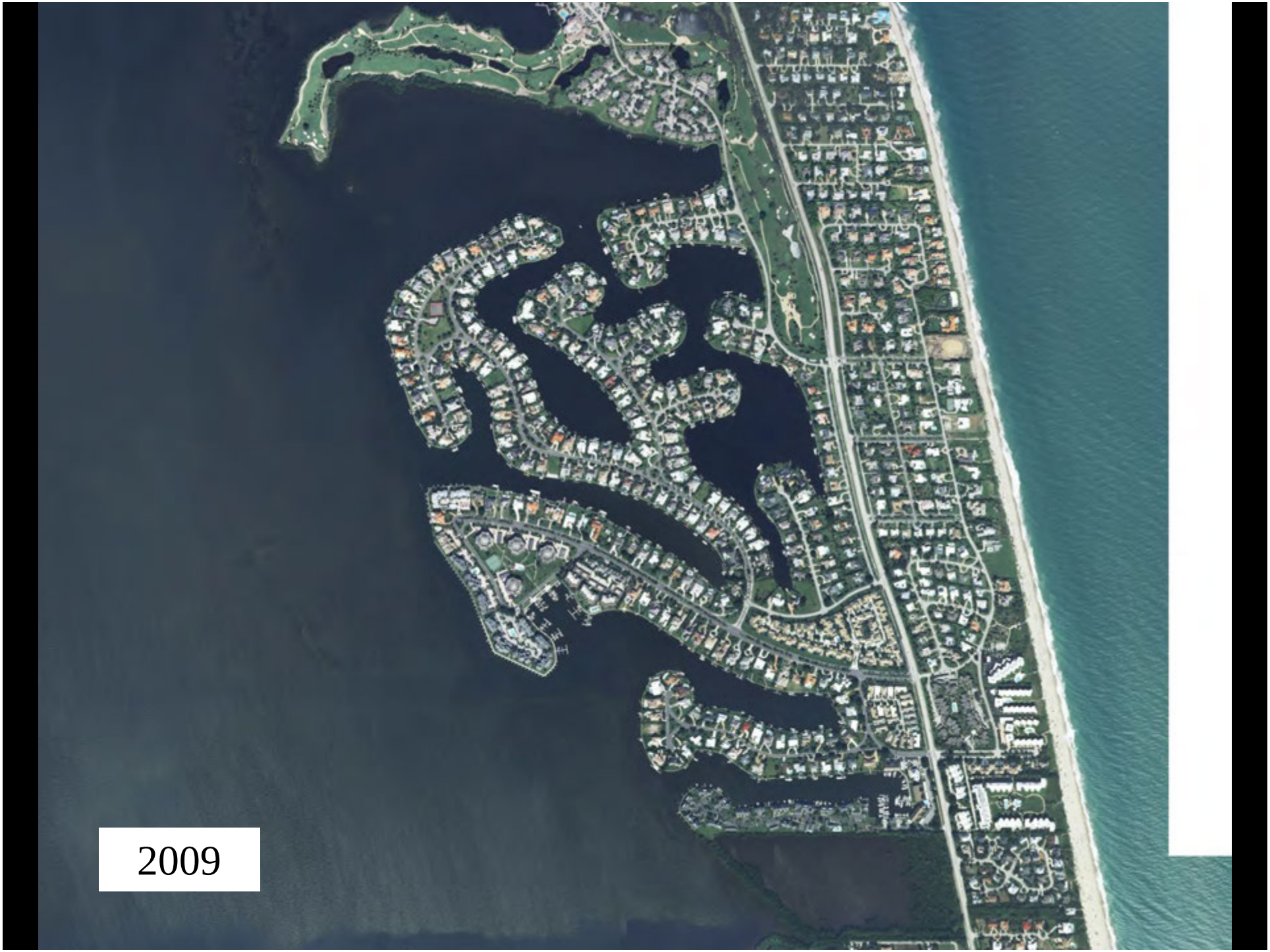
- **Agriculture (grazing; other cultivation; firewood; charcoal)**
- **Oil field development**
- **Filling (sometimes with Dredging)**
- **Impounding**
- **Ditching**


Bethune
Point.
Circa 1870


1943


2009


1943


2009

Recovery Act:
Northeast Florida Coastal Wetland Restoration Initiative

Component #1: This component includes the restoration of over 30 acres of dredge spoil-filled historic saltmarsh at the North Peninsula State Park. The process includes the clearing of vegetation, excavation and disposal of spoil material, grading the site to match adjacent marsh elevations, and revegetation of the site. Over 33,000 hours of labor are estimated to be required to complete this work.

Aero Photo

727.520.8181
www.aerophoto.com

North Peninsula

Image # 100106 2113
Date 01.06.10


CAT
CAT 320C

Coastal Wetlands
Problems & Solutions

IRL contained ~ 65,000 acres

- 20% permanently lost
- 75% of remaining coastal wetlands (39,916 acres) impounded and isolated from the IRL
- And another 4% (>2,000 acres) were dragline-impacted


Impounded Wetland
Dike


N
Meters
0 50 100 200 300 400


A recovering marsh after reconnection.

Fish in Open vs. Closed Impoundments

Prior to opening:

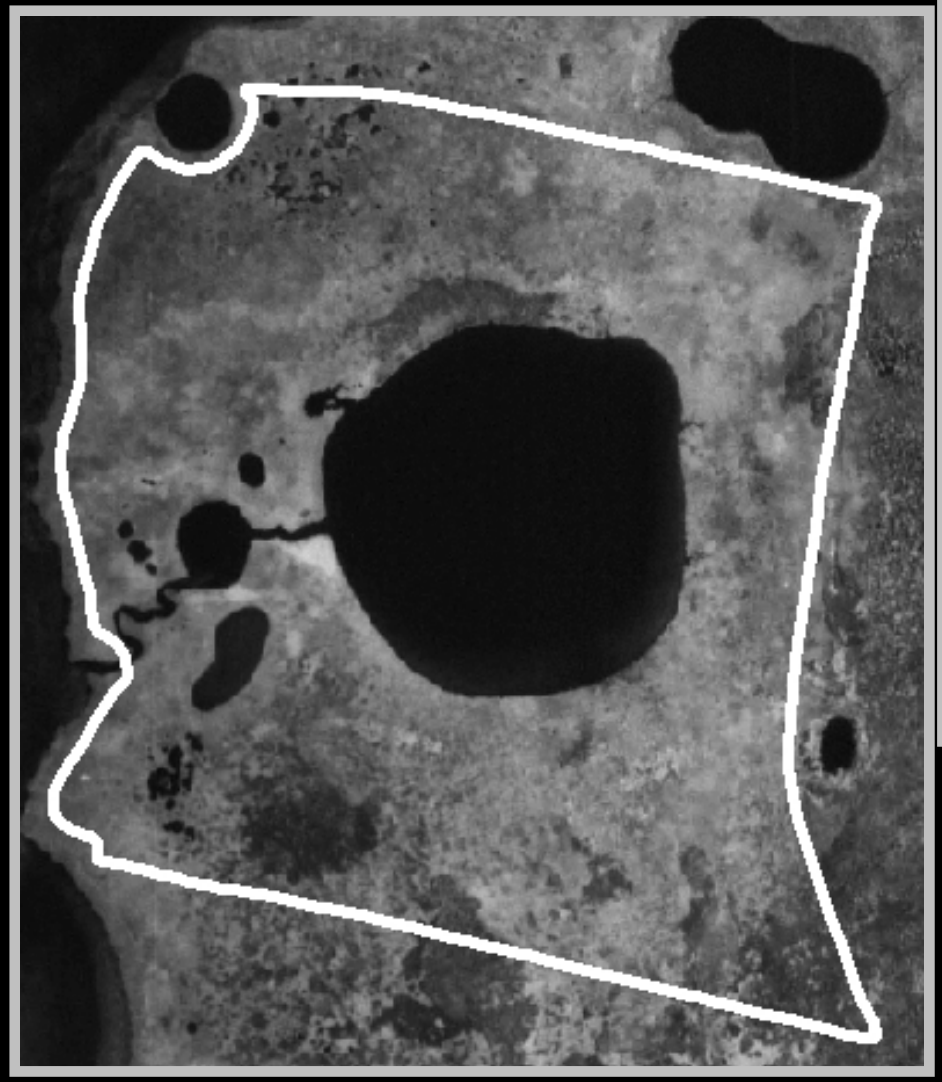
- Sheepshead Minnow
- Mosquitofish
- Sailfin Molly
- 3 Killifish species
- Silverside

Additional species after opening:

- Snook
- Tarpon
- Ladyfish
- Striped Mullet
- White Mullet
- Irish Pompano
- Redfish / Red Drum
- Black Drum
- Yellowfin Mojarra
- Gray Snapper
- Spot
- Croaker
- Pinfish
- Blue Crab
- Penaeid Shrimp
- Over 60 species

Photo Comparison of T-10-D

1943



2000

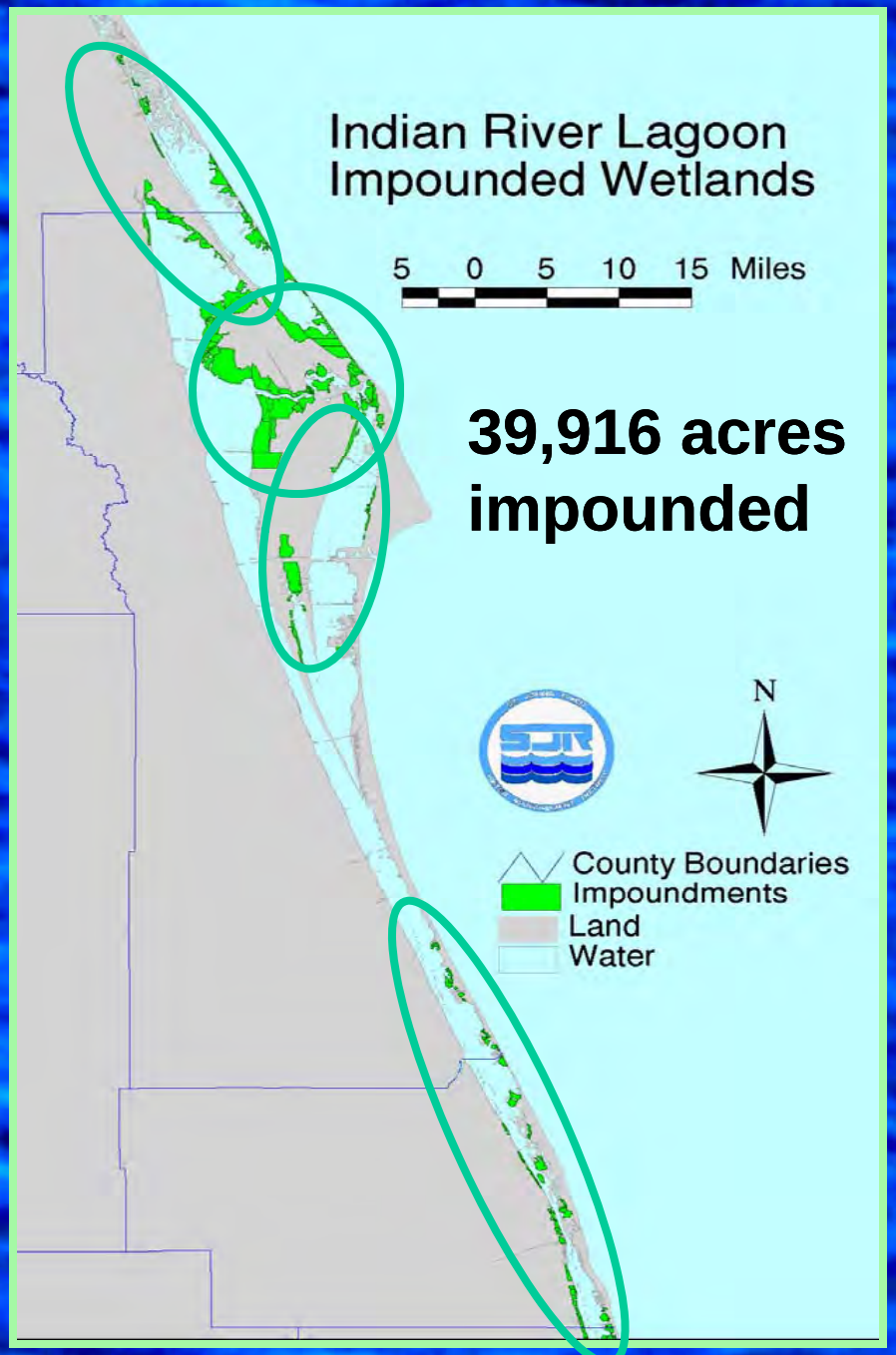

CAT
CAT
320D

Coastal Wetlands
Solutions

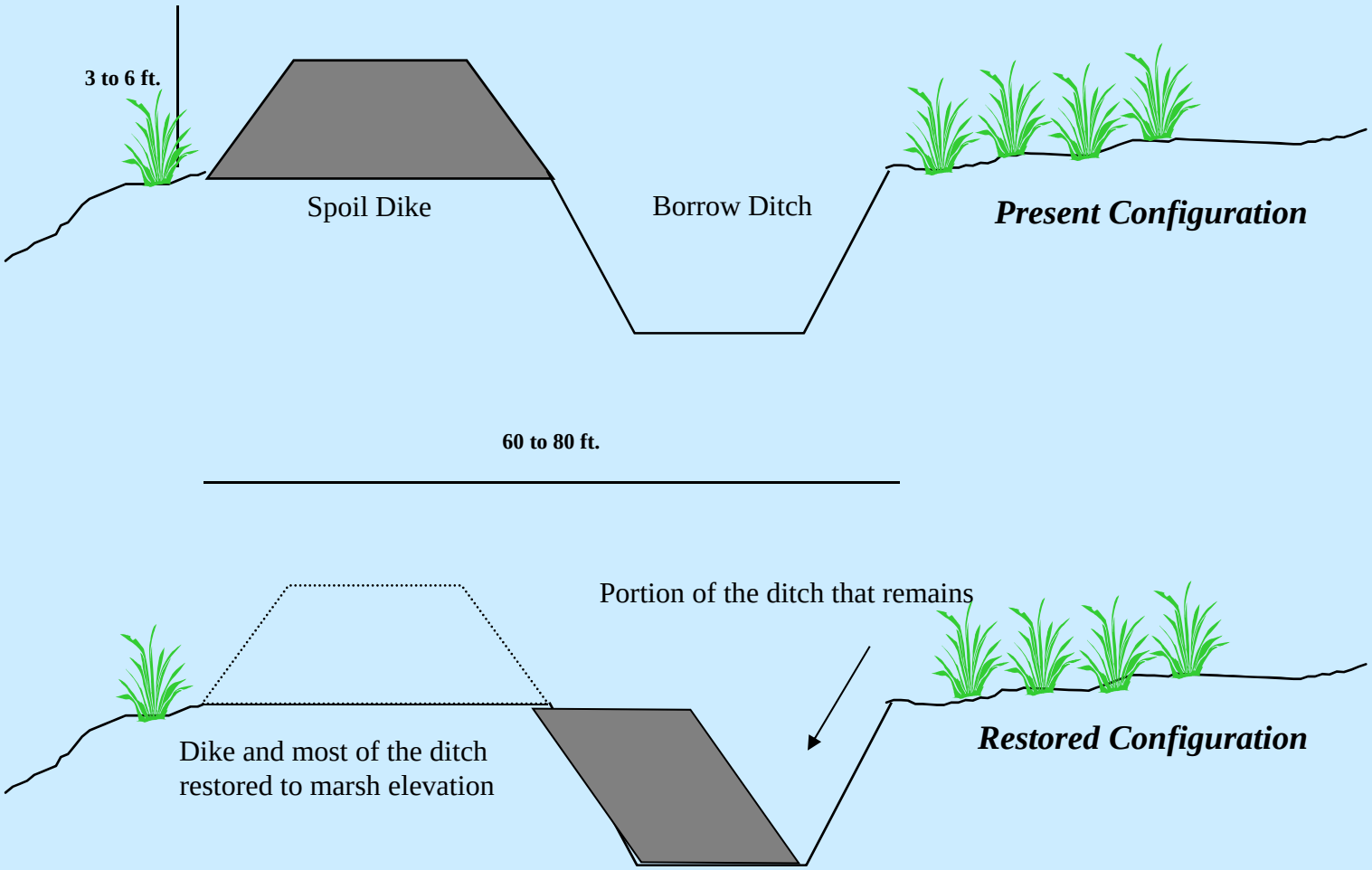
Target: 39,024 acres

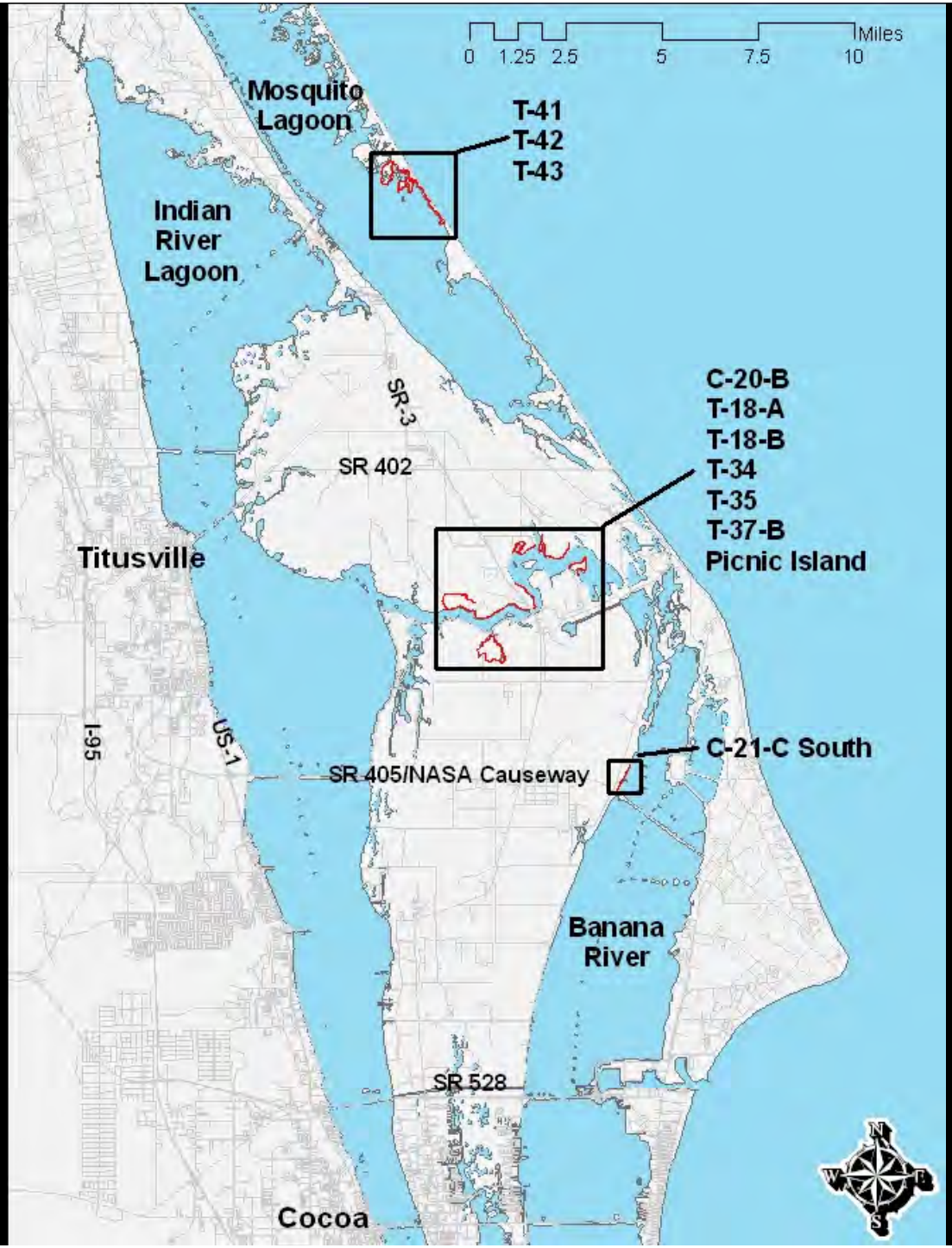
Reconnected: 27,219 acres
Breached: 1,153 acres
Restored: 3,231 acres

Next 5 Years: 7,421 acres



Dike Removal Technique




0 1.25 2.5 5 7.5 10 Miles
Mosquito Lagoon
T-41
T-42
T-43
Indian River Lagoon
SR-3
SR 402
C-20-B
T-18-A
T-18-B
T-34
T-35
T-37-B
Picnic Island
Titusville
I-95
US-1
C-21-C South
SR 405/NASA Causeway
Banana River
SR 528
Cocoa
N
W
E
S

Recovery Act:
Northeast Florida Coastal Wetland Restoration Initiative

Component #2: This component includes the full restoration of impounded coastal wetlands at MINWR by the scraping down of at least 12 miles of impoundment dike. This work will return over 75 acres to wetland elevation and restore natural hydrology to hundreds of additional acres of wetland. Over 10,000 hours of labor are estimated to be required to complete this work.

St. Johns River Water Management District

Acreage Returned to Marsh Elevation

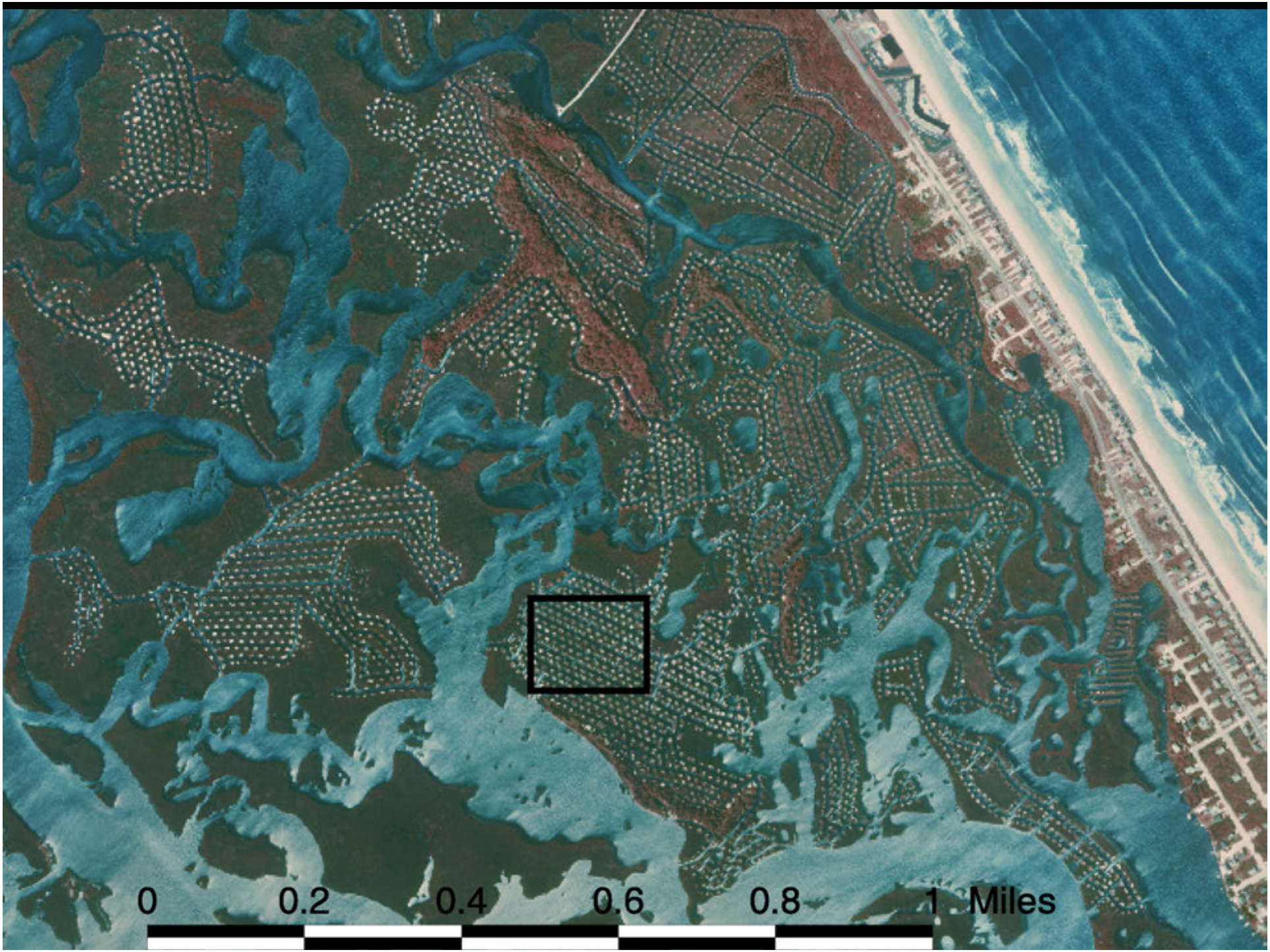
Impoundment	Miles of Dike Restored	Acres Restored Returned to Wetland Elevation	Impoundment Acres Rehabilitated
V-1, V-2, V-5, T-45	4.771	39.67	237
D-12-South	6.076	33.43	278
D-12-North	3.781	11.86	45
C-21-D	1.967	16.60	117
C-8	2.168	13.59	91
T-39-South*	2.414	15.09	84
C-21-CS*	0.774	4.84	58
C-20-B*	2.62	16.38	178
T-37-B*	1.00	6.25	52
T-35*	1.81	11.31	291
T-41*	1.65	10.31	38
T-42*	2.68	16.75	116
T-43 (partial)*	1.53	9.56	76
T-34*	1.23	7.69	65
C-21-CN*	4.32	28.88	248
T-18-A*	2.8	17.5	238
T-18-B*	1.14	7.13	115
TOTAL	**42.757**	**266.84**	**2,318**

*- acres returned are estimated

Recovery Act Coastal Wetland Partnerships:

Implementation Partners

- **NOAA Restoration Center**
- **St. Johns River Water Management District**
- **U.S. Fish and Wildlife Service (MINWR)**
- **FDEP Florida Park Service**
- **NASA Kennedy Space Center**
- **National Park Service (CNS)**
- **Floridan Resource Conservation and Development Council**

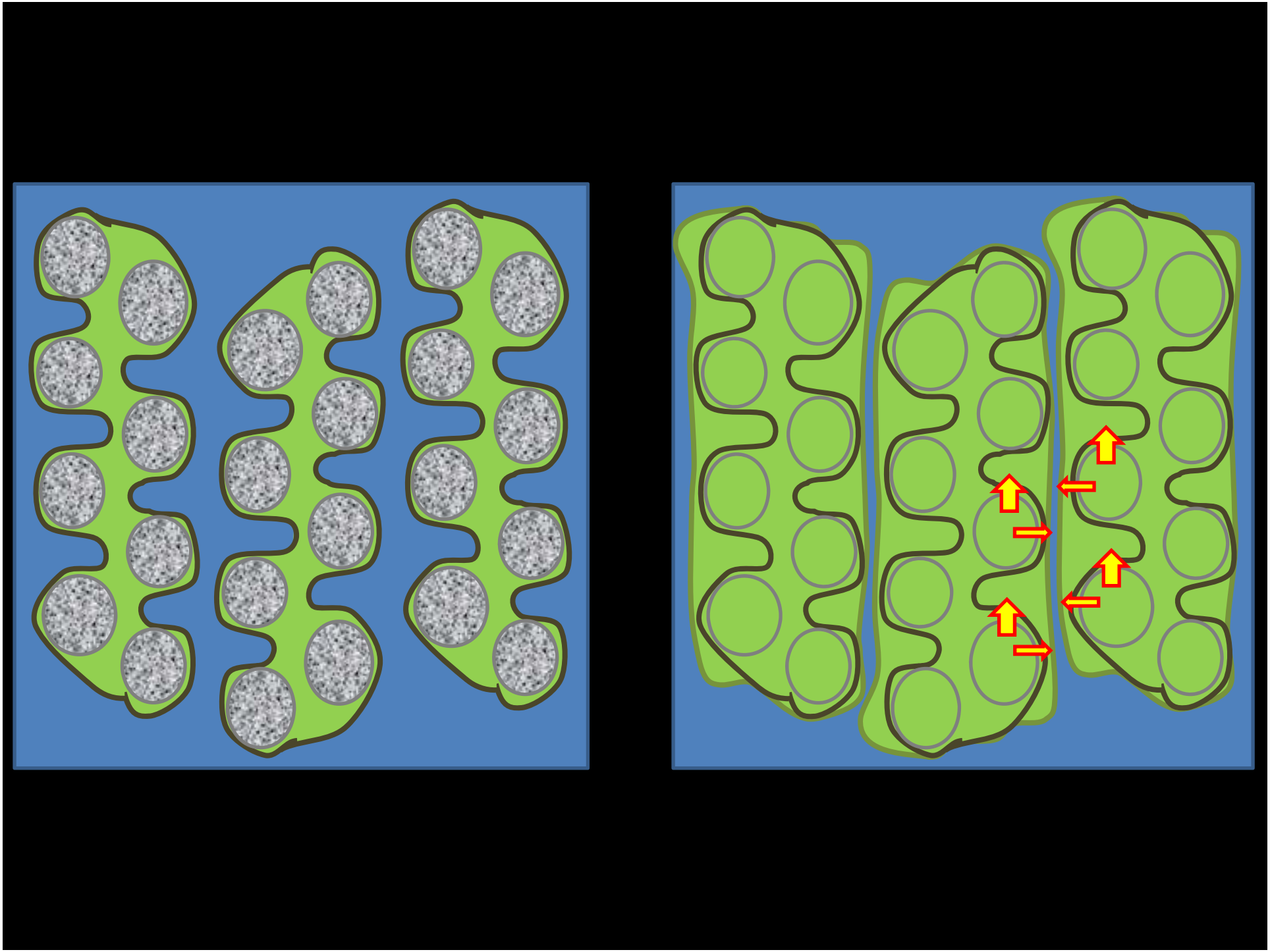

0
0.2
0.4
0.6
0.8
1 Miles

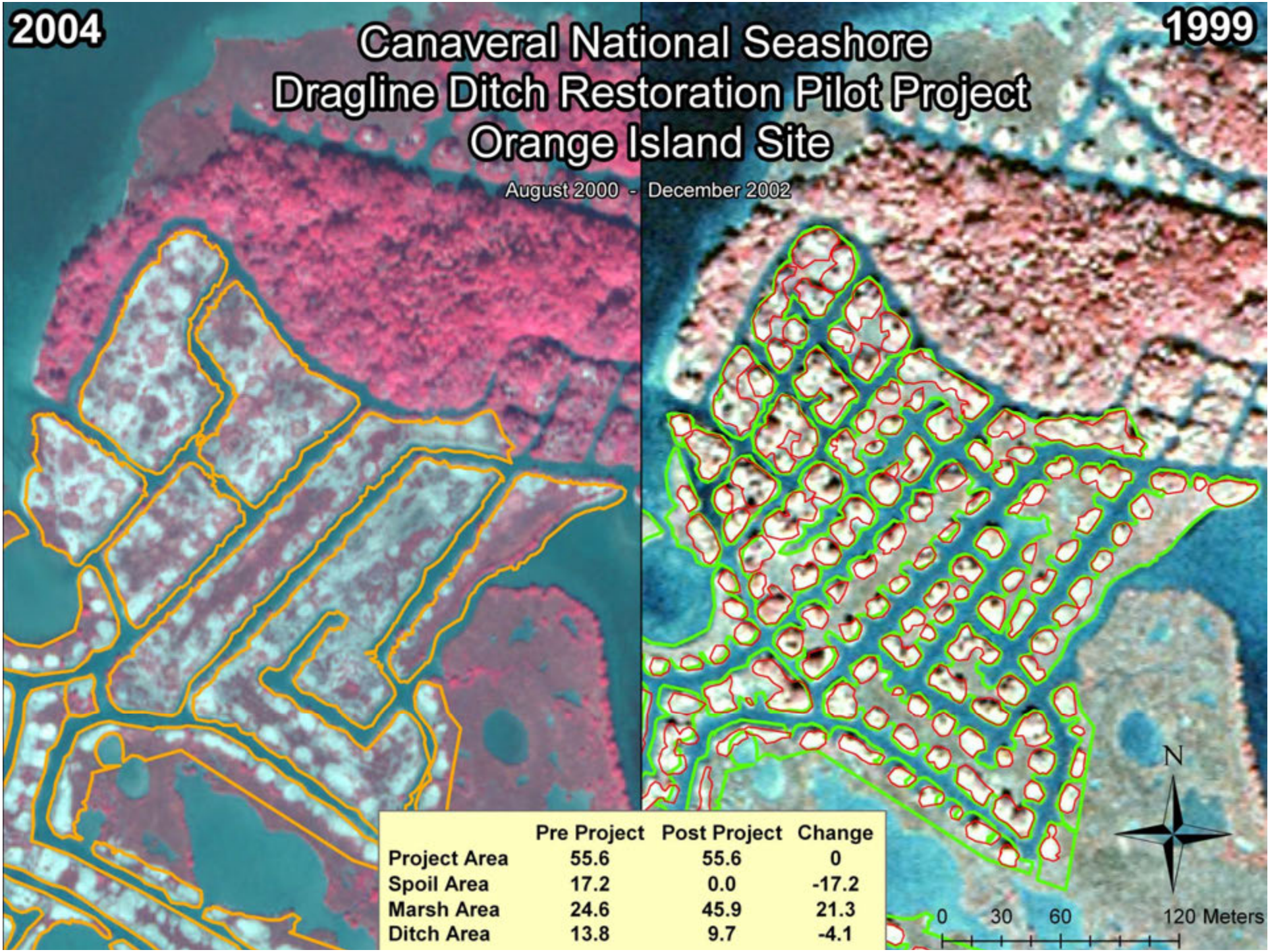

UNIT

Coastal Wetlands
Solutions

Fill ditches & grade draglined marshes

Began 1999, 620 acres rehabilitated

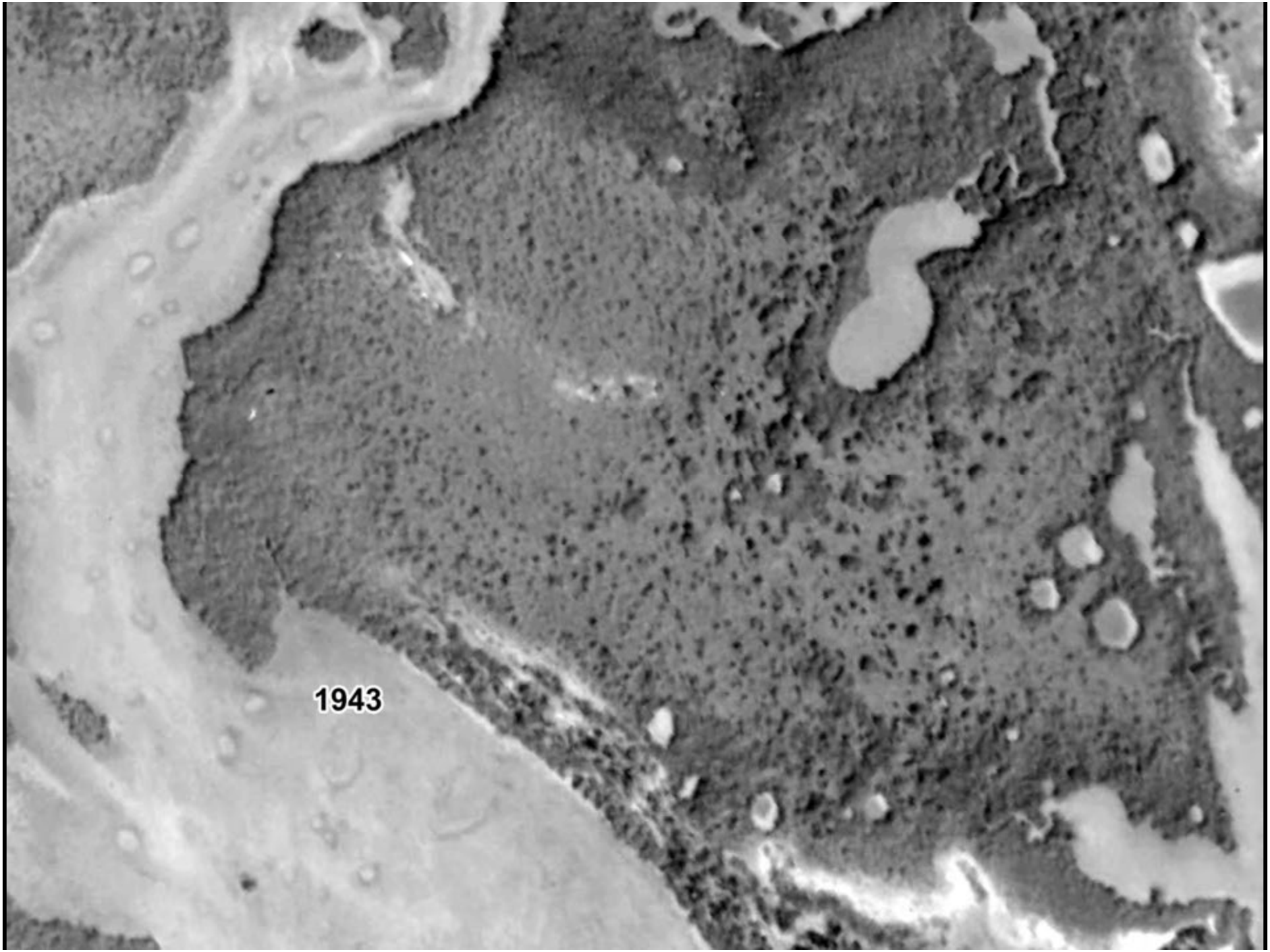


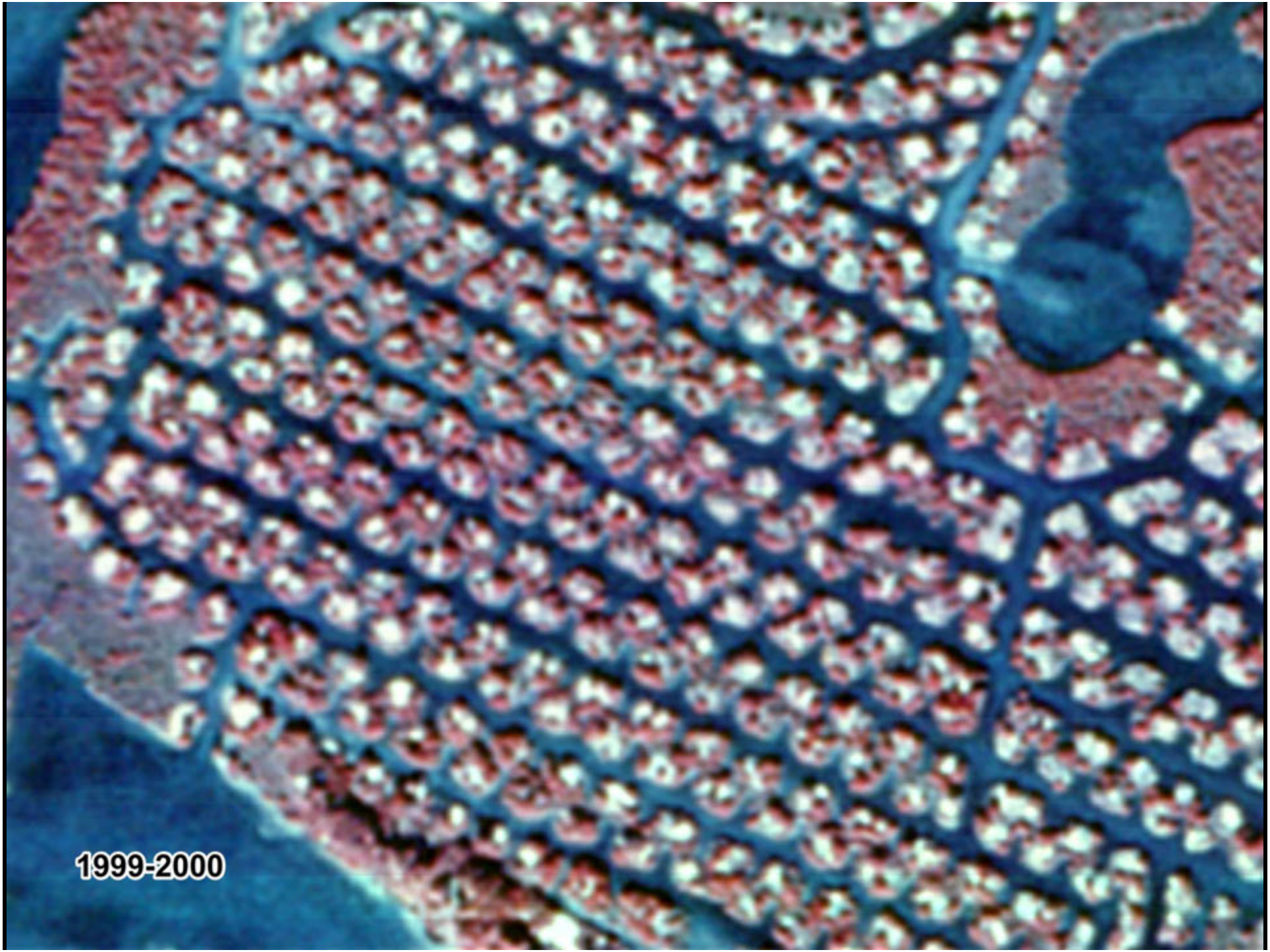


	Pre Project	Post Project	Change
Project Area	55.6	55.6	0
Spoil Area	17.2	0.0	-17.2
Marsh Area	24.6	45.9	21.3
Ditch Area	13.8	9.7	-4.1

National Coastal Wetland Conservation Grants Program:

Phase 1 - Restoration of dragline ditched coastal wetlands in Volusia County, Florida


1943


1999-2000


January 2009


July 2009


CAT


2011


2012


2013


June 2015

Volusia Wetland Partnership

- Volusia County Mosquito Control
- Volusia Environmental Management
- Canaveral National Seashore (U.S. Parks Service)
- Mosquito Lagoon Aquatic Preserve (FDEP CAMA)
- Tomoka Basin State Parks (FDEP State Parks)
- St. Johns River Water Management District
- Florida Fish and Wildlife Conservation Commission (Applicant to USFWS NCWCGP)
- USFWS National Coastal Wetland Conservation Grants Program

Northeast Florida Estuarine Habitat Restoration Initiative

A Comprehensive vision to enhance and restore oyster, salt marsh, mangrove, and seagrass communities

An interagency team is guiding efforts to assemble existing resource data and coastal restoration plans, and to hold workshops with land managers, researchers, and resource management professionals leading to development of a comprehensive restoration plan with regionally-based priorities. The team will strive to interact with and incorporate guiding management principles from as many programs with overlapping interests as possible, including Estuary Restoration Act, Landscape Conservation Cooperatives, State Wildlife Action Plan, South Atlantic Fishery Management Council, Coastal Zone Management, and others. The three primary benefits expected from this collaborative process are as follows:

1) a document endorsed at the local, state, and federal level that would support requests for state and federal grant / program funding.
2) a guide to accomplish prioritized local and regional restoration goals
3) a regional monitoring and assessment strategy to develop, review, and refine restoration techniques

While this effort is focused on Northeast Florida, the process developed will have broader applications. The framework of the document includes: basic characteristics of Florida estuarine habitats, summaries of existing coastal habitat restoration efforts and techniques (see examples), a discussion of restoration and management issues, and a process for identification / prioritization of estuarine restoration projects that can be duplicated on a regional basis throughout the state. A formal set of guidelines or a "protocol" will be provided as an additional product of this work.

Living Shorelines

Oyster Restoration

Dredge-filled Salt Marsh Restoration

Dragline Ditch Restoration

Impoundment Restoration & Reconnection

Restoration and Resource Monitoring

Education and Volunteer Monitoring/Planting Events

Interagency Steering Committee

•Paul Haydt (phaydt@sjrwmd.com), St. Johns River Water Mgmt. Dist., Palatka, FL
•Ron Brockmeyer, St. Johns River Water Mgmt. Dist., Palatka, FL
•Jeff Beal, Florida Fish and Wildlife Cons. Comm., Ft. Pierce, FL
•Kent Smith, Florida Fish and Wildlife Cons. Comm., Tallahassee, FL
•Larry Fooks, Florida Dept. of Environmental Protection, Apopka, FL
•Clifton Maxwell, Florida Dept. of Environmental Protection, Gainesville, FL
•Michael Shirley, GTM National Estuarine Research Reserve, Ponte Vedra Beach, FL
•Daphne Macfarlan, NOAA Restoration Center, St. Petersburg, FL
•Nicole Adimey, USFWS Coastal Program, Jacksonville, FL
•Anne Birch, The Nature Conservancy, Indialantic, FL
•Paul Stodola, U.S. Army Corps of Engineers, Jacksonville, FL
•Troy Rice, Indian River Lagoon National Estuary Program, Palm Bay, FL
•Paul Zajicek, Florida Dept. of Agriculture and Consumer Services, Tallahassee, FL

Coastal Wetlands?

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386-329-4495


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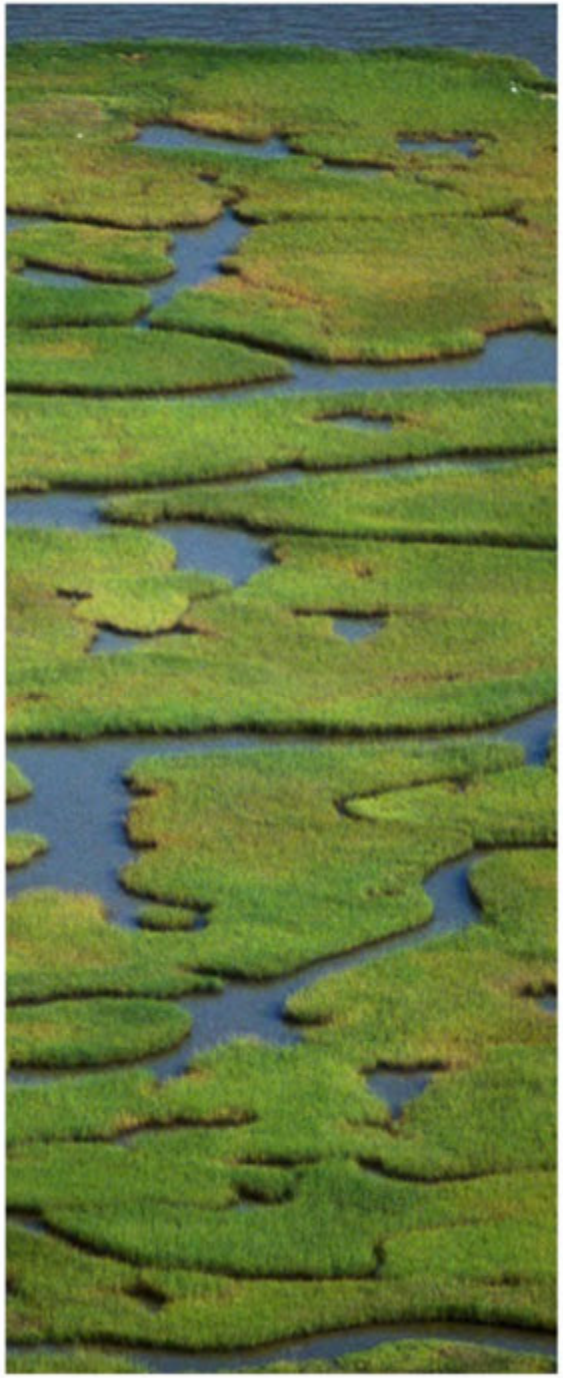


Findings of the
National Blue Ribbon Panel
on the Development
of a **Greenhouse Gas Offset**
Protocol for **Tidal Wetlands**
Restoration and Management

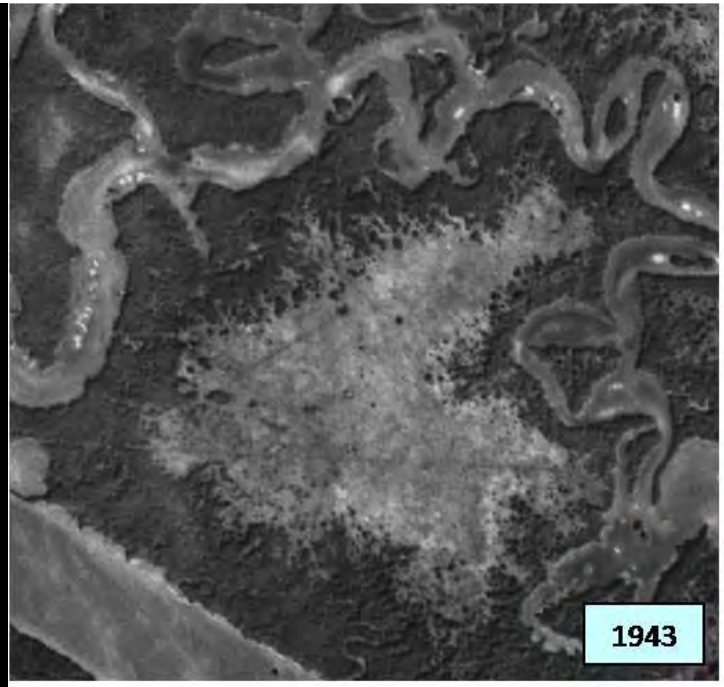
ACTION PLAN TO GUIDE PROTOCOL DEVELOPMENT

Based on a workshop convened by Restore America's Estuaries and held April 12-13, 2010

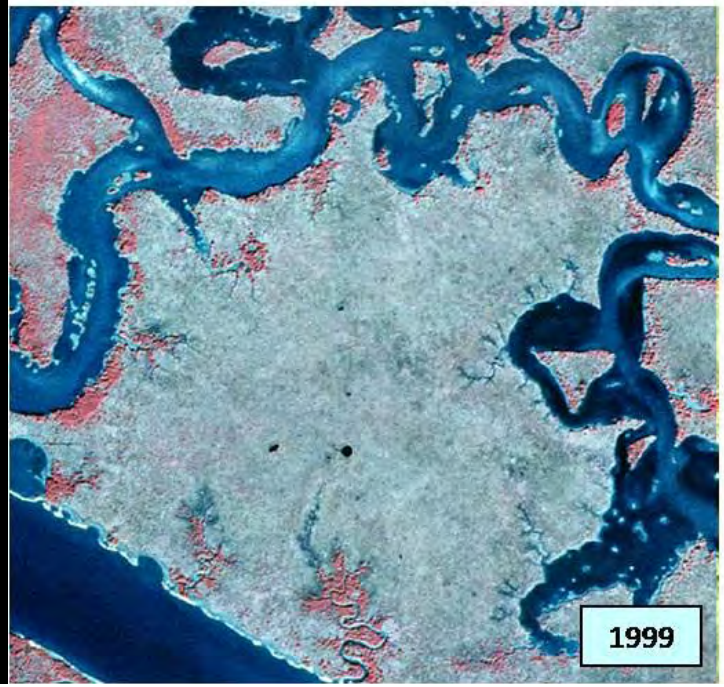
Prepared by Restore America's Estuaries, Philip Williams & Associates, Ltd., and Science Applications International Corporation.

August 2010

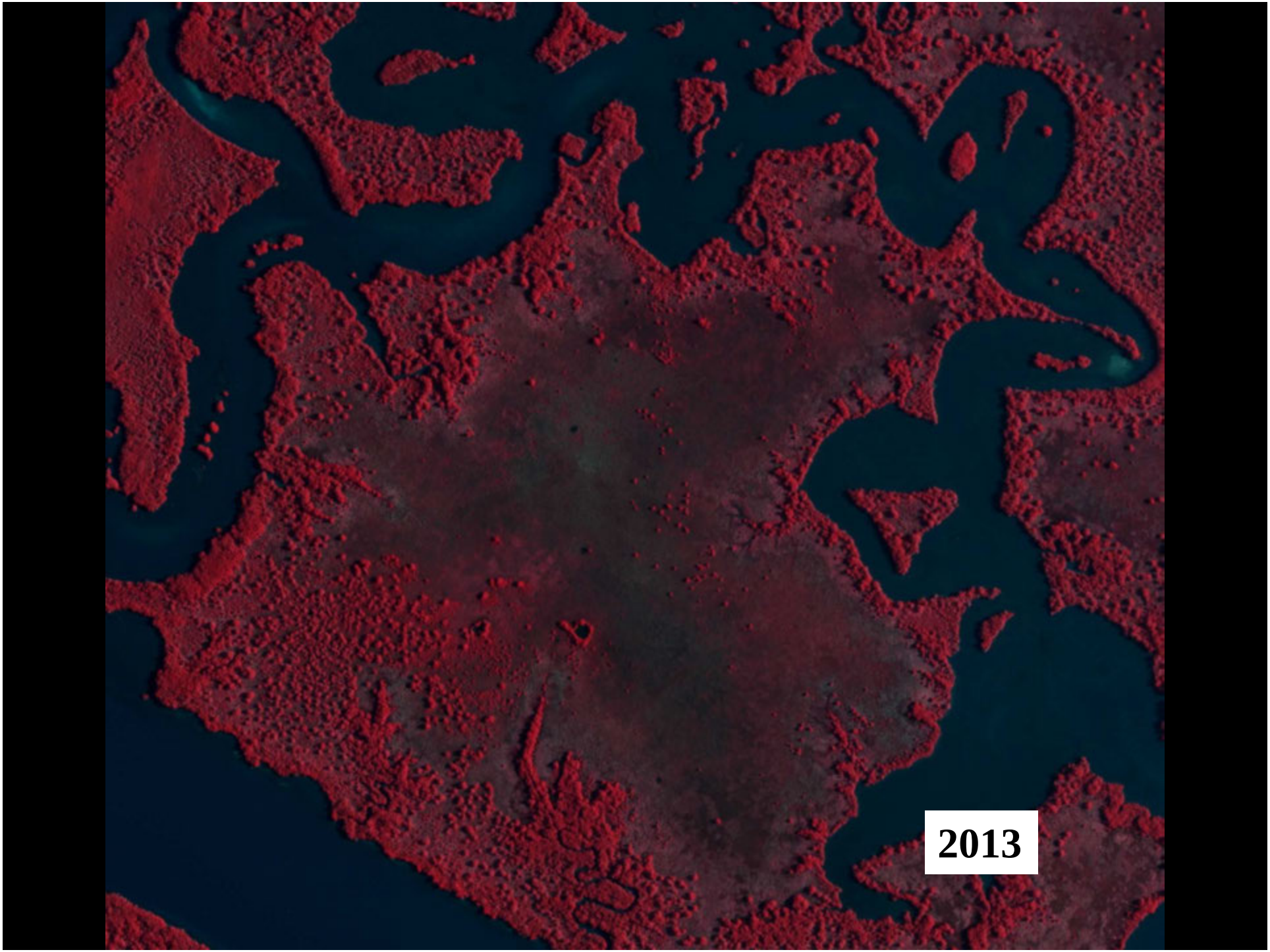
RESTORE AMERICA'S ESTUARIES

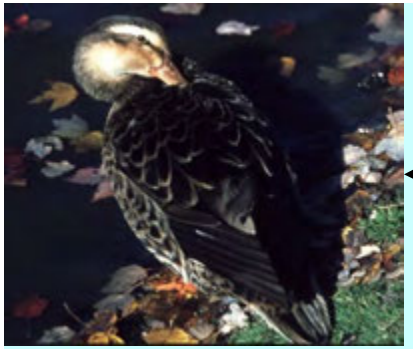

1943


1995


1999


2004


2013



Wildlife/Aquatic Management (WAM)

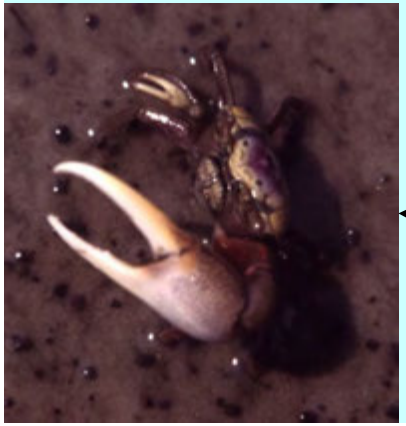
Managed for 8-10 months - Open for 2-4 months

For waterfowl and wading birds

Rotational Impoundment Management (RIM)

Managed for 4 months - Open for 8 months

For mosquito control - can benefit fish and wading birds



Open Management (OPEN) or Restored

Open year round - Natural Hydroperiod

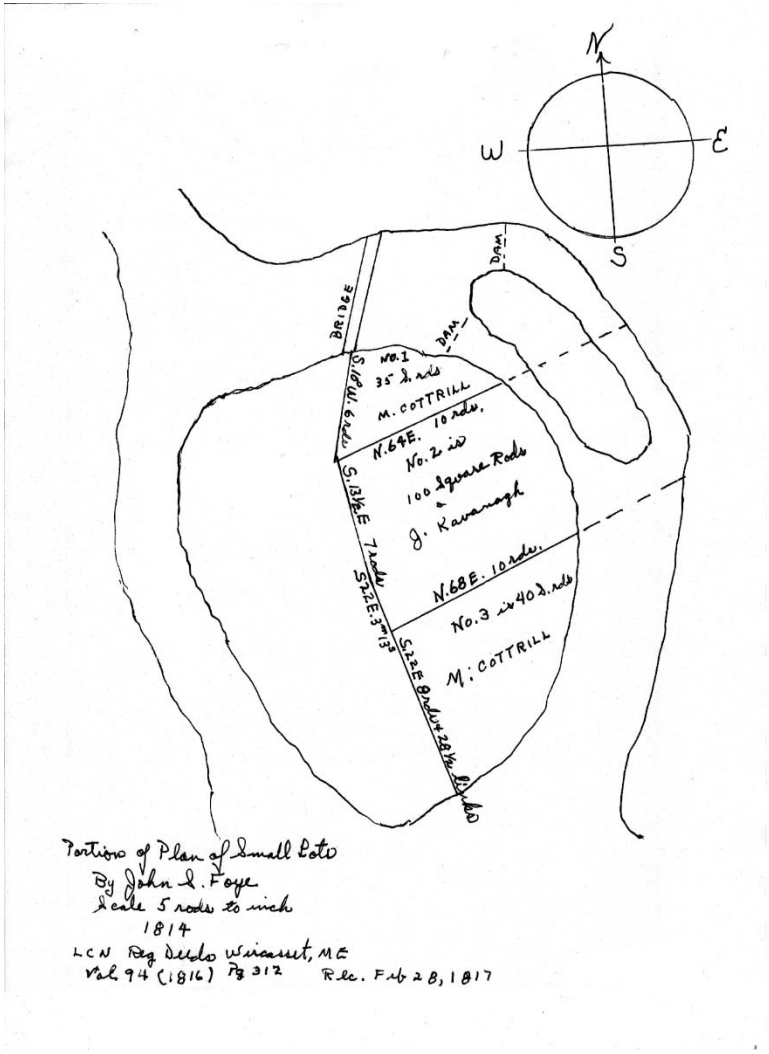
Benefits fish, wildlife that use natural marshes

Towns of Nobleboro and Newcastle
Nobleboro Historical Society
with help from Neighbors and Friends


Madawaska
Fort Kent
Allagash
Long Lake
Eagle Lake
Presque Isle
Allagash River
Churchill Lake
Eagle Lake
Mars Hill
Chamberlain Lake
Houlton
Baxter State Park
Chesuncook Lake
East Branch
Mt. Katahdin
West Branch
Penobscot River
Jackman
Moosehead Lake
Kennebec River
Greenville
Topsfield
The Forks
West Enfield
West Grand Lake
Big Lake
Calais
Kingfield
Rangeley
Bangor
Eastport
Skowhegan
Moosehead Lake
Machias
Fairfield
Ellsworth
Bucksport
Belfast
Bethel
Augusta
Camden
Mount Desert Island
Auburn
Lewiston
Penobscot Bay
Brunswick
Sebago Lake
Freeport
Boothbay Harbor
Portland
Casco Bay
Kennebunkport
Wells
Ogunquit
York
Kittery

1814 Map of the Outlet between Damariscotta Lake and Salt Bay

After the construction of the Fish Ladder in 1807



arting in 1730, the falls were used for mechanical power for mills.

Ca. 1900 – Damariscotta Mills Fish Harvesting Operation

Fish House ca. 1965

Section of the fish ladder ca. 1930

Fish Ladder Repair

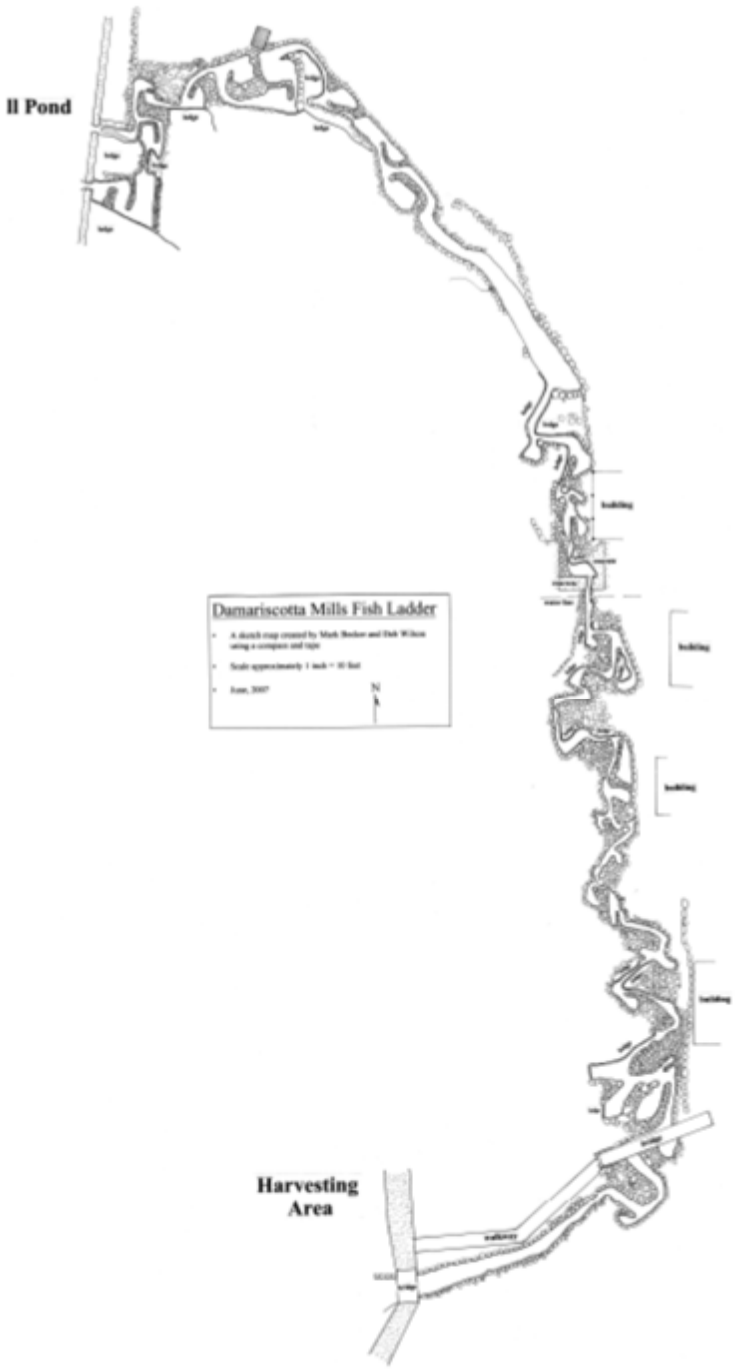
Harry Hagar Jr.- 1970s

Gunnite Fish Ladder Repairs - 1995

Annual Maintenance

Frankie Waltz

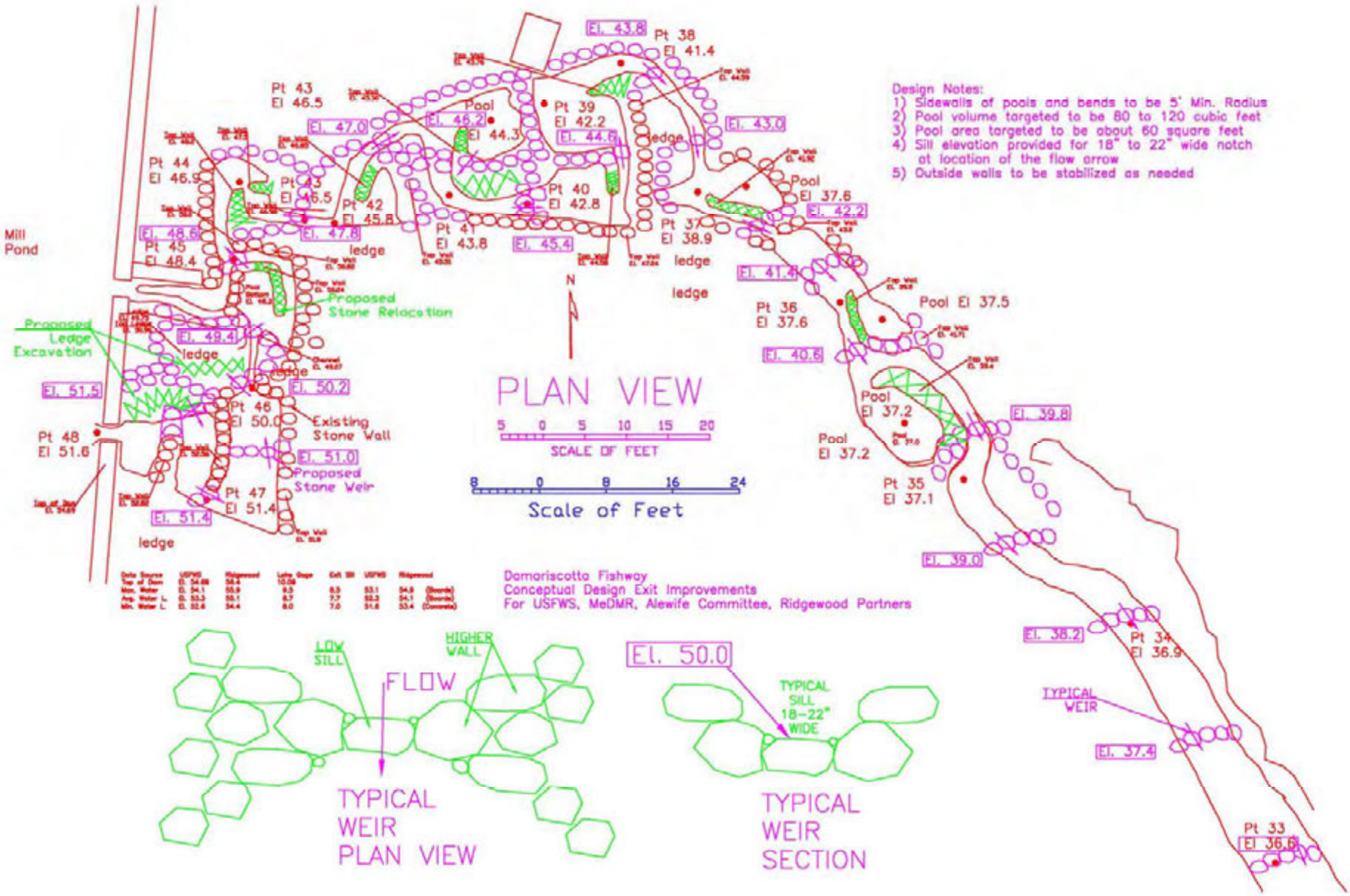
Collapsing Wall near the top of the ladder - 2007


ll Pond
Damariscotta Mills Fish Ladder
A sketch map created by Mark Becker and Dale Wilcox using a compass and tape
Scale approximately 1 inch = 10 feet
June, 2007
N
Harvesting Area

Collapsed wall under vegetation

Fish Ladder Wall during Restoration - 2007

Re-building collapsed wall


Design Notes:
1) Sidewalls of pools and bends to be 5' Min. Radius
2) Pool volume targeted to be 80 to 120 cubic feet
3) Pool area targeted to be about 60 square feet
4) Sill elevation provided for 18" to 22" wide notch at location of the flow arrow
5) Outside walls to be stabilized as needed
Mill Pond
Proposed Ledge Excavation
Proposed Stone Relocation
Existing Stone Wall
Proposed Stone Weir
ledge
Pool
Pt 33 El 36.6
Pt 34 El 36.9
Pt 35 El 37.1
Pt 36 El 37.6
Pt 37 El 38.9
Pt 38 El 41.4
Pt 39 El 42.2
Pt 40 El 42.8
Pt 41 El 43.8
Pt 42 El 45.8
Pt 43 El 46.5
Pt 44 El 46.9
Pt 45 El 48.4
Pt 46 El 50.0
Pt 47 El 51.4
Pt 48 El 51.6
El. 36.2
El. 37.4
El. 39.0
El. 39.8
El. 40.6
El. 41.4
El. 42.2
El. 43.0
El. 43.8
El. 44.6
El. 45.4
El. 47.0
El. 47.8
El. 48.6
El. 49.4
El. 50.2
El. 51.0
El. 51.4
El. 51.5
N
PLAN VIEW
5 0 5 10 15 20
SCALE OF FEET
8 0 8 16 24
Scale of Feet
Damariscotta Fishway
Conceptual Design Exit Improvements
For USFWS, MeDMR, Alewife Committee, Ridgewood Partners
LOW SILL
HIGHER WALL
FLOW
TYPICAL WEIR PLAN VIEW
El. 50.0
TYPICAL SILL 18-22" WIDE
TYPICAL WEIR SECTION
TYPICAL WEIR

2008-2009 Upper Ladder


DAMARISCOTTA MILLS
FISH LADDER RESTORATION


DAMARISCOTTA MILLS
FISH LADDER RESTORATION
patagonia


5r RADIUS

2009-2010: Middle Section

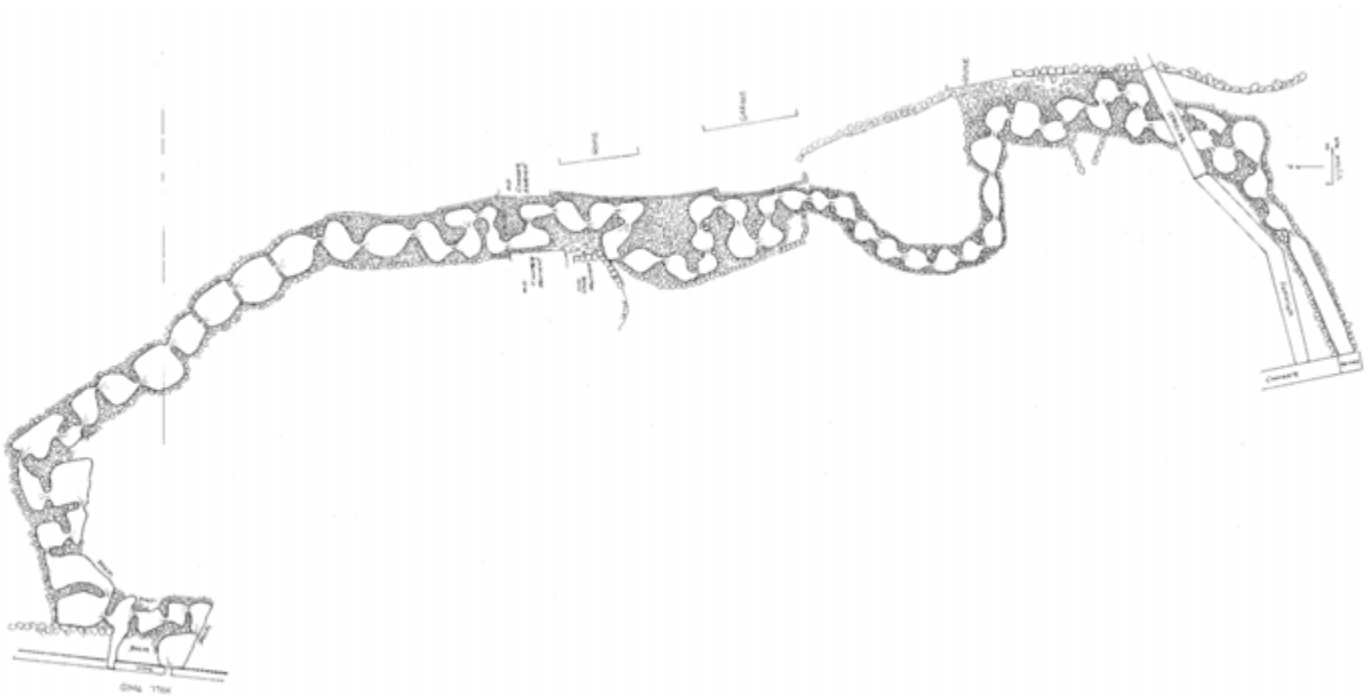

DEERE

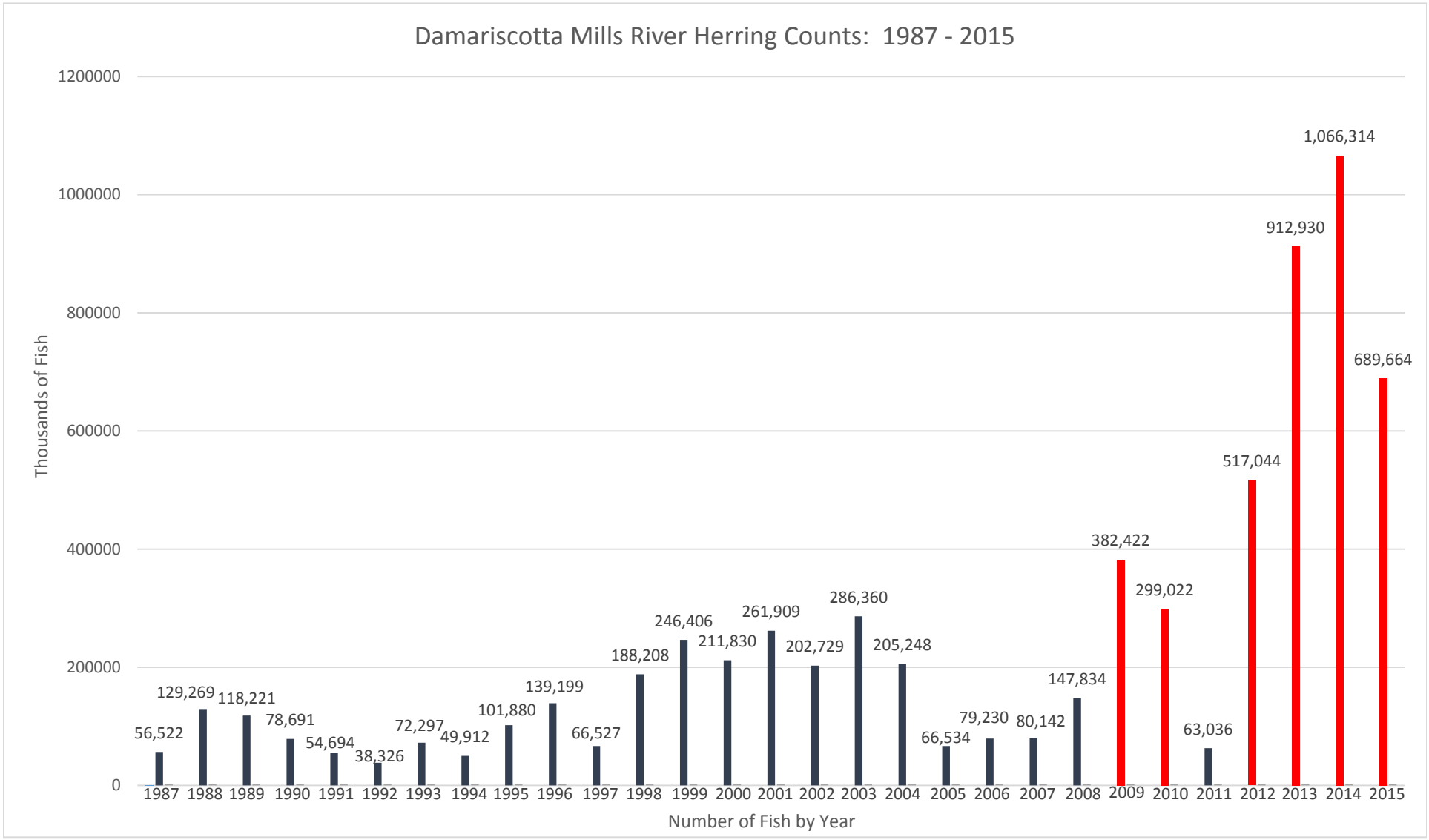
Stone facing middle section pools – 2010-2011

The lower Third – upper 2011-2012


DEERE

2012-2013 Lower Part of Lower Third




Damariscotta Mills River Herring Counts: 1987 - 2015
Thousands of Fish
1200000
1000000
800000
600000
400000
200000
0
56,522
129,269
118,221
78,691
54,694
38,326
72,297
49,912
101,880
139,199
66,527
188,208
246,406
211,830
261,909
202,729
286,360
205,248
66,534
79,230
80,142
147,834
382,422
299,022
63,036
517,044
912,930
1,066,314
689,664
1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
Number of Fish by Year

Prioritizing Environmental Stressors in Coastal and Marine Ecosystems

Jake Kritzer

ASMFC Habitat Committee meeting
St. Augustine, Florida
November 3, 2015

EDF
ENVIRONMENTAL DEFENSE FUND®
Finding the ways that work


GOAL
Develop a compelling vision and strategy for supporting a robust marine & coastal environment, with a focus on sustainable fisheries, in the Northeast US that will catalyze support and engagement from stakeholders including fishermen, regional coastal landowners, and others.

OBJECTIVES

To articulate and prioritize factors affecting ecosystem and human resiliency in the region.

To describe and draw the relationships between habitats and stressors to increase understanding of the impacts and interactions of multiple stressors on coastal and marine systems.

To identify critical gaps in understanding, barriers to mitigation of stressors, and pressing and catalytic science and policy actions to better manage coastal stressors in a climate changing environment.

EXPERT SURVEY ON STRESSORS AND CLIMATE CHANGE

1. 1. Of the following environmental drivers, please rank the level of impact each is <u>currently</u> having on these elements of coastal and marine ecosystems: (n=80)

2. 2. How important is each of these environmental stressors likely to be <u>in 2050 under the following climate change scenario (modified IPCC A2 emissions scenario):</u> 4ºF increase in air temperature; 5ºF increase in sea surface temperature; 3 feet of additional sea level rise; 10% precipitation increase? (n=43)

1 = No Impact / N/A **2 = Minor / Moderate Impact** **3 = High Impact**
4 = Very High Impact **0 = Uncertain**

ECOSYSTEM COMPONENTS

Erosion

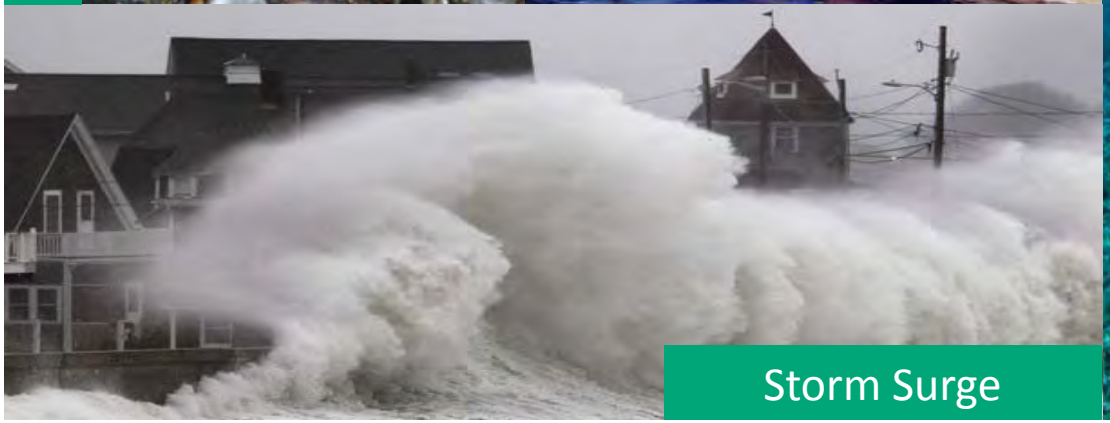
Pollution

STRESSORS…+15 MORE

Invasive Species

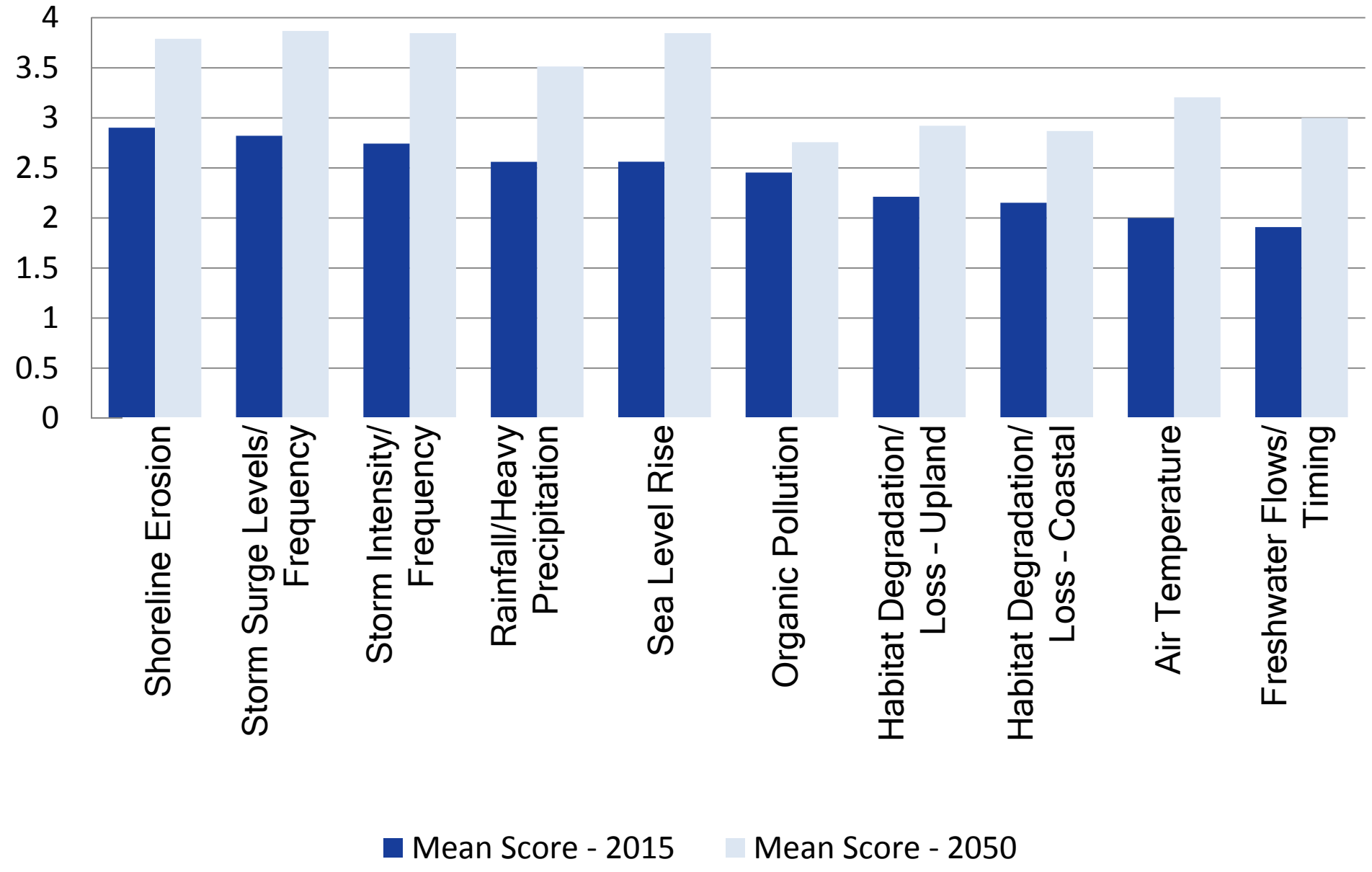
Dredging

Fishing Impacts



Storm Surge

SURVEY RESULTS:
MEAN IMPACT SCORES FOR COASTAL CITIES AND TOWNS



WORKSHOP DELIBERATIONS:
TOP STRESSORS FOR COASTAL CITIES AND TOWNS

	Current Conditions	Future Conditions
1	Storm Surge Levels, Intensity and Frequency	Storm Surge Levels, Intensity and Frequency
2	Shoreline Erosion	Sea Level Rise
3	Rainfall / Heavy Precipitation	Shoreline Erosion
4	Organic Pollution	Rainfall / Heavy Precipitation
5	Habitat Degradation/Loss-Coastal	Air/Sea Surface Temperature
6	Sea Level Rise	Habitat Degradation/Loss-Coastal
7	Air Temperature	Organic Pollution
8	Freshwater Flows/Timing	Impacts of Hardening or Other Protection Structures (Development)
9	Trash	

SURVEY RESULTS:
MEAN IMPACT SCORES FOR WETLAND & ESTUARINE HABITATS

WORKSHOP DELIBERATIONS:
TOP STRESSORS IN WETLAND & ESTUARINE HABITATS

	Current Conditions	Future Conditions
1	Development*	Sea Level Rise
2	Organic Pollution	Development*
3	Sedimentation/Dredging	Storm Surge Level, Intensity and Frequency
4	Sea Level Rise	Freshwater Flows/Timing
5	Storm Surge Level, Intensity and Frequency	Ocean Acidification
6	Freshwater Flows/Timing	Sea Surface Temperature
7	Invasive Species	Air temperature
8		Rainfall / Heavy precipitation

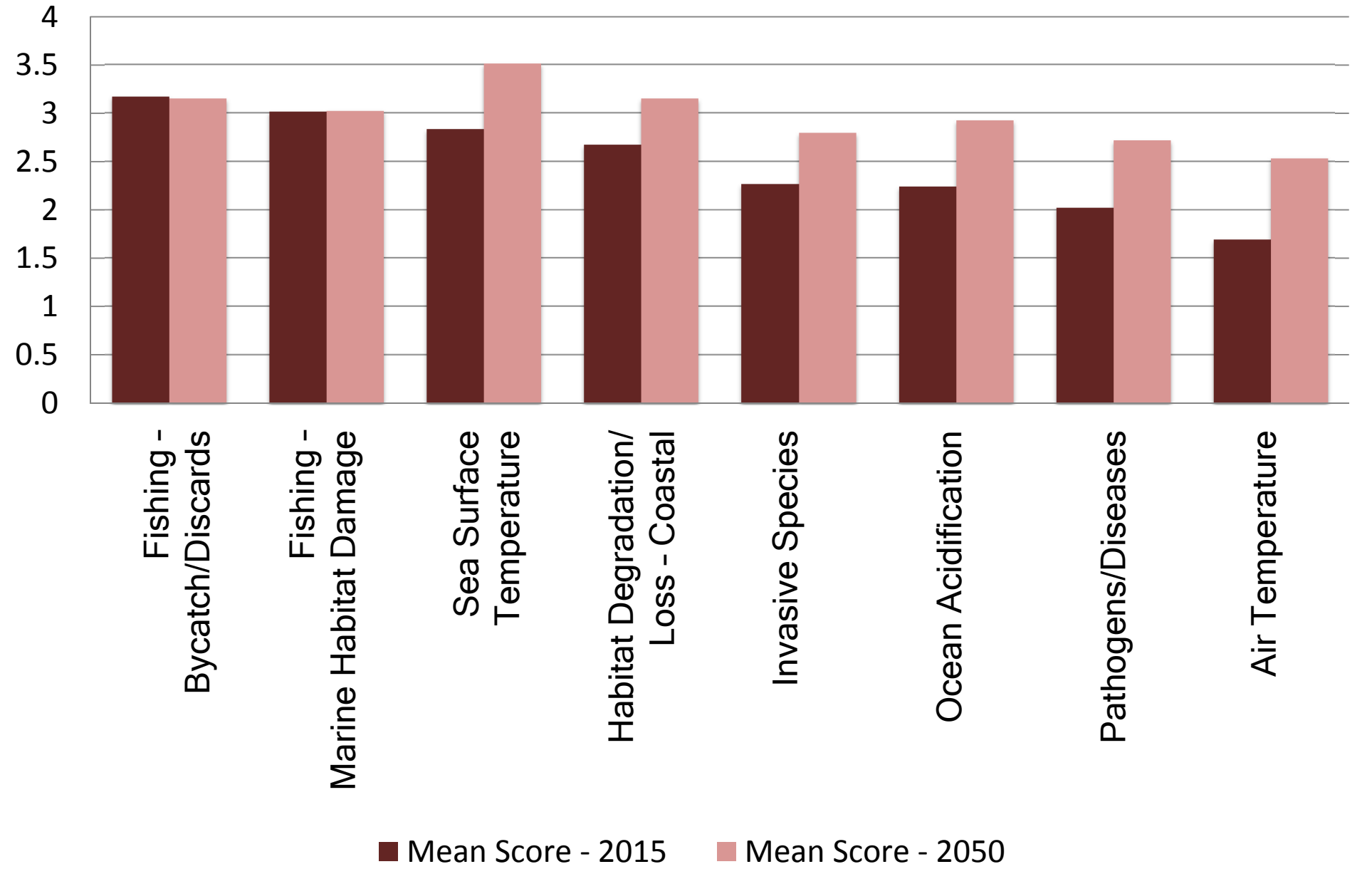
*Development was a new stressor category that was developed at workshop and includes 6 sub-categories: (1) hydrologic barriers, (2) direct impact/fill, (3) watershed inputs, (4) hardened shorelines, (5) impervious areas, and (6) aquaculture

SURVEY RESULTS:
MEAN IMPACT SCORES FOR MARINE HABITATS

WORKSHOP DELIBERATIONS:
TOP STRESSORS FOR MARINE HABITATS

	Current Conditions	Future Conditions
1	Fishing - Marine Habitat Damage	Habitat Degradation / Loss – Coastal and Upland
2	Sea Surface Temperature	Sea Surface Temperature
3	Organic Pollution	Organic Pollution
4	Habitat Degradation / Loss- Coastal and Upland	Ocean Acidification
5	Ocean Acidification	Fishing - Marine Habitat Damage
6	Invasive Species	Freshwater Flows/Timing
7		Invasive Species
8		Storm Surge Levels / Frequency

SURVEY RESULTS:
MEAN IMPACT SCORES FOR MARINE FISH POPULATIONS



WORKSHOP DELIBERATIONS:
INSHORE-OFFSHORE IN PRIORITY STRESSORS

Sea-Run
(ESA + state)

Coastal
(ASMFC + state)

Marine
(Magnuson)

Importance of Stressor

F
Dams

Other
Stressors

F

Habitat degradation
Increasing SST
Coast. Acidification
Freshwater Inputs

Other
Stressors

F

Habitat degradation
Increasing SST
Ocean Acidification
Freshwater Inputs

Other Stressors

Summary Across All Resources

SURVEY RESULTS:
AVERAGE SCORE OF TOP 10 STRESSORS FOR CURRENT CONDITIONS (2015)

Current Conditions	Average score	Wetlands / Estuarine Habitats	Coastal Cities and Towns	Marine Habitats	Marine Fish Populations
Organic Pollution	2.61	3.13	2.45	2.5	2.37
Habitat Degradation / Loss - Coastal	2.60	3.25	2.15	2.32	2.68
Invasive Species	2.43	2.89	1.92	2.66	2.27
Sea Surface Temperature	2.40	2.29	1.77	2.71	2.84
Fishing - Marine Habitat Damage	2.34	1.81	1.6	2.94	3.01
Trash	2.29	2.29	2.29	2.37	2.22
Shoreline Erosion	2.19	2.69	2.9	1.77	1.41
Sea Level Rise	2.14	2.69	2.56	1.69	1.64
Rainfall / Heavy Precipitation	2.14	2.38	2.56	1.83	1.77
Fishing - Bycatch / Discards	2.13	1.64	1.49	2.2	3.17

Notes a priority stressor across all resources from the expert workshop

Notes a stressor of research importance across all resources with less consensus on level of impact

SURVEY RESULTS:
AVERAGE SCORE OF TOP 10 STRESSORS FUTURE CONDITIONS (2050)

Future Conditions	Average Score	Wetland/ Estuarine Habitats	Coastal Cities and Towns	Marine Habitats	Marine Fish
Sea Surface Temperature	3.24	3.2	2.82	3.41	3.51
Habitat Degradation / Loss - Coastal	3.16	3.71	2.87	2.93	3.15
Sea Level Rise	3.15	3.74	3.85	2.61	2.39
Storm Surge Levels / Frequency	3.03	3.65	3.87	2.5	2.1
Shoreline Erosion	3	3.67	3.79	2.4	2.13
Storm Intensity / Frequency	2.97	3.46	3.85	2.41	2.17
Rainfall / Heavy Precipitation	2.89	3.34	3.51	2.45	2.25
Air Temperature	2.85	3.1	3.21	2.56	2.54
Freshwater Flows/Timing	2.79	3.32	3	2.49	2.34
Organic Pollution	2.7	2.97	2.76	2.64	2.41

Notes a priority stressor across all resources from the expert workshop

Notes a stressor of research importance across all resources with less consensus on level of impact

SURVEY RESULTS:
TOP STRESSORS ACROSS ALL RESOURCE COMPONENTS

	Current Conditions	Future Conditions
1	Organic Pollution	Sea Surface Temperature
2	Habitat Degradation / Loss - Coastal	Habitat Degradation / Loss - Coastal
3	Invasive Species	Sea Level Rise
4	Sea Surface Temperature	Storm Surge Levels/Frequency
5	Fishing – Marine Habitat Damage	Shoreline Erosion
6	Trash (Plastics, etc)	Increasing Storm Intensity/Frequency
7	Shoreline Erosion	Rainfall/Heavy Precipitation
8	Sea Level Rise	Air Temperature
9	Rainfall/Heavy Precipitation	Freshwater Flows/Timing
10	Fishing – Bycatch/Discards	Organic Pollution

FROM EVALUATION TO ACTION: CONSIDERATIONS FOR DEVELOPING MANAGEMENT STRATEGIES

- Healthy habitats are important for resiliency
  - Coastal and upland restoration
  - Protecting and creating coastal buffers
- Scale is an important consideration:
  - Need for feedback loops between federal, state, and local levels
  - Need to be able to scale up actions at the local level
  - Develop support for solutions at the local scale
  - Nested scales of management (watershed and other)
- Need for actions that can address multiple stressors
- Adaptive management to address uncertainty
- Importance of partnerships to achieve broad goals
- Transfer risk from the public to the private sector