An aerial photograph of a shallow water area, likely a bay or lagoon, with a prominent winding channel. The water is a mix of light and dark blue, indicating varying depths. The surrounding land is a mix of light and dark green, suggesting different vegetation types. The overall scene is a complex network of water and land.

Florida Keys Shallow Water Boating Impact Analysis and Trends Assessment – Preliminary Results

Curtis Kruer

Sponsored by the Florida Keys Environmental Fund

Presented to the FKNMS Sanctuary Advisory Council

April 19, 2016

Project Purpose is to Assess:

- History of Boat Impacts and Shallow Water Management in the Keys
- Value and Benefit of Existing Shallow Water Management
- Trends and Current Conditions Based on 2015 Aerial Photo Interpretation

Kruer Relevant Work History

- **FDER Keys Wetlands Permitting Program 1977-1980**
- **USACE Keys Wetlands Program Biologist 1980-1988**
- **Organized the Keys Boating Impact Work Group in 1989**
- **Managed the Florida Keys Environmental Restoration Trust Fund in the 1990s, including seagrass restoration**
- **EPA Keys Wetlands Mapping in 1994**
- **Member of EPA's FKNMS Water Quality Protection Program Technical Advisory Committee from 1993-1999**
- **Conducted Keys Prop Scar Mapping for State 1993-1994**
- **FKNMS Benthic Habitat Mapping for State of Florida in mid-1990s**
- **Conducted all photointerpretation and mapping for NOAA's Coral Reef Ecosystem mapping in the US Virgin Islands and Puerto Rico in 2000-2001**

Available Resources Include:

- Full history for this issue in the Keys and Everglades NP
- ~ 1600 low-level 35 mm aerials of shallow water from 1980 to 2000
- # of sets of vertical aerial imagery dating from 1945 to 2015
- GIS coverages including:
 - 1995 Keys prop scar mapping
 - Pennekamp and Lignumvitae scar mapping in 1993 and 1997
 - FKNMS benthic habitat maps
 - Existing management areas, markers, buoys, etc.
 - SAC Shallow Water Working Group maps and documentation

Acknowledge that major issues exist with seagrass habitat related to water quality – in Florida Bay and elsewhere.

This review is related to **Degradation by boats of shallow seagrass habitats (“flats”) throughout the Keys with a focus in this presentation on the Upper Keys.**

Degradation:

- Physical Destruction of Habitat
- Erosion
- Elevated Turbidity
- Disturbance of Fish and Wildlife by Vessel Passage and Noise

And It's More Than Just Fish

From the USFWS in the draft minutes of February 2016
SAC Meeting:

- *In reference to great white herons and seagrass habitat, degraded grassbeds with mechanical damage from boating impacts have been shown to reduce the value of the grassbeds as foraging habitat for these birds.*
- *Great white herons are impacted by the loss of contiguous seagrass foraging areas and human disturbance.*

Project Purpose is to Assess:

- History of Boat Impacts and Shallow Water Management in the Keys
- Value and Benefit of Existing Shallow Water Management
- Trends and Current Conditions Based on 2015 Aerial Photo Interpretation

1976 - Zieman, J. C. The Ecological Effects of Physical Damage from Motor Boats on Turtle Grass Beds in Southern Florida. *Aquatic Botany*. 2: 127-139 pp.

1981 - U.S. and Florida D.E.R. vs M.C.C. of Florida, Inc., Tugboats and barges destroyed 27 acres of seagrass in north Niles Channel in the Great White Heron NWR. Clean Water Act authority was confirmed by the US Supreme Court.

1985 - Lignumvitae Key Aquatic Preserve, Resource Report:
“Damage to grassbeds is readily apparent.....cumulative damage from numerous prop cuts over extensive areas is of concern”.

1986 – In a letter to the Army Corps of Engineers the Florida Marine Fisheries Commission states:

“.....photos provide graphic evidence of the damage inflicted by power boats in shallow water.....the historic and continuing loss of habitat, including seagrass.....is a principal limiting factor in the decline of fisheries experienced in Florida.....”

1987 – National Marine Fisheries Service Administrator in a Memo regarding “Prop Scars in Seagrass Meadows”:

“This scar problem is really of major concern in Florida, and not just in the Keys.”

1987 - FDER Secr. Twachtmann to Monroe County Mayor Lytton:

“Prop dredging has become a major source of damage to seagrasses in the Keys.”

1988 - P. Mallison, FDNR Director of Division of State Lands To National Audubon Society:

“As Florida develops, I’m afraid that you may be correct that our management programs will be pushed to the point of establishing restricted boating areas.”

1989 - Boating Impact Work Group organized and in October held a *Workshop on Prop Dredging and Boating Impacts to Nearshore Areas of the Florida Keys* in Marathon

1990 - City of Key West Resolution signed by Mayor Tony Tarracino encouraging management of boating impacts around Key West

1992 – FKNMS Strategy Identification Work Session identifies 45 high priority direct and indirect boating issues in the Management Strategy Rankings

1993 to 1994 - Seagrass Management Work Group comprised of agencies and NGOs organizes and meets regularly with NOAA during FKNMS draft Management Plan review

1994 to 1997 - FKNMS SAC and Monroe County Channel Marking Work Group organized and meets regularly

1996 - FKNMS Management Plan addresses boating impacts to shallow water seagrass habitats

1999 - Seagrass Outreach Partnership formed as a multi-agency effort to carry out education and outreach regarding shallow water boating impacts

2011 - FKNMS Condition Report:

“Injuries to seagrass caused by small boats are also a chronic problem.”

Boating Impact Work Group, 1989 - 1992

- Florida Keys Fishing Guides Association
- National Audubon Society
- Florida Keys Audubon Society
- Izaak Walton League – Keys Chapter
- The Wilderness Society
- U.S. Fish and Wildlife Service
- Florida Keys Citizen Coalition
- Last Stand
- Florida Game and Fish Commission
- National Marine Fisheries Service
- Florida Keys Environmental Fund
- Everglades National Park
- Lewis Environmental Services

**1990 – 36 page
report produced
by the Boating
Impact Work
Group**

**Was the initial
recommendation
of a 4 - Point
Plan to address
the problem**

**IS UNCONTROLLED BOATING DAMAGING
THOUSANDS OF ACRES OF FLORIDA'S
SUBMERGED SEAGRASS MEADOWS?**



June 4, 1987 Whale Harbor, THE FLORIDA KEYS.

**THE ANSWER IS YES!
WE NEED YOUR HELP TO STOP THIS DESTRUCTION!**

An information package prepared by:
**THE WILDERNESS SOCIETY, FLORIDA KEYS AUDUBON SOCIETY
AND
LEWIS ENVIRONMENTAL SERVICES, INC.**

1990 Boating Impact Work Group

4 - Point Plan:

- Education
- Expanded and Improved Channel Marking
- Enforcement
- Boating Restricted/Management Zones

- 1995 Statewide Report documented 30,000 acres of Keys shallow seagrasses impacted by boats as of 1993/94.

- Concluded that boats are the #2 impact to Florida's seagrasses behind water quality degradation.

- Incorporated the BIWG 4-Point Plan

FLORIDA MARINE RESEARCH INSTITUTE TECHNICAL REPORTS

Scarring of Florida's Seagrasses: Assessment and Management Options

F.J. Sargent, T.J. Leary, D.W. Crewz and C.R. Krueger



Florida Department of
Environmental Protection

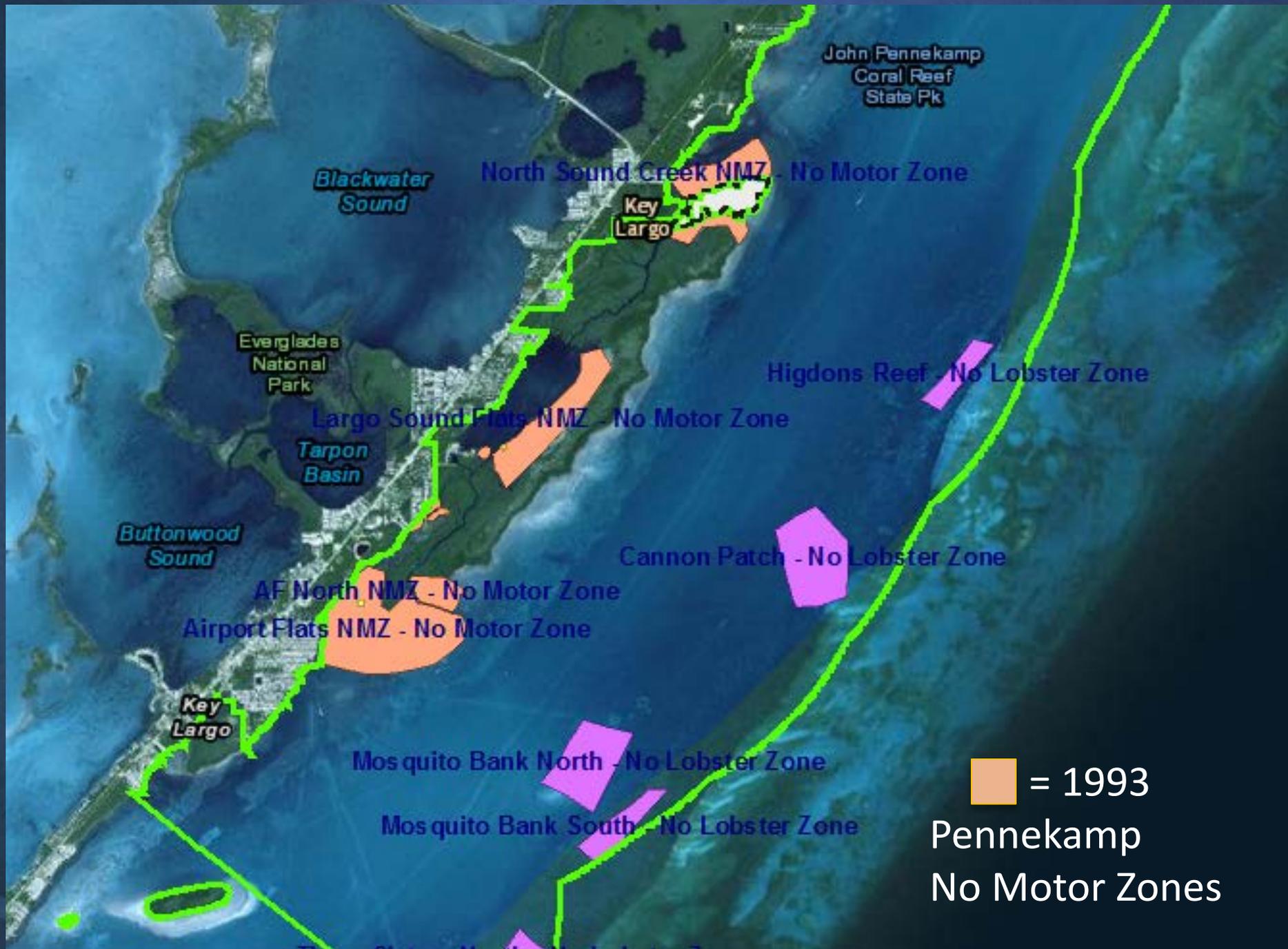


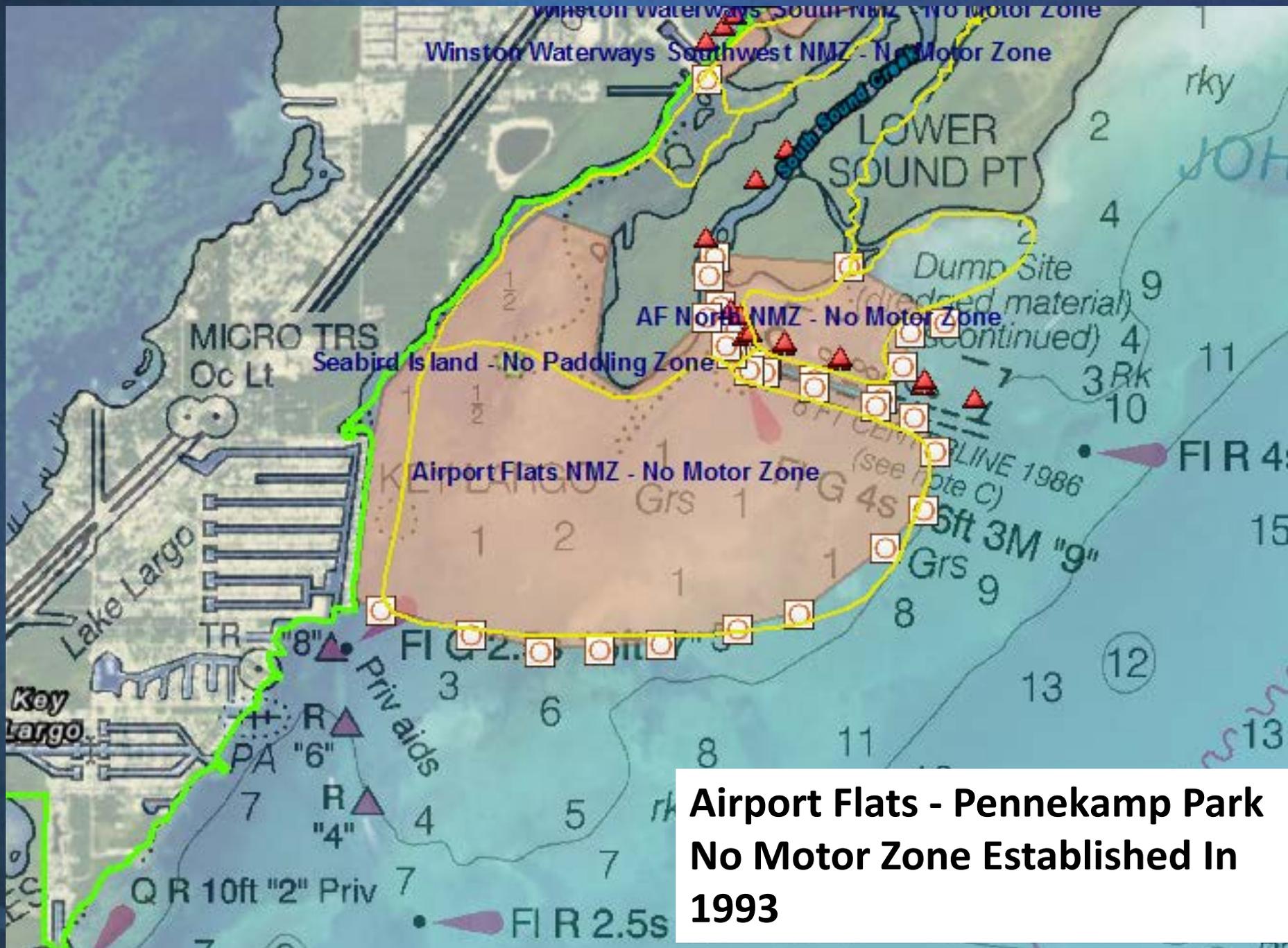
FMRI Technical Report TR-1

1995

Project Purpose is to Assess:

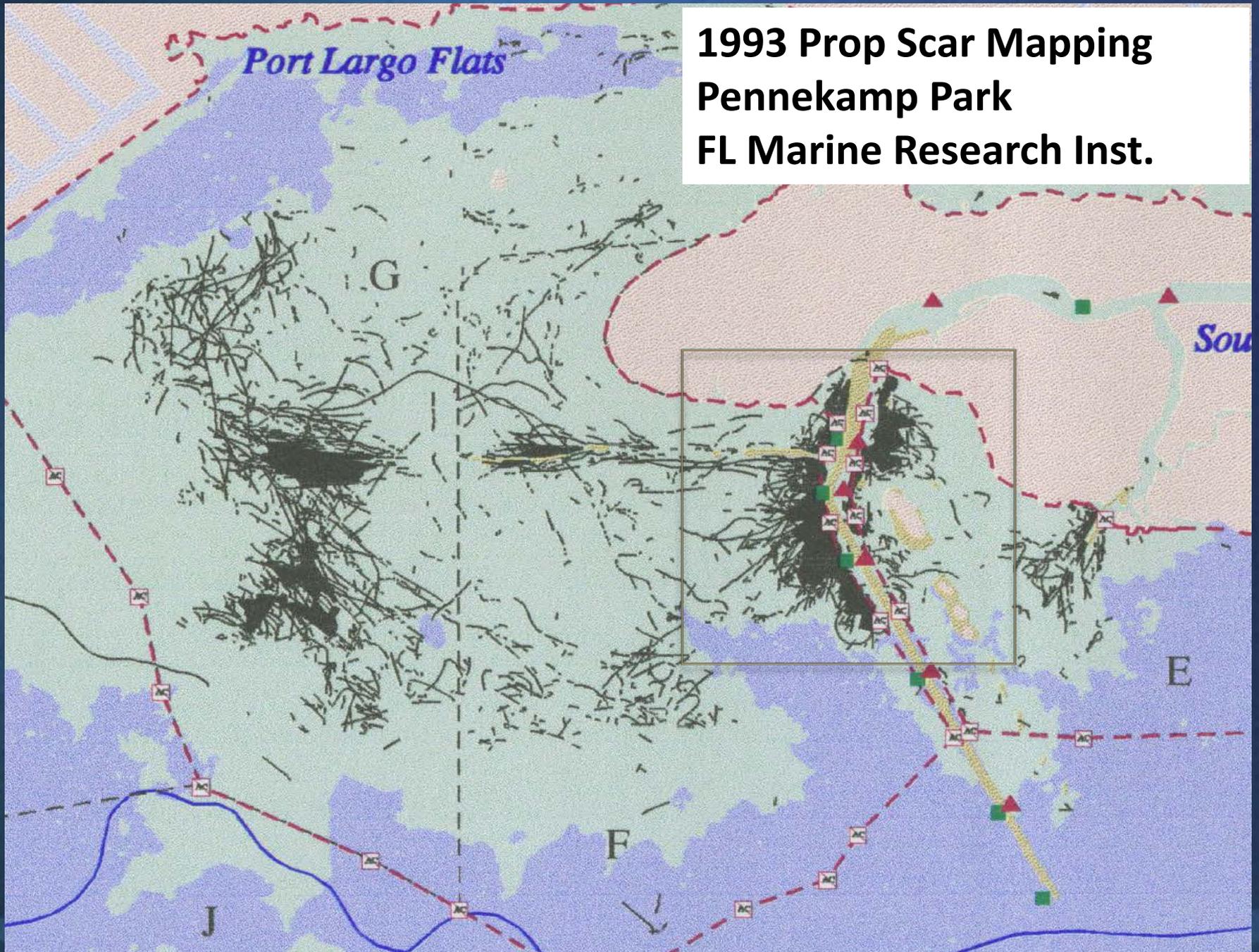
- History of Boat Impacts and Shallow Water Management in the Keys
- Value and Benefit of Existing Shallow Water Management
- Trends and Current Conditions Based on 2015 Aerial Photo Interpretation

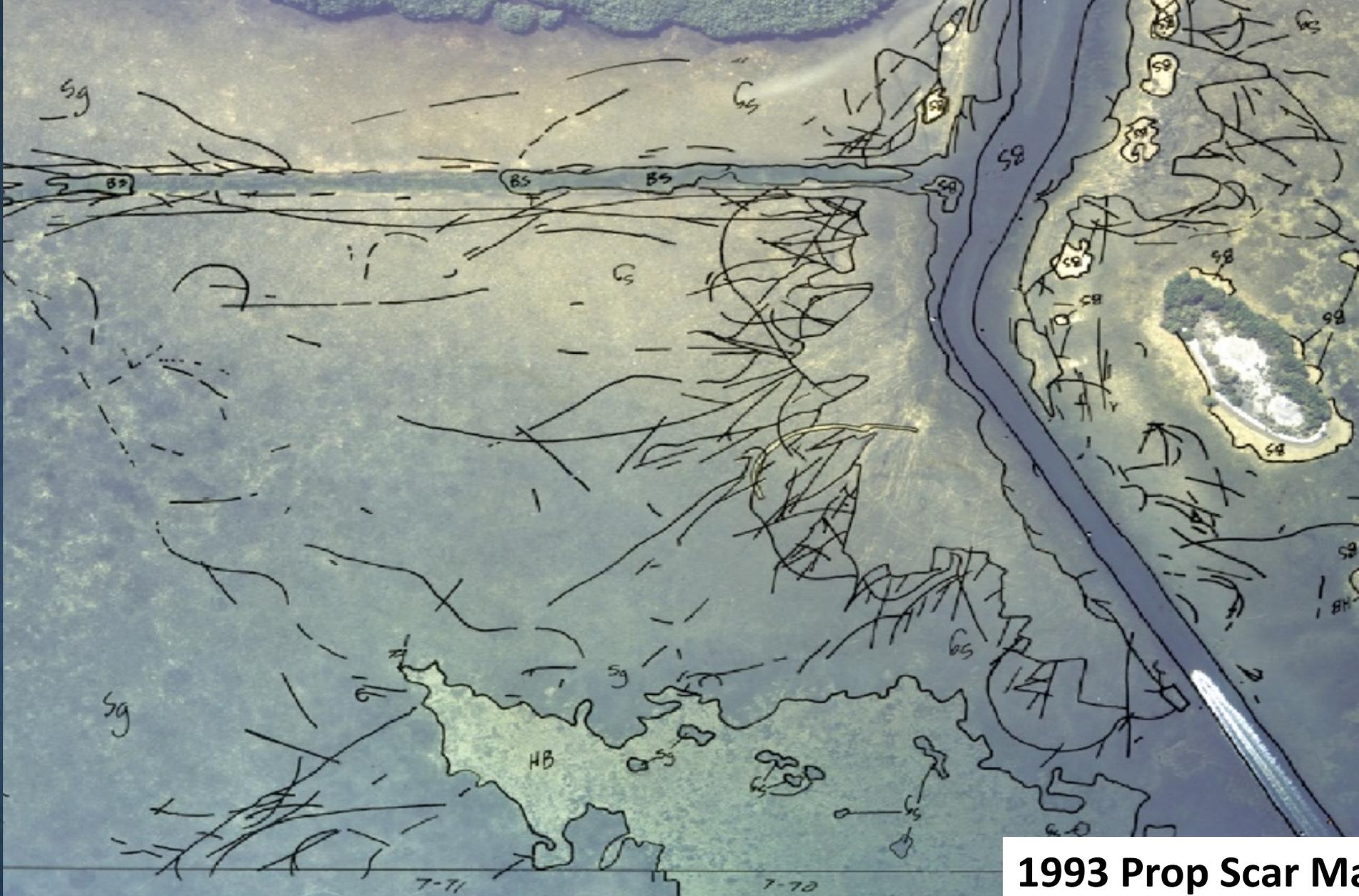




**Airport Flats - Pennekamp Park
No Motor Zone Established In
1993**

**1993 Prop Scar Mapping
Pennekamp Park
FL Marine Research Inst.**





South Sound Creek

1993 Prop Scar Ma
Pennekamp Park
FL Marine Research



South Sound Creek December 2014

Google earth

1994

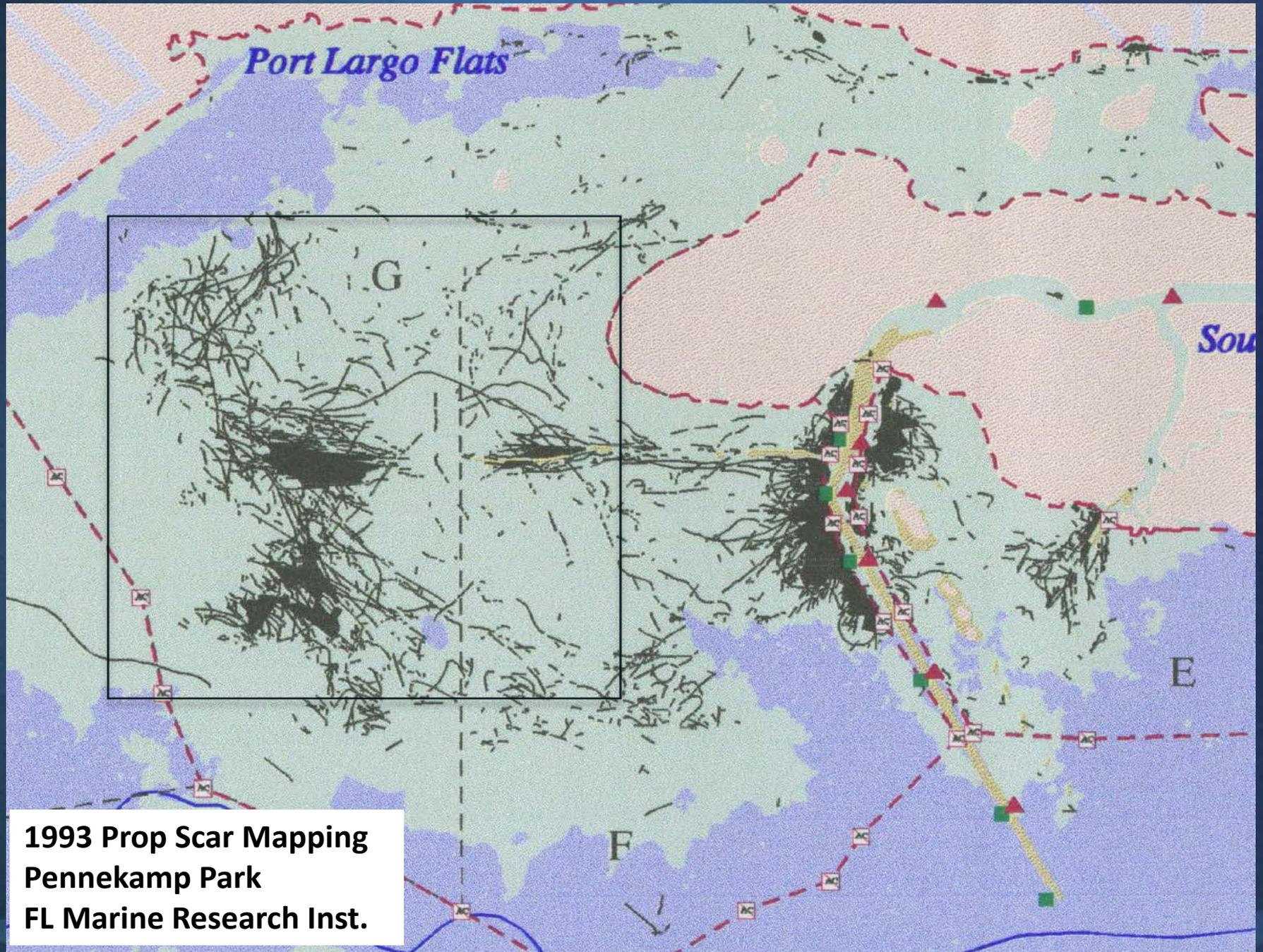
Imagery Date: 12/16/2014 25° 5.931' N 80° 24.826' W elev 0 ft eye alt 3218 ft

South Sound Creek
December 2014

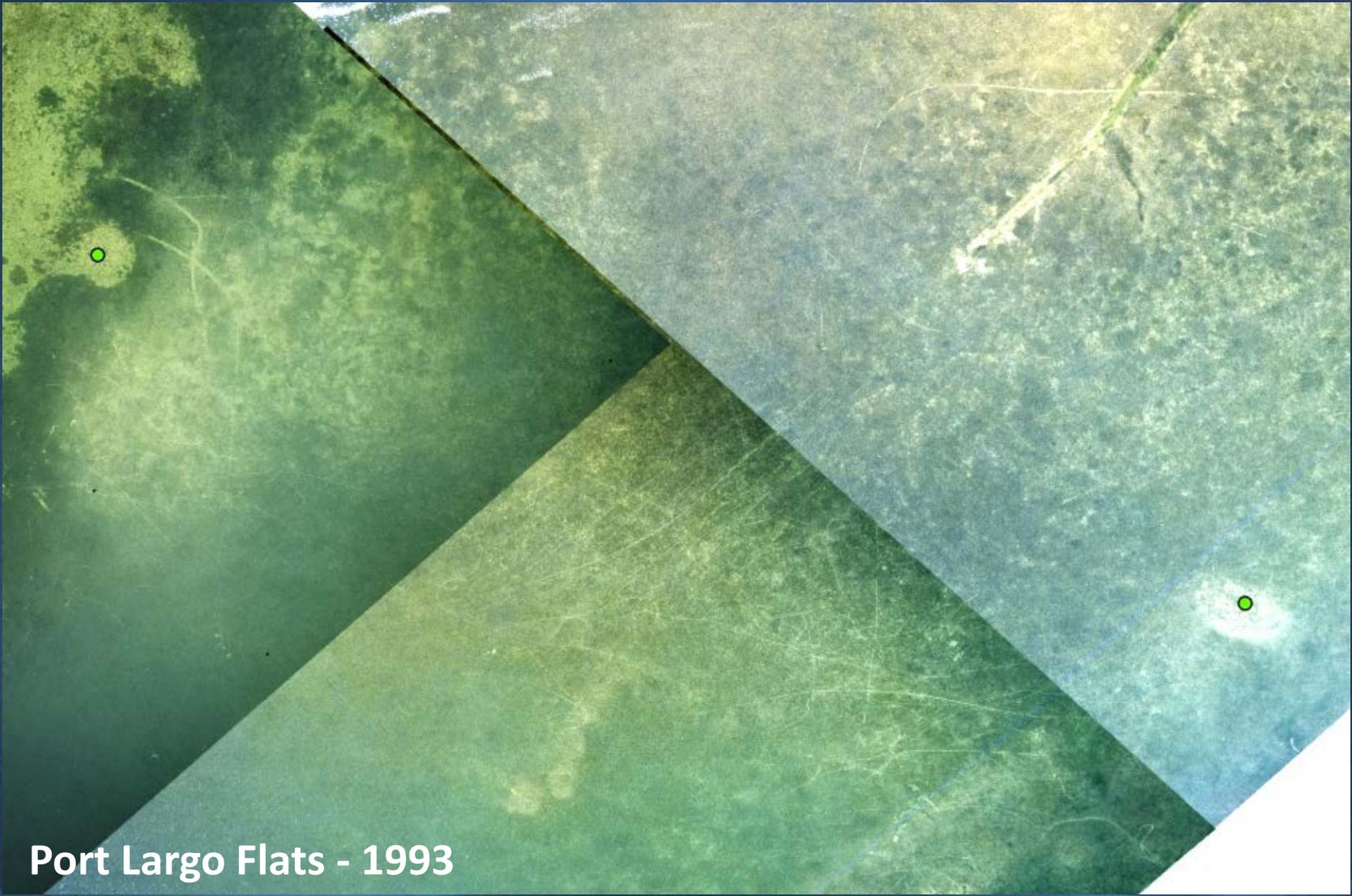
1994

Imagery Date: 12/16/2014 25° 5.963' N 80° 24.727' W elev 0 ft eye alt 934 ft

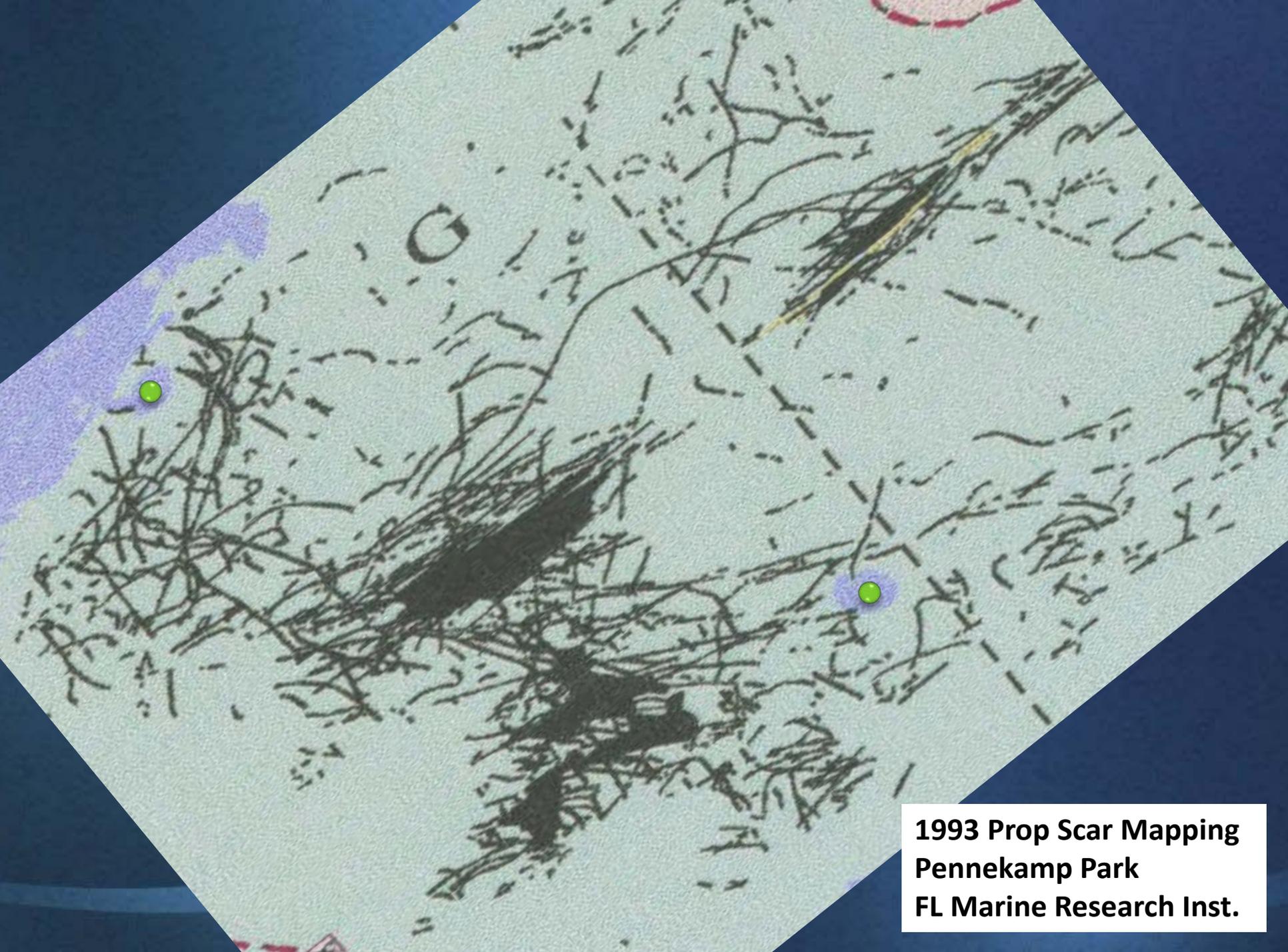
Google earth



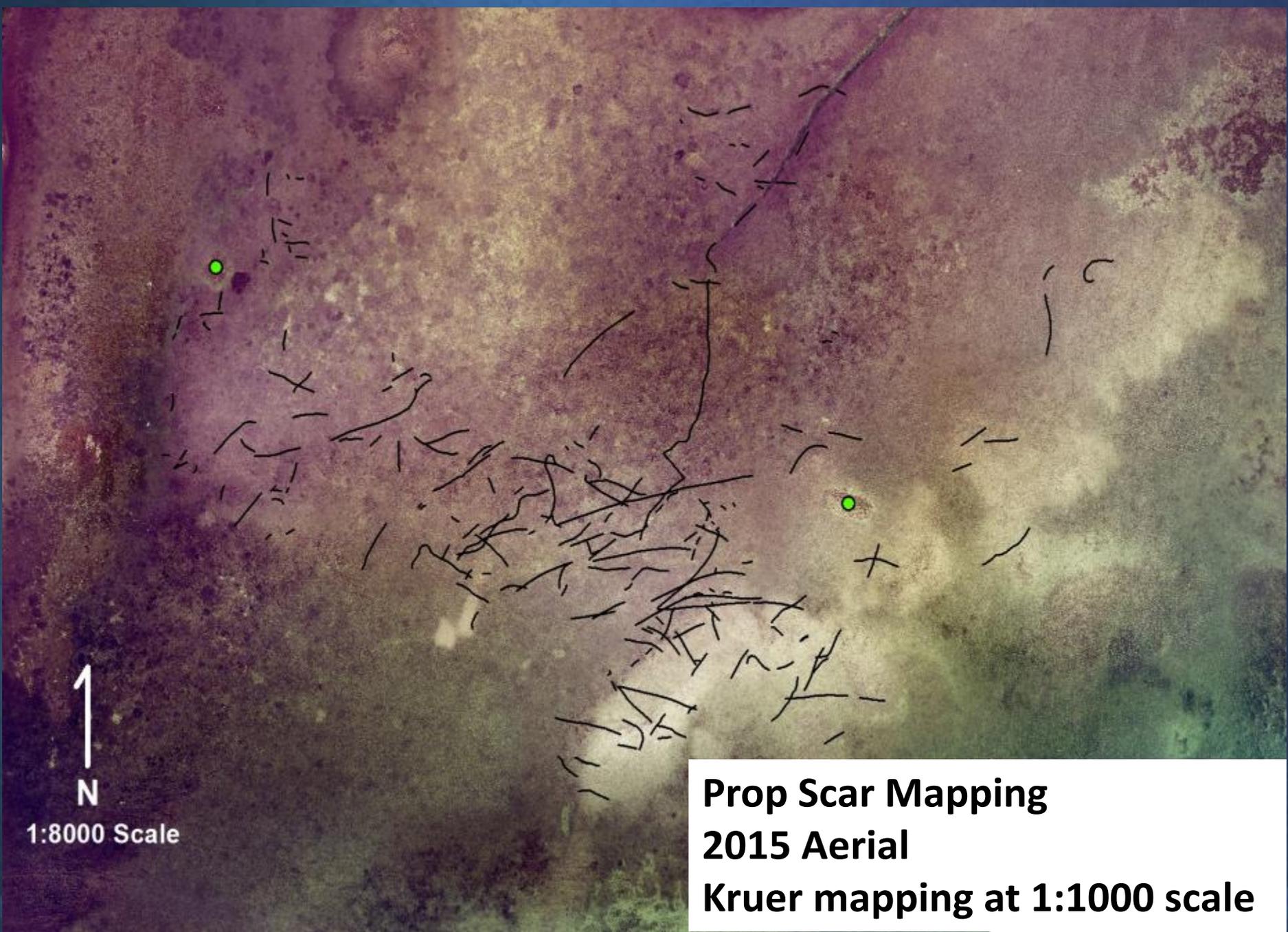
**1993 Prop Scar Mapping
Pennekamp Park
FL Marine Research Inst.**



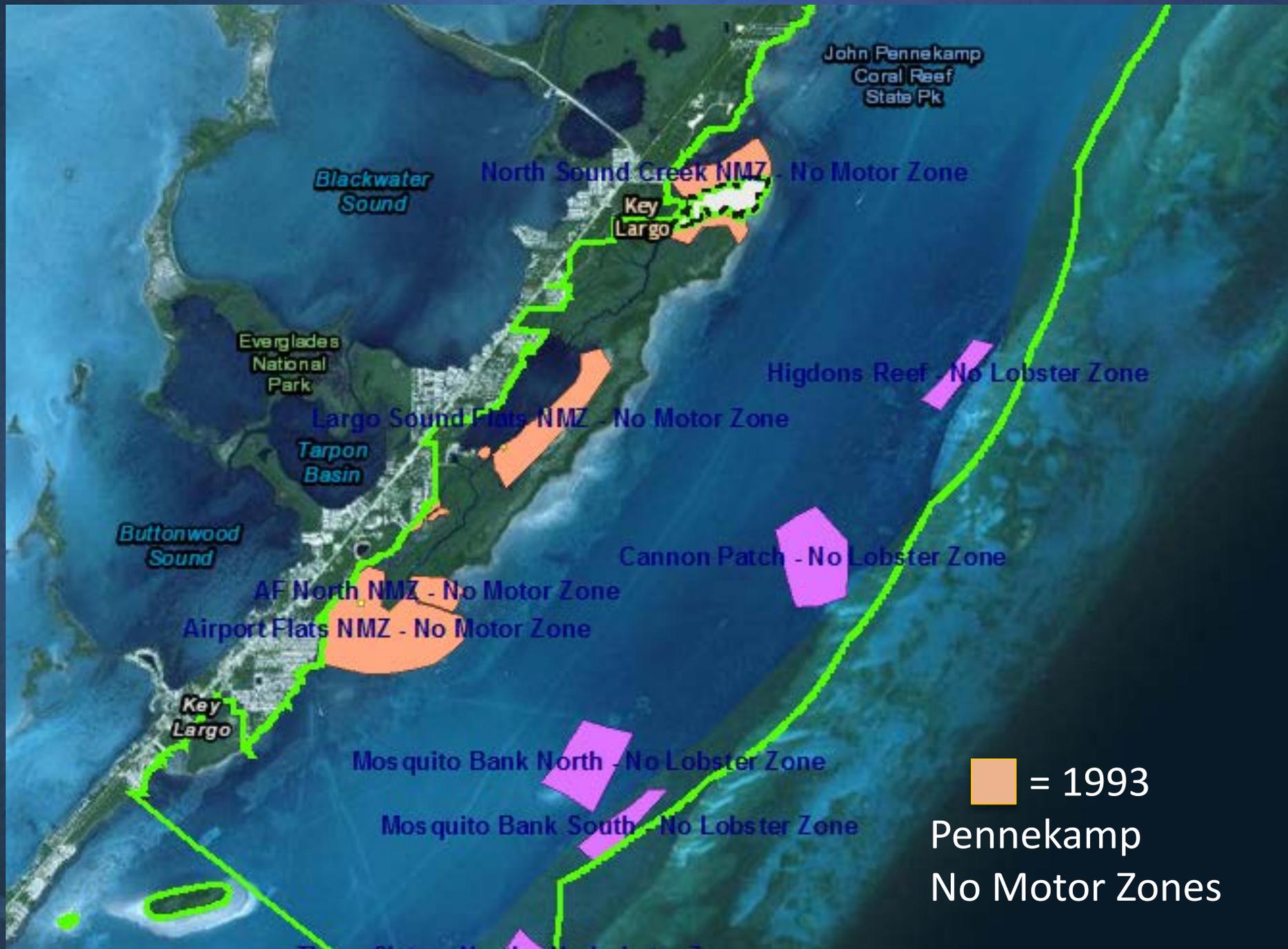
Port Largo Flats - 1993



**1993 Prop Scar Mapping
Pennekamp Park
FL Marine Research Inst.**



**Prop Scar Mapping
2015 Aerial
Kruer mapping at 1:1000 scale**



JOHN PENNEKAMP CORAL REEF STATE PARK PROPELLER SCAR STUDY 1999 FINAL REPORT

FMRI mapped vessel damage in 1993 (creation of No Motor Zones) and again in 1997 using aerial imagery acquired specifically for the purpose of mapping boat impacts.

Summary of Results:

1993 - PROTECTED SEAGRASS RESOURCES DAMAGED
= 190,530 m² = **47.1 acres**

1997 - PROTECTED SEAGRASS RESOURCES DAMAGED
= 106,671 m² = **26.4 acres**

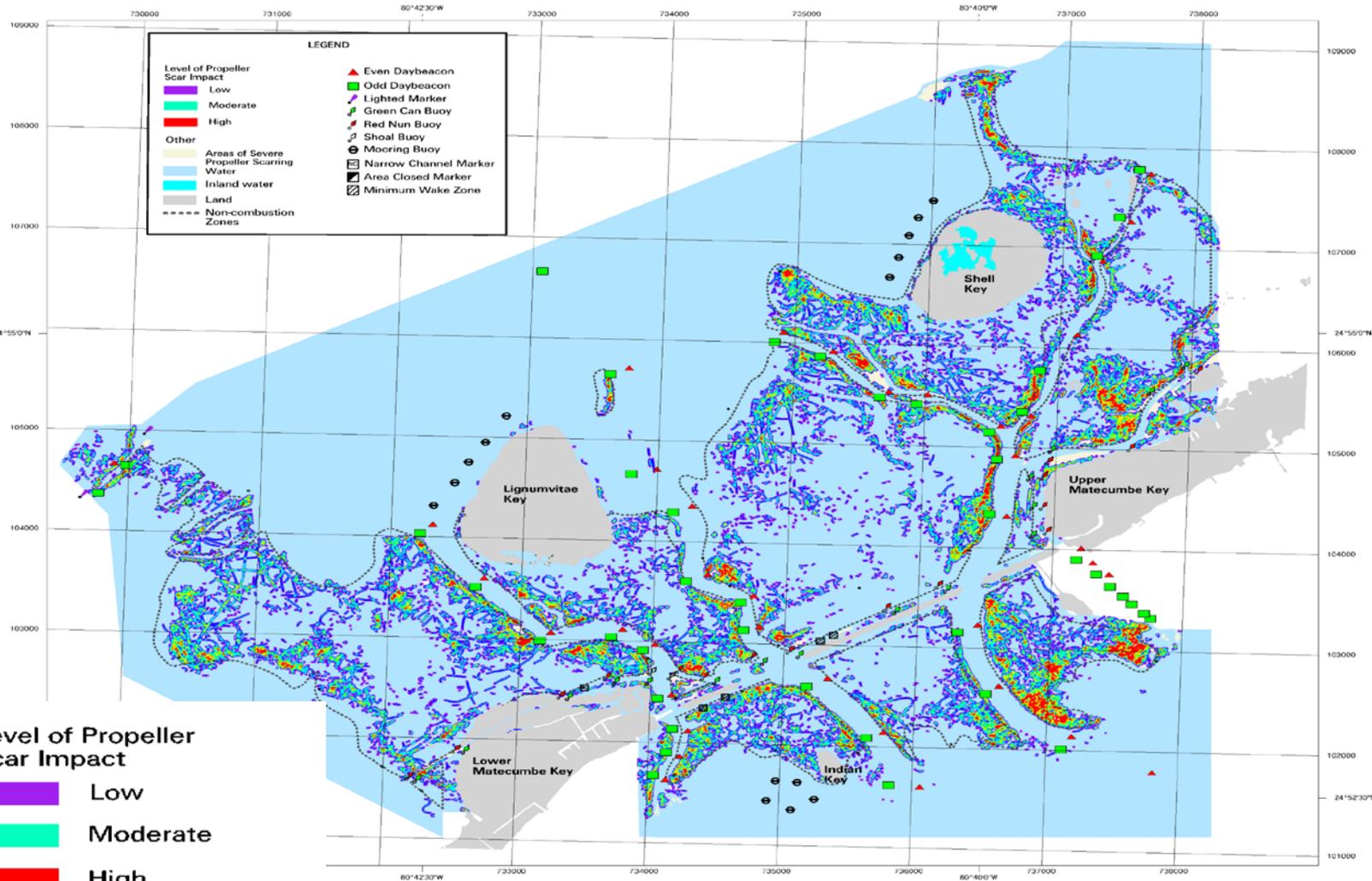
A reduction of 20.7 acres of impact in 4 years = 44%



LIGNUMVITAE KEY
STATE BOTANICAL SITE
1994-97 Propeller Scar Impact Intensities



Your Purchase of Fishing Equipment
and Motorboat Fuels Supports
Sport Fish Restoration
and Boating Access Facilities



LEGEND

Level of Propeller Scar Impact	▲ Even Daybeacon
Low	■ Odd Daybeacon
Moderate	◆ Lighted Marker
High	● Green Can Buoy
Other	● Red Nun Buoy
Areas of Severe Propeller Scarring Water	● Shoal Buoy
Inland water	● Mooring Buoy
Land	■ Narrow Channel Marker
Non-combustion Zones	■ Area Closed Marker
	■ Minimum Wake Zone

Level of Propeller Scar Impact

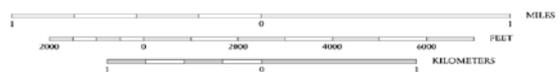
Low

Moderate

High

Other

Areas of Severe Propeller Scarring Water



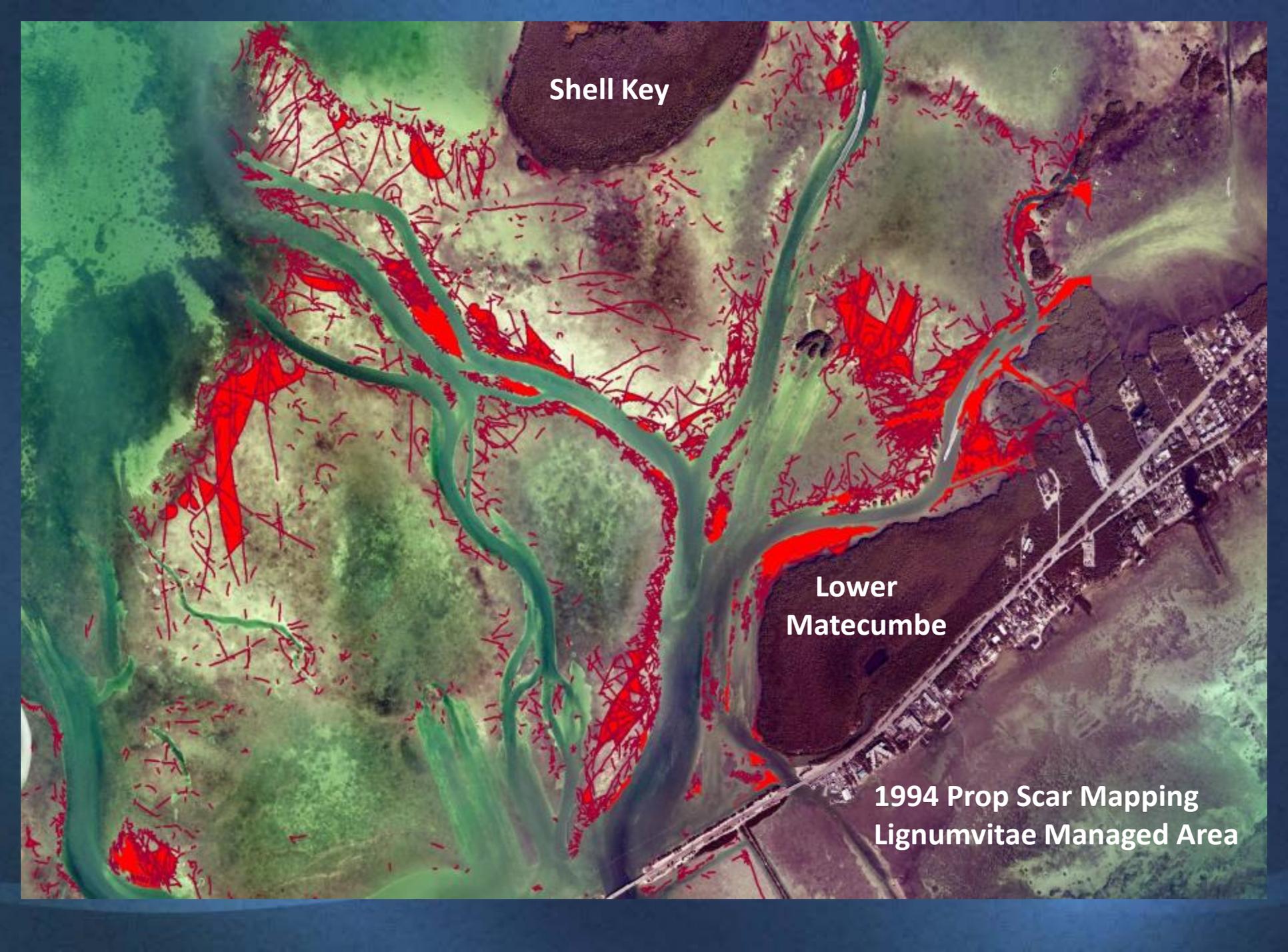
1994-1997

User Notes:

The propeller scar data were derived from 1:4,800 scale natural color aerial photography flown in 1994 and 1997.

Propeller scar widths were generalized to 1 meter for purposes of site selection and do not represent actual widths on the ground.

Data extend beyond the Lignumvitae Key State Botanical Site boundary.

An aerial photograph of a river system, likely the Lignumvitae River, with red overlays indicating mapped prop scars. The river flows from the top left towards the bottom right, with several tributaries. A large, dark, circular area at the top center is labeled 'Shell Key'. A large, dark, irregular area at the bottom right is labeled 'Lower Matecumbe'. The red overlays are concentrated along the river channels and their tributaries, showing a complex network of linear and polygonal features. The background is a mix of green and brown, representing vegetation and land. The text '1994 Prop Scar Mapping Lignumvitae Managed Area' is located in the bottom right corner.

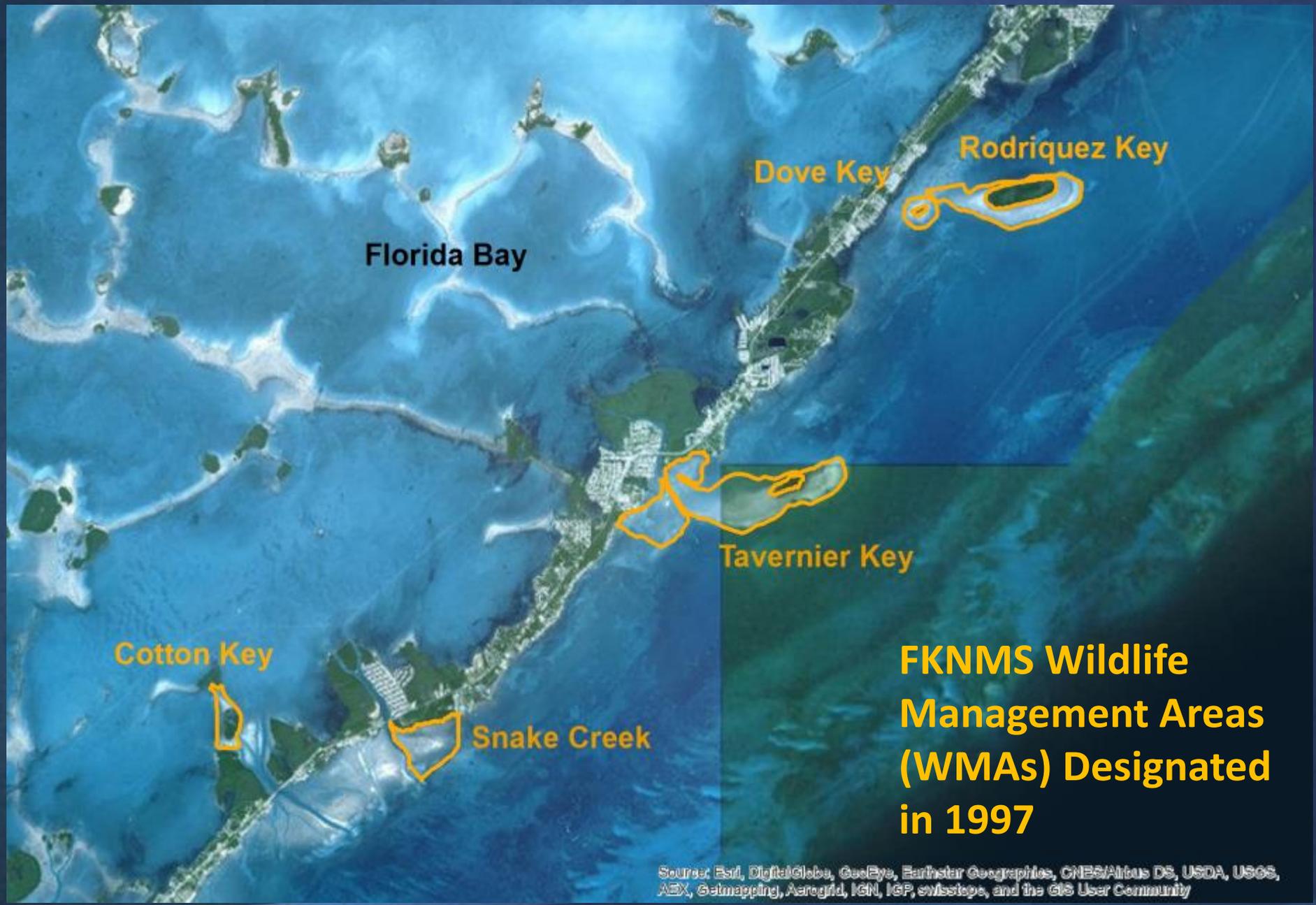
Shell Key

Lower
Matecumbe

1994 Prop Scar Mapping
Lignumvitae Managed Area

Wildlife Management Areas (NOAA)

- “Established to minimize disturbance to especially sensitive wildlife populations and their habitats to ensure protection and preservation consistent with the Sanctuary designation and other applicable laws governing the protection and preservation of wildlife resources in the Sanctuary.”



Florida Bay

Dove Key

Rodriguez Key

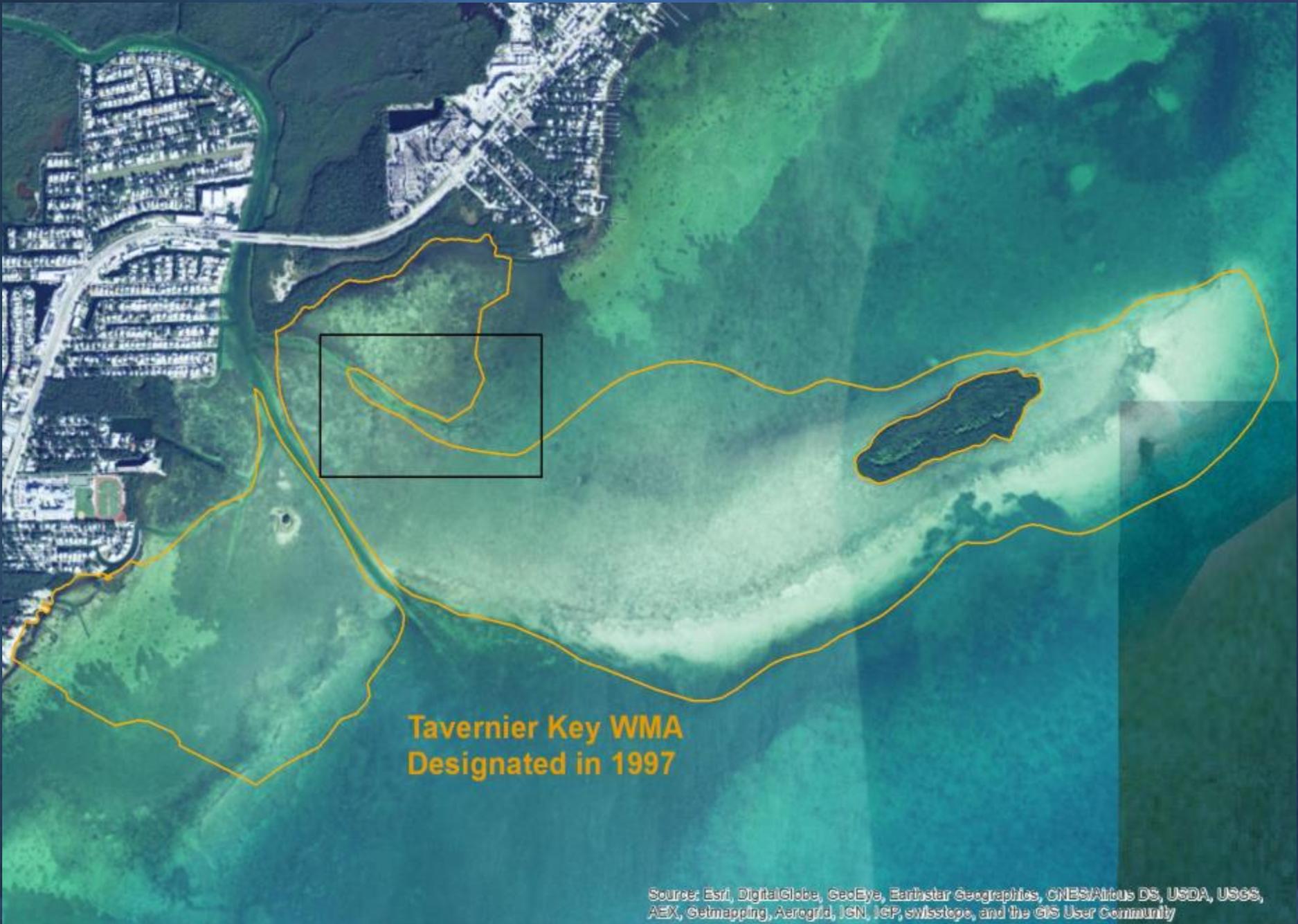
Tavernier Key

Cotton Key

Snake Creek

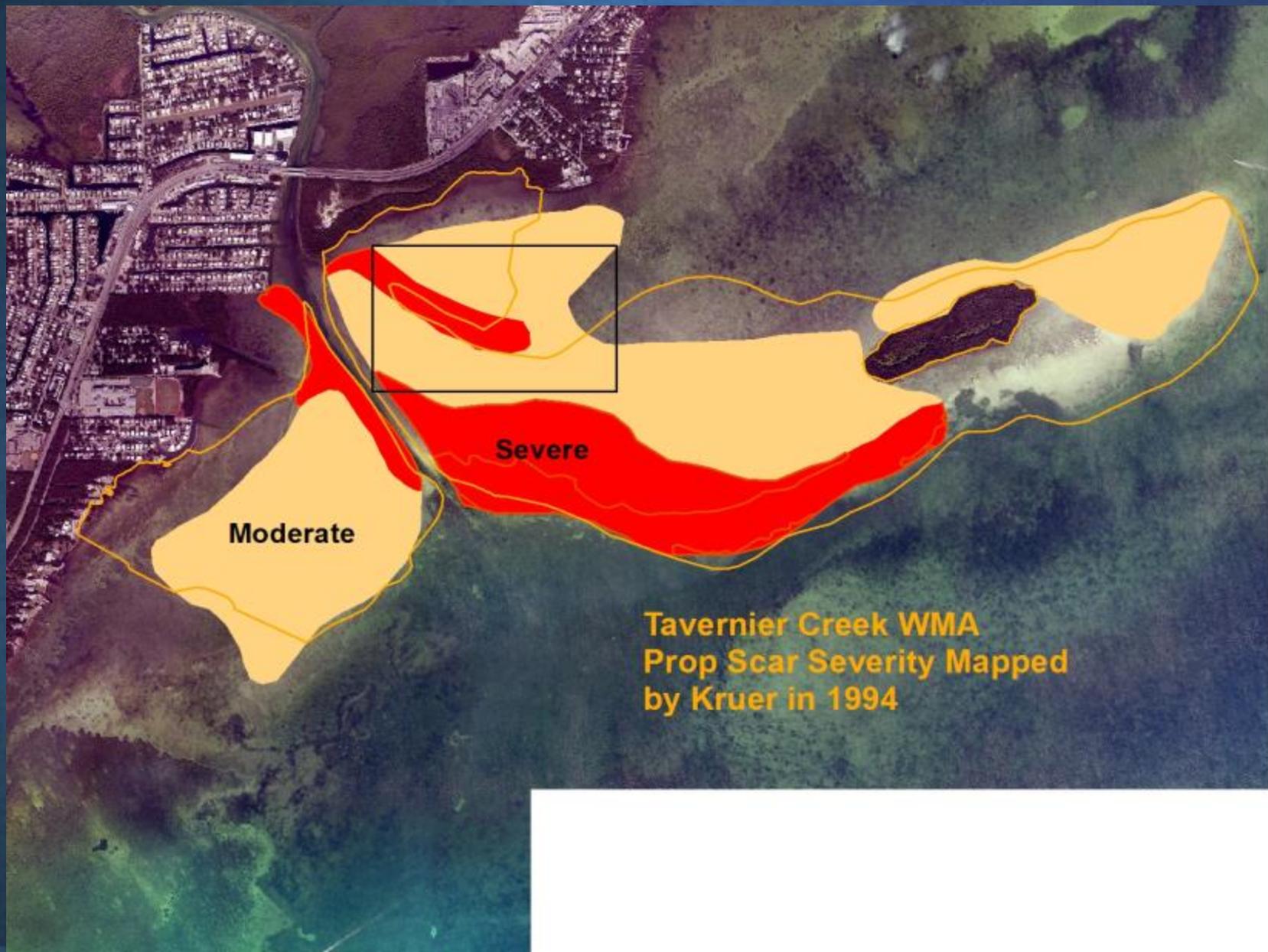
**FKNMS Wildlife
Management Areas
(WMAs) Designated
in 1997**

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



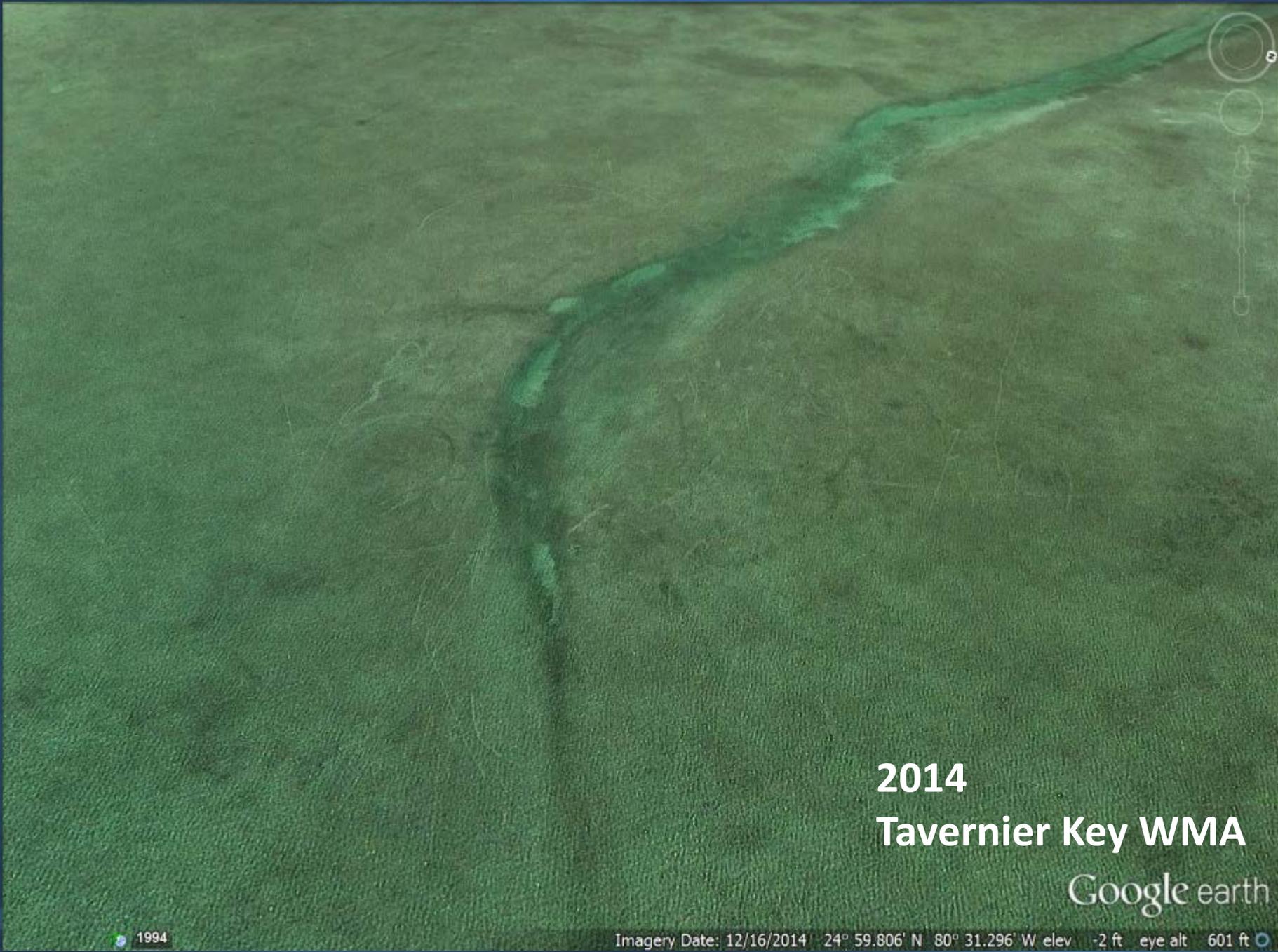
**Tavernier Key WMA
Designated in 1997**

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community





**1998 - Kruer Photo
Tavernier Key WMA**

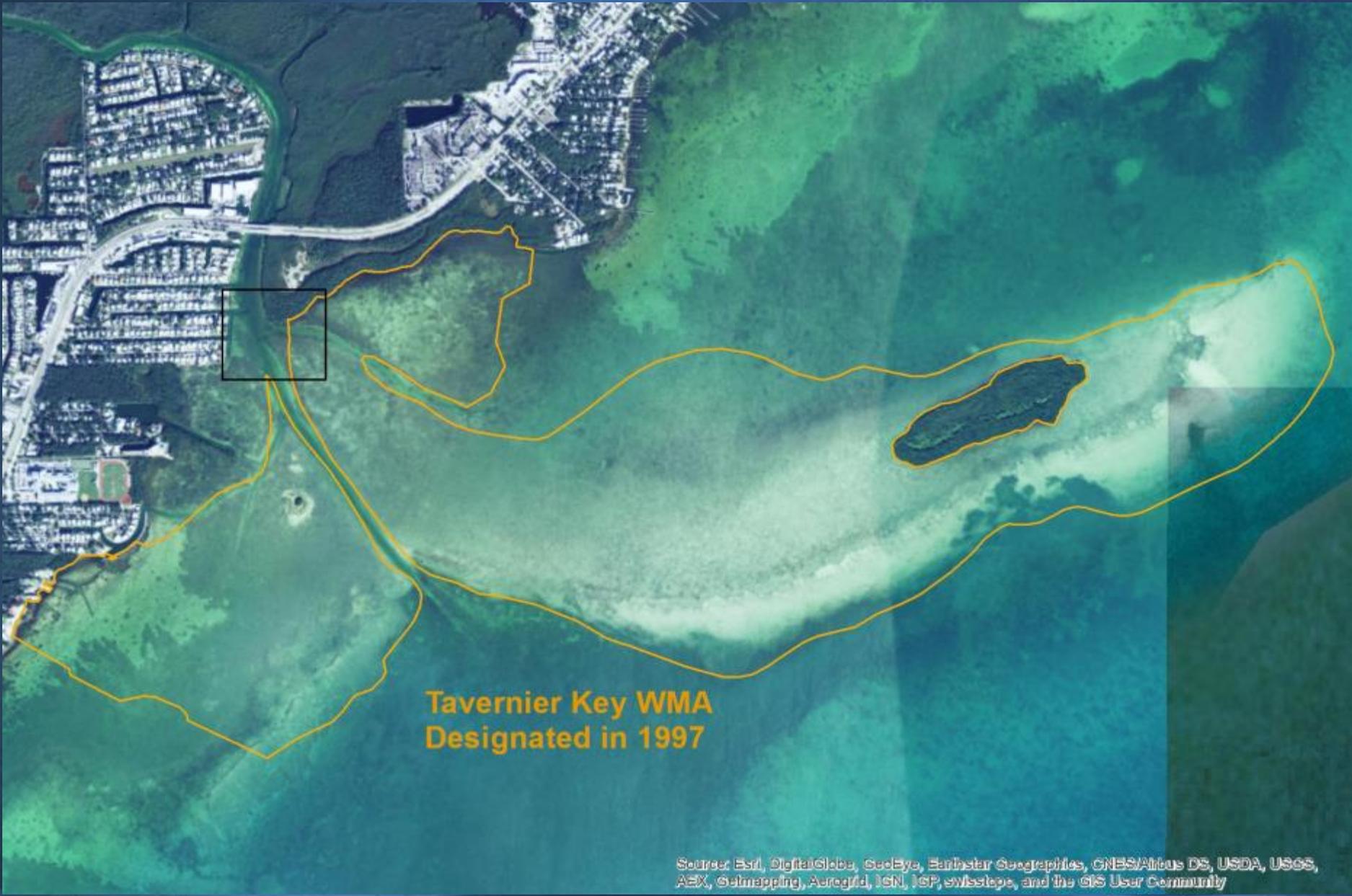


2014
Tavernier Key WMA

Google earth

1994

Imagery Date: 12/16/2014 24° 59.806' N 80° 31.296' W elev -2 ft eye alt 601 ft



**Tavernier Key WMA
Designated in 1997**

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Geomatics, AeroGRID, IGN, IGP, swisstopo, and the GIS User Community

**1996 - Kruer Photo
Tavernier Creek WMA**



2014 - Tavernier Creek WMA and No Wake Zone



1994

Imagery Date: 12/16/2014 24° 59.910' N 80° 31.775' W elev 0 ft eye alt 599 ft

**Tavernier Creek
1988 – Kruer,
Unmanaged**



**Tavernier Creek
2014, No Wake
Zone and WMA**



An aerial photograph of Tavernier Key, Florida, showing a large area outlined in orange and a smaller area outlined in cyan. The orange outline covers most of the island, while the cyan outline covers a small section of the western shore. The image shows a mix of green vegetation, brownish water, and grey buildings.

**Tavernier Key WMA
Designated in 1997**

**Nearby Area with
No Management**

1995



2006



2015



Other Areas Managed for Boat Impacts to Seagrass in Florida to be Reviewed:

Mosquito Lagoon - Merritt Island NWR

Charlotte Harbor - Charlotte Harbor National Estuarine Program

St. Andrews Bay - St. Andrews Bay Aquatic Preserve

Ft. DeSoto Management Area – Pinellas County

Weedon Island Preserve – Pinellas County

Cockroach Bay, Tampa Bay

Everglades National Park

Project Purpose is to Assess:

- History of Boat Impacts and Shallow Water Management in the Keys
- Value and Benefit of Existing Shallow Water Management
- Trends and Current Conditions Based on 2015 Aerial Photo Interpretation

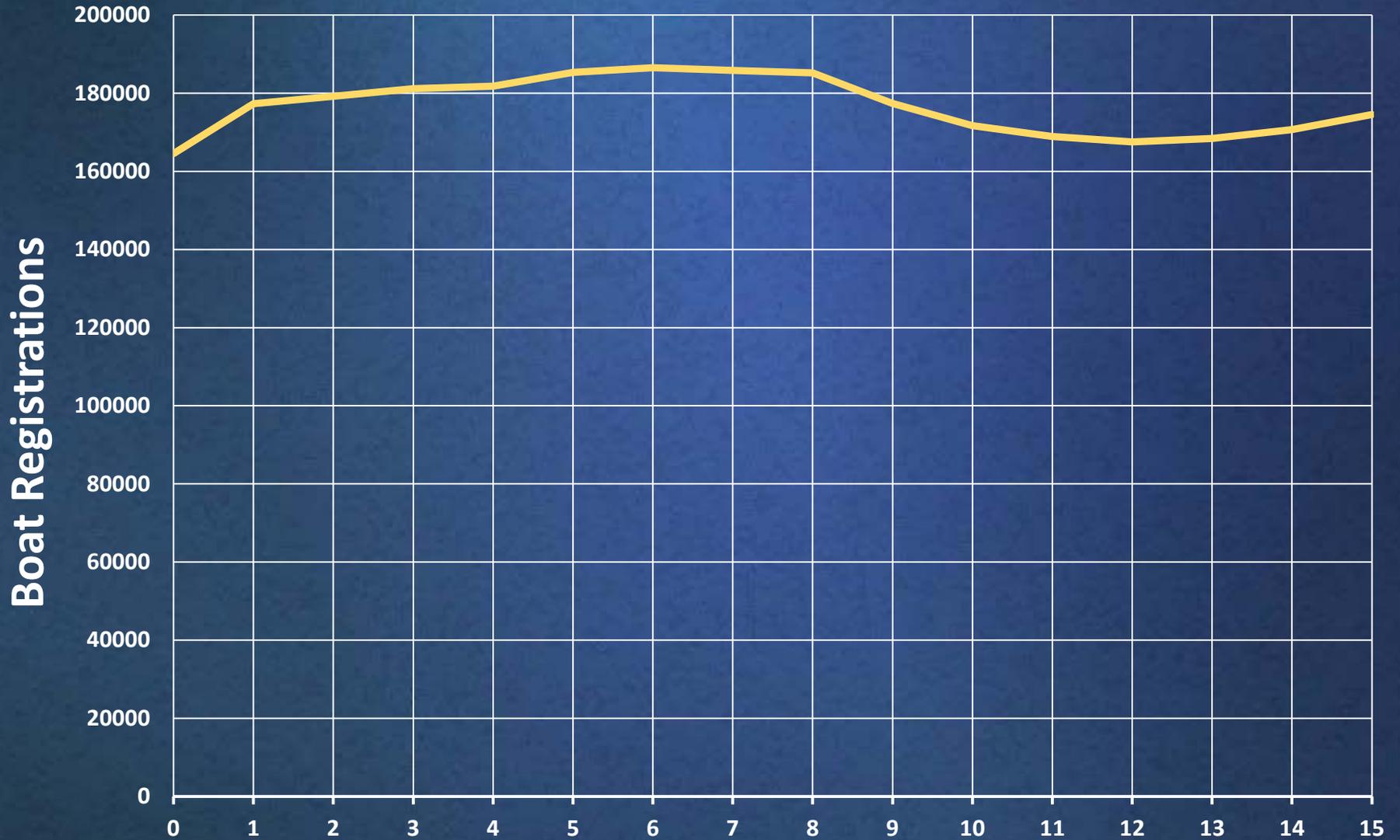
Good Trends:

- Blatant prop dredging for channel creation has ceased
- Interior of large managed areas show far fewer impacts
- Idle speed/no wake zones show improvements in scarring
- There is an increased recognition of the problem

Bad Trends:

- Number of registered vessels in SE Florida is increasing
- Problem areas (hot spots) outside of managed areas persist or are getting worse and erosion of impacted areas is more serious
- Dock and pier construction that often leads to additional boat impacts continues

Southeast Florida/4 Counties



YEAR 2000 to 2015

No Longer Happening in the Keys:



Coco Plum – 1984, Kruer photo



Lower Matecumbe Key – 1982, Kruer photo

Gulf of Mexico

Marathon

Big Pine

Key West

Atlantic Ocean

**Prop Scar Mapping by Kruer
from Sargent et al. 1995**

-  = Light Scarring
-  = Moderate Scarring
-  = Severe Scarring

2013 World Map aerial
1:400,000

Florida Bay

Tavernier Key

Lignumvitae

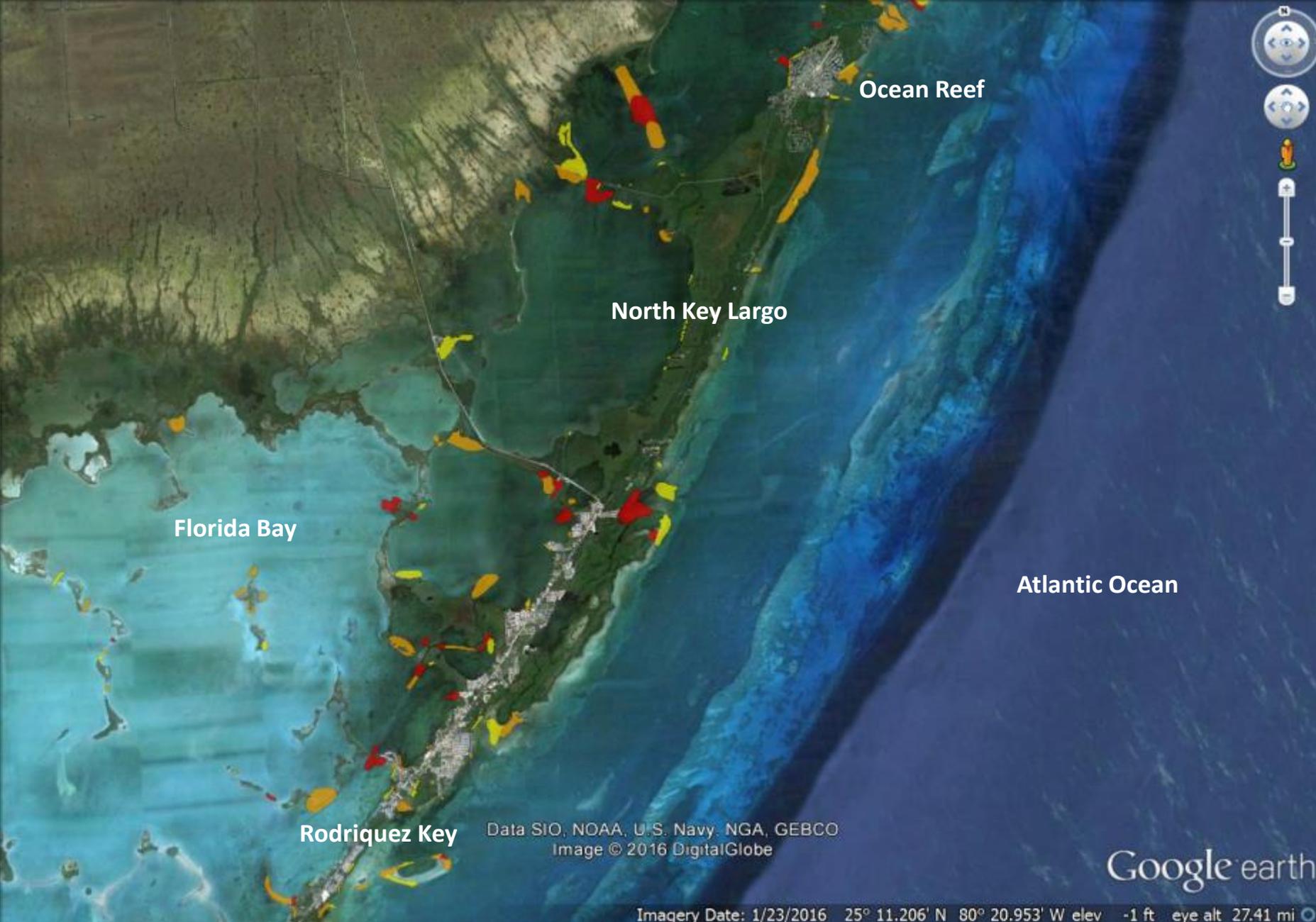
Atlantic Ocean

Long Key

Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Google earth

Imagery Date: 12/16/2014 24° 53.983' N 80° 39.822' W elev -6 ft eye alt 20.37 mi



Ocean Reef

North Key Largo

Florida Bay

Atlantic Ocean

Rodriquez Key

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2016 DigitalGlobe

Google earth

Imagery Date: 1/23/2016 25° 11.206' N 80° 20.953' W elev -1 ft eye alt 27.41 mi

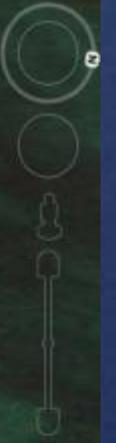
**November 1985
7-Mile Bridge Gulfside
Kruer photo**





**February 1998
7-Mile Bridge Gulfside
Kruer photo**

December 2014
7-Mile Bridge Gulfside



Google earth

1995

Imagery Date: 12/16/2014 24° 42.737' N 81° 7.623' W elev -2 ft eye alt 1147 ft

Whale Harbor Channel
Bayside, 1987 Kruer photo



**Whale Harbor Channel
Bayside, 1995 Kruer photo**



Whale Harbor Channel Bayside, 2014



1994

Imagery Date: 12/16/2014 24° 56.835' N 80° 37.136' W elev -4 ft eye alt 468 ft

Google earth

Florida Keys National Marine Sanctuary and Protection Act - 1990

- Section 7(a)(1) – *facilitate all.....uses of the Sanctuary consistent with the primary objective of Sanctuary resource protection*
- Section 7(a)(2) – *consider temporal and geographic zoning to ensure protection of Sanctuary resources*

Project Goals

- To encourage review of the impending DEIS with an eye to the facts regarding boat impacts and the health of shallow seagrass habitats throughout the FKNMS.
- To research and present data regarding the trend of continuing shallow habitat degradation and the role that marine zoning (i.e. pole and troll zones, idle speed zones) can play in reversing that trend.

Project Goals

- To develop data that can be shared with the SAC, NOAA and other agencies, NGOs, and the public on existing problem areas and potential solutions to those problems.
- To assist the FKNMS with the development of alternatives for a comprehensive shallow water protection program that can be accomplished without cutting off access to those areas.

Questions?

