Long-term monitoring of seagrasses using a WV-2 satellite image, historical aerial photography and field data

Mariana C. León-Pérez, William J. Hernández and Roy Armstrong
Bio-Optical Oceanography Laboratory
Marine Science Department
University of Puerto Rico, Mayagüez Campus


doris.ffessm.fr © Franck MAZEAS

Photos by: JP Zegarra

Reported cases of seagrass loss have increased, suggesting increased rates of seagrass decline worldwide (Orth *et al.,* 2006).

Water quality

marinas.com

Objective

- The main goal of this study is to determine long-term changes in seagrass habitat cover at Caja de Muertos Island Nature Reserve (CMINR).
    - Generate a more accurate and current seagrass benthic map of CMINR.
    - Reconstruct the historic distribution of seagrass around CMINR.

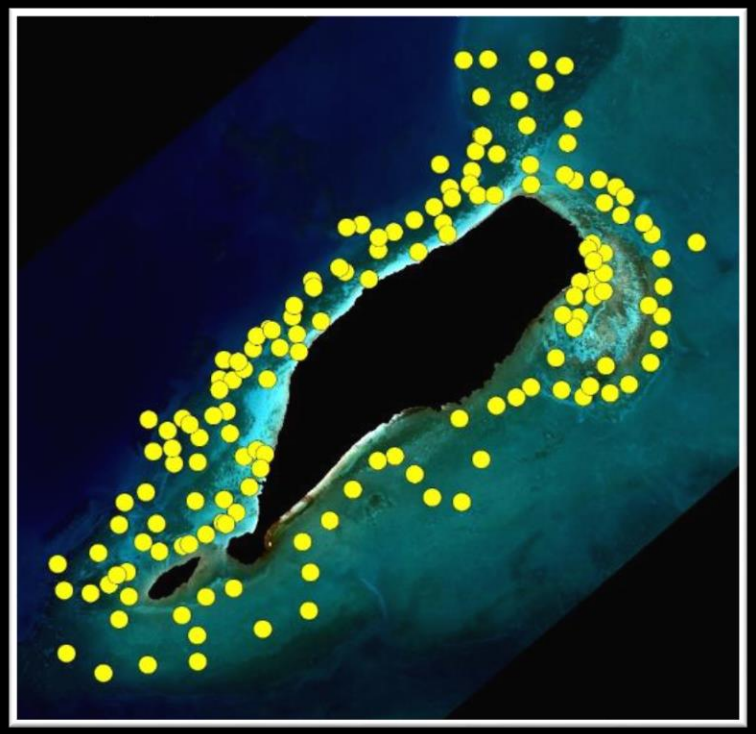

N
Image Landsat
Data LDEO-Columbia, NSF, NOAA
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Google earth
Tour Guide
Imagery Date: 4/9/2013 18°01'46.22" N 66°24'25.30" W elev 570 ft eye alt 196.73 mi

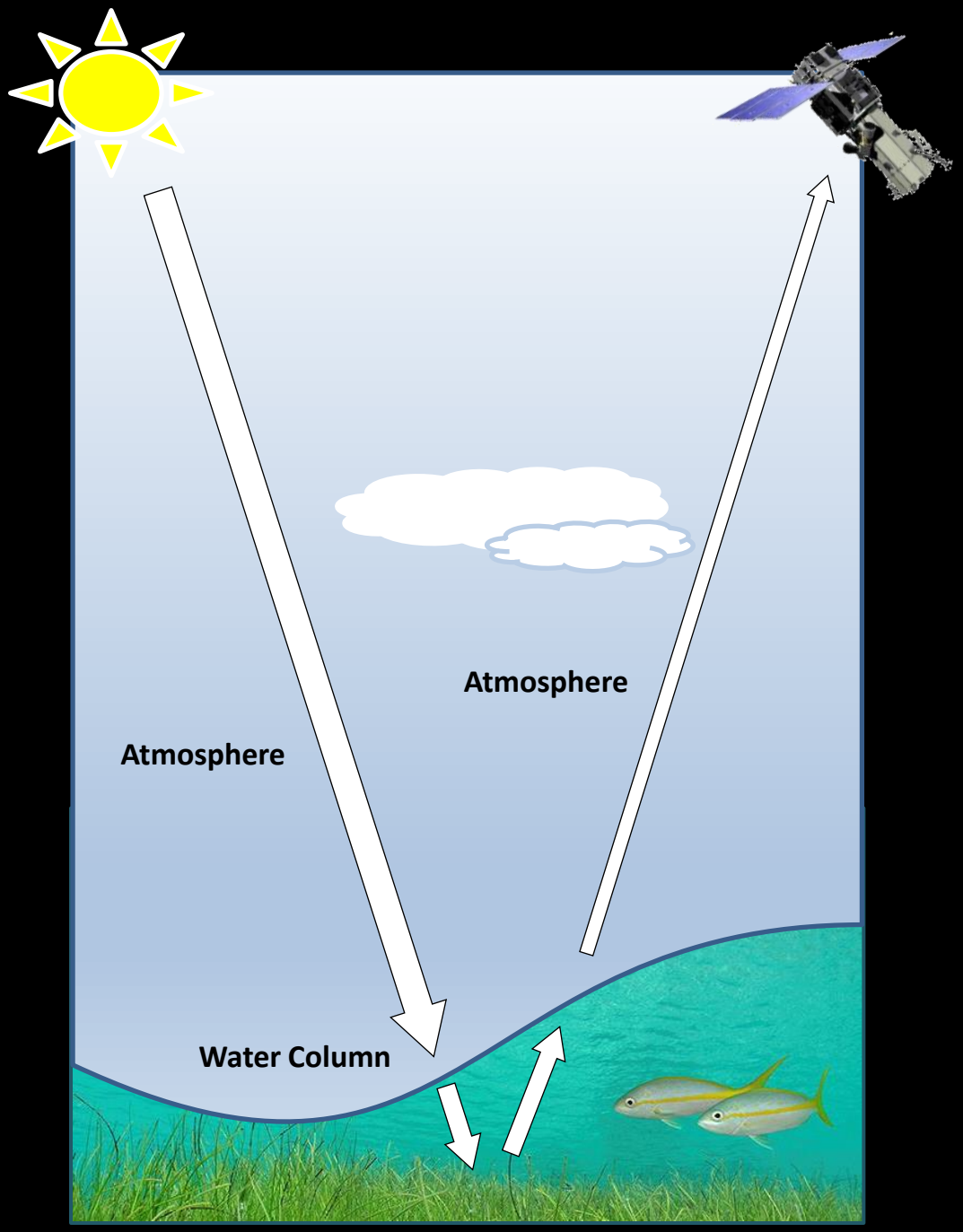
Study Area


Ponce
villasevilla.blogspot.com
Caja de Muertos Island
Nature Reserve
villasevilla.blogspot.com
N
Natural Protected Areas of Puerto Rico: Gap Project and Natural and Environmental Resourses Department

Field work

- Sampled area was determined based on 3 criteria:
  - Depth limit of *Thalassia testudinum*
  - Distance from shore
  - Seagrass detection limit of historic photos
- Sampling sites
  - 155 sites for calibration and validation
- Equipment
  - On-board submersible HD video camera
  - Boat depth sounder
  - Trimble Juno 3D Series



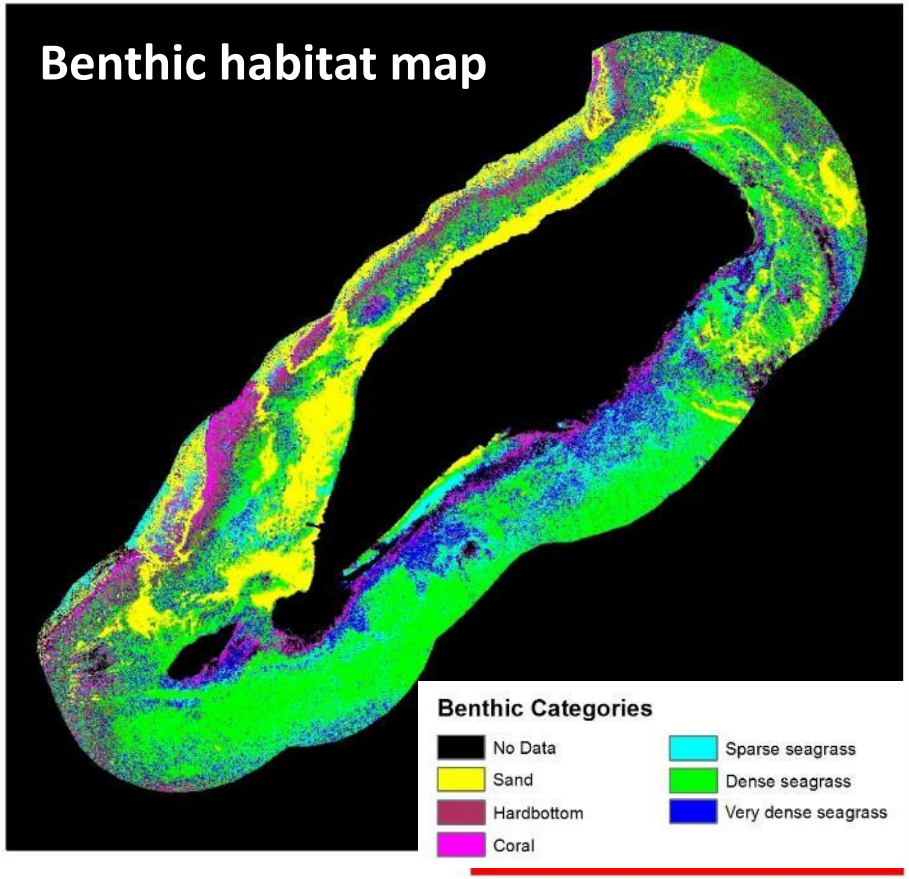

< 10% Solar Radiation
Atmosphere
Atmosphere
Water Column

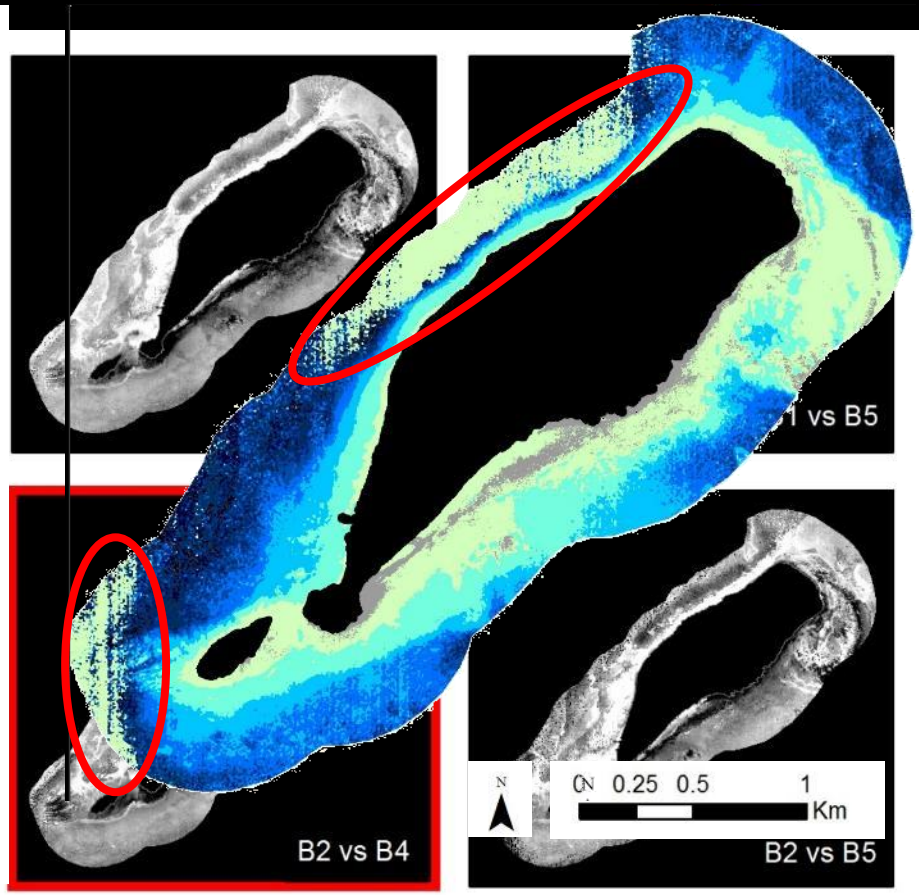
WorldView-2

F

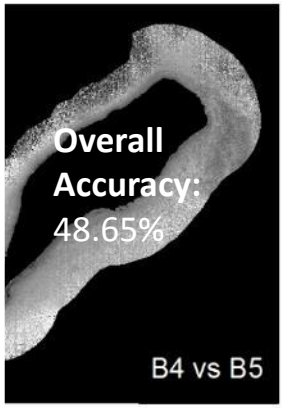
ve
n

lap

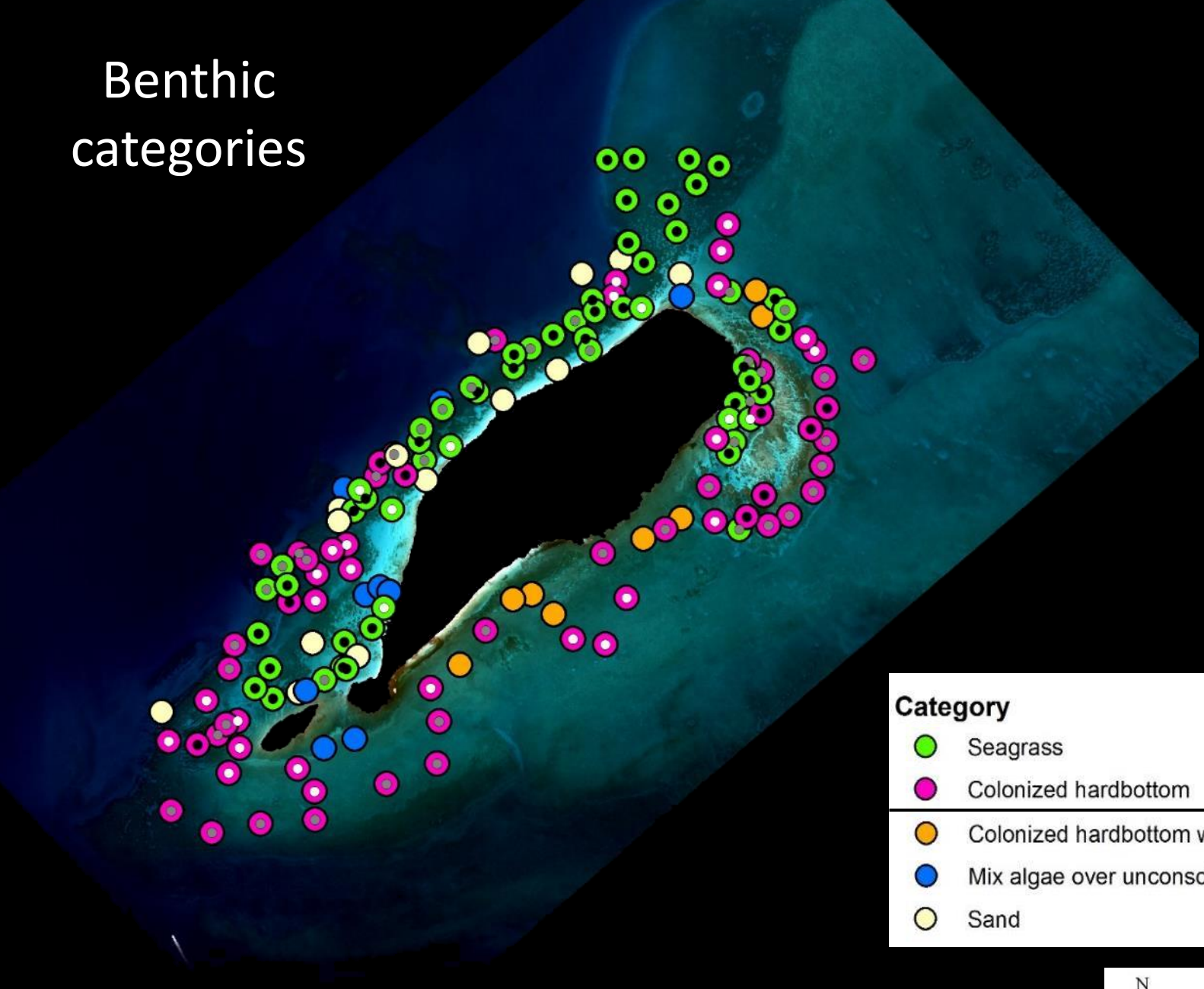




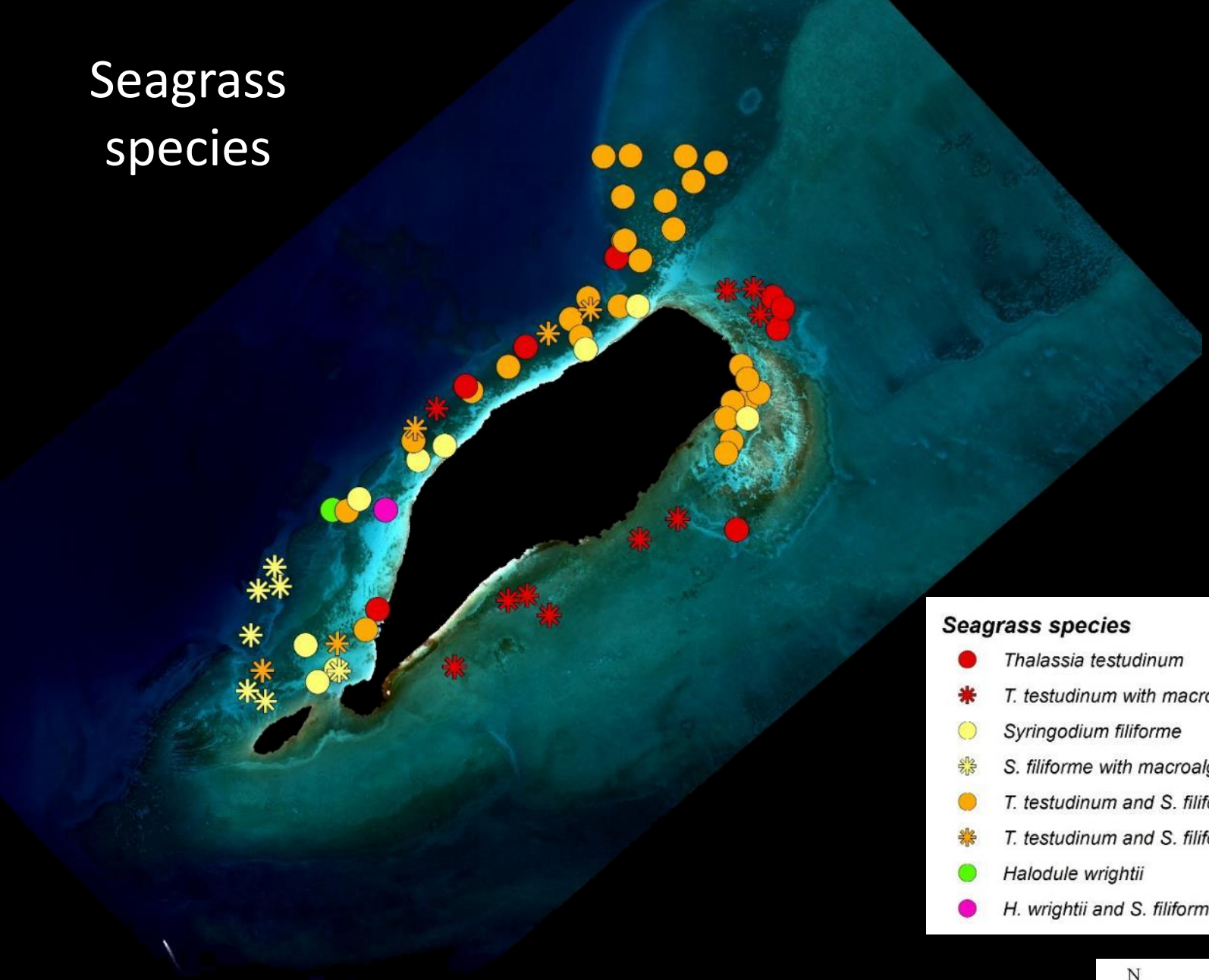
		Truth data							
	Benthic class	Sand	Hardbottom	Coral	Sparse seagrass	Dense seagrass	Very dense seagrass	**Classification overall**	**Producer accuracy**
Classifier results	Sand	8			1			9	88.89%
	Hardbottom			4	1		1	6	0.00%
	Coral			1			1	2	50.00%
	Sparse seagrass				4			4	100.00%
	Dense seagrass	3	2		2	3		10	30.00%
	Very dense seagrass					4	2	6	33.33%
	Truth overall	11	2	5	8	7	4	37	
	User accuracy	72.73%	0.00%	20.00%	50.00%	42.86%	50.00%		

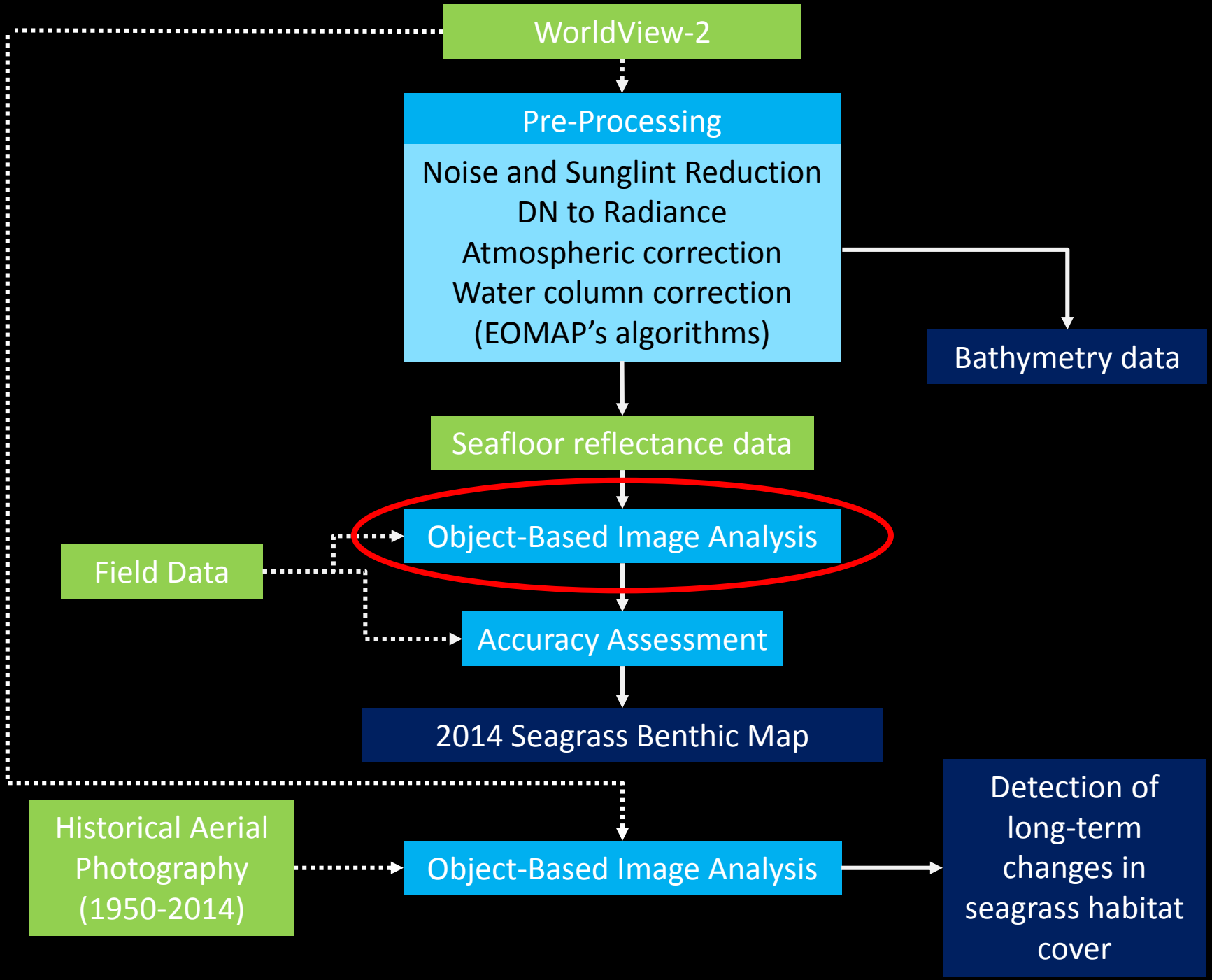


Benthic categories

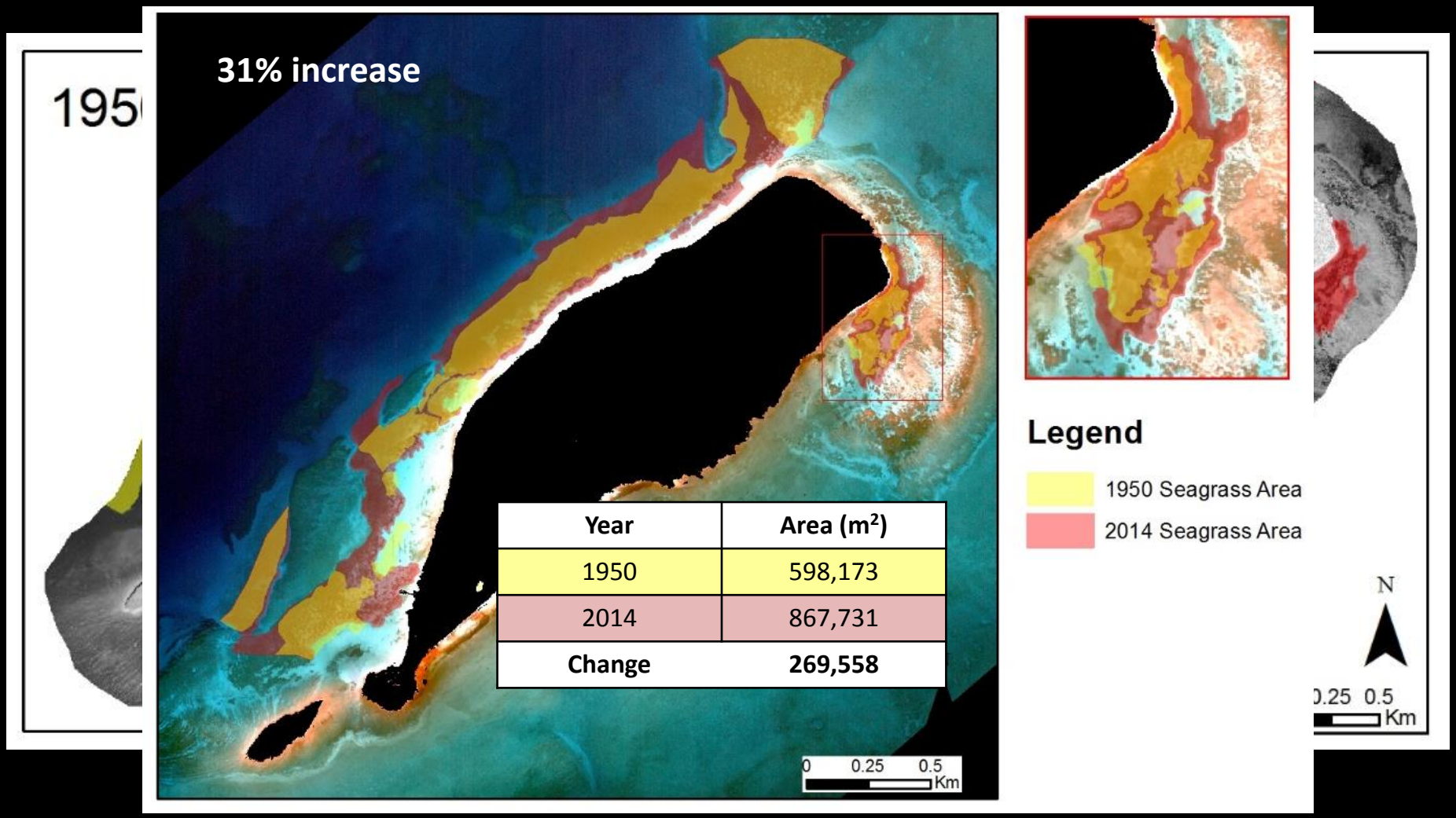


Seagrass species




WorldView-2
Pre-Processing
Noise and Sunglint Reduction
DN to Radiance
Atmospheric correction
Water column correction
(EOMAP's algorithms)
Bathymetry data
Seafloor reflectance data
Object-Based Image Analysis
Field Data
Accuracy Assessment
2014 Seagrass Benthic Map
Historical Aerial Photography (1950-2014)
Object-Based Image Analysis
Detection of long-term changes in seagrass habitat cover

1950-2014 Seagrass Cover Change



Acknowledgments

- This project is supported by NOAA CREST
  - Grant #NA06OAR480162, UPR-Mayaguez
  - Sea Grant Puerto Rico
- WorldView-2 Imagery
  - Puerto Rico Seagrass Fund
- Special thanks to:
  - Jan P. Zegarra
  - Juan P. Alvarez
  - Hector Martinez
  - Nick Hammerman
  - Jeremy Kravitz
  - Luis Lugo (Vita)
  - Hector Ruiz
  - Milton Carlo
  - Orlando Espinosa