

Florida Keys Shallow Water Boating Impact Analysis and Trends Assessment - Mapping Summary Report

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Project Summary

The sustained health of the nearshore marine environment is vital to and drives the tourist-based Florida Keys economy, and supports the full coral reef ecosystem in many ways. It is of paramount importance to maintain the quality of the Keys shallow water habitats that support the diverse abundance of fish and wildlife that make the Keys unique. Flats fishing alone in the Keys generates an estimated \$427 million annually to Florida's economy (Fedler 2013), and much of this economic activity is known to benefit the Keys economy as well. Disturbance and direct impacts (including prop scarring, groundings, turbidity, water quality degradation, disturbance, etc.) to these shallow areas by vessels of all types are believed to be major contributing factors to a decline in the Keys of birds, fish, and other animals dependent on these habitats. The most logical way to address this problem is through better science-based management of Keys shallow water habitats and implementation of management based on this science. Boat usage in nearshore waters of the Keys is increasing and up-to-date mapping and assessment of trends in the extent and severity of boating impacts to shallow water in the Keys is critical to proper management. In 1993 there were 20,163 watercraft registered in Monroe County and in 2015 there were 28,247, an increase of 40%.

The problem is widely acknowledged by local, state, and federal agencies and has been for many years (Kruer 2016). The project purpose is to create a new, scientifically valid map dataset for the Florida Keys National Marine Sanctuary (FKNMS) to allow improved management for impacted shallow water habitats, and to allow an examination of trends through comparison to vessel impacts mapped about 20 years ago (Kruer 1994, Sargent et al. 1995). In 2014 the Florida Keys National Marine Sanctuary Advisory Council (SAC) addressed this continuing serious threat to Keys shallow water habitats through formal recommendations to the FKNMS Marine Zoning and Regulatory Review process. In 2014, the FKNMS identified the status and trends of seagrass habitats and the anthropogenic influence on seagrass as "immediate science needs for critical management issues" and recommended re-evaluation of marine zones in the FKNMS for their effectiveness (<http://sanctuaries.noaa.gov/science/assessment/fknms.html>, accessed March 2017). Carlson and Fourqurean (2016) assessed the general status of seagrasses in the Keys for the Florida Fish and Wildlife Conservation Commission and recommended that the locations of propeller scarring be inventoried and strategies be developed to reduce impacts.

A presentation on Keys boating impacts, the history of the issue, trends, and the value of boating management was made to the SAC in April, 2016 (Kruer 2016), and led to SAC comments that improved management and science (including updated mapping) of nearshore shallow waters was needed. The ultimate goal of this Monroe County funded mapping project is to assist agencies in the development of a comprehensive plan to better manage and protect these areas, including as part of the current FKNMS Marine Zoning and Regulatory Review and the U.S. Fish and Wildlife Service Backcountry Plan update.

Methods

Using improved aerial imagery and GIS technology not available in the mid-1990s allowed this map update to be carried out in greater detail while adhering to the methods of Sargent et al. (1995) as much as possible. The subjectivity of mapping scar and grounding intensity was improved through the use of the same diagrammatic representation and visual aid used for the 1995 scar maps (Sargent et al. 1995, Figure 6, page 11). Heads-up digitizing in ArcMaps 10.2.2 was used to create polygons of the impacted areas in 3 categories – light (presence of scars in <5% of polygon), moderate (5%-20%), and severe (>20%). High resolution (0.5 foot) 2015 NAIP color aerial imagery was used as the digital base for most of the area mapped, west of Key West 2013 NAIP (1.0 meter) imagery was used. Collateral imagery useful for photointerpretation included 2014 (Google Earth) and available historical imagery. Photointerpretation took place at scales ranging mostly from 1:600 to 1:3000 and on screen digitizing at scales from 1:1000 to 1:1500, essentially the greatest useful magnification possible. A minimum mapping unit of 0.5 acre was applied to the mapping.

Results and Trends

Maps produced by this project show a large increase in the extent and severity of boating impacts to shallow water habitats, primarily seagrass, in the FKNMS over that mapped in the mid-1990s. Visible scarring and grounding impacts (in nearly 3,000 polygons) were mapped from the northern boundary of the FKNMS north of Ocean Reef to the west side of the Marquesas Keys. Impacts to shallow benthic habitats included those from scarring by vessels under power, groundings, vessels on anchor, vessels using docks, and wake wave erosion. This mapping is a conservative estimate of the extent of boating impacts in the Keys as only visible, obvious impacts (no matter how old) were mapped and many areas with questionable signatures, especially on the deeper end of depths mapped (typically from the intertidal zone to about 6 feet deep), were not included. Trends in the existing marine managed areas (local, state, and federal) appear to be mixed with some reflecting improvements since the mid-1990s and others showing increased overall impacts. Produced as part of this mapping dataset is a master ArcMap shapefile (.shp) as well as a kml/kmz format map set (.kmz) viewable in Google Earth.

Due to the difference in some of the methods used and in the increased resolution of available aerial imagery over the last 20 years, direct comparison of the data from 1995 to this mapping may not be possible. However, since the locations of much of the impact has not changed, and since the author carried out the mapping for both projects, it is believed that generally the acreage data show trends of greatly expanded impacts and increasing severity. The extent of combined moderately and severely impacted areas doubled in 20 years.

Acreage of Mapped Impact:

Year	Light	Moderate	Severe	Moderate+Severe	Total
1995	14,560	10,430	5,060	15,490	30,050
2015	26,007	11,481	19,462	30,943	56,950

References

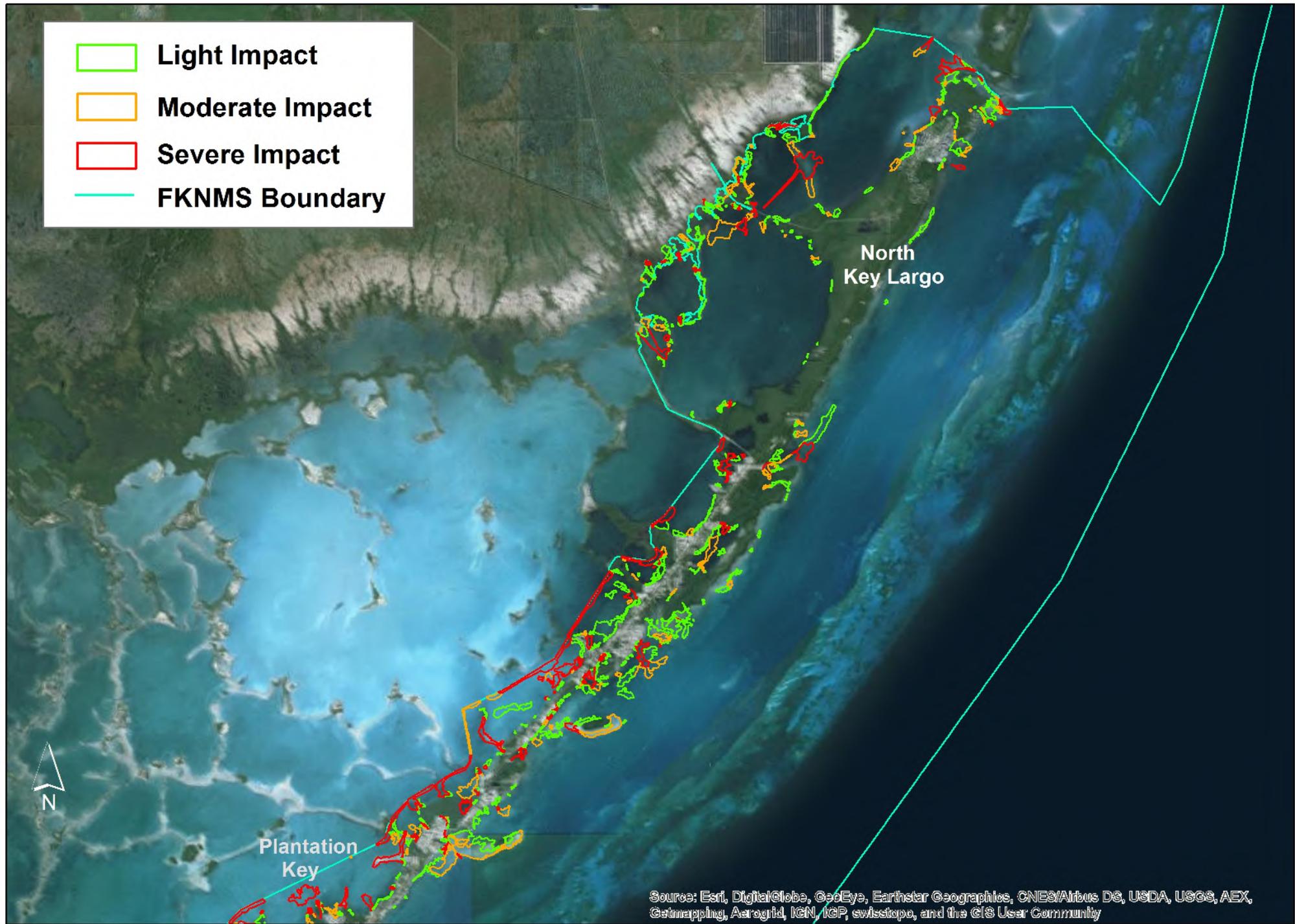
Carlson, P. R. Jr., and J. W. Fourqurean. 2016. Summary report for the Florida Keys National Marine Sanctuary. pp. 214-221, *in* L. A. Yarbrow and P. R. Carlson Jr., eds. Seagrass Integrated Mapping and Monitoring Report No. 2. Fish and Wildlife Research Institute Technical Report TR-17, version 2. Florida Fish and Wildlife Conservation Commission, St. Petersburg. 281 p. DOI: 10.13140/RG.2.2.12366.05445.

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Kruer, C. 2016. Presentation to the FKNMS Advisory Council, April 19, 2016. (<http://floridakeys.noaa.gov/sac/othermaterials/20160419boatingimpacts.pdf>)

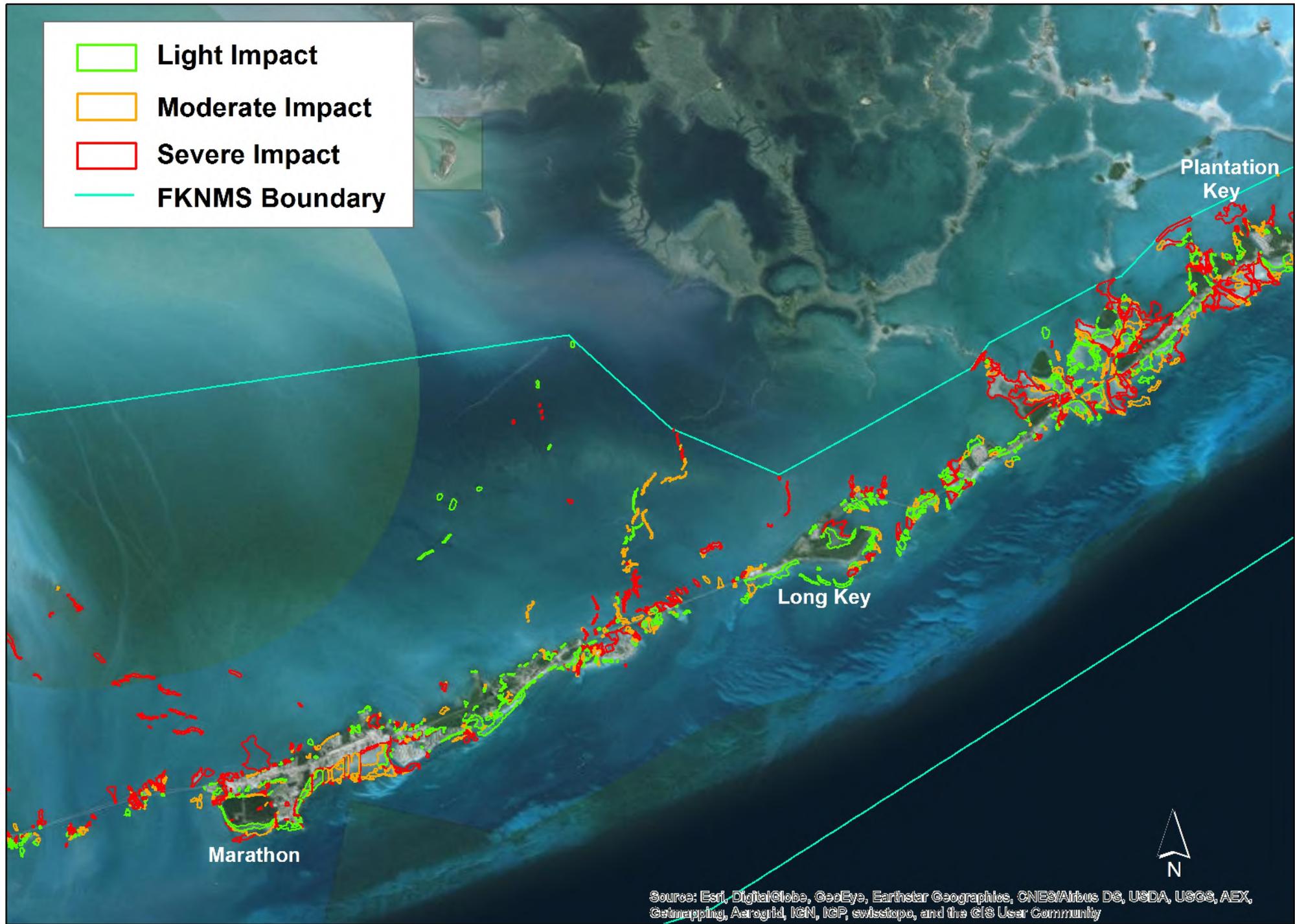
Sargent, F.S., T.J. Leary, D.W. Crewz, and C.R. Kruer. 1995. Scarring of Florida's seagrasses: assessment and management options. Florida Marine Research Institute Technical Report TR-1, Florida Department of Environmental Protection, St. Petersburg, Florida, 37 pp. plus appendices.



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



Mapped Boating Impacts - Upper Keys
Maps by C. Kruer, Lines Approximate
March 2017

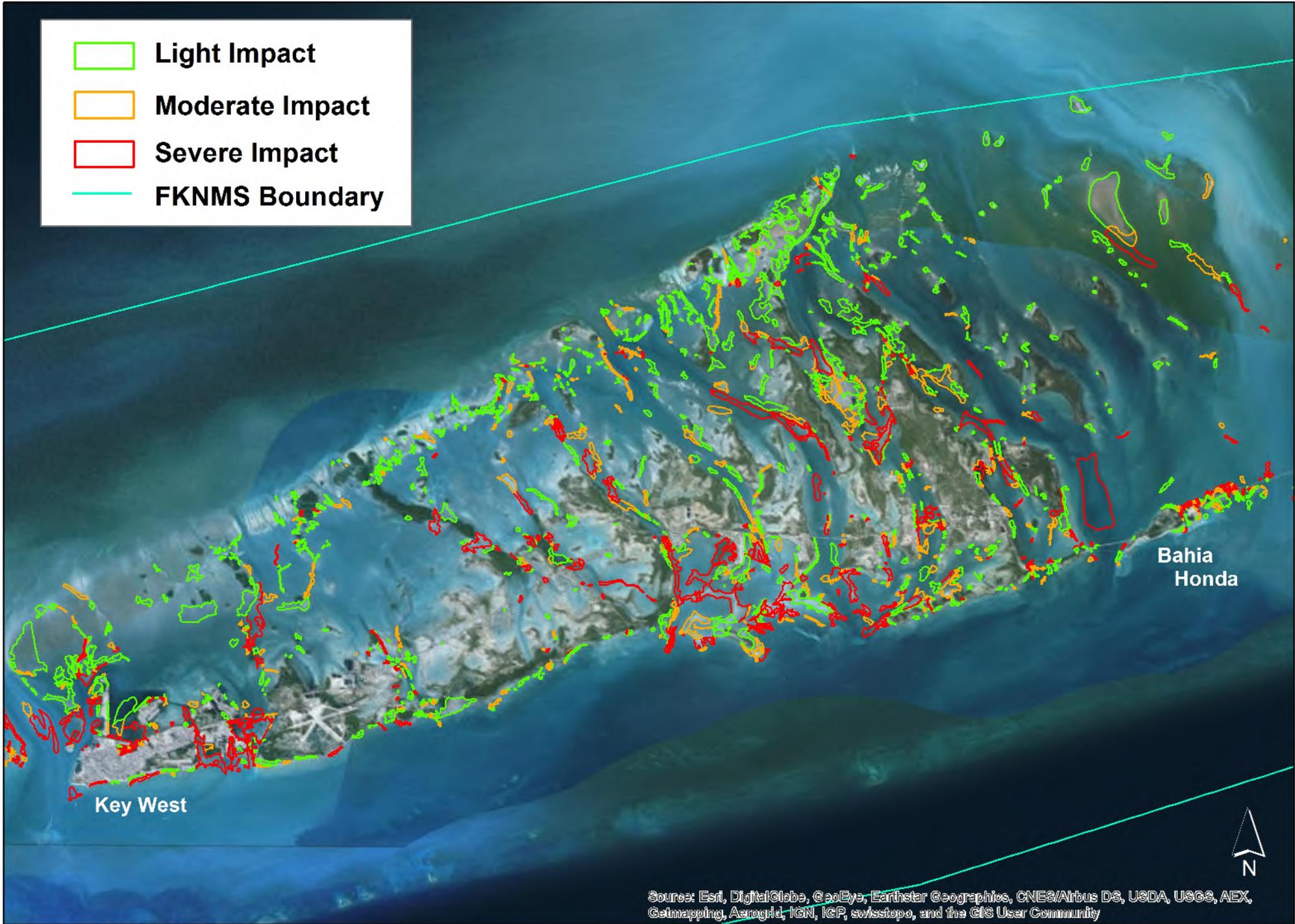


Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 5 10 20 Miles

Mapped Boating Impacts - Middle Keys
Maps by C. Kruer, Lines Approximate
March 2017

- Light Impact
- Moderate Impact
- Severe Impact
- FKNMS Boundary

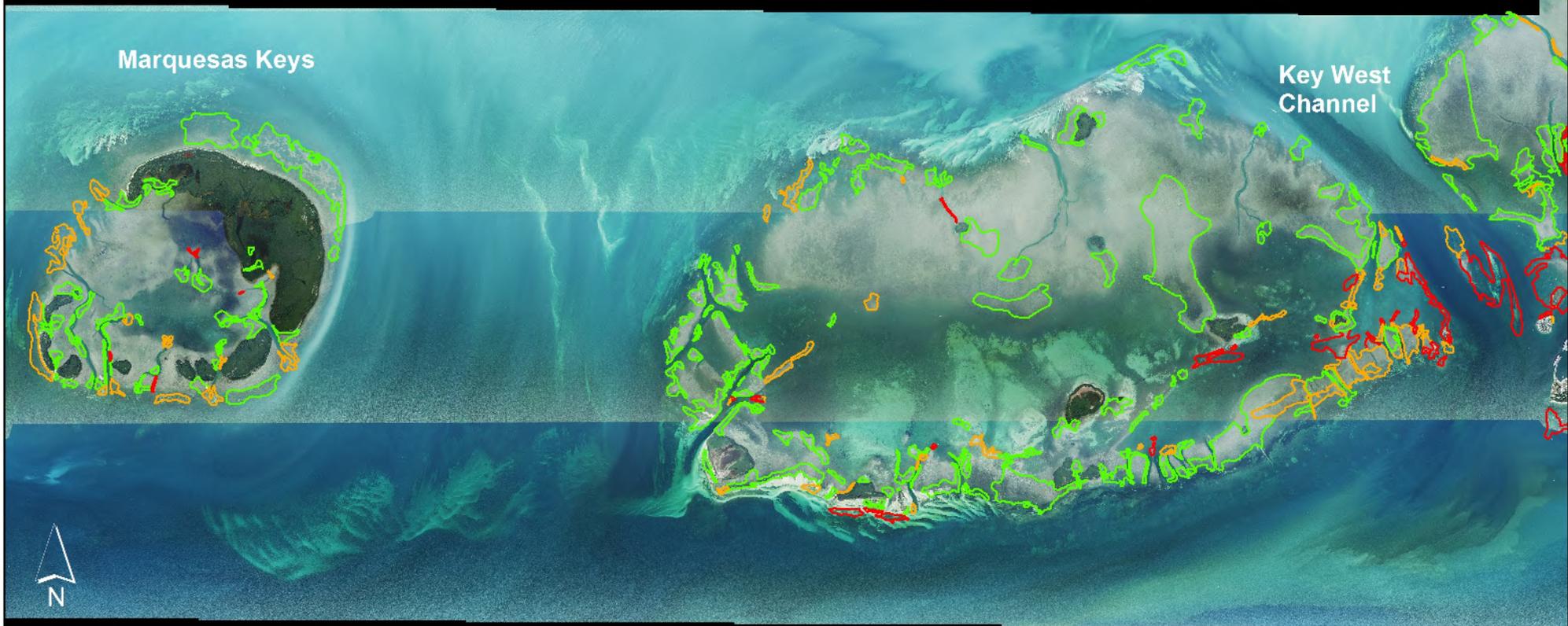


Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 5 10 20 Miles

Mapped Boating Impacts - Lower Keys
Maps by C. Kruer, Lines Approximate
March 2017

- Light Impact
- Moderate Impact
- Severe Impact
- FKNMS Boundary



0 2.5 5 10 Miles

Mapped Boating Impacts - West of Key West
Maps by C. Krueger, Lines Approximate
March 2017