

FDOU Project 26A Part 5 Task 2–Our Florida Reefs (OFR) Survey Results

Florida Department of Environmental Protection
Coral Reef Conservation Program
Project 26A Part 5



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Executive Summary

This report contains results from the *Our Florida Reefs* (OFR) Coastal and Ocean Use Survey, an online, opt-in, survey conducted in southeast Florida between October 1st, 2014 and March 31, 2015. The survey looked at stakeholder engagement in coastal and coral reef related activities within the southeast Florida region, from north of Biscayne national Park in Miami-Dade County, northward, to the St. Lucie Inlet in Martin County. The information was used to understand which activities stakeholders participate in related to the reefs, as well as where and how often. Stakeholder use data can inform management recommendations to balance reef resource use and protection as part of the OFR community planning process.

Survey outreach effort included emailing various list-serves, agencies, and coral reef related groups, visiting local business, and presenting at stakeholder clubs and events. These efforts generated a total of 1,101 registrants, but 368 (33.4%) did not begin the survey and 432 (39.2%) were partially completed. The remaining 301 (27.3%) participants completed the survey entering a total of 1,969 activity points. The majority (93%) of the completed surveys were filled out by full-time Florida residents. Broward and Palm Beach county residents had the largest number of completed surveys with 46% of the activity points coming from Broward residents and 24% from Palm Beach residents. Miami-Dade residents comprised 12% of the participants and Martin County residents comprised 6% of the participants.

The data were gathered using an online, non-probability based, “opt-in” sample method, meaning survey participants were targeted, not randomly selected. The survey outcomes are completely dependent on the survey participation and the information that was provided.

Survey participants were asked to select the sites they visited in the southeast Florida coastal region in the last 12 months, identify their favorite spot in the region, and a few demographic questions. In order to reduce participant hesitation of identifying specific locations which they may not want to disclose, the southeast Florida coastal area was overlaid with a grid system comprised of 200 m x 200 x cells. Participants selected cells rather than specific points. Additionally, locations were chosen using a 150 m cursor which selected any 200 m square planning units it intersected. This ensured that exact locations would not be divulged. Survey participants also indicated how many days they spent at the mapped location. This provided an intensity of use as well as location.

There were 44 different activities that a survey participant could select from including an “Other” category for which the participant could type in their activity manually. The OFR Community Working Groups (CWG) identified nine specific activity groupings to integrate into the OFR marine planner and decision support tool in order to inform their recommended management actions. The activity groupings identified included: All Activities, Boating, Recreational Fishing, SCUBA Diving, Spearfishing, Extractive Diving, Watersports, and Recreational Fishing and Diving Overlap. These datasets were created by summing the appropriate corresponding survey activities within these nine categories and projecting them in ArcGIS. A six class graduated, monochromatic color ramp was chosen to visually represent the data in various maps.

The final survey GIS layers were added to the OFR Marine Planner for CWG members and the general public to view. They were also added to the OFR Marine Planner Designs, a decision support tool that filters planning units by data values. This tool assists the CWG in making informed decisions regarding the siting of recommended management actions which have a spatial component.

The “All Activities” feature showed the highest activity in Broward and Palm Beach counties, specifically in waters near the City of Lauderdale-by-the-Sea and the Town of Palm Beach. Although some participants indicated using deeper waters offshore of southeast Florida, the majority of activities were shown in the nearshore habitat in depths of 50 feet or less.

In Martin County, the highest use was indicated at the mouth of the St. Lucie Inlet. In North Palm Beach County, high use (> 300 activity-days) was offshore the city of Tequesta at a popular dive site known as Jupiter Ledge (> 100 activity-days). In south Palm Beach County, high use occurred offshore the city of Palm Beach along the Outer Reef and nearshore hardbottom habitats. Many locations here had over 300 activity-days corresponding to numerous popular dive sites including Breaker’s Reef, Flower Gardens, and the Outfall Trench.

In Broward County, just over 100 activity-days were indicated on the Middle Reef offshore of Lighthouse Point and over 150 days near Hillsboro Inlet. Anglin’s Pier in Lauderdale-by-the-Sea had 5 planning units with over 300 activity-days. There was a small area showing over 300 activity-days in the deeper waters offshore of Dania Beach. In Miami-Dade County high activity (275 activity-days) was present very close to the shore of North Miami Beach. No other areas in Miami-Dade County showed similar use; however, there were some locations on the Middle Reef that showed 20-50 activity-days. The low survey participation by County residents could have been a possible factor affecting this outcome.

There were several areas in the region that showed overlap between the “Recreational Fishing” and “Diving” activities. The results showed that most recreational fishing and diving overlap occurred near inlets, with the largest number of occurrences in Broward County. In Martin County, recreational fishing and diving overlap occurred at the mouth of the St. Lucie Inlet. This may be an area of potential recreational activity conflict as both activities indicate high activity-days. Overlap was moderate on the Deep Ridge Complex at a congregation of wrecks including St. Jacques, Shasha Boekanier, and Governor’s River Walk. Because both recreational fishing and diving showed a high number of activity-days this may be a potential area of use overlap between fishers and divers. Diving activities dominated overlap on the south side of Anglin’s Pier in Lauderdale-by-the-Sea with 598 versus 52 fishing activity-days. A potential area of overlapping use was apparent just over one nautical mile east from Port Everglades. In Miami-Dade County there was low overlap of diving and recreational fishing indicated by participants.

Broader scale patterns showed that the reefs in Broward and Miami-Dade counties were used over a wider spatial scale than those north or south. However, places where there is much less reef habitat (e.g. Martin County) focused users into smaller areas. This illustrates the importance of not only understanding where activities occur but also how often. Areas

that are revisited at high rates may receive more impacts than those infrequently visited, depending on the activity.

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List of Acronyms

CWG- Community Working Group
DST- Decision support tool
FDEP- Florida Department of Environmental Protection
FDOU- Fishing, Diving, and Other Uses
LAS – Local Action Strategies
NOAA- National Oceanic and Atmospheric Administration
NSU- Nova Southeastern University
OFR- Our Florida Reefs
PPT - Process Planning Team
SEFCRI- Southeast Florida Coral Reef Initiative

INTRODUCTION

In 2004 the Southeast Florida Coral Reef Initiative (SEFCRI) identified 140 local action strategies to better understand and manage southeast Florida coral reefs (FDEP, 2004). Within the Fishing, Diving, and Other Uses (FDOU) priority threat area, Project 26 to “Organize and hold public workshops to obtain input on the condition and usage trends, possible resource goals, and the potential (i.e. rationale, effectiveness, alternative approaches, etc.) of traditional fishery management and special management zones to achieve targets...”, was developed as a stakeholder driven community planning process called *Our Florida Reefs* (OFR). The OFR process began in June 2013, with a series of informational public meetings for the residents and stakeholders of the southeast Florida region from Miami-Dade, Broward, Palm Beach, and Martin counties about the purpose of the process and how they could be involved. Applications were accepted to select stakeholders from all four counties that represent various reef resource use interests to serve on a North and South Community Working Group (CWG). Additional community working group membership included appointed representatives from various local, state, and federal agencies. Those CWGs of agency and non-agency individuals are spending approximately 18 months representing their stakeholder groups and developing recommended management actions for the reefs of southeast Florida.

During the early stages of OFR, a Process Planning Team (PPT) was formed to help plan the details of executing the OFR process. The PPT identified the need for a mapping and decision support tool (DST) program or application throughout the decision making process to allow for visual representation of data and information to all stakeholders, to allow for surveying of stakeholders, to provide CWG members with a tool to analyze datasets, to visualize spatial options for their recommended management actions, and for other needs that may arise throughout the OFR process. Existing software and web based applications were assessed for the ability to incorporate various local datasets, run smoothly on various operating systems and devices, ease of use for stakeholders and citizens not familiar with mapping or spatial analysis programs, usability and understandability of product outputs for the OFR, probable amount of time required for upkeep and maintenance, and cost (Walker and Costaregni, 2013). This analysis determined that Point 97 (formerly Ecotrust) was the only software that could meet all of the OFR needs. The Florida Department of Environmental Protection (FDEP) contracted Point 97 to customize the Point 97 online map viewer and decision support tool, Marine Planner, for SEFCRI and OFR. Nova Southeastern University was contracted to provide in-meeting support of CWG members using the DST, provide technical knowledge and expertise in spatial analytic analysis with existing and future GIS based datasets, provide feedback to Point97 on OFR needs, assist in designing and conducting the outreach and trainings on completing the online survey, and analyze the survey results.

High concentration of human activities in coastal regions has resulted in various pressures and associated impacts that adversely affect the coastal and marine environment (O’Mahony et al., 2009). One concern today is the conflict between human use and the environment (Douve, 2008), and how to balance use and protection. Many anthropogenic influences directly harm surrounding ecosystems. Competition for resource use between various stakeholder groups in these regions adds further tension to the system.

Understanding the location, frequency, and types of stakeholder activities as they relate to reef resources helps management processes better balance that use and protection, facilitate buy-in by taking those activities into consideration, and identify any spatial use conflicts. This inclusion of stakeholders is known as ‘bottom-up’ or collaborative planning approach (Human & Davies, 2010). Stakeholder engagement and participatory methods elicit feelings of empowerment, legitimacy, participation and equity, achieving a more effective management plan (McCall & Dunn, 2012).

To accomplish this, an online coastal and reef resource use survey was designed concurrent with the development of the OFR Marine Planner to provide current information on which activities stakeholders are engaging in, and where. This survey was designed to inform the CWG of current resource use, inform a wider audience about the OFR process, and provide an avenue for the broader community to participate in the OFR process. This report presents the spatial resource use results of the survey. Point 97 is providing a concurrent report on the survey development and demographic analyses.

1. METHODS

1.1. Survey Collection

The online OFR survey used a non-probability based sample method that engaged ocean and coastal recreation stakeholders by deploying targeted outreach strategies to solicit participation in an “opt-in” method of data collection. This method provides many benefits. It gathers data from populations that are not well-defined and in which a robust probability based sample cannot be developed or feasibly collected. With a population size of over six million (www.census.gov), getting a representative sample size within the four counties could not be achieved given the project timeline and funding. Also, since the survey only applied to a small proportion of the general population, reaching out to the population as a whole would not achieve the objective. Instead this type of survey provides the ability to collect data and obtain larger sample sizes from specific user groups (e.g. SCUBA divers, kayakers, etc.) that are difficult to adequately capture in general population surveys. It also provides a participatory approach and engages and builds stakeholder investment. Lastly, it increases the likelihood that stakeholders will trust the survey results and therefore accept their use in policy-making processes. Because it is a non-probability based survey these data cannot be extrapolated to the general population or be presumed to be a complete picture of the activities being conducted offshore (LaFranchi and Daugherty, 2011). The survey outcomes are completely dependent on the survey participation and the information that was provided. For this reason, an extensive outreach campaign was conducted to solicit as many survey respondents as possible within the allotted time and project budget. Twenty-four outreach locations were visited in the four county region. Of these locations visited, three were in Miami-Dade County, six were in Broward County, twelve were in Palm Beach County, and three were in Martin County. It is important to note that the number of dive shops located in Palm Beach County and Broward County in general are much higher than in the other counties. Also, a higher number of dive shops were visited compared to tackle shops, marinas, and surf shops with nineteen of the locations being dive shops. In addition to outreach at store locations, twelve outreach presentations were organized at various club gatherings and special events. One club was presented to in

Miami-Dade County, six in Broward County, four in Palm Beach County, and one in Martin County. A separate report describes the outreach efforts in detail (Walker and Costaregni, 2015).

The survey participants were asked to select from a list of 44 offshore activities including boating, recreational fishing, commercial fishing, SCUBA diving from shore, SCUBA diving by boat, snorkel/freediving from shore, snorkel/freediving by boat, watersports, and other. Each of these broader categories were broken up into more activities to allow the participant to give detailed information. This detailed list is presented in Table 1. For the “Other” category, the participants were asked to manually type in an activity that they were unable to find in the selections provided.

Stakeholder-driven mapping of use areas was chosen to maintain respondent privacy while still gathering data at a meaningful scale. Survey participants were asked to provide basic demographic information and map their coastal and ocean recreation activities from the last 12 months. The focus area was from Key Biscayne, northward, to near the northern border of Martin County; and from shore, to five miles offshore (Figure 1). This area was gridded into 200 m square individual adjacent planning units. When mapping, the cursor became a 150 m diameter circle within which the activity should have occurred. Each 150 m diameter mapped location was then associated with all of the 200 m planning units it intersected, yielding an area large enough to conceal specific participant locations (Figure 2). The minimum area chosen was one planning unit and the maximum was four.

Since the county boundaries do not line up well with the offshore coral reef ecosystem, the survey data were displayed with the Coral Reef Ecosystem Region designations of Walker (2012) and Walker and Gilliam (2013) to help provide an understanding of use in each region (Figure 1). Starting in the south, the Biscayne Region spans approximately 22 km of coastline bounded by the end of the SEFCRI area (south) and Government Cut (north). The Broward-Miami Region spans approximately 48 km of coastline bounded by Government Cut (south) and the Hillsboro inlet (north). The Deerfield Region spans approximately 15 km of coastline bounded by the Hillsboro Inlet and Boca Raton boundary. The South Palm Beach Region spans approximately 36 km of coastline from Boca Raton (south) to the Bahamas Fault Zone (north). The North Palm Beach Region spans approximately 32 km of coastline from the Bahamas Fault Zone (south) to southern Martin County just north of the Deep Ridge Complex (north). The Martin Region extends from this location north to the end of the mapped area (northern Martin County line) (Walker and Gilliam, 2013).

Table 1. List of activities that survey participants could choose. Participants were able to select multiple activities. (Crowther and Chen, 2015)

Activity Group	Activity
Boating	Motor
	Sail
	Kayak
	Personal Watercraft
	Research (boating)
Recreational fishing	Shore/pier (recreational fishing)
	Private vessel (recreational fishing)
	Charter vessel (recreational fishing)
	Research (recreational fishing)
Commercial	Shore/pier (commercial fishing)
	Commercial/private vessel (commercial fishing)
	Charter vessel (Fishing Charter Captain)
	Charter vessel (Dive Boat Captain)
	Lobstering (commercial fishing)
	Research (commercial fishing)
SCUBA diving from shore (includes kayak)	Spearfishing (diving from shore)
	Photography (diving from shore)
	Pleasure (diving from shore)
	Lobstering (diving from shore)
	Collection for aquarium trade or for personal tank (diving from shore)
SCUBA diving by boat	Research (diving from shore)
	Spearfishing (diving by boat)
	Photography (diving by boat)
	Pleasure (diving by boat)
	Lobstering (diving by boat)
	Collection for aquarium trade or for personal tank (diving by boat)
Snorkel/freediving from shore (includes kayak)	Research (diving by boat)
	Spearfishing (snorkel/freediving from shore)
	Photography (snorkel/freediving from shore)
	Pleasure (snorkel/freediving from shore)
	Lobstering (snorkel/freediving from shore)
	Collection for aquarium trade/personal tank (from shore)
Research (snorkel/freediving from shore)	

Table 1. Continued.

Activity Group	Activity
Snorkel/ freediving from vessel	Spearfishing commercial/recreational (snorkel/freediving from vessel)
	Photography (snorkel/freediving from vessel)
	Pleasure (snorkel/freediving from vessel)
	Lobstering (snorkel/freediving from vessel)
	Collection for aquarium trade or for personal tank (snorkel/freediving from vessel)
	Research (snorkel/freediving from vessel)
Watersports	Surfing
	Kiteboarding
	Stand-up paddle boarding
	Windsurfing
Other	Respondent typed in activity

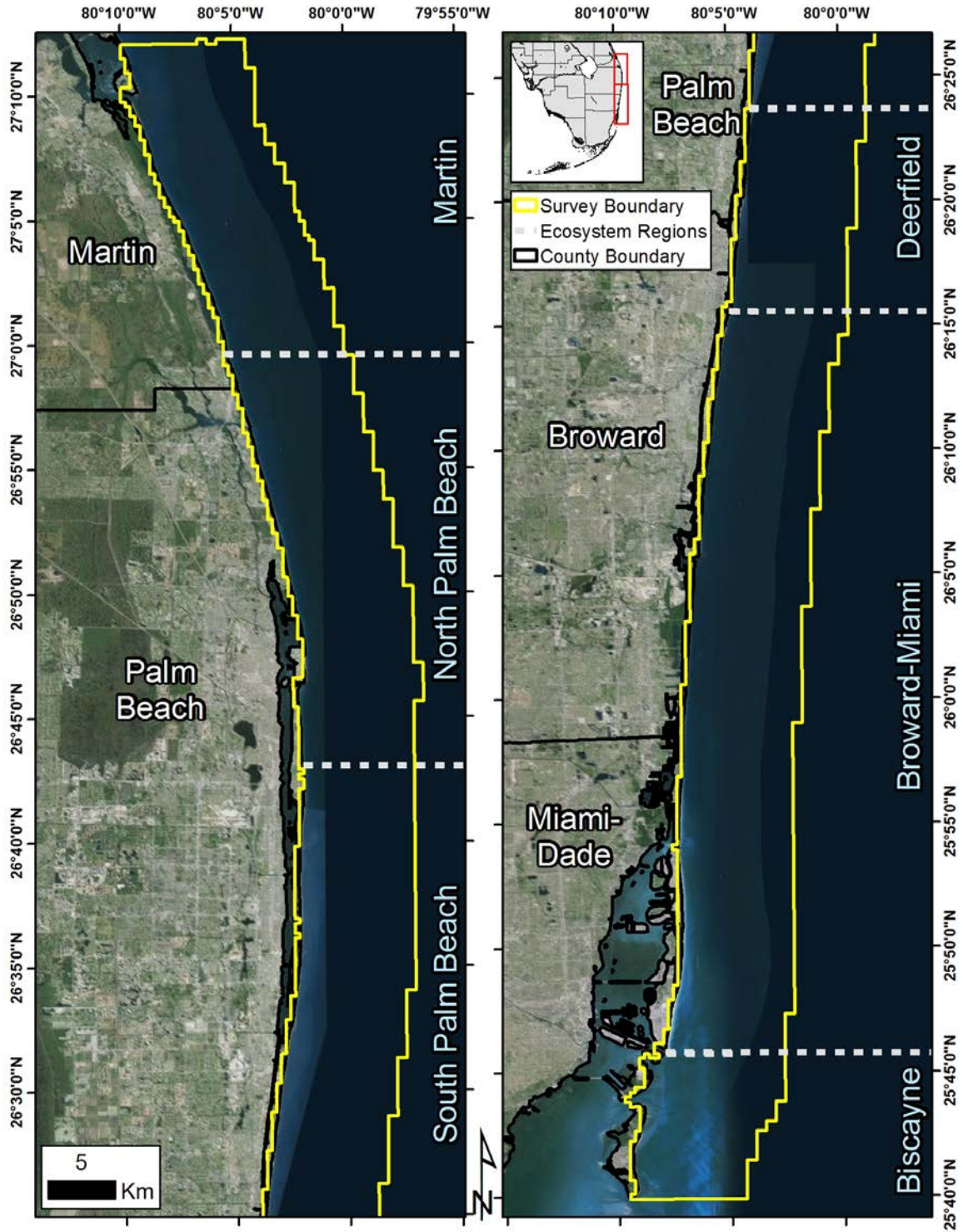


Figure 1. Boundary of the OFR activity survey showing the county and coral reef ecosystem region boundaries.

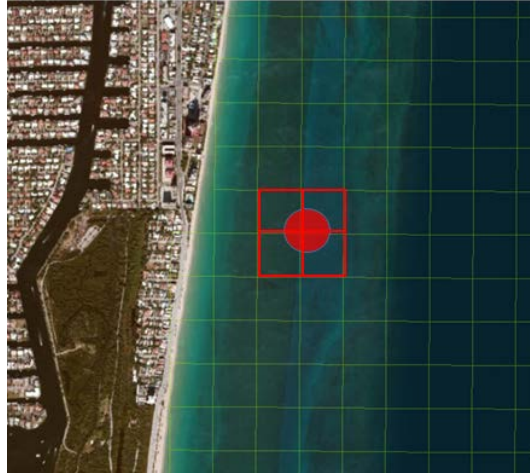


Figure 2. Example of survey activity mapping. Red circle is the 150 meter wide cursor which selects any 200 x 200 meter planning units it intersects. This records a larger area which conceals the exact participant locations.

Since repetitive activities in the same location likely occur by stakeholders (i.e. visit the same spot multiple times a year), each mapped activity location required the number of days the respondent visited the location in the past year. This value was used to weight the activity according to how many activity-days were spent on given activities to help understand the intensity of use without having the respondent enter the same location many times.

The final mapping question in the survey asked participants to highlight the area that is their favorite or most valued location in the southeast Florida reef system. Unlike the previous mapping questions, this location did not have to be one that they had visited in the past year. Also unlike the previous mapping question, they were only permitted to choose a single location. Once the location was selected, participants were asked why the location was important to them and provided a list to choose from presented in Table 2. They were permitted to choose as many options from this list as applied. Finally, the participant was asked what their primary activity was at this location. For this question only one answer was accepted.

Table 2. List of reasons provided to participants for them to indicate why a location is important to them. Participants were able to choose more than one reason.

Favorite Location Reason
Activity-based - The site is perfect for my particular activity (e.g. fishing area, dive site, etc)
Beautiful - The site is beautiful or has striking natural features
Water Quality - The water is clean, clear and/or good to swim in
Marine Life - Marine life is abundant and diverse
Memories - I have a lot of memories from this place
Secluded - The site is secluded, away from crowds, and offers privacy
Educational- It is a place I can learn about, teach, or research the natural environment
Inspiring - This is a spiritual/inspiring place for me
Social - This is where my friends/family frequent
Livelihood - Professional purposes
Collecting - There are specific natural resources I like to collect here
Other

The OFR survey ran 182 days from October 1st, 2014 through March 31, 2015. Maps depicting spatial patterns of use (extent and intensity of use) for specific coastal recreational activities were created. These maps aggregated into broader activity categories requested by the Community Working Group members to help facilitate their use in planning and policy contexts. The final activity categories were All Activities, Boating, Recreational Fishing, SCUBA Diving, Spearfishing, Extractive Diving, Watersports, and Overlap of Recreational Fishing and Diving (SCUBA and free) to show locations where both fishing and diving occurs in close proximity. These datasets were created by summing the appropriate corresponding survey activities within these nine activity categories and projecting them as activity features in ArcGIS.

The final survey GIS features were added to the OFR Marine Planner for CWG members and the general public to view. They were also added to the OFR Marine Planner Designs, a decision support tool that filters out planning units by data values set by the user, to assist in making informed decisions regarding the siting of recommended management actions which have a spatial component.

1.2. Feature Activity Category Creation

The activity categories requested by the CWG helped to categorize activities by their similarities. The Boating Activities feature contained any activity that involved a vessel. These included charter vessel (dive boat captain), charter vessel (fishing charter captain), charter vessel (recreational fishing), collection for aquarium trade or for personal tank (diving by boat), commercial/private vessel (commercial fishing), lobstering (snorkel/freediving from vessel), lobstering (diving by boat), motor (boating), personal watercraft, photography (snorkel/freediving from vessel), photography (diving by boat), pleasure (diving by boat), pleasure (snorkel/freediving from vessel), private vessel (recreational fishing), research (recreational fishing), research (boating), research (diving by boat), research (snorkel/freediving from vessel), sail (boating) spearfishing - commercial or recreational (snorkel/freediving from vessel), and spearfishing (diving by boat).

The Recreational Fishing Activities feature included fishing activities from both shore and boat. It included hook and line fishing, spearfishing, lobstering, and collection for the aquarium trade.

The SCUBA Diving Activities feature included those activities that used SCUBA equipment for diving (not free diving or snorkel). This feature included both shore diving and boat diving (private and charter boats).

The Spearfishing and Extractive Diving Activities features were fairly similar in that they both include spearfishing by free diving and SCUBA diving from vessel and beach entry. The extractive diving activity feature additionally included any collection for the aquarium trade.

The Watersport activities feature included surfing, stand-up paddle boarding, kiteboarding, kayaking, and outrigger canoeing.

The CWG members requested a Commercial Fishing Activities feature, however, only one survey indicated commercial fishing. These data did not accurately depict commercial fishing activity in the southeast Florida region and therefore were not included in the requested data sets.

A Recreational Fishing and Diving Overlap feature was created to determine areas where these activities occurred in close proximity. First, all recreational fishing activities by SCUBA or free diving (e.g. spearfishing, lobstering) were removed from the recreational fishing activity feature and included with the diving feature which included all SCUBA and free diving activities. All planning units where both fishing and diving did not occur were removed because use overlap did not occur in close proximity (within planning units). All activity-day values in the recreational fishing category were made negative while the diving activity-day values were kept positive. The two values (negative fishing and positive diving) for each planning unit were then summed to create a negative to positive scale. Negative values indicated more recreational fishing than diving, values close to zero

indicated fairly equal fishing and diving, and positive values indicated more diving than fishing.

1.3. Feature Symbology

A six class graduated, monochromatic color ramp was chosen to visually represent the data in various maps displayed by associating quantities with the graduated colors. An example of the SCUBA diving activity feature on Breaker's Reef in Palm Beach County is shown in Figure 3. These classes were created and binned by activity-days as follows: 1 - 5, 6 - 20, 21 - 50, 51 - 100, 101 - 300, and 301 or greater (Figure 3). The activity-day bins remained the same for all activity features. However not all activities had the same number of activity-days, and therefore only the relevant bins are displayed for any given feature. For example, extractive diving activity had fewer than 100 activity points; therefore, only 4 activity bins were applicable for this feature. The color scale ranged from a light yellow (RGB: 255, 255, 128), indicating a low number of activity points, to a dark reddish-brown (RGB: 107, 6, 1), indicating a high number of activity points. This monochromatic color scale was chosen to avoid interpretation difficulties that may have arisen for color-blind individuals.

The color symbology for the recreational fishing and diving overlap area differed from that of the other activity features. Seven classes were used with the following bin labels: High fishing activity: -190 - -20, moderate fishing activity: -20 - -6, equal fishing and diving activity: -5 - 5, moderate diving activity: 5 - 200, and high diving activity: 200 - 643. The color symbology for this feature used two shades of red for the fishing activity, two shades of blue for the diving activity, and yellow with an orange outline to indicate equal fishing and diving activity (Figure 4).

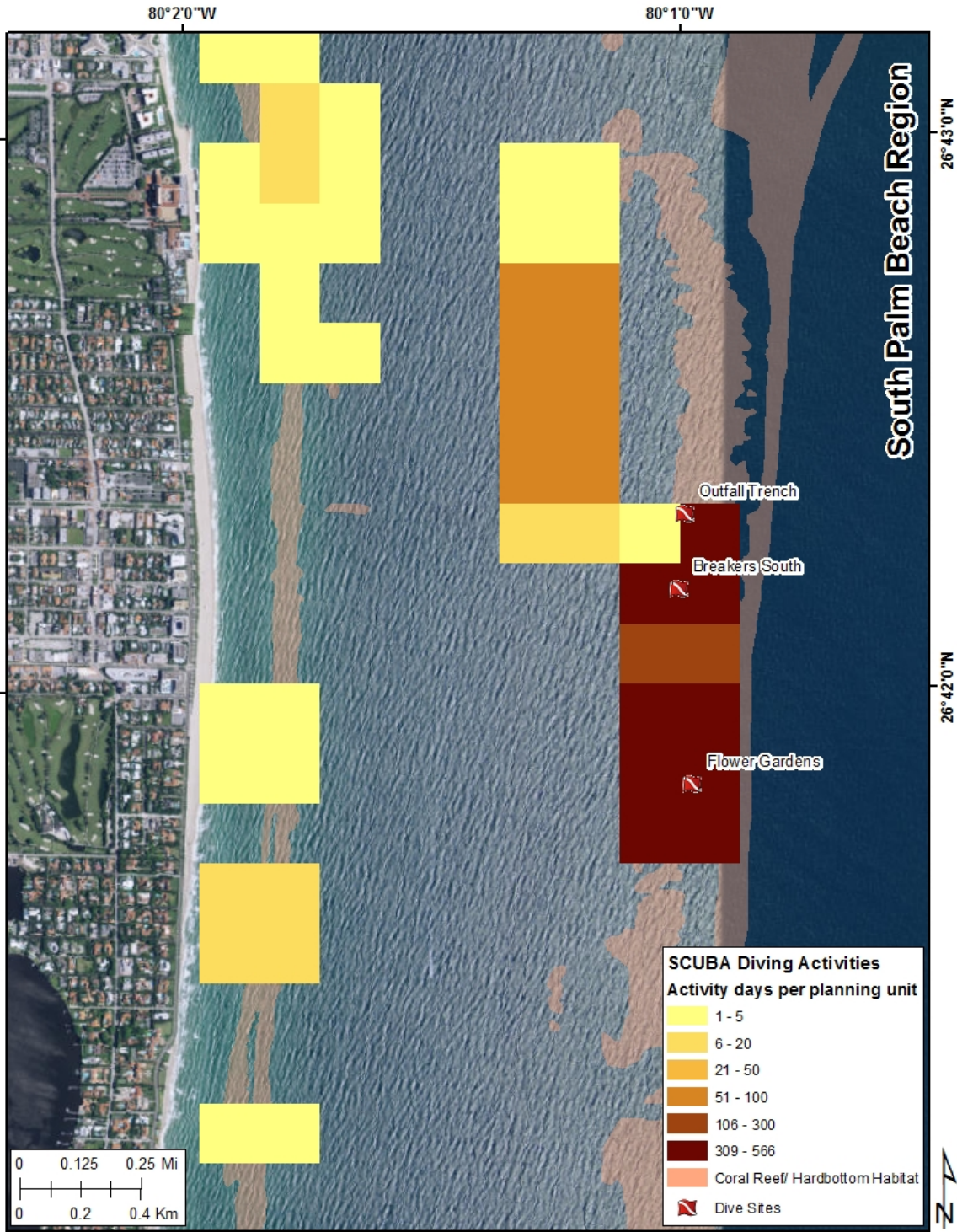


Figure 3. Example of color ramp for areas of SCUBA diving activity, including high activity (309-566 activity-days per planning unit) on coral reef and hardbottom on Breaker's Reef in Palm Beach.

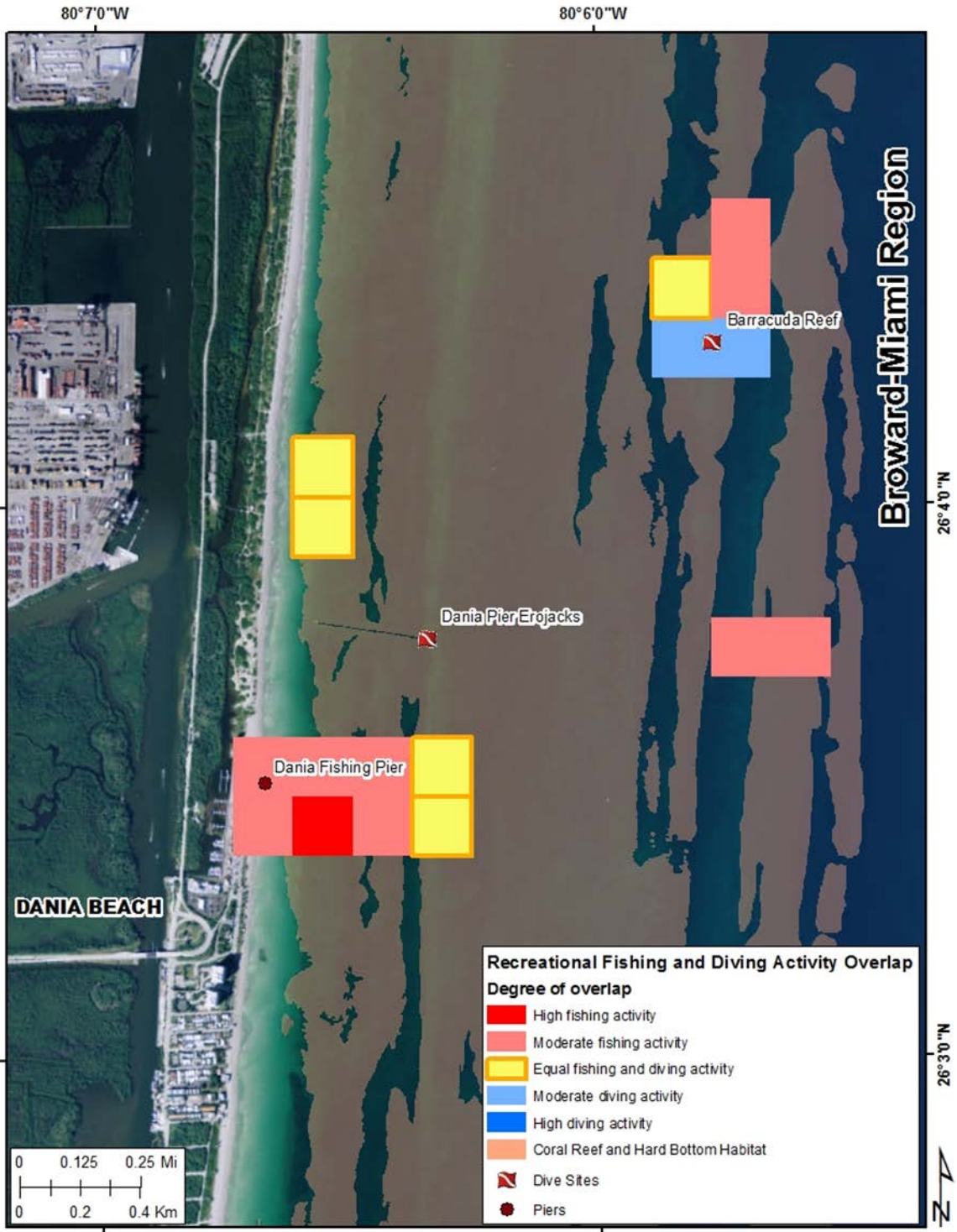


Figure 4. Example of color symbology for the Recreational Fishing and Diving Activity overlap feature in the Broward-Miami coral reef ecosystem region focusing on Hollywood and Dania Beach.

2. RESULTS

2.1. Surveys Collected

Participant demographics for this survey were collected to aid in understanding the population of the respondents. This report only presents the spatial survey results. Point 97 is providing a report on the survey development and demographic analyses. The demographics report should be consulted to fully understand the outcomes herein.

After 182 days, the OFR survey yielded a total of 1,101 registrants. Of these, 368 (33.4%) did not start and 432 (39.2%) only partially completed the survey. A total of 301 (27.3%) participants completed the survey entering 1,969 activity points which selected 2,993 planning units (Table 3). Two hundred and eighty (93%) completed surveys were full-time Florida residents. Forty six percent of the activity points came from Broward County residents (898 activity points), 24% from Palm Beach county residents (474 activity points), 10% from Miami-Dade county residents (205 activity points), and 6% from Martin county residents (116 activity points).

Table 3. The number of 200 x 200 m planning units selected by activity. The sum does not equate to the total because some activities were included in more than one category. For example, Boating and SCUBA diving from vessel.

Activity	Planning Units
Total	2993
Boating	2232
SCUBA Diving	1508
Recreational Fishing	1033
Research	577
Extractive Diving	510
Watersport	389
Spearfishing	189
Fishing Diver Overlap	152
Commercial Fishing	1

2.2. Survey Results

2.2.1. All Activities

The All Activities feature showed the highest activity in Broward and Palm Beach counties, specifically offshore the city of Lauderdale-by-the-Sea and the city of Palm Beach (Figures 5 – 9). Although some respondents indicated using deeper areas off southeast Florida, the majority of activities were shown in the nearshore habitat in depths of 50 feet or less. There some activities were indicated in water deeper than 100 feet.

In Martin County, the highest use was indicated near the mouth of the St. Lucie Inlet (Figure 5). In North Palm Beach County, high use (> 300 activity-days) was offshore the city of Tequesta just north of Jupiter Inlet and at a popular dive site known as Jupiter Ledge (> 100 activity-days) (Figure 6). There were also more than 300 activity-days offshore Riviera Beach in the nearshore (Figure 7). In South Palm Beach County, high use occurred offshore the city of Palm Beach along the Outer Reef (Walker, 2012) and nearshore hardbottom habitats (Figure 8). Many locations there had over 300 activity-days corresponding to numerous popular dive sites including Breaker's Reef, Flower Gardens, and the Outfall Trench. There was also an area with 100 activity-days offshore of Boynton Beach in the deeper waters east of Outer Reef.

In Broward County, just over 100 activity-days were indicated on Middle Reef (Walker, 2012) offshore Lighthouse Point and over 150 days near Hillsboro Inlet (Figure 9). Offshore of Anglin's Pier in Lauderdale-by-the-Sea, 5 planning units showed over 300 activity-days. There was a small area showing over 300 activity-days in the deeper waters east of Outer Reef offshore of Dania Beach. In Miami-Dade County high activity (275 activity-days) was present very close to the shore offshore North Miami Beach. No other areas in Miami-Dade showed similar use; however, there were some locations on the Middle Reef that had 20-50 activity-days. The low survey participation by county residents could have been a possible factor affecting results in Miami-Dade County.

2.2.2. *Boating Activities*

Boating activity showed between 20 and 100 activity-days in the Martin County (Figure A-1) with the most frequently visited areas around the St. Lucie Inlet and south along St. Lucie Reef. In Palm Beach County (Figure A-2), Jupiter Ledge had over 100 activity-days and between 50 and 100 days at the Esso Bonaire III and Zion Train. There were high use areas along the Outer Reef offshore the City of Palm Beach where a lot of drift diving is known to occur. Many of these high-use areas reported between 100 and 400 activity-days.

In Broward County (Figures A-4 and A-5), there was high activity near the mouth of Hillsboro inlet and Anglin's Pier in the City of Lauderdale-by-the-Sea. Many planning units showed between 51 and 100 activity-days. The Oakland Ridge mooring buoys also had planning units with between 51 and 100 days. Close to 200 activity-days were indicated east of the Outer Reef just north of Port Everglades and north and south of Dania Beach Pier. A location on the Inner Reef (Walker, 2012), offshore south Fort Lauderdale Beach, had just over 100 activity-days. In Miami-Dade County (Figure A-5), there was an area east of the Outer Reef offshore Haulover Inlet with 80 activity-days. Other high use areas were located south of Government Cut in the Biscayne Bay region. Although high for Miami-Dade County, they were lower than other counties with most areas showing under 50 activity-days.

2.2.3. *SCUBA Diving Activities*

A SCUBA diving use area with 55 activity-days was indicated in Martin County but most areas had 20 or less activity-days (Figure B-1). In Palm Beach County (Figures B-2 and B-3), SCUBA diving activity greater than 100 activity-days was indicated on Jupiter Ledge and around the Esso Bonaire III and the Zion Train wrecks. Many locations offshore Lake Worth Inlet showed around 50 activity-days. Planning units with 300 plus SCUBA diving activity-days were also found along the Outer Reef and near shore hardbottom off of Palm

Beach where many popular dive sites are located including Breakers, King Neptune, the Outfall Trench, and the Flower Gardens (Figure B-4). Some diving also occurred offshore Boynton Beach with one area consisting of 4 planning units having 100 activity-days.

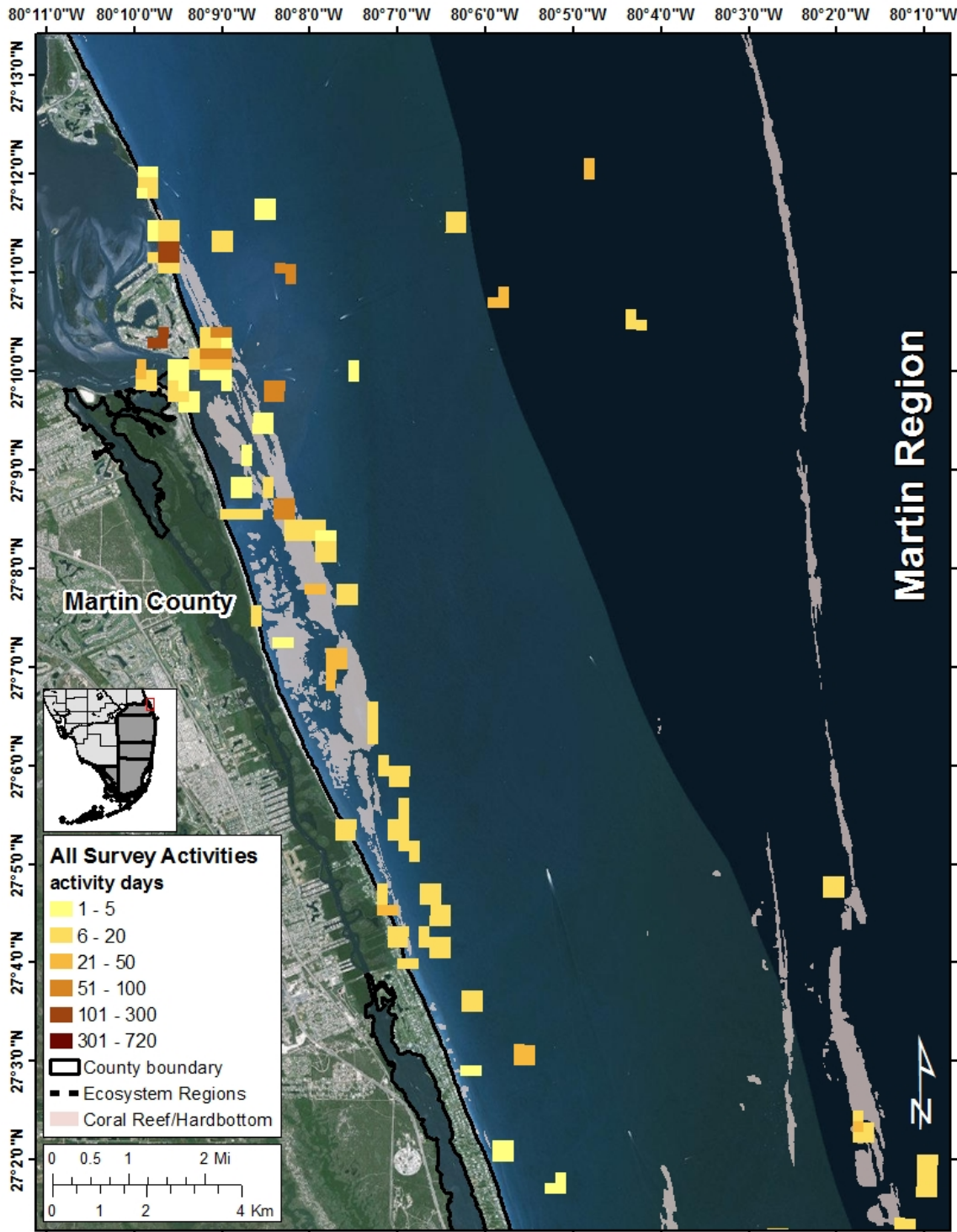


Figure 5. Map of final survey results displaying the total number of activity-days per planning unit for all activities within the Martin coral reef ecosystem region.

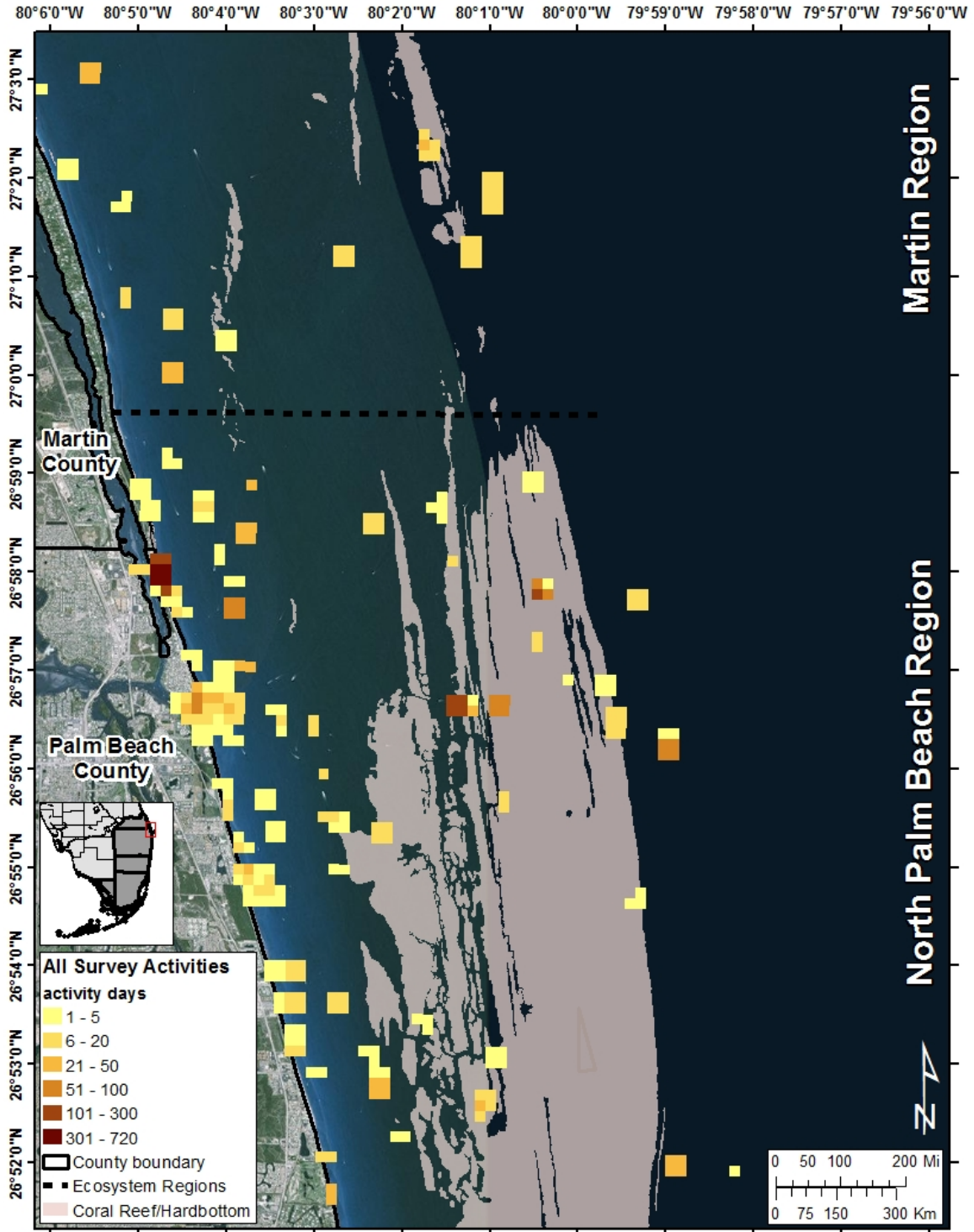


Figure 6. Map of final survey results displaying the total number of activity-days per planning unit for all activities within the Martin and North Palm Beach coral reef ecosystem regions.

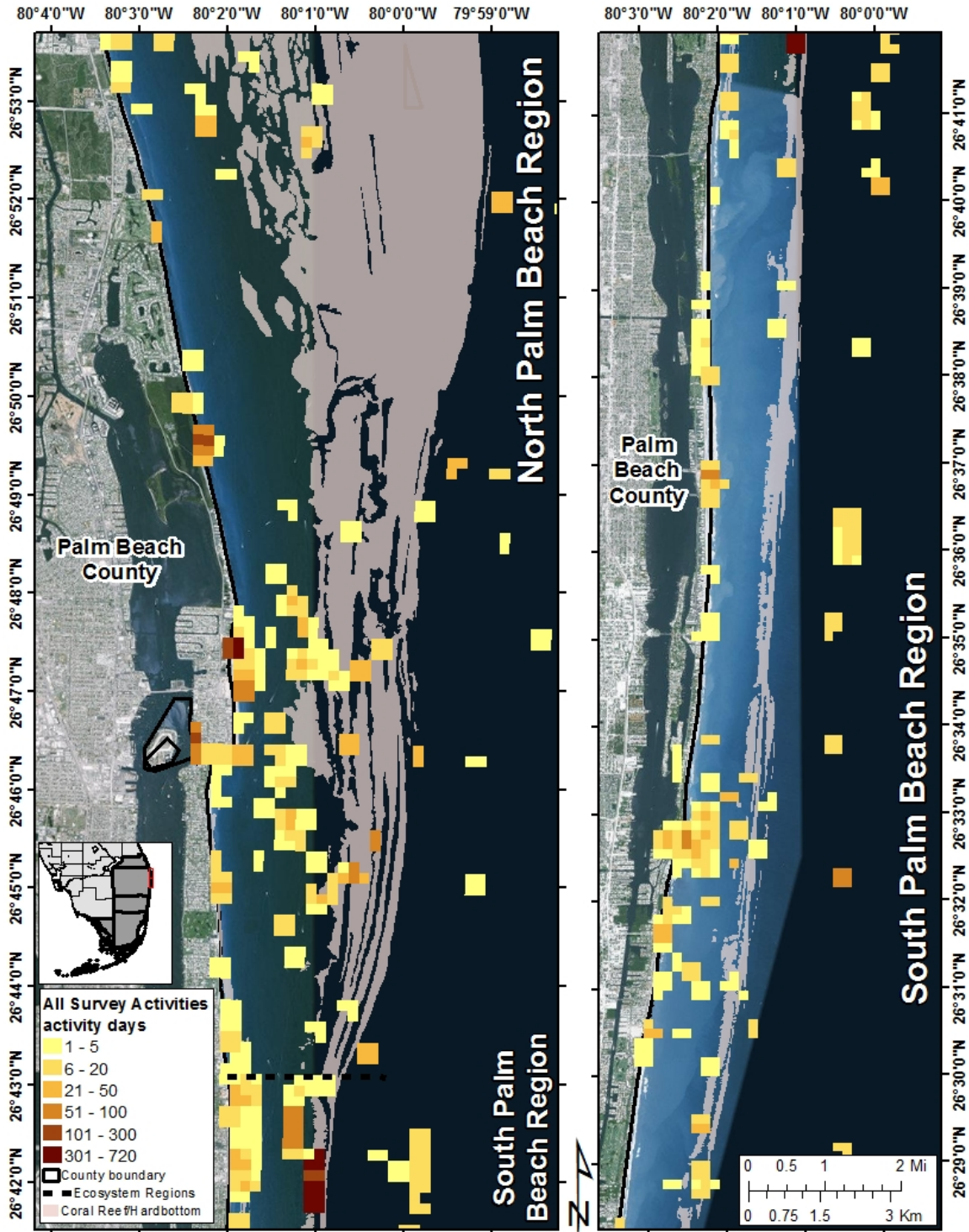


Figure 7. Map of final survey results displaying the total number of activity-days per planning unit for all activities within the North Palm Beach and South Palm Beach coral reef ecosystem regions.

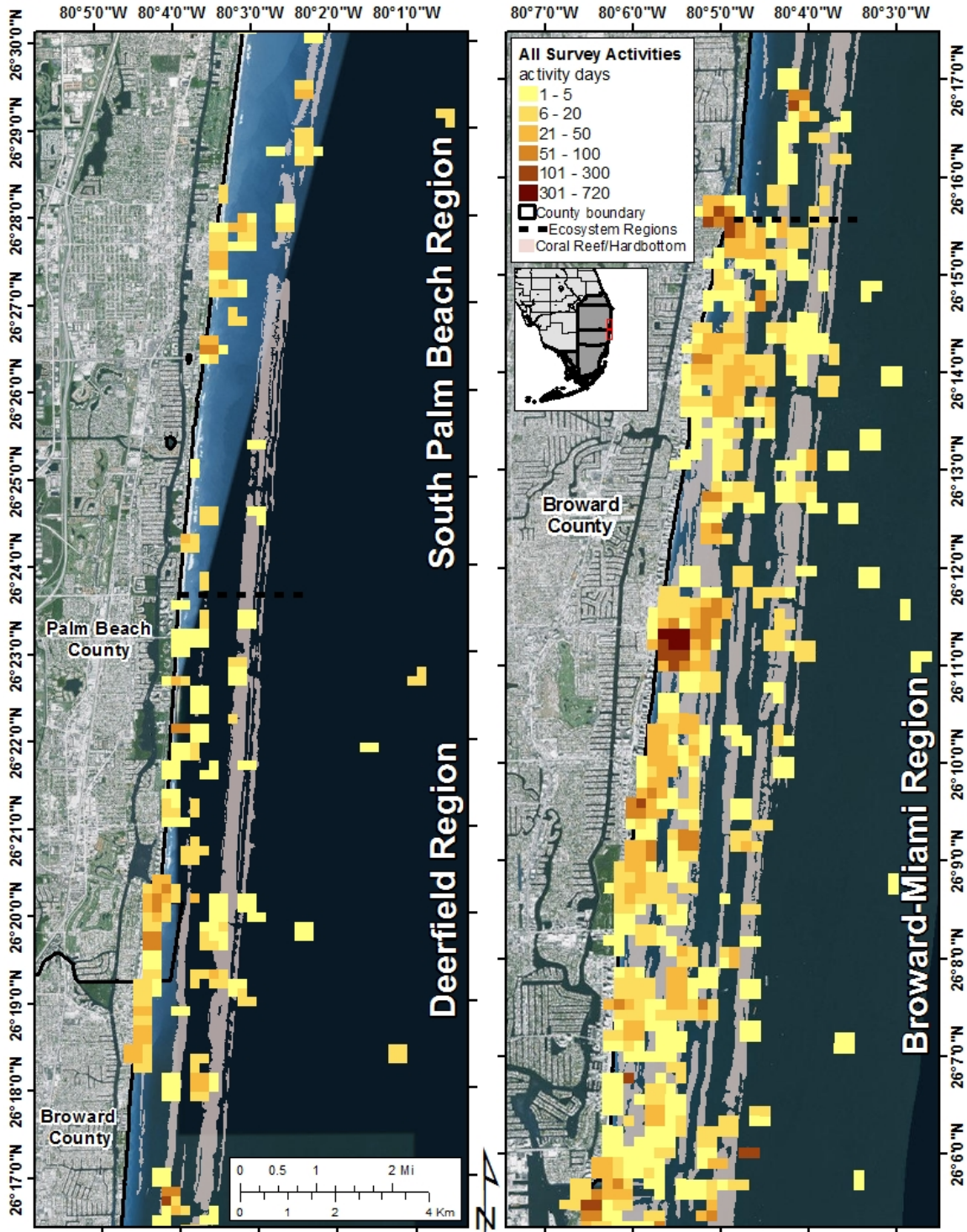


Figure 8. Map of final survey results displaying the total number of activity-days per planning unit for all activities within the South Palm Beach, Deerfield, and Broward Miami coral reef ecosystem regions.

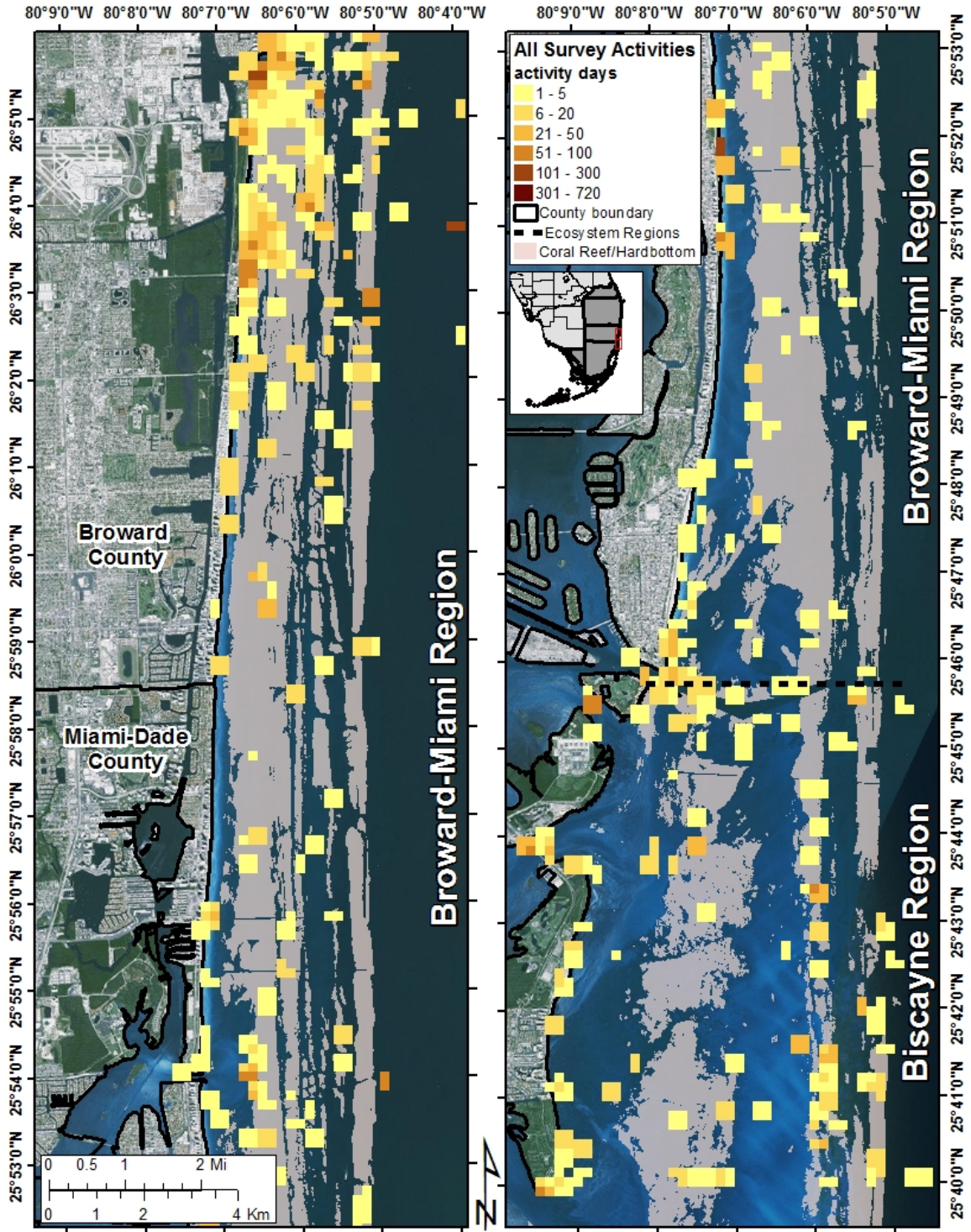


Figure 9. Map of final survey results displaying the total number of activity-days per planning unit for all activities within the Broward-Miami and Biscayne coral reef ecosystem regions.

In Broward County, extensive SCUBA diving activity was found near Anglin's Pier in the City of Lauderdale-by-the-Sea with several planning units having over 100 activity-days and some having over 400 activity-days (Figures B-4 and B-5). This high activity continued south along the Inner Reef in Fort Lauderdale and north of Port Everglades. In Miami-Dade County (Figure B-5), higher SCUBA diving activity was on the Middle and Outer Reef offshore Key Biscayne. Although high for Miami-Dade County, compared to other parts of the reef tract they were relatively low (> 30 activity-days).

2.2.4. *Recreational Fishing Activities*

High recreational fishing activity was found at the mouth of the St. Lucie Inlet, On St. Lucie Reef south of the inlet, and at Texas Reef (Figure C-1). In Palm Beach County there were a few areas of higher activity with values of 20-40 activity-days on the Deep Ridge Complex (Walker, 2012) offshore Jupiter Island. Other higher activity locations were evident in the nearshore area and Outer Reef offshore Tequesta, just north of Jupiter Inlet (Figure C-2). Higher fishing activity was indicated near the shore of Juno Beach and in the deeper area on Juno Ledge with close to 50 activity-days. Many high fishing areas (~60 activity-days) were scattered along the northern portion of Palm Beach County near a number of popular dive locations including many artificial reefs and wrecks (Figure C-3). These areas were associated with the southern portion of the Deep Ridge Complex. Further south, there was an area of high recreational fishing activity at the mouth of Boca Raton Inlet and slightly north and south of the inlet (Figure C-4).

Recreational fishing was relatively high at the areas known as Pompano Dropoff and Steve's Ledge showing around 20 activity-days. High recreational fishing (30 - 75 activity-days) was noted offshore of Lauderdale-by-the-Sea with many locations being indicated on the coral reefs and hardbottom areas near Anglin's Pier (Figure C-5). In Miami-Dade County, respondents indicated a high number of recreational fishing activity-days (80) just outside the Outer Reef offshore Haulover Inlet. Although locations were indicated, no other areas showed high activity with all locations having 20 activity-days or less.

2.2.5. *Recreational Fishing and Diving Use Overlap*

There were several areas in the southeast Florida region that showed overlap between recreational fishing and diving activity (Figures G-1 - G-5). This layer included SCUBA, free diving, and snorkeling activity while fishing in this case only included hook and line activities; not spearfishing or lobstering which are conducted by divers. These were considered diving activities. Hook and line fishing and diving are often considered conflicting uses because they are not spatially compatible with one another. It is dangerous to fish from a boat with divers in the water below and divers may scare fish away. The results showed that most recreational fishing and diving overlap occurred near inlets, with the largest number of occurrences in Broward County.

In Martin County, recreational fishing and diving overlap occurred at the mouth of the St. Lucie Inlet. Areas here show high overlap. Most of these areas were dominated by recreational fishing with some planning units having up to 75 more recreational fishing activity-days than diving activity-days. Other planning units showed slightly higher diving activity-days with values of 42 more diving activity-days than fishing activity-days. These

may be areas of potential recreational activity conflict. Overlap of activity was located at the mouth of Jupiter Inlet where diving activity was moderately dominant over recreational fishing activity having about 40 more activity-days in some areas. It is important to note that recreational fishing days were less than 10 in these locations. Areas just north and south of Lake Worth inlet showed overlap. The majority of these locations had either equal recreational fishing and diving activity or slightly higher diving activity. Some areas here showed high activity-days for both diving and recreational fishing at between 20 and 25 days while others showed low activity-day numbers of less than 5 days. At the Cross Current Barge artificial reef just south of Lake Worth Inlet, equal activity overlap occurred with a higher number of activity-days indicated for both diving and fishing. Here, diving activity-days were 25 and recreational fishing activity-days were 22. Overlap was moderate on the Deep Ridge Complex at a congregation of wrecks including St. Jacques, Shasha Boekanier, and Governor's River Walk. The survey data indicate that recreational fishing was more dominant west of the wrecks with 20 activity-days while diving only showed 1 activity-day. Diving was more dominant to the east with 51 activity-days while fishing showed 20 activity-days. Because these numbers are both high, this appears to be an area of potential conflict between fishers and divers. Overlap was indicated at Boynton Inlet and east near the Outer Reef. Recreational fishing activity dominated diving activity, however, most planning units had a lower number of activity-days in general with values of 10 days or less. One planning unit did indicate that diving activity showed 17 days while recreational fishing activity showed 47 days. Overlap occurred on Outer Reef where dive sites the Budweiser Bar, M/V Caster and Genesis Reef are located. This overlap, although equal, was low with only two activity-days for both recreational fishing and diving shown. Overlap observed at the mouth of Boca Raton inlet was moderately dominated by diving activity. Relatively low activity-days were indicated here for both diving and recreational fishing with values of 26 days and 7 days respectively. Outside of Hillsboro inlet, many areas of overlap were observed. This overlap was fairly equal in both recreational fishing and diving activity and both activities showed a low number of days at these locations in general.

Offshore Pompano Beach, fairly equal recreational fishing and diving overlap was observed along the beach and out to the eastern edge of the inner reef. In areas that one activity did dominate over the other, it was only moderate and dominated by diving. There was diving-dominated overlap on the south side of Anglin's Pier in Lauderdale-by-the-Sea with diving activity-days being over 598 and fishing activity-days being 52. The high number of activity-days indicated for both activities shows that this is an area of concern for conflicts. Overlap was observed in Fort Lauderdale on all three reefs, with diving dominating the Inner Reef and parts of the Middle Reef and fishing activity dominating the area of overlap on parts of the Outer Reef. The overlap was moderate with most locations showing between 5 and 50 activity-days for both recreational fishing and diving. Locations south of Port Everglades showed mostly equal recreational fishing and diving overlap but the activity-days for both were low in general. One location, just over one mile east from Port Everglades had 50 diving activity-days and 24 fishing activity-days. Some locations around Barracuda Reef showed higher diving activity but it is important to note that the activity-days indicated were low in general at eleven days or less. Overlap was also observed off Dania Beach Pier with recreational fishing activity dominating diving activity by up to 22 days. In Miami-Dade County, equal diving and recreational fishing overlap

occurred at the mouth of Government Cut. Overlap was also observed in an area called Half Moon Preserve offshore the northern tip of Key Biscayne. The overlap was moderate and diving was the slightly more dominant activity with eight diving activity-days and two recreational fishing activity-days. At the southern tip of Key Biscayne, near the Cape Florida Channel, there was moderate to equal overlap, diving being the slightly more dominant activity with 40 activity-days and recreational fishing being low with 12 activity-days.

2.2.6. *Favorite Location*

A total of 336 participants entered favorite locations which selected 810 planning units (Table 4). Although 702 out of 810 planning units (86.7%) were associated with one favorite location, 108 planning units had at least partial overlap. Two planning units were overlapped by ten different people. The number of occurrences of favorite location overlap can be viewed in Table 4 below. In Martin County almost all favorite locations were associated with St. Lucie reef (Figure 11). About one mile north of Jupiter Inlet, four participants chose overlapping planning units directly off the beach (Figure 12). Most of these participants indicated that snorkeling/freediving from shore for pleasure was their primary activity here. Jupiter Ledge was chosen by five survey participants who indicated that diving by boat was their favorite activity here (Figure 12). Of those, four dove there for pleasure and one dove to collect lobster. The area along John D. McArthur Beach State Park was six participants' favorite for snorkeling/freediving from shore (Figure 13). Shallow Breaker's Reef was chosen by five participants (Figure 13). For diving from a boat (3), snorkeling/freediving from shore (1) and boating (1). An area just south of Flower Gardens on the Outer Reef and Ridge was chosen by five participants (Figure 13) for diving by boat for pleasure (3), for photography (1), and for catching lobster (1). Ten participants' favorite location was the waters off Anglin's Pier (Figure 14). Diving from shore for pleasure (3), diving from shore for photography (1), pleasure snorkeling/freediving from shore (2), diving for research (3), and surfing (1) were the activities indicated. In Miami-Dade County, four participants indicated the southern tip of Key Biscayne as their favorite and five participants indicated Emerald Reef (Figure 15). On Emerald Reef diving by boat for research (1), snorkel/freediving by boat for pleasure (1), diving by boat for pleasure (1) and boating were the primary activities.

The activities engaged in at the participants' favorite location were numerous and varied (Table 5). Diving by boat for pleasure was the dominant activity encompassing 59 of the favorite or most valued locations. Forty-one participants chose snorkel/freediving from shore as the activity they engaged in at their favorite location. Recreational fishing from a private vessel was indicated by 32 survey participants and diving from shore for pleasure was indicated by 24 survey participants. All other activities were chosen by twenty or less participants including diving by boat for research which was indicated in nineteen surveys. The remaining favorite location activities and the number of participants who chose them are listed in Table 5. The favorite location data appear to cluster in areas offshore Jupiter Inlet, North Palm Beach, Riviera Beach and Palm Beach in Palm Beach County. In Broward County, apparent clusters occurred offshore Pompano Beach, Lauderdale-by-the-Sea, and North Fort Lauderdale. In Miami-Dade County, apparent clusters occurred offshore the southern tip of Key Biscayne. No clustering was apparent in Martin County.

Table 4. The number of times a planning unit was chosen as part of a favorite location (selection frequency). A total of 810 planning units were chosen by participants, of these 108 locations overlapped with at least one other.

Selection Frequency	# of occurrences
1	702
2	71
3	21
4	6
5	5
6	2
7	1
8	0
9	0
10	2

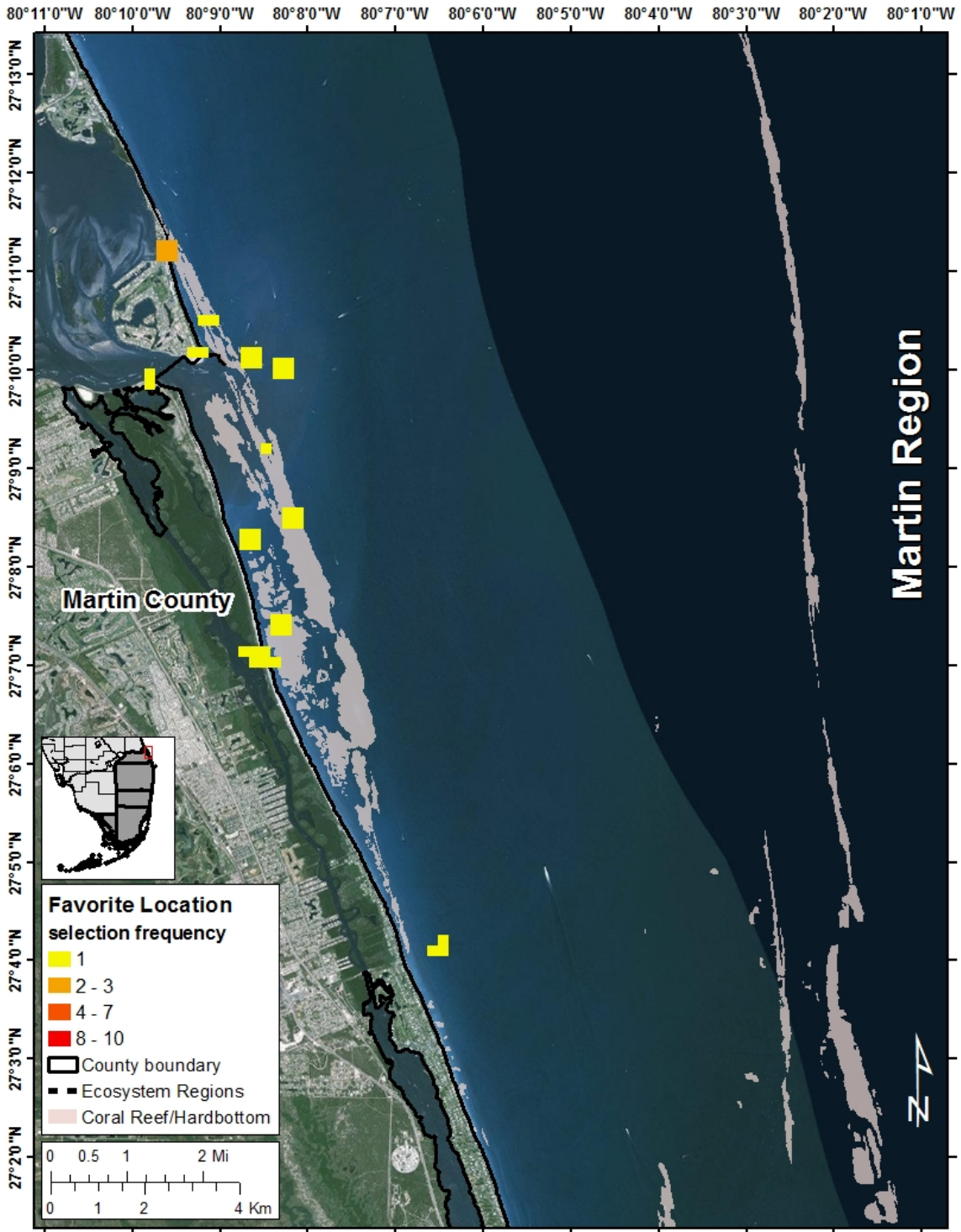


Figure 10. Map displaying the number of survey participants who selected planning units in the Martin coral reef ecosystem region as their favorite or most valued location.

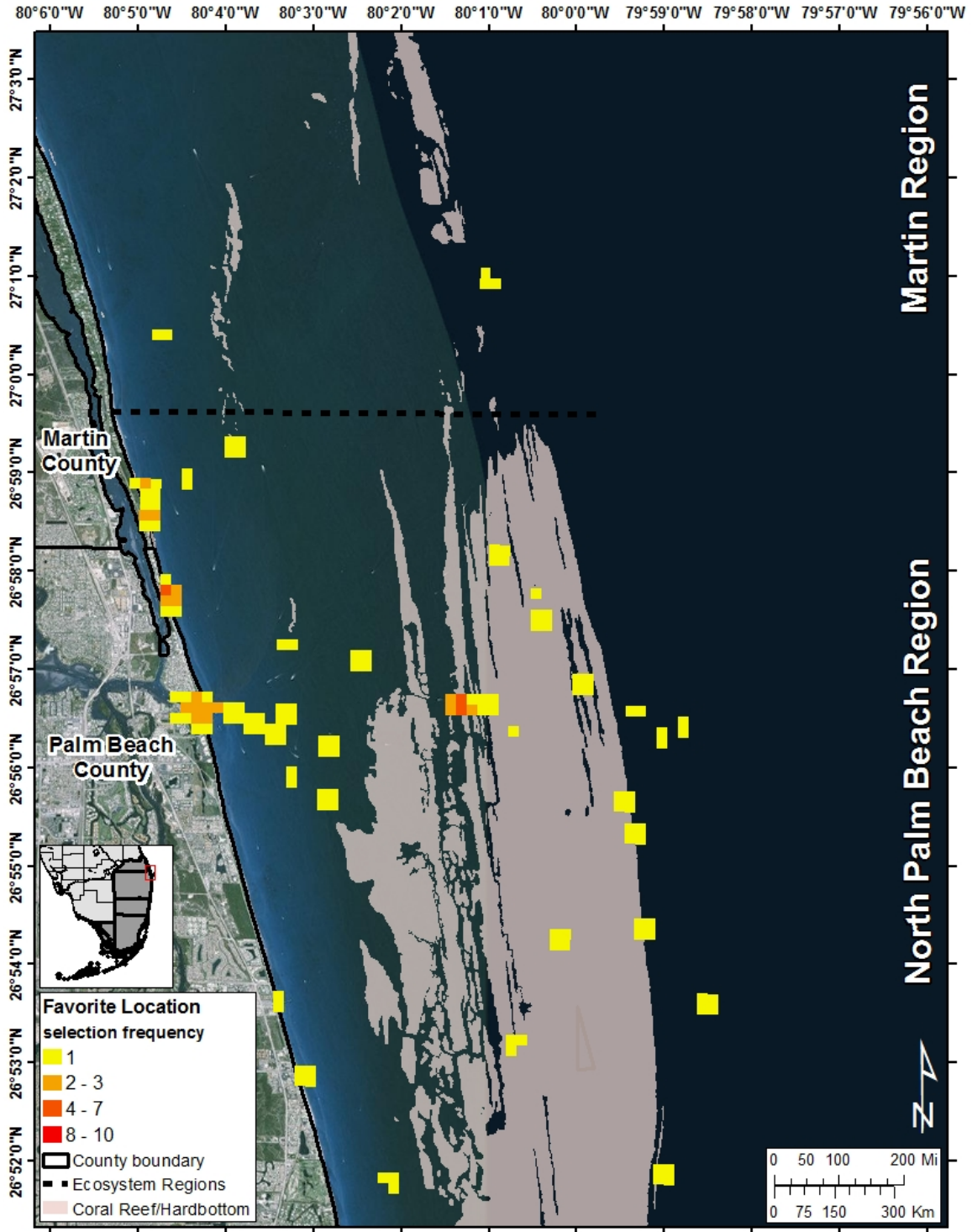


Figure 11. Map displaying the number of survey participants who selected planning units in the Martin and North Palm Beach coral reef ecosystem regions as their favorite or most valued location.

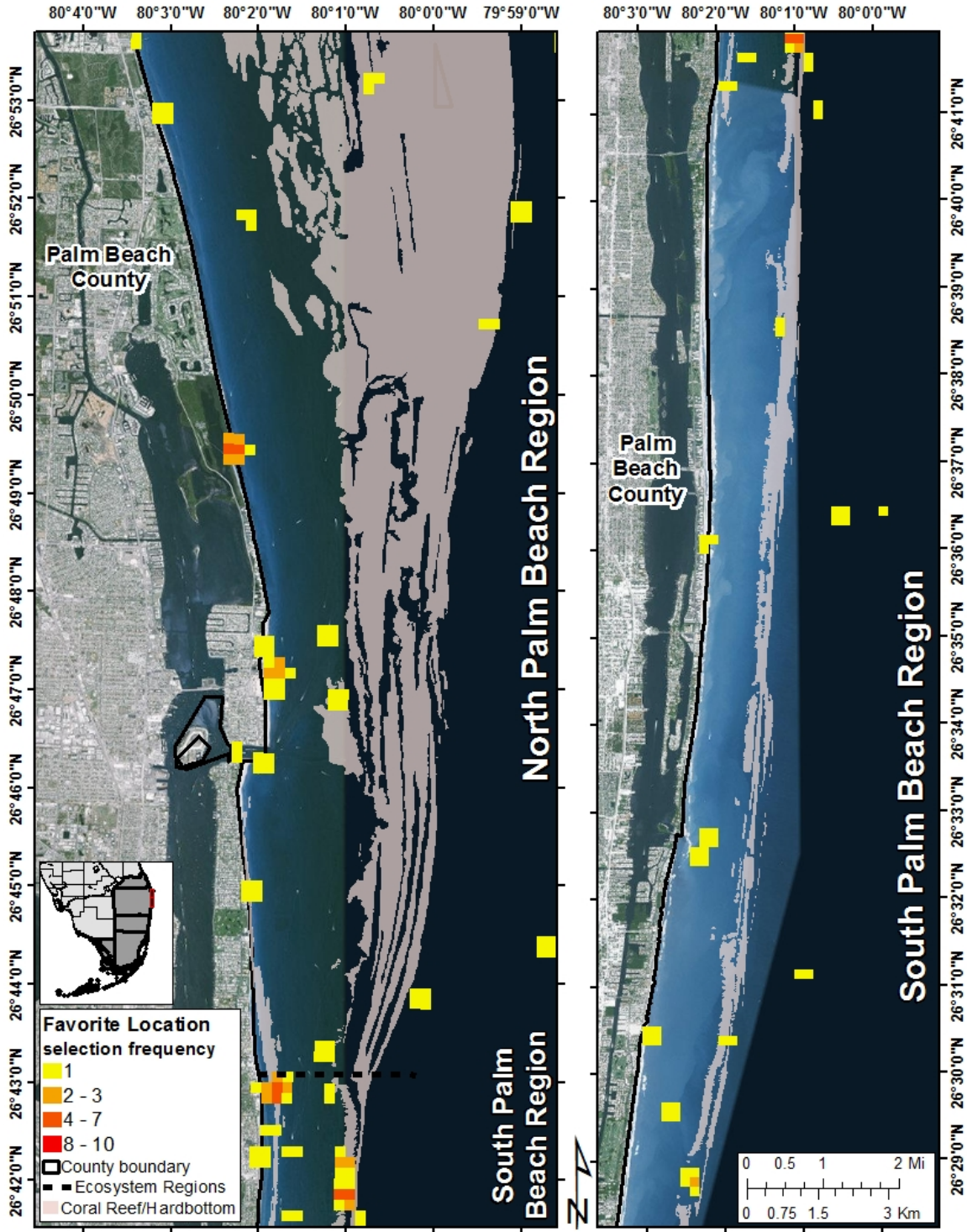


Figure 12. Map displaying the number of survey participants who selected planning units in the North Palm Beach and South Palm Beach coral reef ecosystem regions as their favorite or most valued location.

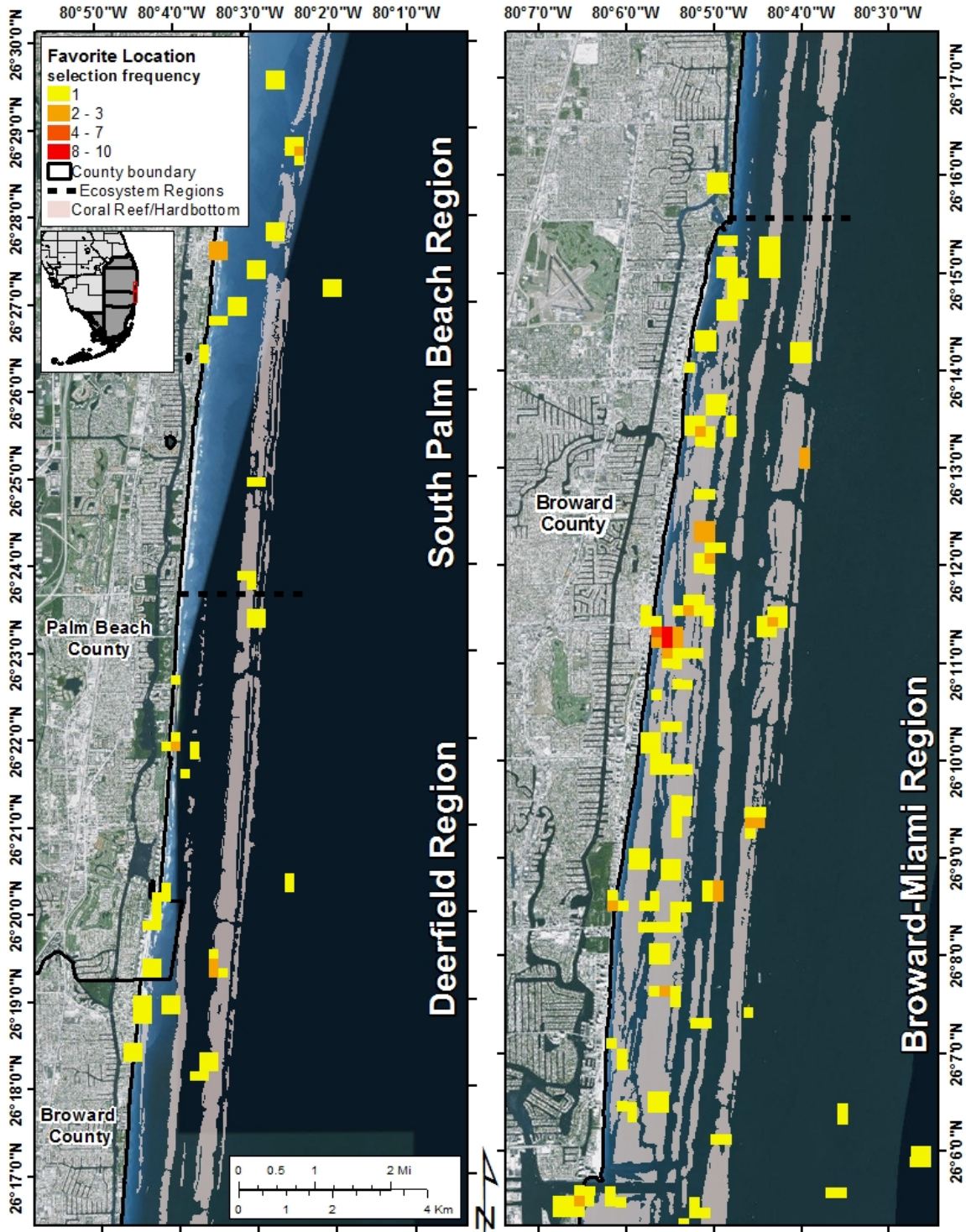


Figure 13. Map displaying the number of survey participants who selected planning units in the South Palm Beach, Deerfield, and Broward-Miami coral reef ecosystem regions as their favorite or most valued location.

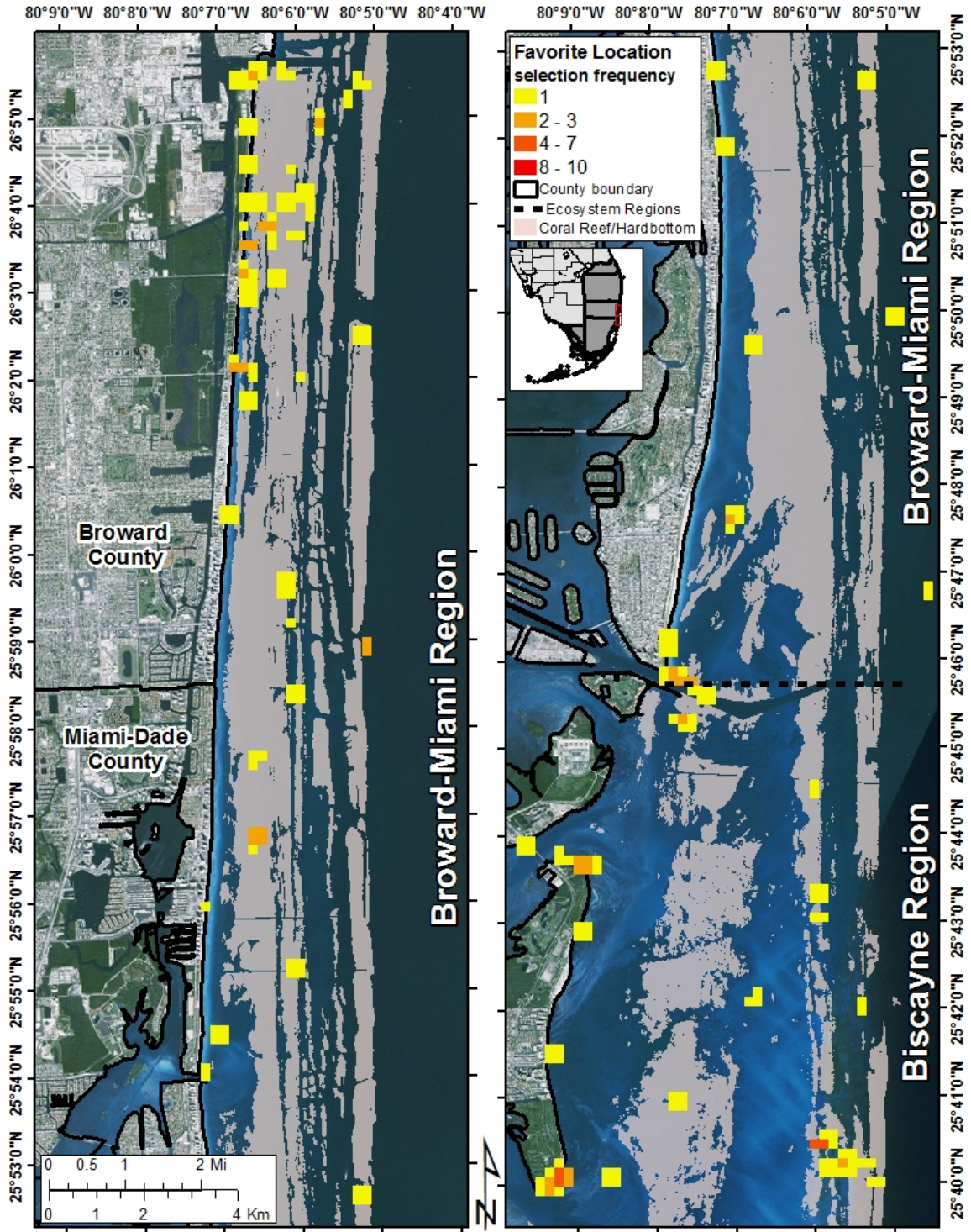


Figure 14. Map displaying the number of survey participants who selected planning units in the Broward-Miami and Biscayne coral reef ecosystem regions as their favorite or most valued location.

Table 5. Number of surveys by primary activity at participants' favorite location. Each survey respondent was only allowed to choose one primary activity for their favorite location. (Crowther and Chen, 2015)

Favorite Spot Activities	# Surveys
Pleasure (diving by boat)	59
Pleasure (snorkel/freediving from shore)	41
Private vessel (recreational fishing)	32
Pleasure (diving from shore)	24
Research (diving by boat)	19
Motor	16
Photography (diving by boat)	15
Lobstering (diving by boat)	14
Pleasure (snorkel/freediving from vessel)	11
Shore/pier (recreational fishing)	7
Surfing	6
Research (snorkel/freediving from shore)	5
Photography (diving from shore)	5
Research (diving from shore)	4
Spearfishing (diving by boat)	3
Photography (snorkel/freediving from shore)	3
Kayak	3
Spearfishing - commercial or recreational (snorkel/freediving from vessel)	2
Photography (snorkel/freediving from vessel)	2
Stand-up paddle boarding	1
Shore/pier (commercial fishing)	1
Sail	1
Research (snorkel/freediving from vessel)	1
Research (recreational fishing)	1
Lobstering (snorkel/freediving from vessel)	1
Lobstering (snorkel/freediving from shore)	1
Lobstering (diving from shore)	1
Collection for aquarium trade or for personal tank (diving by boat)	1
Other	47

Favorite locations were chosen by participants for various reasons; however, there were a few dominant ones. Activity-based was the top reason with 204 surveys indicating that the location was perfect for their particular activity. The location being beautiful was chosen by 177 survey participants and good water quality was chosen by 137 participants. Abundant and diverse marine life was also an important quality indicated by 129 surveys. All other favorite location reasons were chosen by fifty or fewer participants and can be seen below in Table 6.

Table 6. Number of surveys by the chosen reasons for a favorite location. Survey respondents could choose more than one reason for liking this location. The “other” responses were a type-in response that is not detailed here. (Crowther and Chen, 2015)

Favorite Location Reason	# Surveys
Activity-based - The site is perfect for my particular activity (e.g. fishing area, dive site, etc)	204
Beautiful - The site is beautiful or has striking natural features	177
Water Quality - The water is clean, clear and/or good to swim in	137
Marine Life - Marine life is abundant and diverse	129
Memories - I have a lot of memories from this place	48
Secluded - The site is secluded, away from crowds, and offers privacy	40
Educational- It is a place I can learn about, teach, or research the natural environment	39
Inspiring - This is a spiritual/inspiring place for me	38
Social - This is where my friends/family frequent	33
Livelihood - Professional purposes	15
Collecting - There are specific natural resources I like to collect here	10
Other	3

3. SUMMARY AND OTHER CONSIDERATIONS

The survey data obtained are of value to the OFR community planning process. They indicated where people conducted their on-the-water activities in the past year and how frequently (or intensely). These data were included as filtering layers in the OFR Marine Planner decision support tool to provide reef resource user information to the Community Working Groups while they explore spatial options and design spatial plans for their recommended management actions.

Broader scale patterns showed that the reefs in the Broward-Miami region were used over a wider spatial scale than those north or south. However places where there is less reef habitat (e.g. Martin) focused use in smaller areas. This illustrates the importance of not only understanding where activities occur but also how often. Areas that are revisited at high rates may receive more impacts than those infrequently visited, depending on the activity.

Although valuable data were gathered during this survey, there are a few considerations to be noted about the survey method. This survey used a non-probability based, “opt-in” sample method meaning targeted participants (instead of a random population) agreed to provide their information. For this reason these data cannot be extrapolated to the general population or be presumed to be a complete picture of the activities being conducted offshore (LaFranchi and Daugherty, 2011). The survey outcomes are completely dependent on the survey participation and the information that was provided. An outreach campaign

was conducted to solicit as many coastal users as possible within the allotted time and project budget. Despite the many user groups who were engaged, some user groups showed higher participation than others. This may be due to the lower number of user groups that exist and that were presented to in both Miami-Dade and Martin counties. The commercial fishing community was severely underrepresented with only 1 survey taken indicating 14 activity points while the diving community showed high participation, with over 500 surveys indicating over 1500 activity points. Also some counties had more respondents than others. For example, 46% of participants who completed the survey were from Broward County while only 12% were from Miami-Dade County. This is a large disparity considering the high population density in Miami-Dade County; however, it is also known that Broward County has considerably more dive shops and presumably diving activity.

The design of the survey was unique in that it allowed participants to provide locations of their use through an interactive map. However, the trade-off in this design was that it was more complicated and potentially lengthy depending on how many activities the user participated in, and how frequently they engaged in those activities. These factors likely affected the number of completed surveys and the amount of data received. Participant comments included “I only selected a small area of the areas we visit because it was going to be very time consuming to select each little grid.”, “Too many steps to add sites”, and “Mapping was very tedious...”. Many participants also found the mapping difficult to learn and counterintuitive. For example “The mapping tool was a bit confusing” and “Mapping too clumsy”.

There were two main designs conceived for the interactive mapping within the survey. The first design was to select all of the planning units in which they conducted a given activity at one time. The second was to select point locations individually for each activity. The first design was beneficial to users who visited a large area in a single trip because it would allow for the entire area to be selected. The second design was beneficial to those who visited smaller areas. Since the survey was collecting intensity data (number of visits) in addition to location data, it was decided the second design was easier for the survey participant to enter their data. The first design would have required the participant to map every visit separately, even those that overlapped, which would have made the survey harder and longer. By having the participant select individual point locations for an activity, they could enter the number of days within the year that they visited that specific location for that specific activity. This design allowed participants to mark one place and indicate a number for the amount of times they performed that activity there, saving heavy users a lot of time. This design was problematic for those activities that were not necessarily associated with one place because they could not map their use with the highest spatial precision. For example, a drift dive along the reef, boating up and down the coast, or trolling for pelagic fish species are all activities that utilize a much larger area than could be indicated with this survey method. The participants had little guidance as to how to map such activities to accurately reflect their activity which may have resulted in incomplete surveys or inaccurate data. Some may have mapped multiple locations for one day’s activity and some may have mapped one. These types of measurement errors are unknown.

Mapping activity points appeared to be the most arduous for participants. This is demonstrated by the high number of surveys with “Activities Information” as the final completed question. Out of the 432 surveys that were incomplete 334 of these surveys did not complete the mapping question. Some of these survey participants entered locations but did not move on to the next question. These data were still used in the survey results summaries. There were some participants that did not even begin the mapping question as well. They stopped after the residency question (18 surveys) or the county of residence question (19). After reading the question asking them to indicate which activities they participated in the past twelve months, participants may have realized that they had not participated in any of the activities in general or may have not participated in any of the activities in the time frame indicated. In future surveys, it may be advantageous to add a selection that indicates the participant had not engaged in any of the activities in the past twelve months. Twenty four survey participants stopped at the demographic questions. This may be because they ran out of time or simply did not feel comfortable answering these questions. As mapping of activities was most important in this survey, these demographic questions were placed toward the end of the survey to allow those participants who may not have wanted to provide that personal information an opportunity to still complete the mapping portion of the survey. In future surveys, an opt-out option should be included so that participants are able to skip over questions they are uncomfortable answering or those they simply do not understand.

This survey showed that both where and how often activities are being conducted are relevant to discussing the future management of southeast Florida reefs. Given the considerations above, future surveys should attempt to collect both types of information in a user-friendly format that is easy for both one-time and daily users. Certain stakeholder groups, like commercial fishermen, may need to be engaged separately in an effort to obtain their spatial use data. We recommend that a similar survey be repeated after management actions are implemented to understand how people’s activities spatially change in response to the action.

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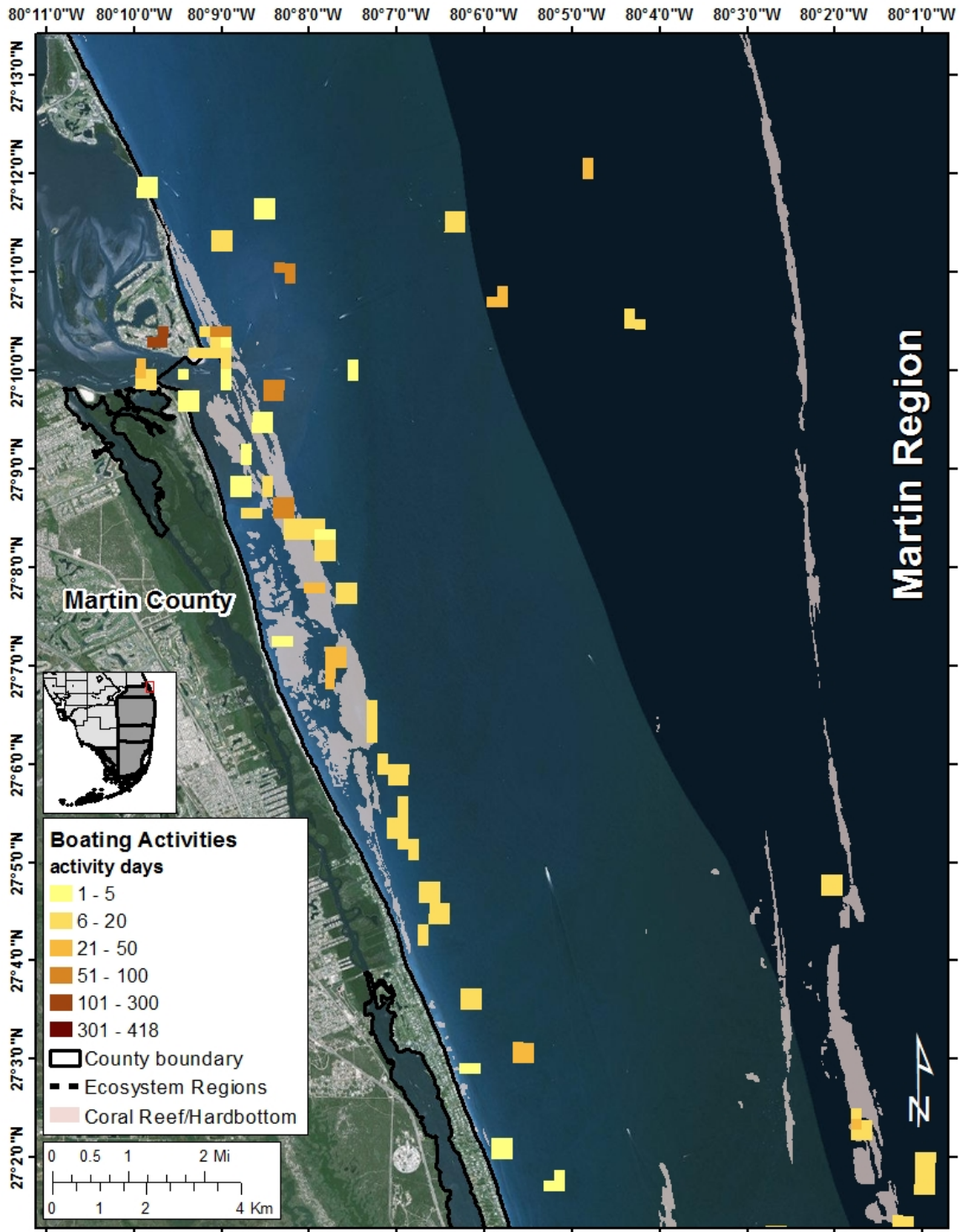
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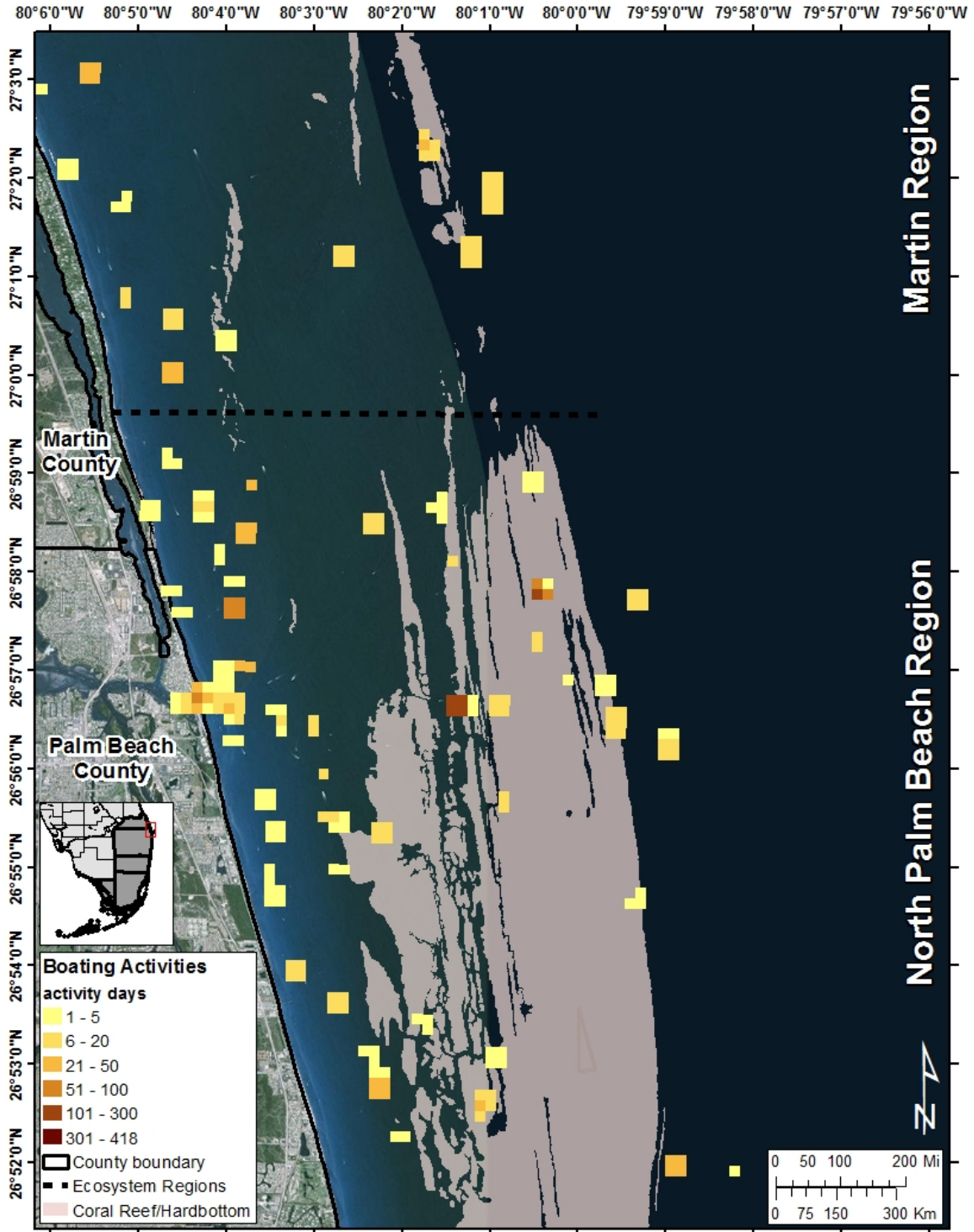
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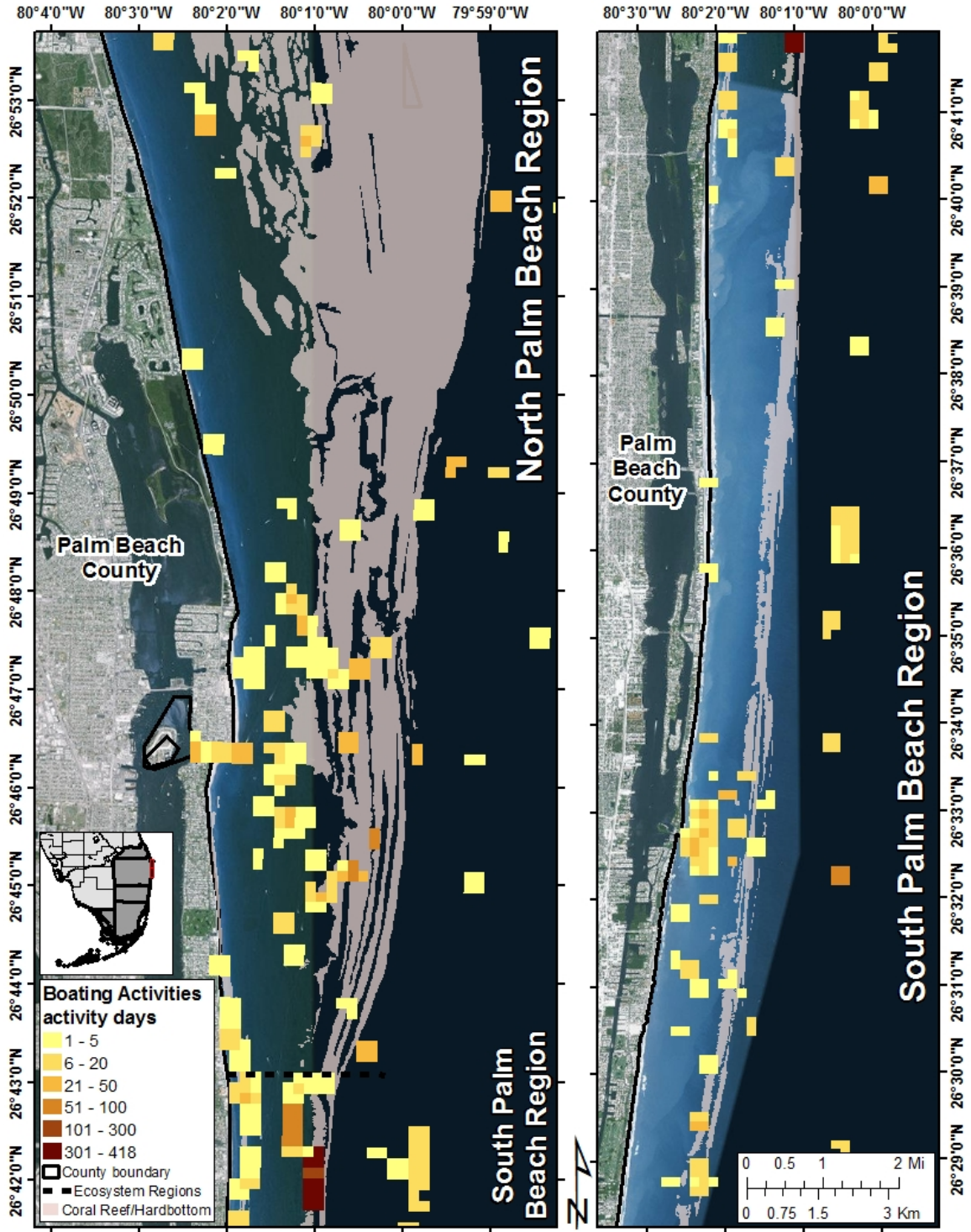
Appendix A Boating activity maps.



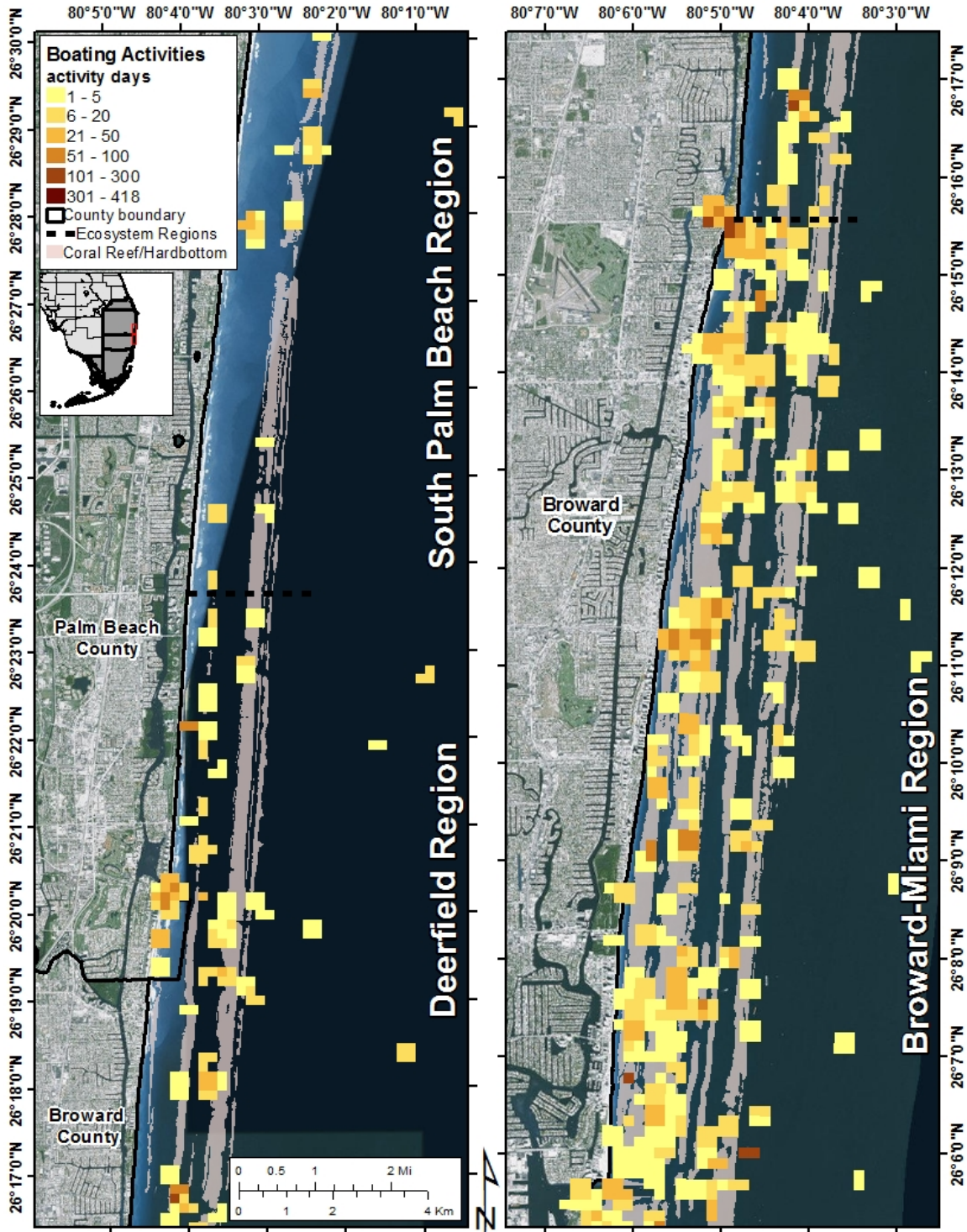
A- 1. Map of final survey results displaying the total number of activity-days per planning unit for boating activities within the Martin coral reef ecosystem region.



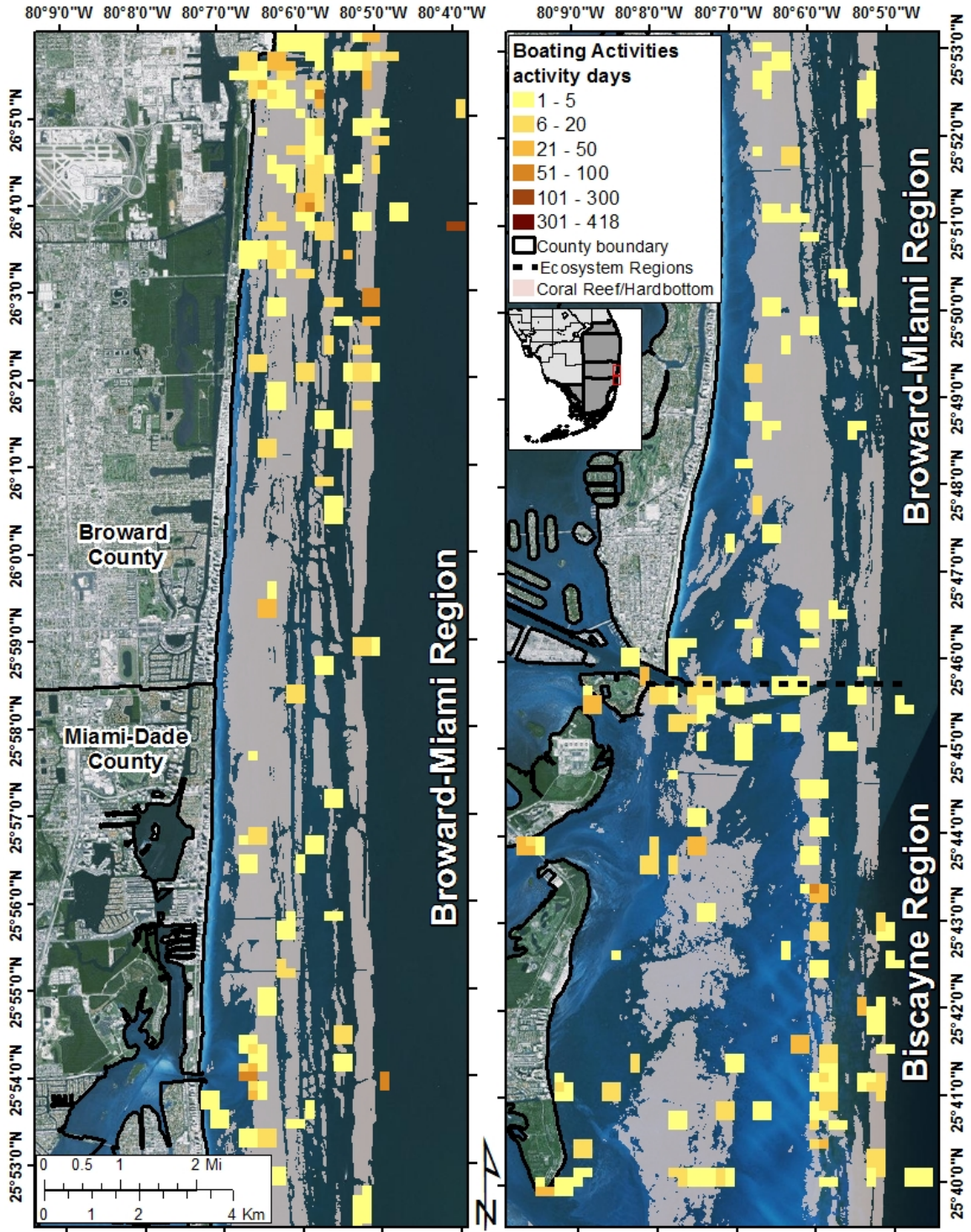
A- 2. Map of final survey results displaying the total number of activity-days per planning unit for boating activities within the Martin and North Palm Beach coral reef ecosystem regions.



A- 3. Map of final survey results displaying the total number of activity-days per planning unit for boating activities within the North Palm Beach and South Palm Beach coral reef ecosystem regions.

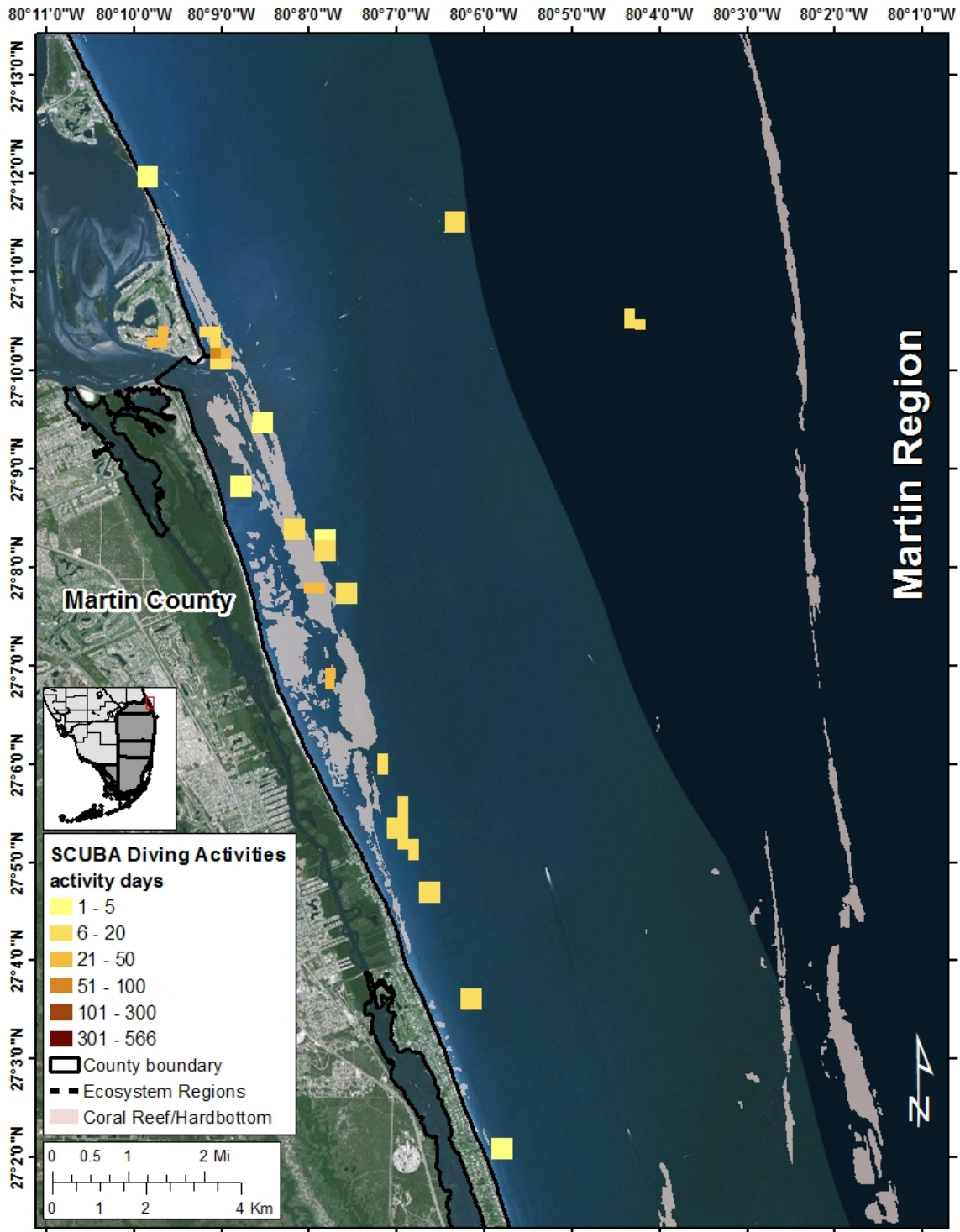


A- 4. Map of final survey results displaying the total number of activity-days per planning unit for boating activities within the South Palm Beach, Deerfield, and Broward-Miami coral reef ecosystem regions.

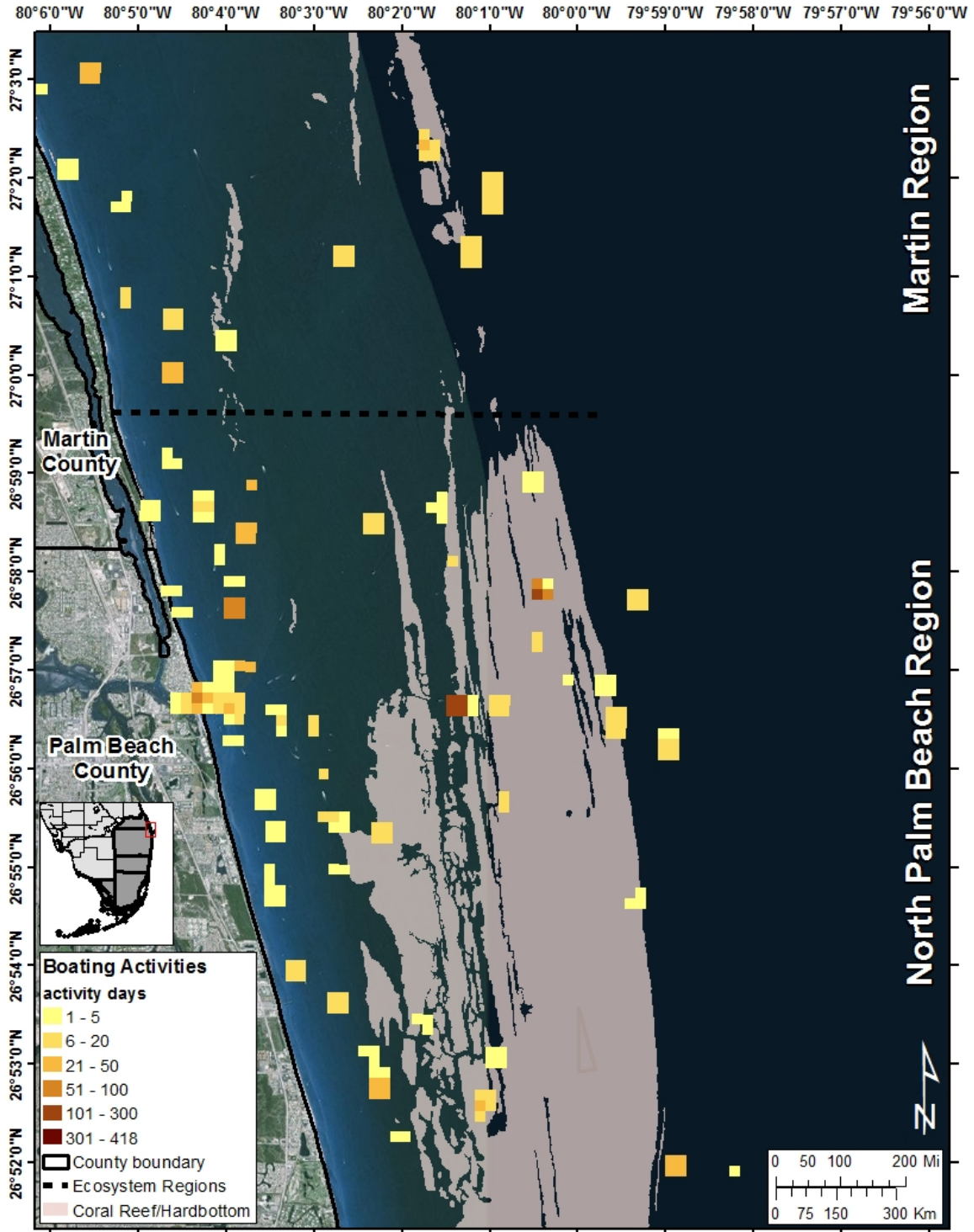


A- 5. Map of final survey results displaying the total number of activity-days per planning unit for boating activities within the Broward-Miami and Biscayne coral reef ecosystem regions.

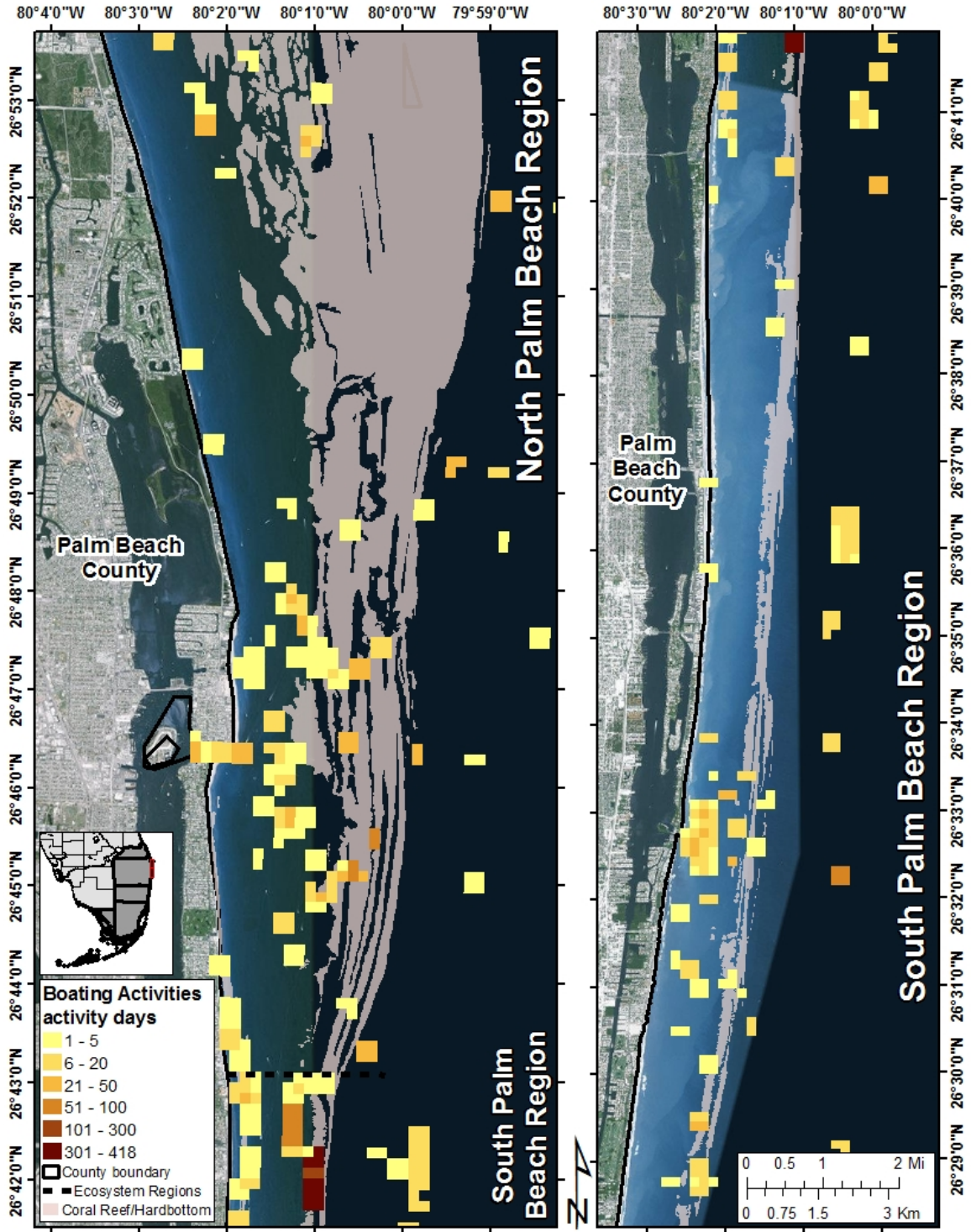
Appendix B SCUBA diving activity maps.



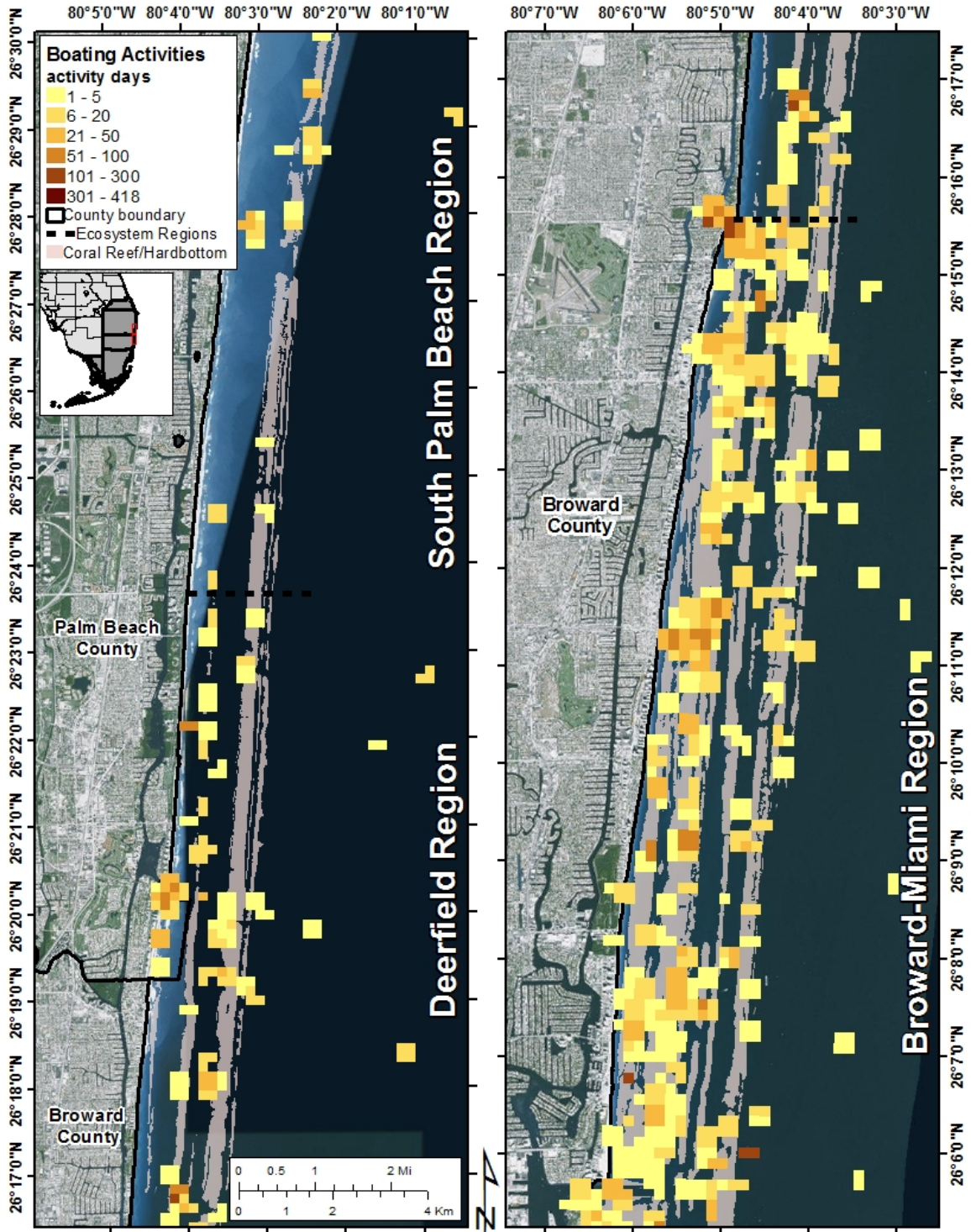
B- 1. Map of final survey results displaying the total number of activity-days per planning unit for SCUBA diving activities within the Martin coral reef ecosystem region.



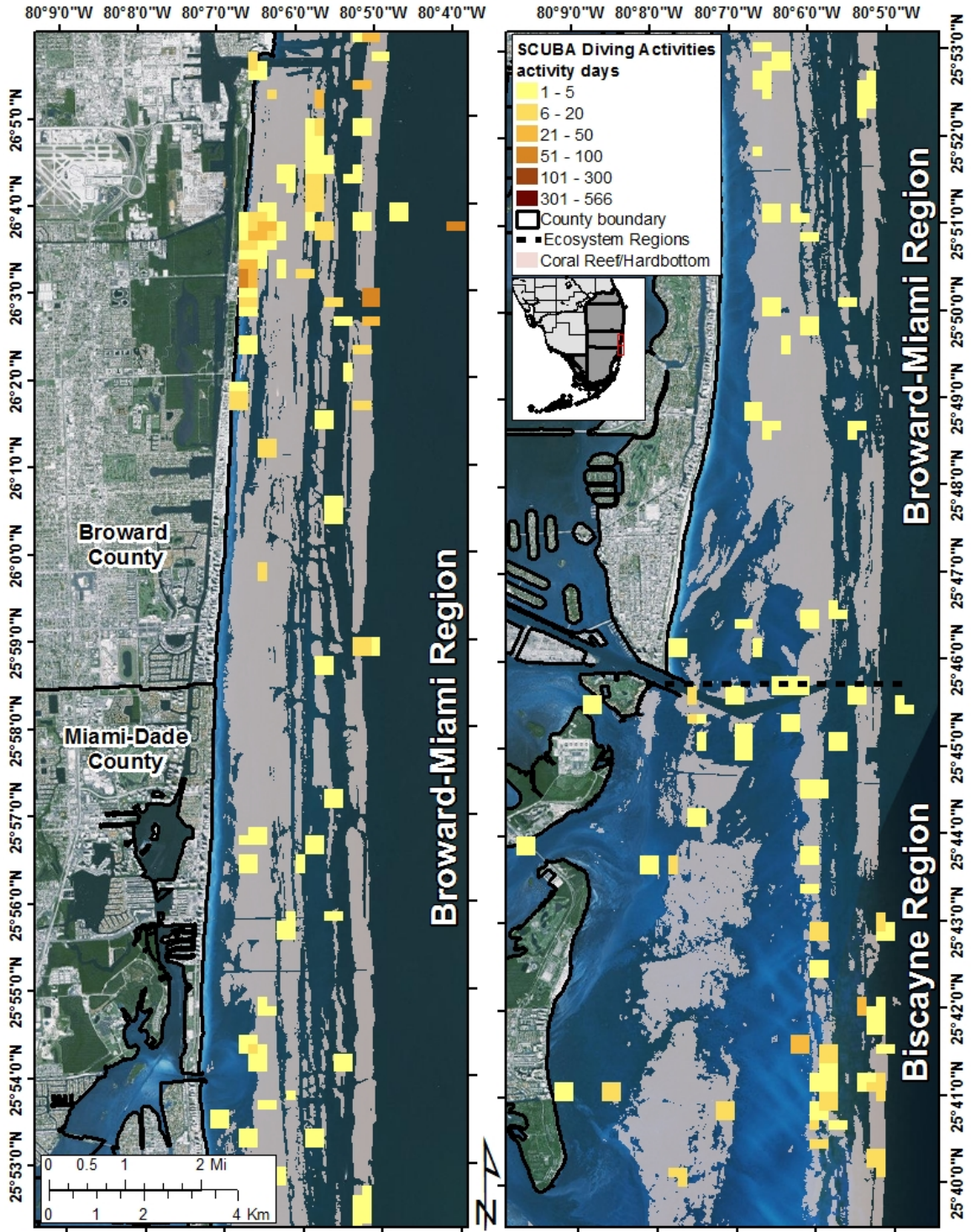
B- 2. Map of final survey results displaying the total number of activity-days per planning unit for SCUBA diving activities within the Martin and North Palm Beach coral reef ecosystem regions.



B- 3. Map of final survey results displaying the total number of activity-days per planning unit for SCUBA diving activities within the North Palm Beach and South Palm Beach coral reef ecosystem regions.

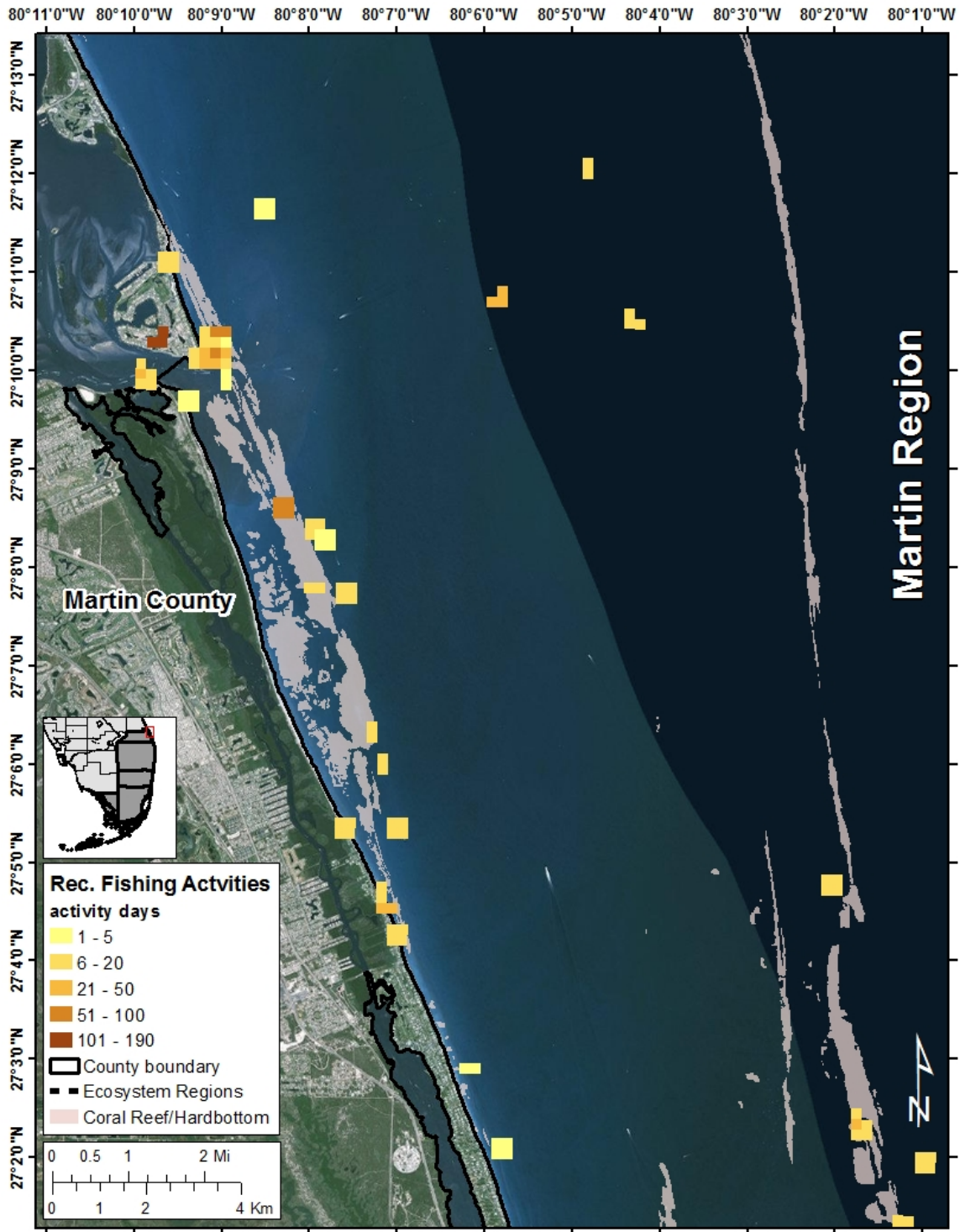


B- 4. Map of final survey results displaying the total number of activity-days per planning unit for SCUBA diving activities within the South Palm Beach, Deerfield, and Broward-Miami coral reef ecosystem regions.

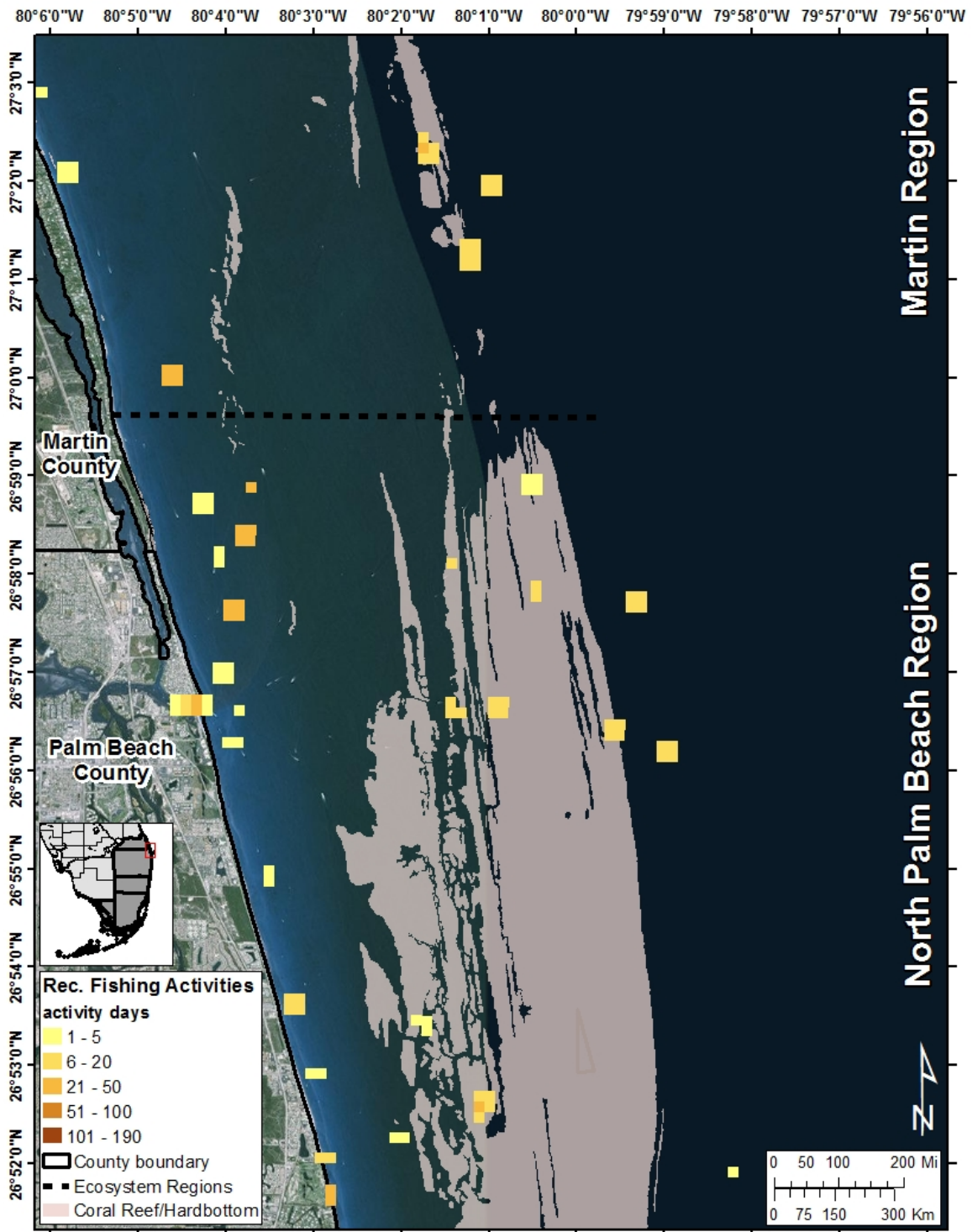


B- 5. Map of final survey results displaying the total number of activity-days per planning unit for SCUBA diving activities within the Broward-Miami and Biscayne coral reef ecosystem regions.

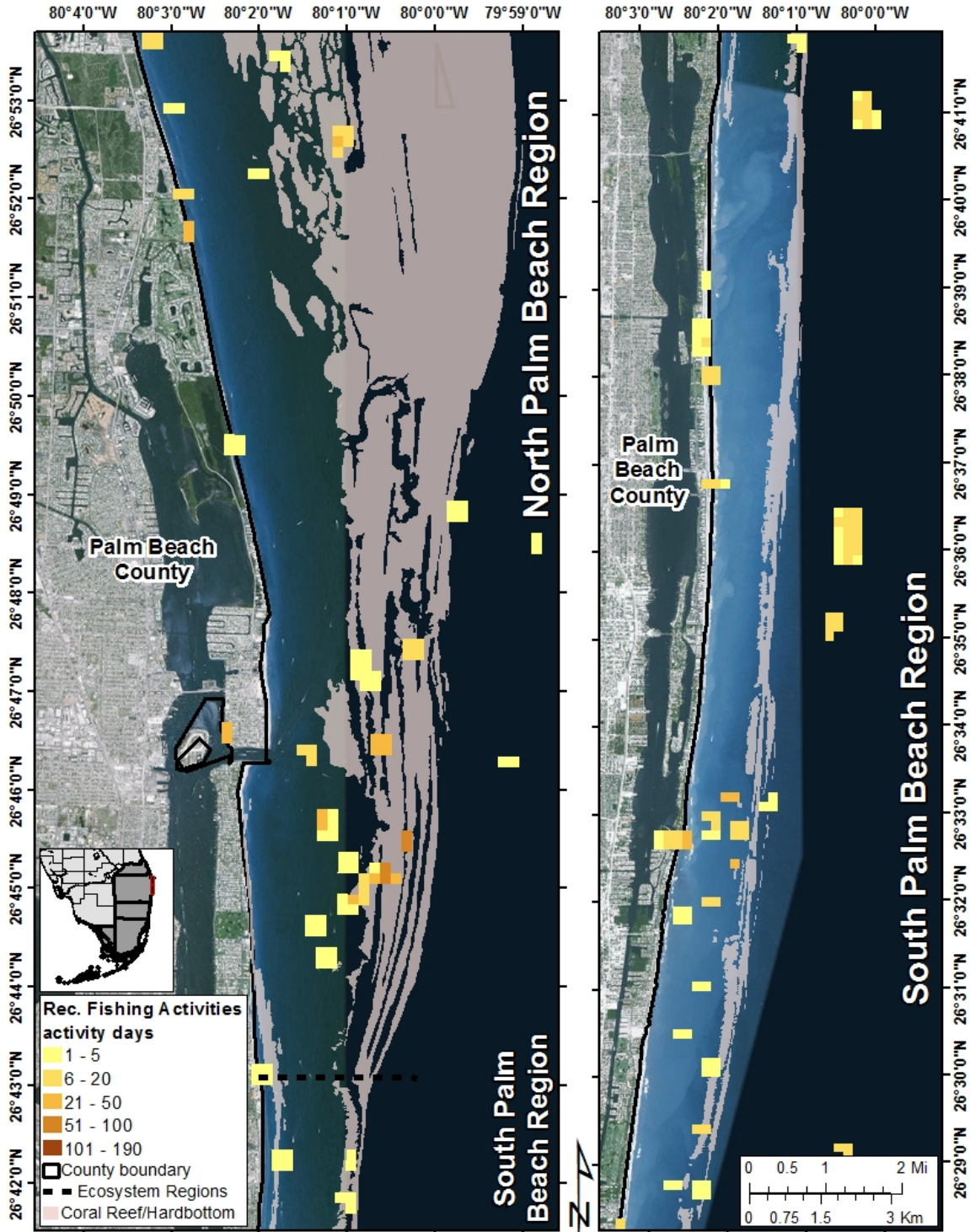
Appendix C Recreational fishing activity maps.



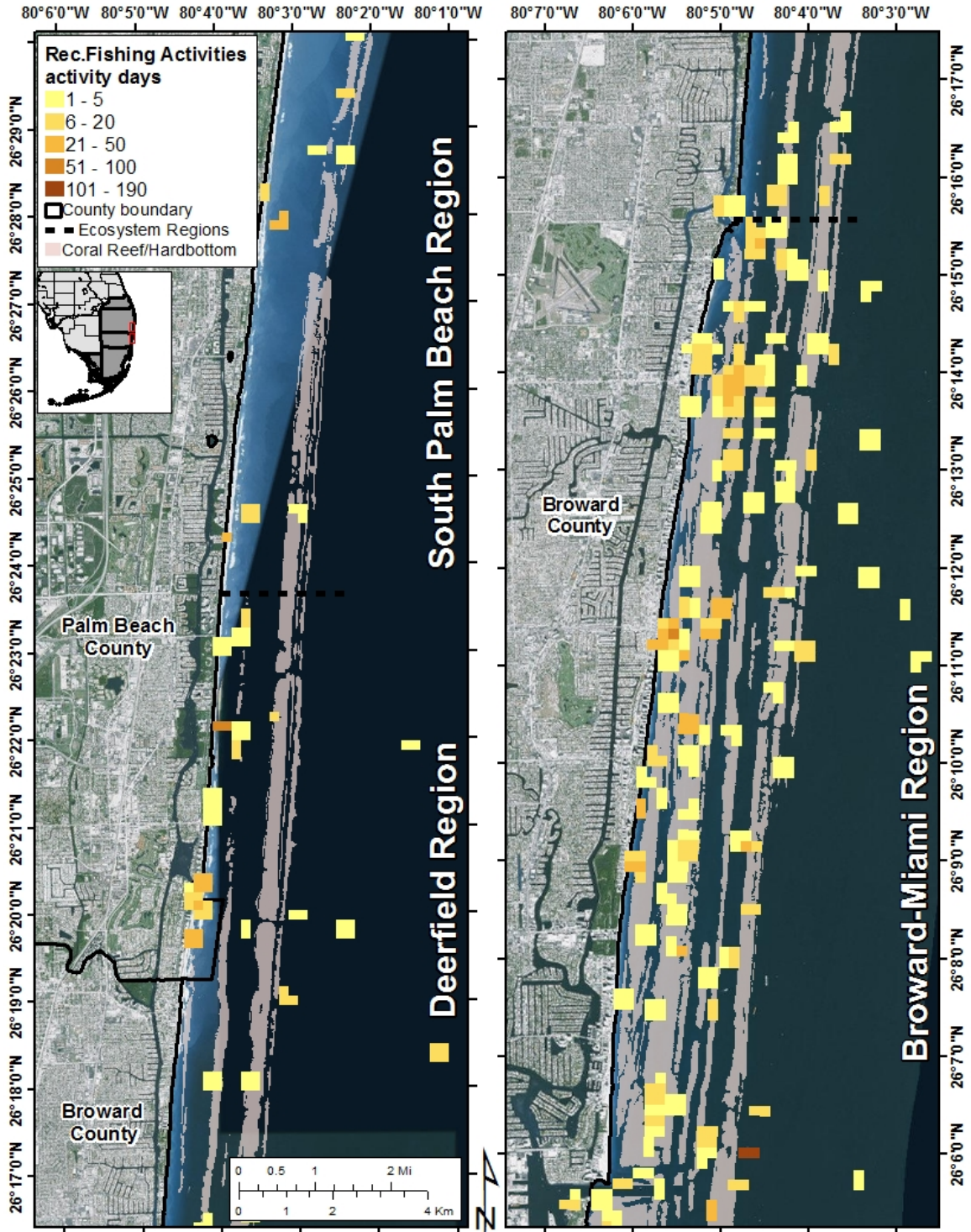
C- 1. Map of final survey results displaying the total number of activity-days per planning unit for recreational fishing activities within the Martin coral reef ecosystem region.



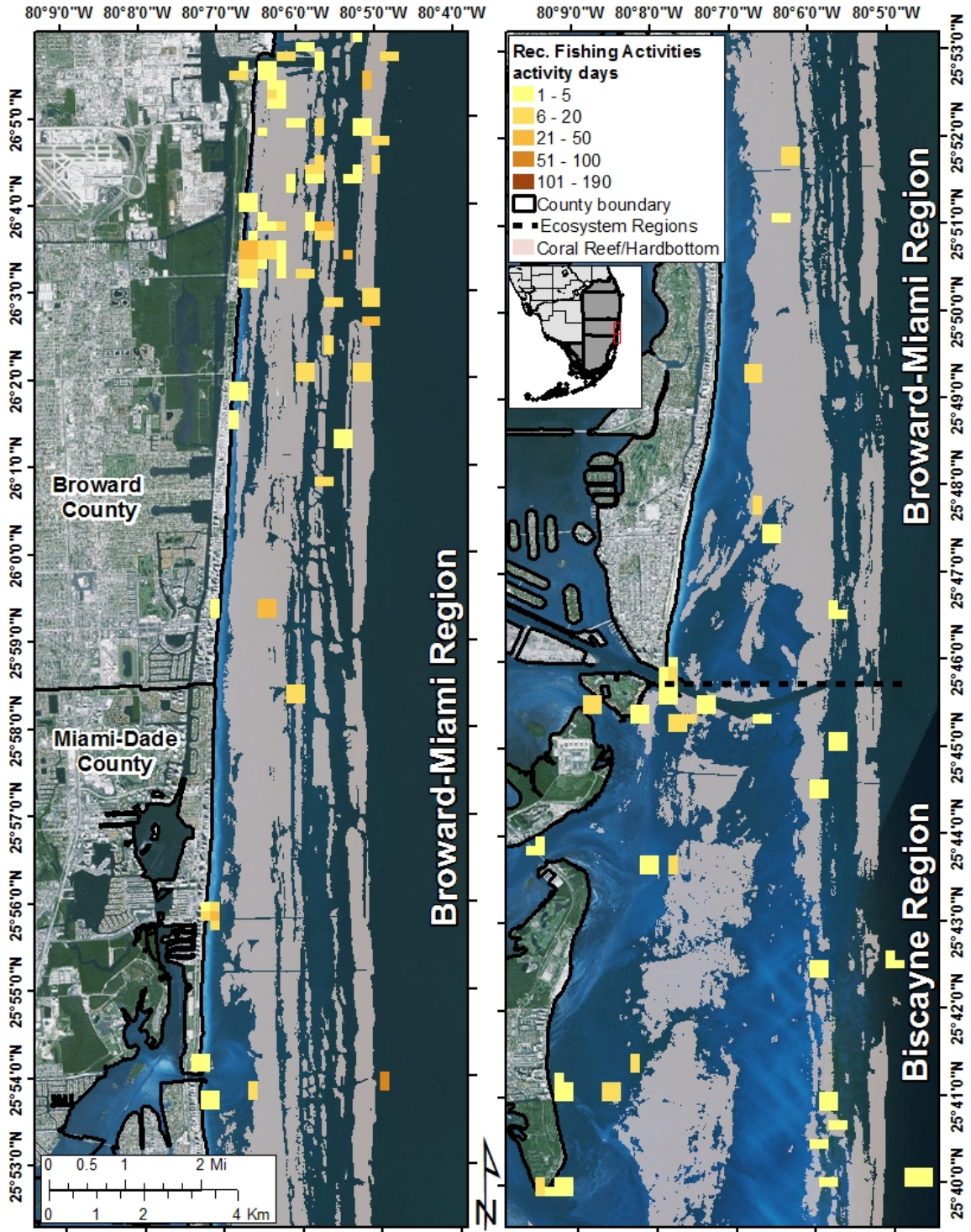
C- 2. Map of final survey results displaying the total number of activity-days per planning unit for recreational fishing activities within the Martin and North Palm Beach coral reef ecosystem regions.



C- 3. Map of final survey results displaying the total number of activity-days per planning unit for recreational fishing activities within the North Palm Beach and South Palm Beach coral reef ecosystem regions.

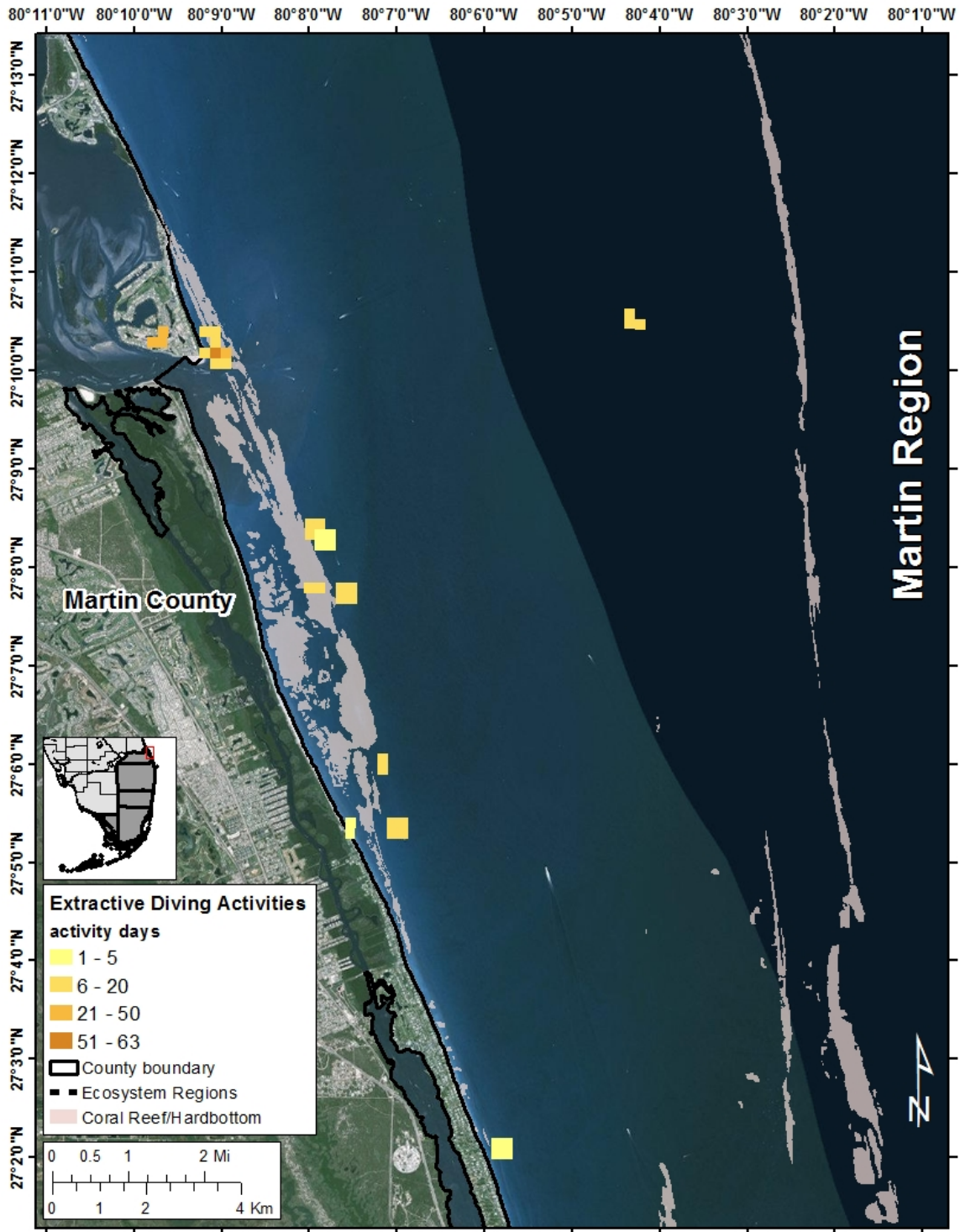


C- 4. Map of final survey results displaying the total number of activity-days per planning unit for recreational fishing activities within the South Palm Beach, Deerfield, and Broward-Miami coral reef ecosystem regions.

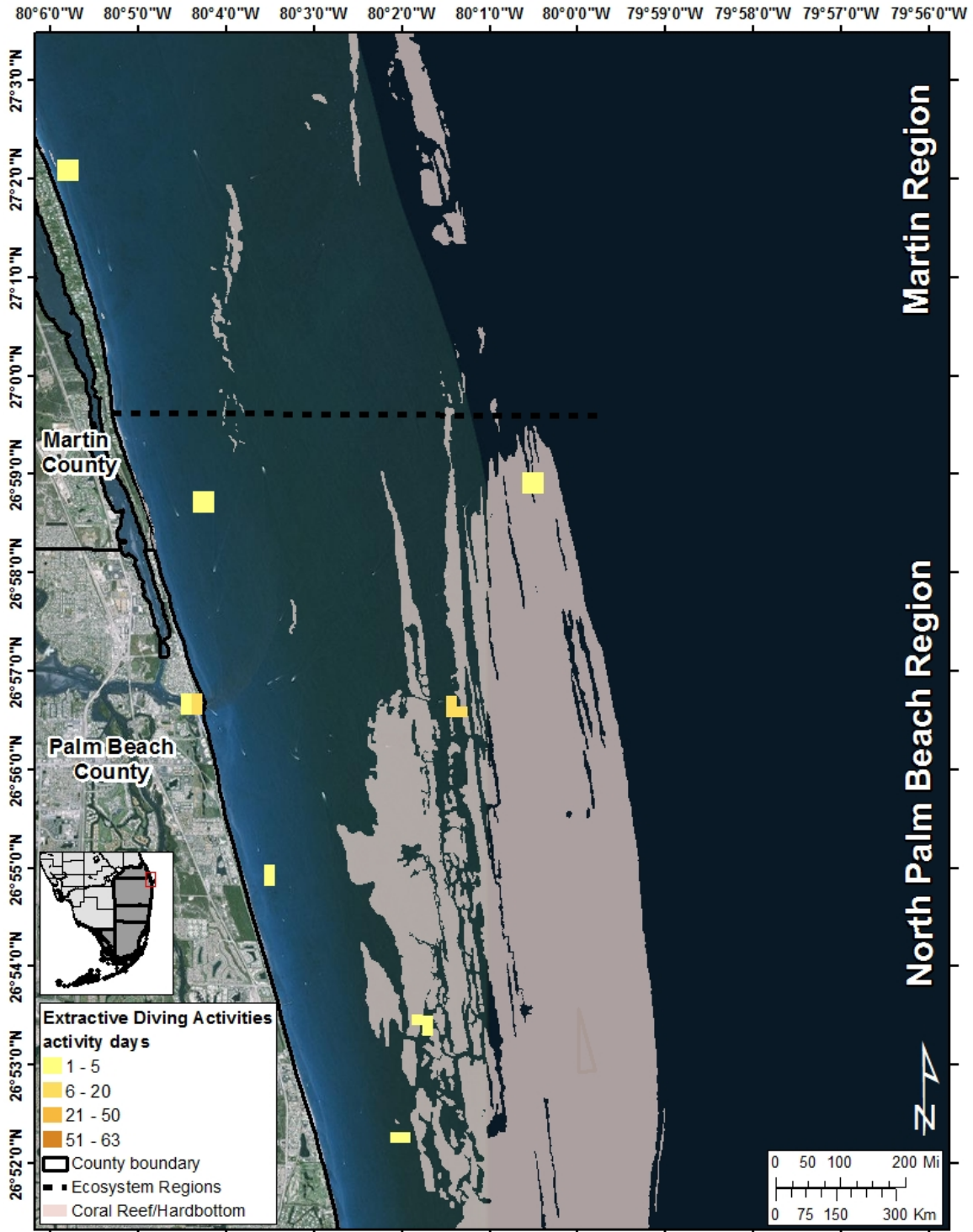


C- 5. Map of final survey results displaying the total number of activity-days per planning unit for recreational fishing activities within the Broward-Miami and Biscayne coral reef ecosystem regions.

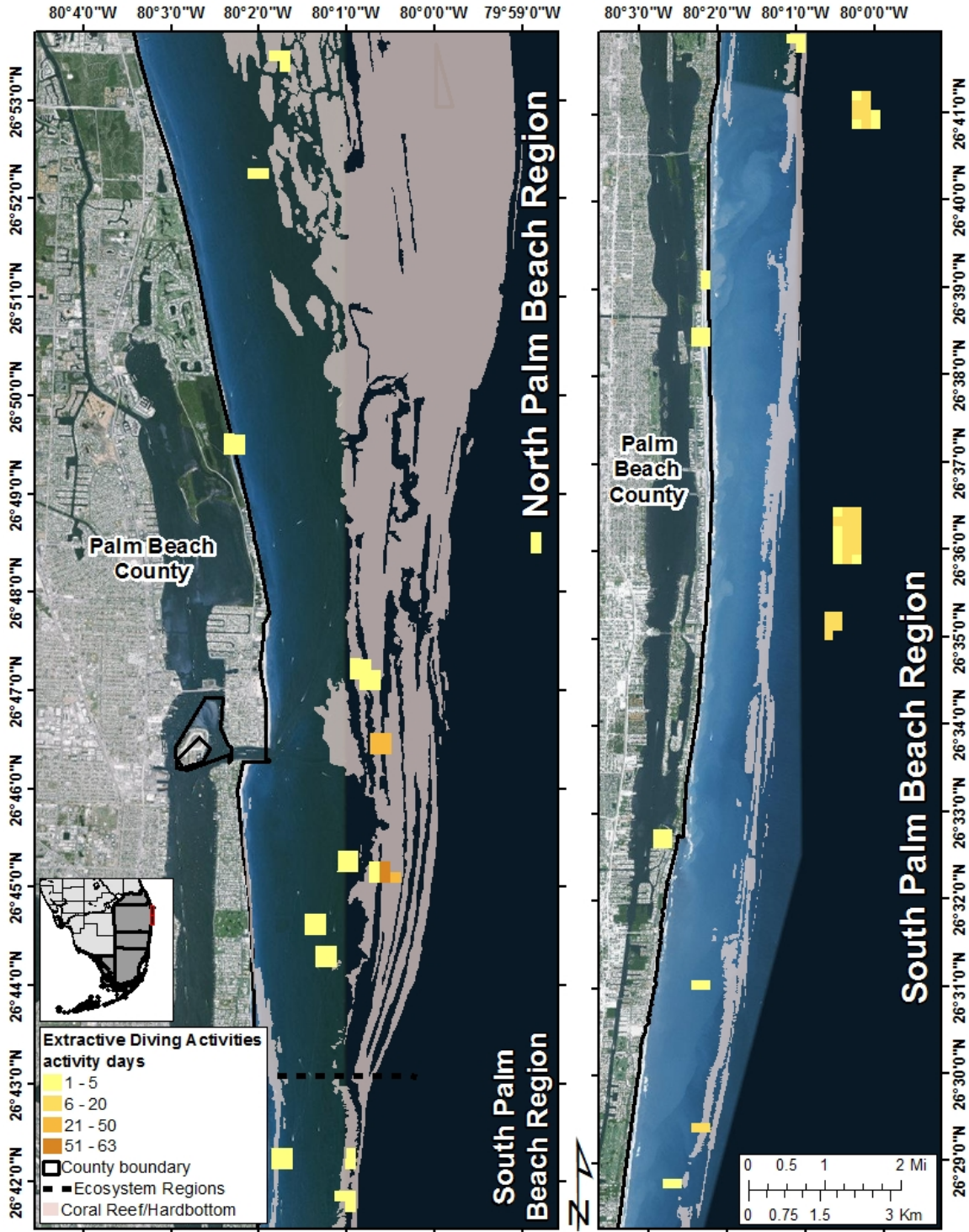
Appendix D Extractive diving activity maps.



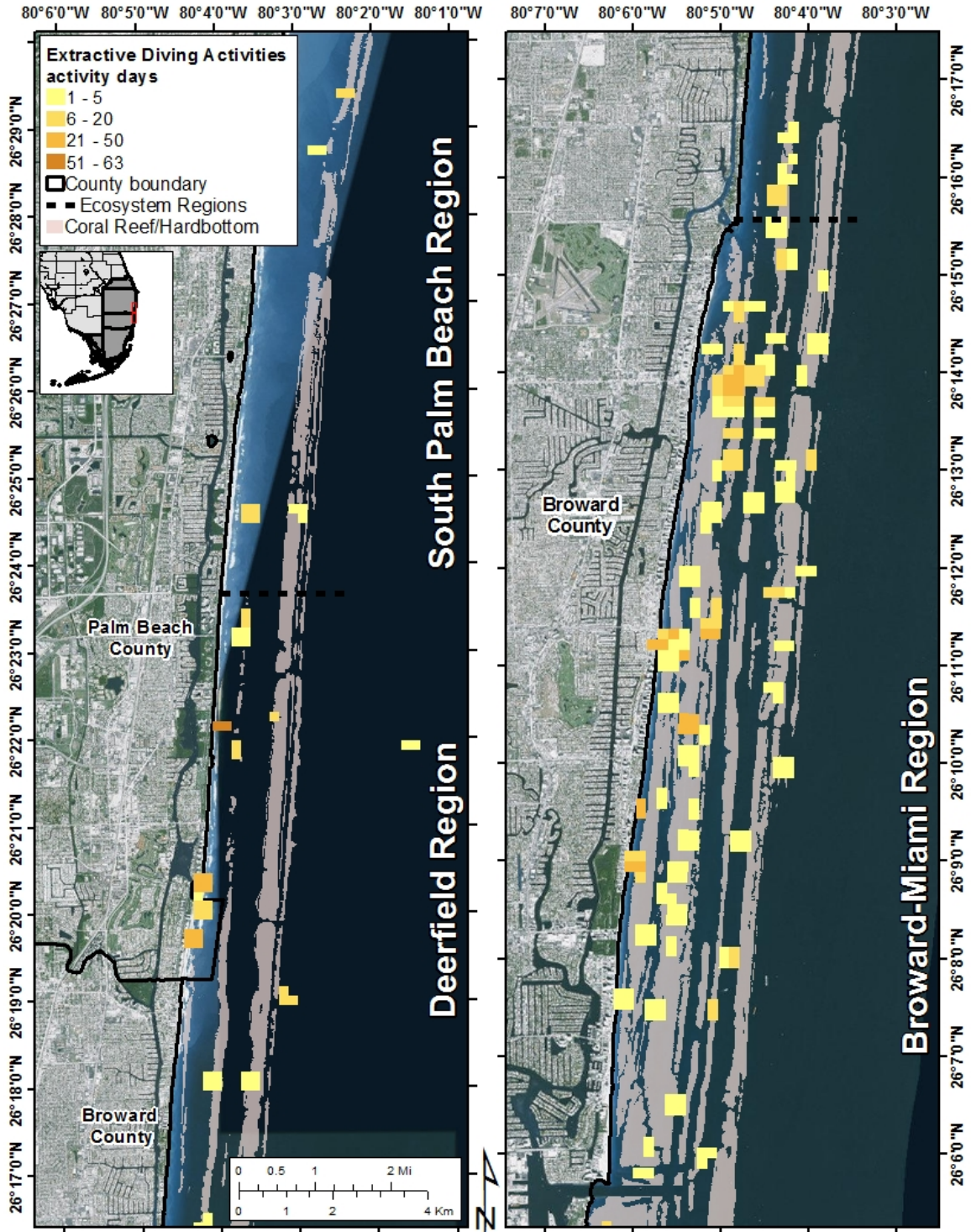
D- 1. Map of final survey results displaying the total number of activity-days per planning unit for extractive diving activities within the Martin coral reef ecosystem region.



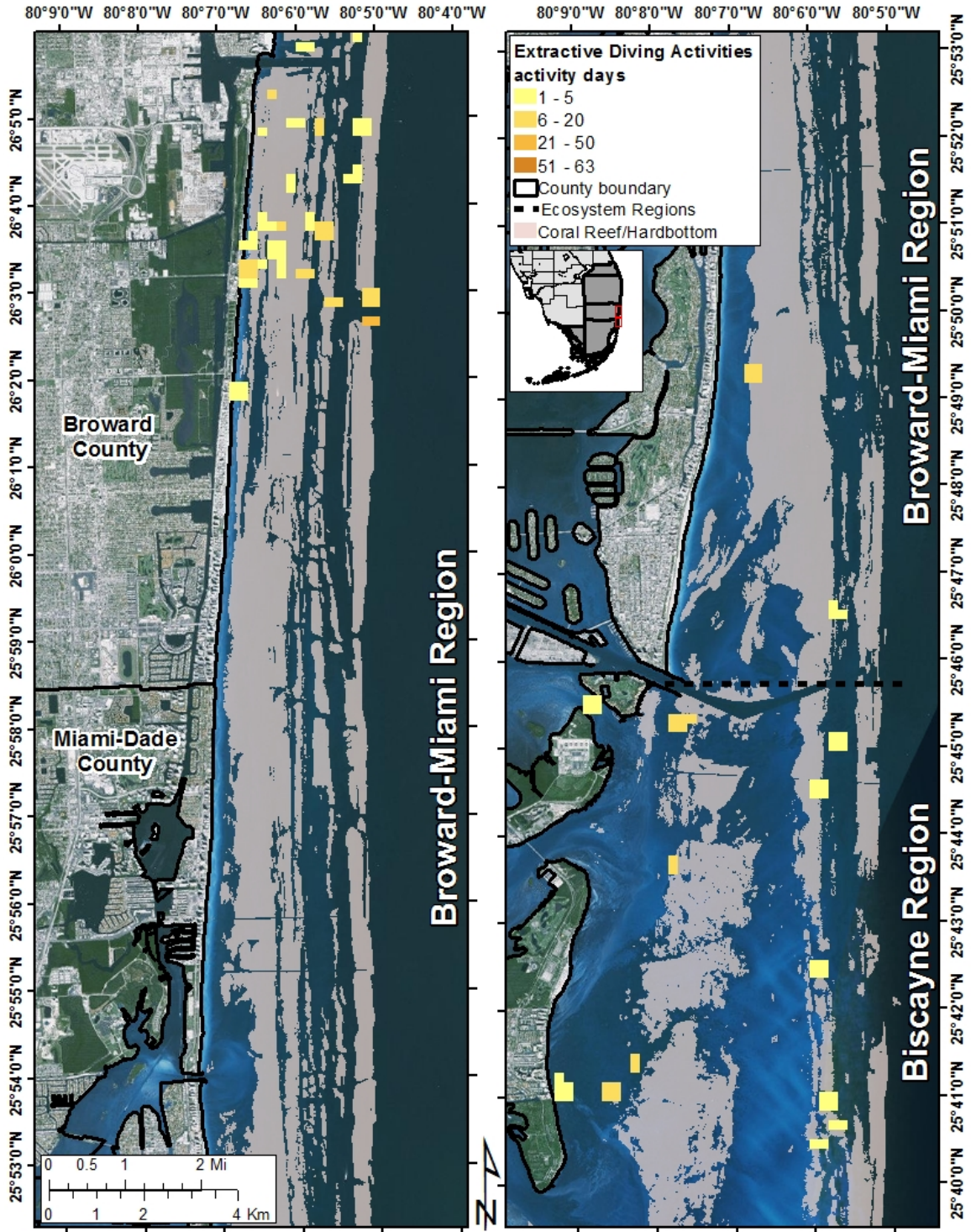
D- 2. Map of final survey results displaying the total number of activity-days per planning unit for extractive diving activities within the Martin and North Palm Beach coral reef ecosystem regions.



D- 3. Map of final survey results displaying the total number of activity-days per planning unit for extractive diving activities within the North Palm Beach and South Palm Beach coral reef ecosystem regions.

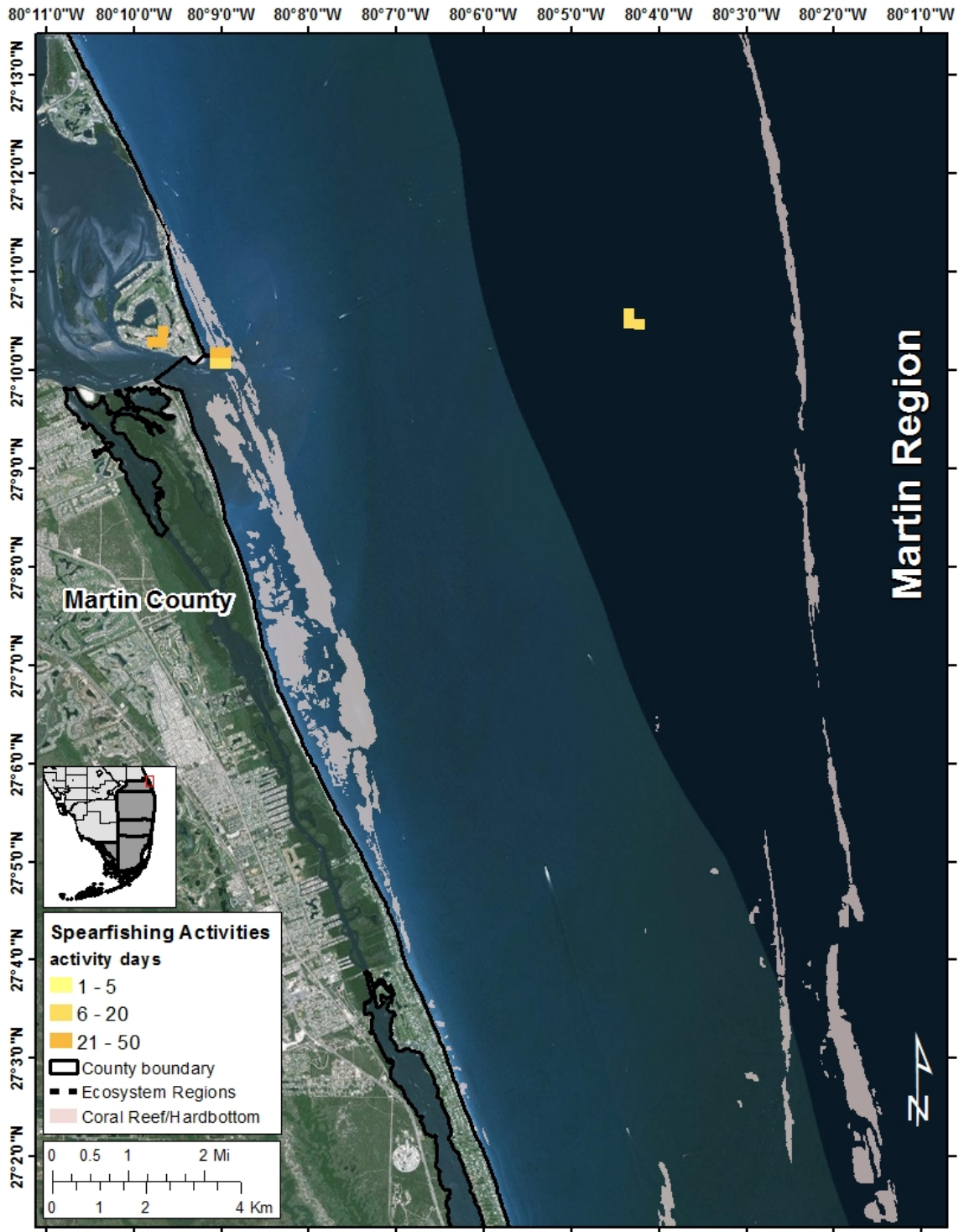


D- 4. Map of final survey results displaying the total number of activity-days per planning unit for extractive diving activities within the South Palm Beach, Deerfield, and Broward-Miami coral reef ecosystem regions.

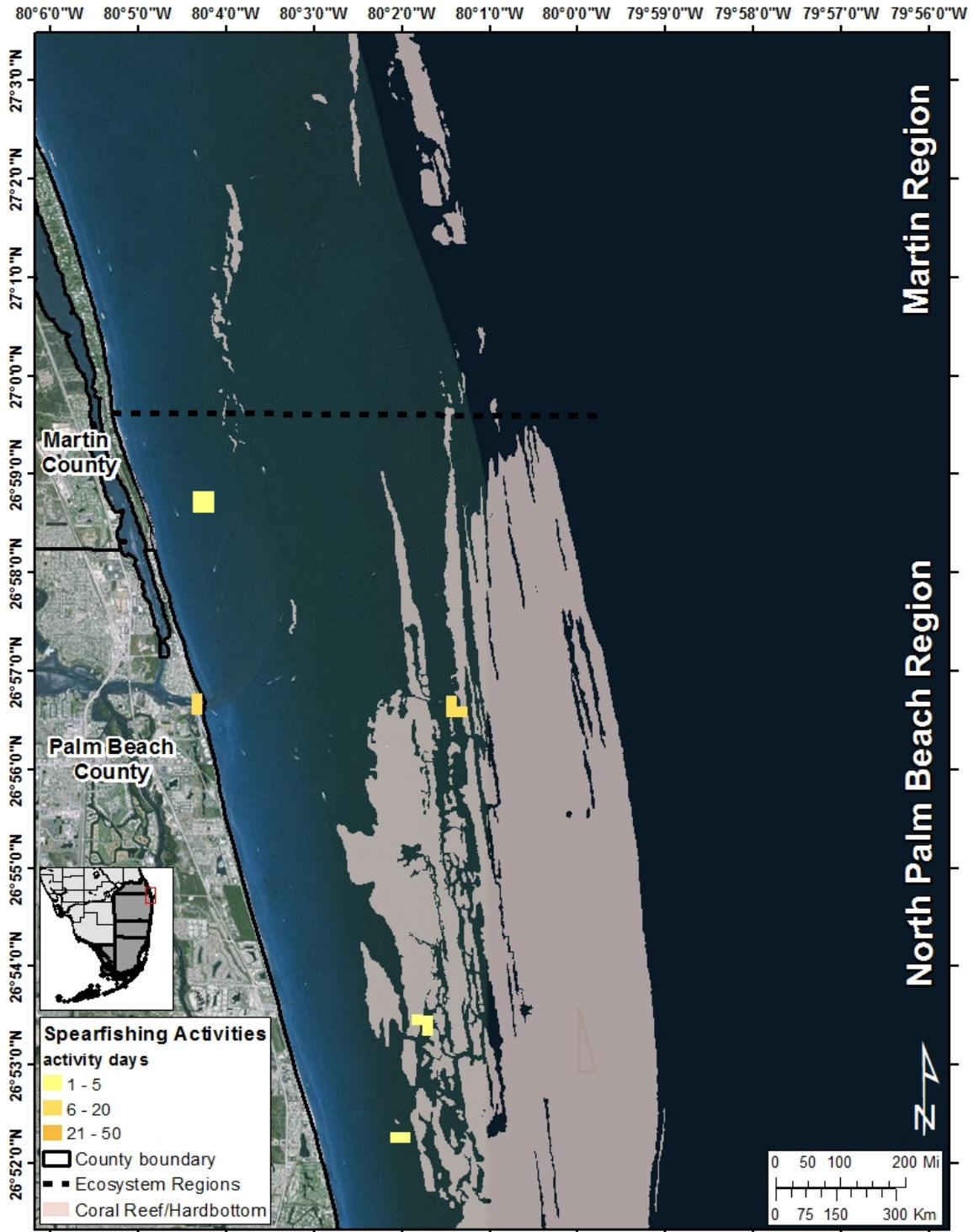


D- 5. Map of final survey results displaying the total number of activity-days per planning unit for extractive diving activities within the Broward-Miami and Biscayne coral reef ecosystem regions.

Appendix E Spearfishing activity maps.



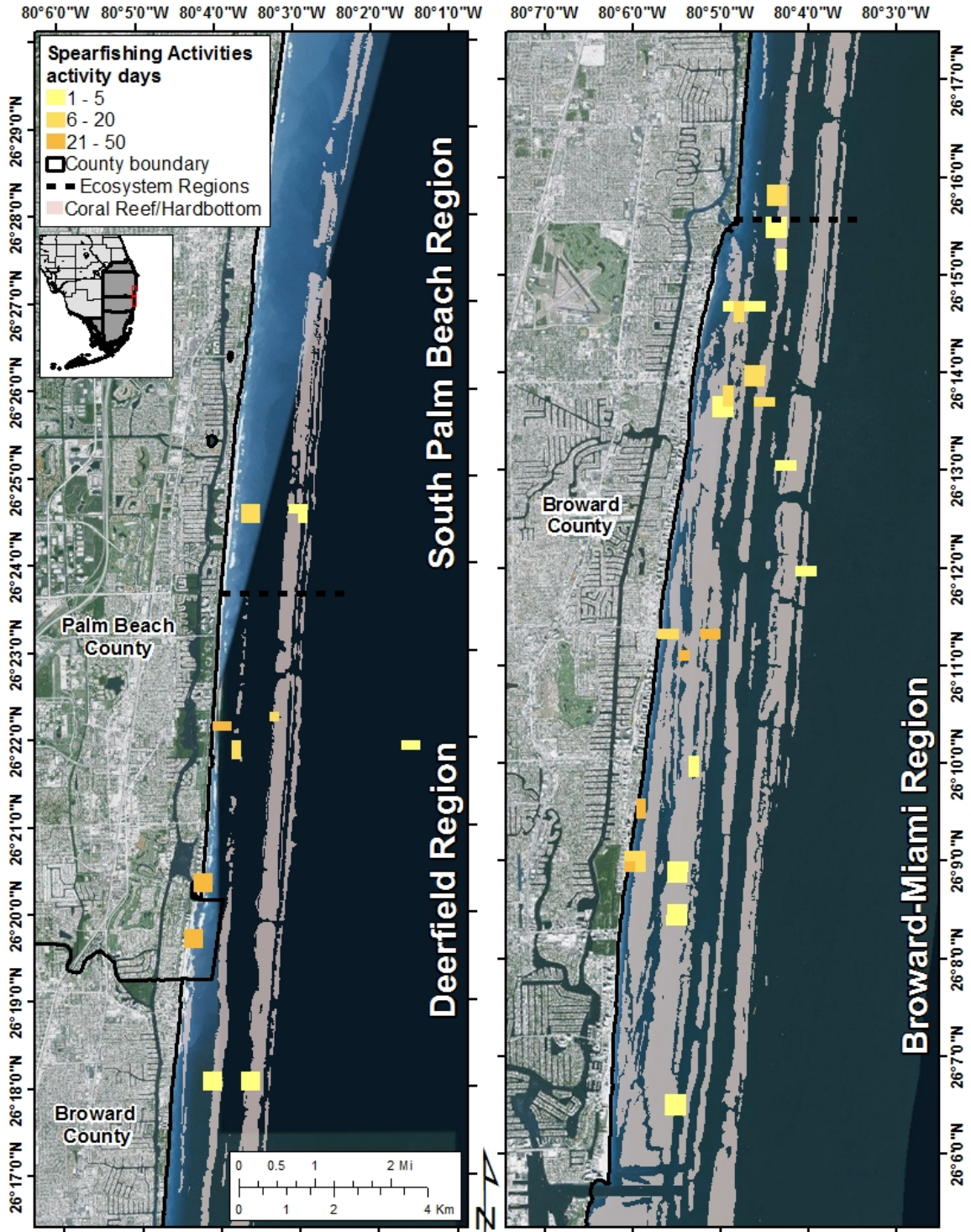
E- 1. Map of final survey results displaying the total number of activity-days per planning unit for spearfishing activities within the Martin coral reef ecosystem region.



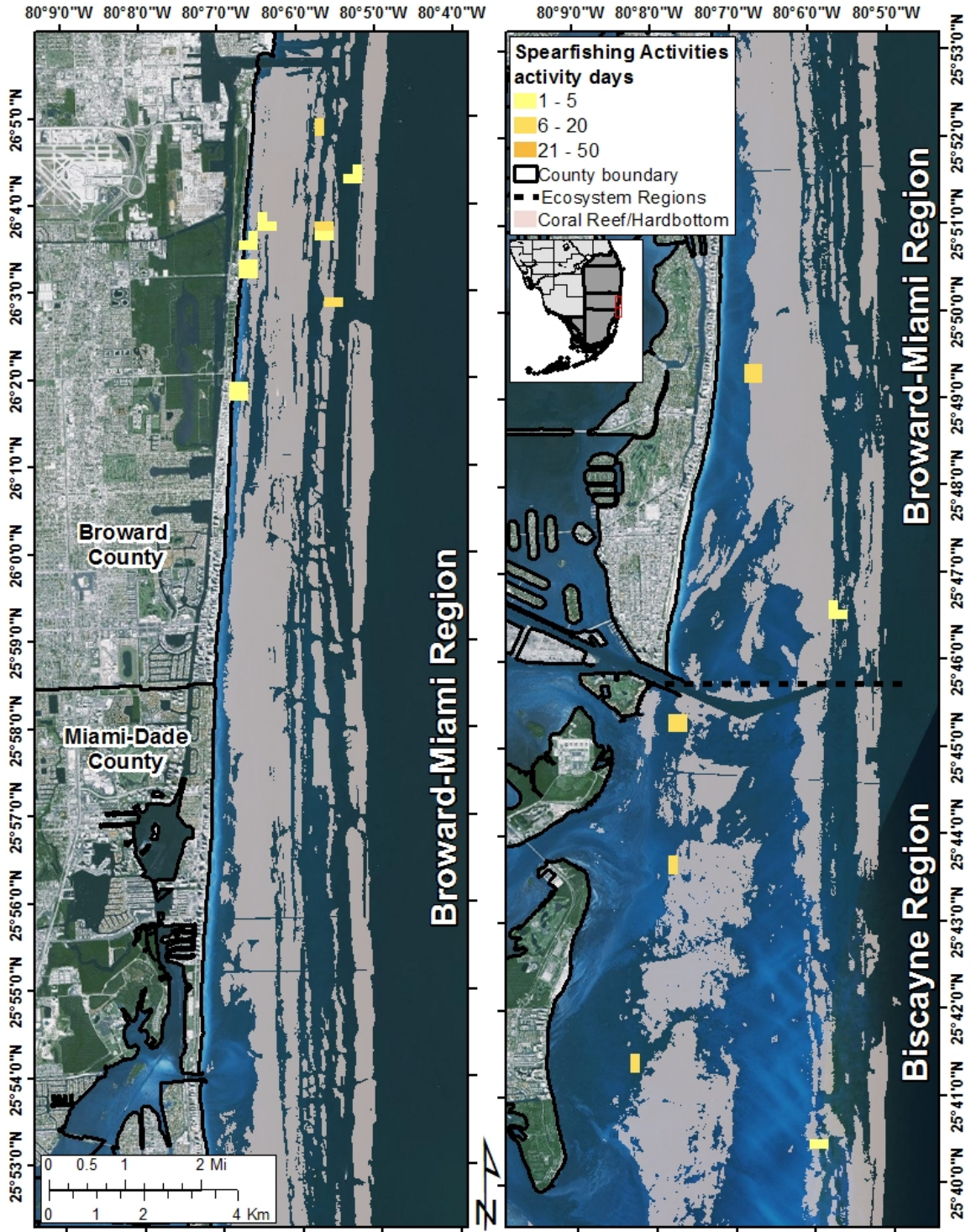
E- 2. Map of final survey results displaying the total number of activity-days per planning unit for spearfishing activities within the Martin and North Palm Beach coral reef ecosystem regions.



E- 3. Map of final survey results displaying the total number of activity-days per planning unit for spearfishing activities within the North Palm Beach and South Palm Beach coral reef ecosystem regions.

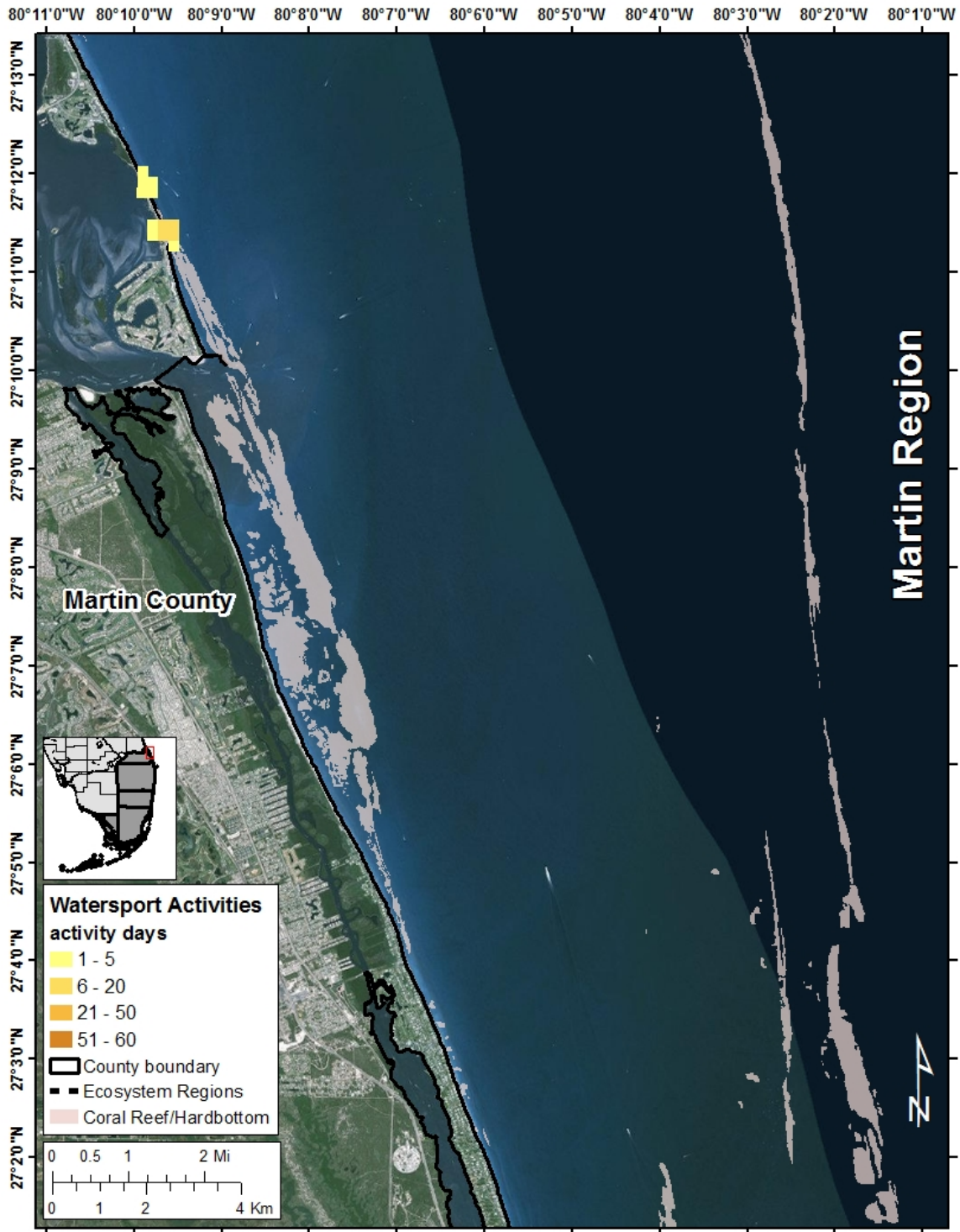


E- 4. Map of final survey results displaying the total number of activity-days per planning unit for spearfishing activities within the South Palm Beach, Deerfield, and Broward-Miami coral reef ecosystem regions.

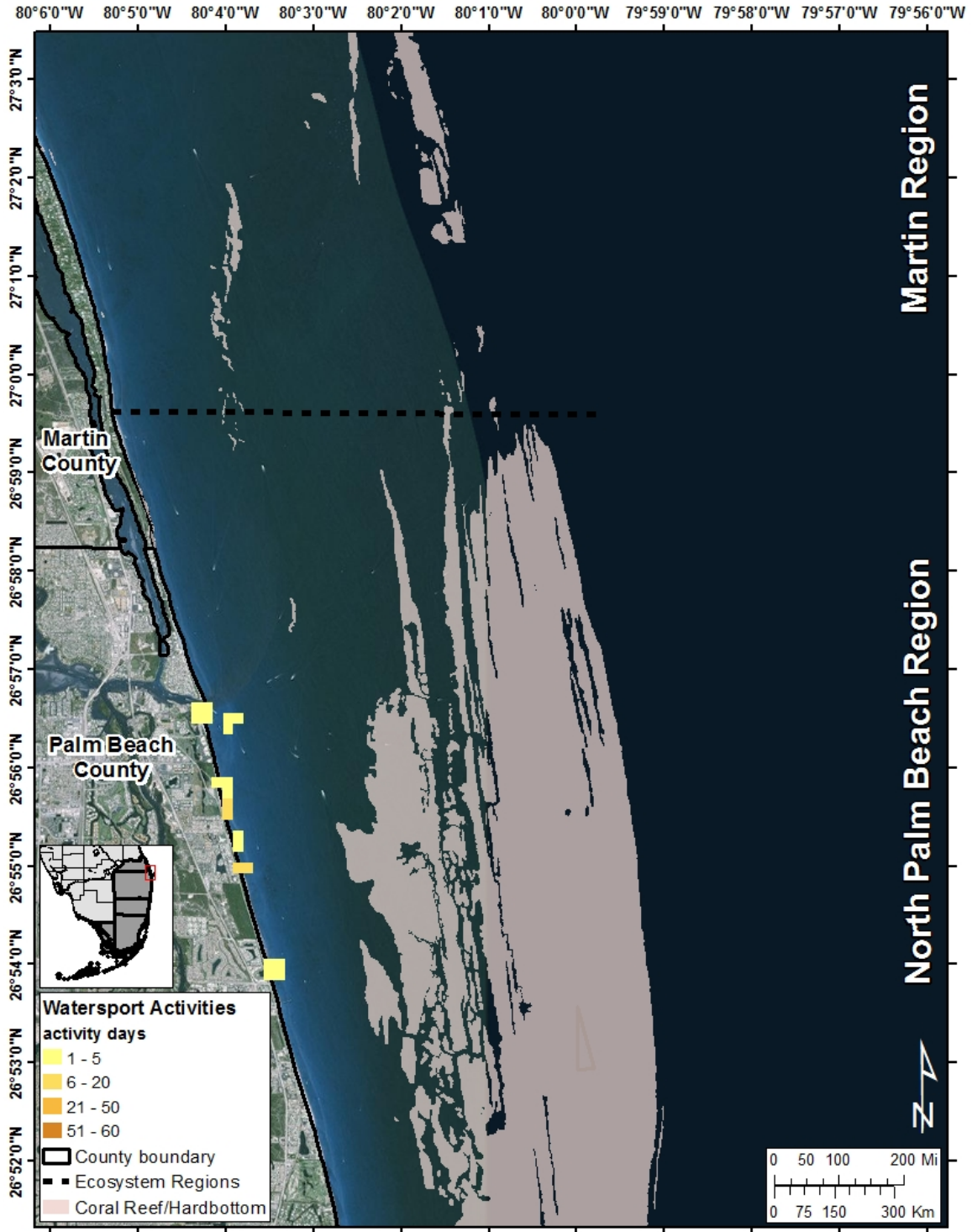


E- 5. Map of final survey results displaying the total number of activity-days per planning unit for spearfishing activities within the Broward-Miami and Biscayne coral reef ecosystem regions.

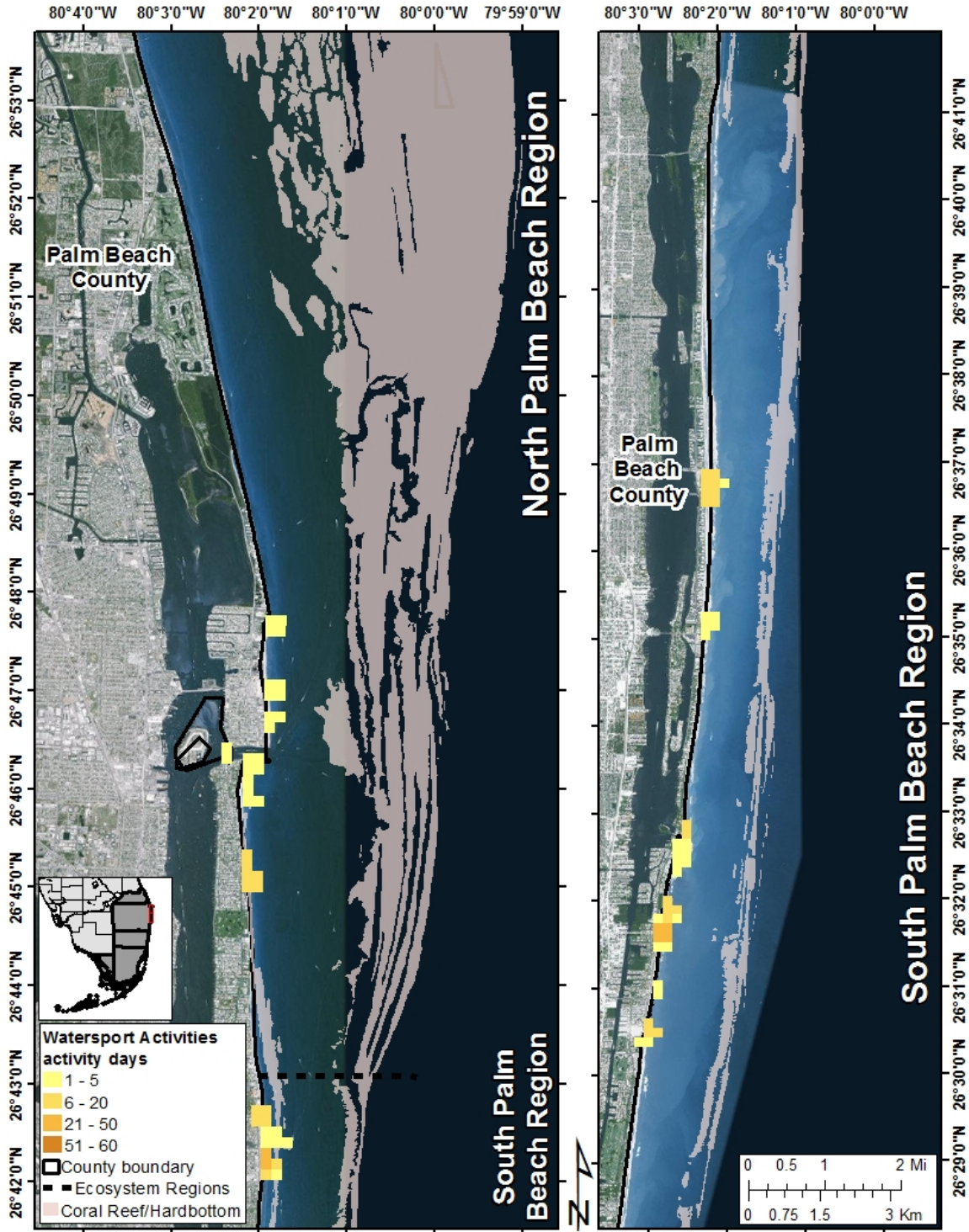
Appendix F Watersport activity maps.



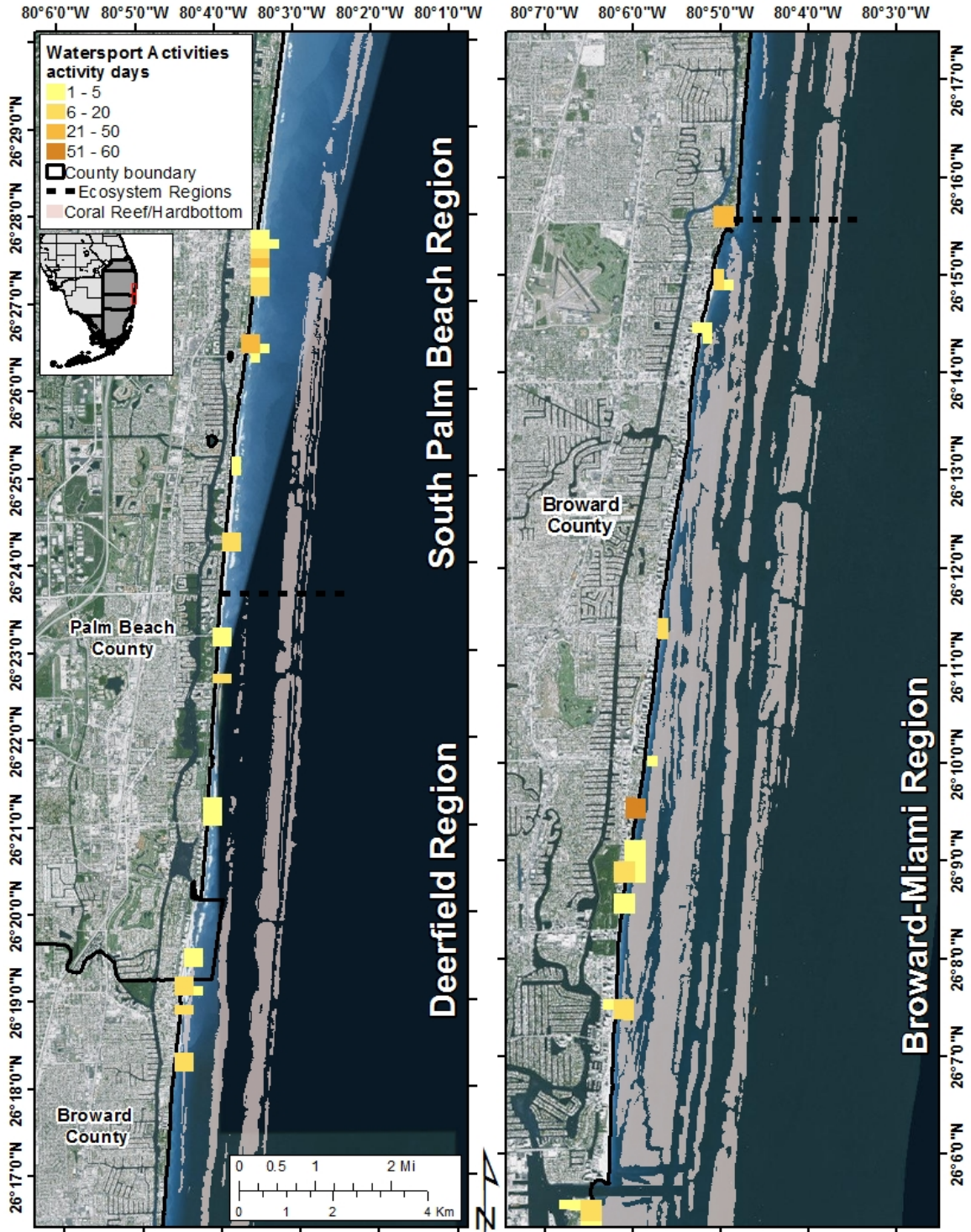
F- 1. Map of final survey results displaying the total number of activity-days per planning unit for watersport activities within the Martin coral reef ecosystem region.



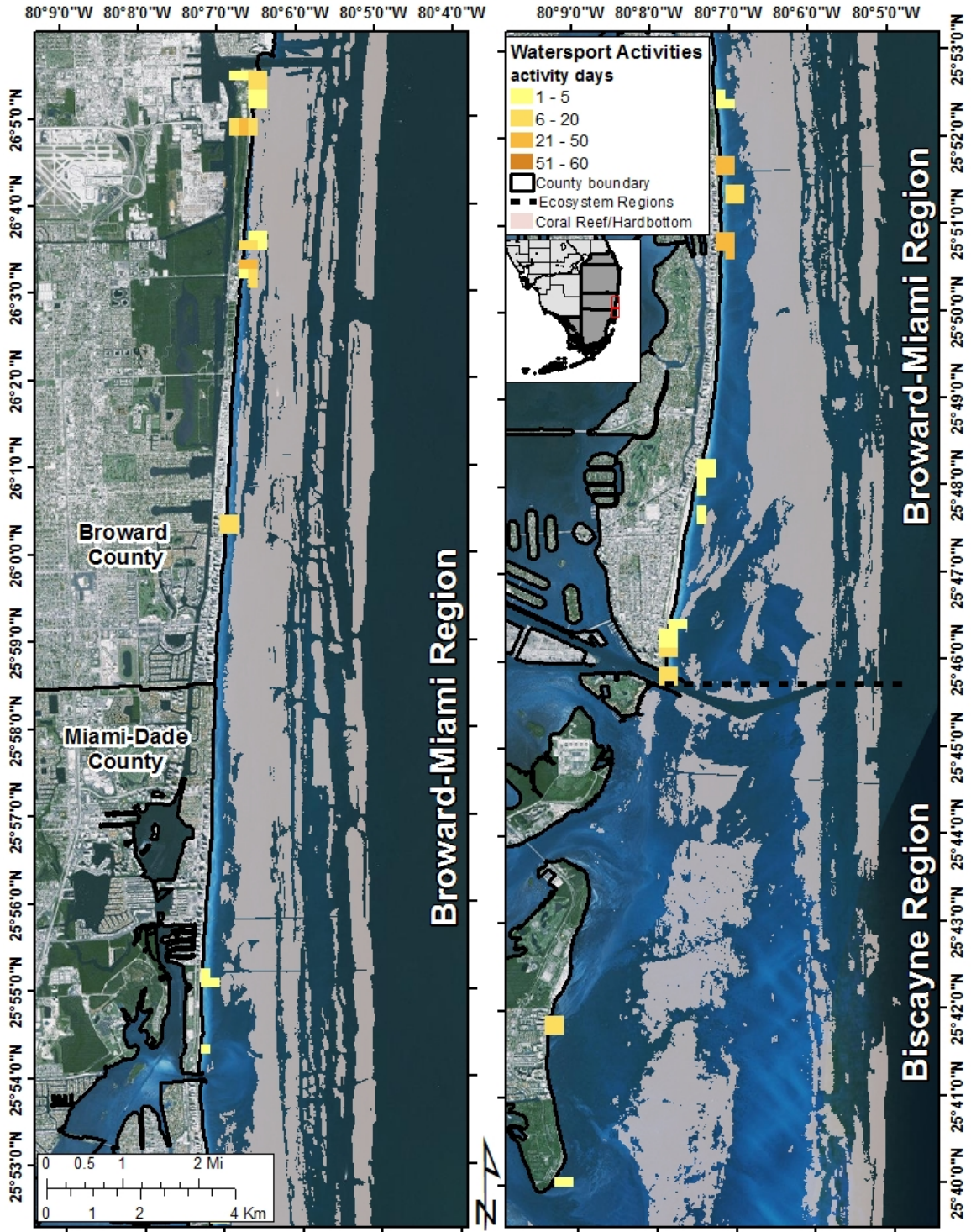
F- 2. Map of final survey results displaying the total number of activity-days per planning unit for watersport activities within the Martin and North Palm Beach coral reef ecosystem regions.



F- 3. Map of final survey results displaying the total number of activity-days per planning unit for watersport activities within the North Palm Beach and South Palm Beach coral reef ecosystem regions.

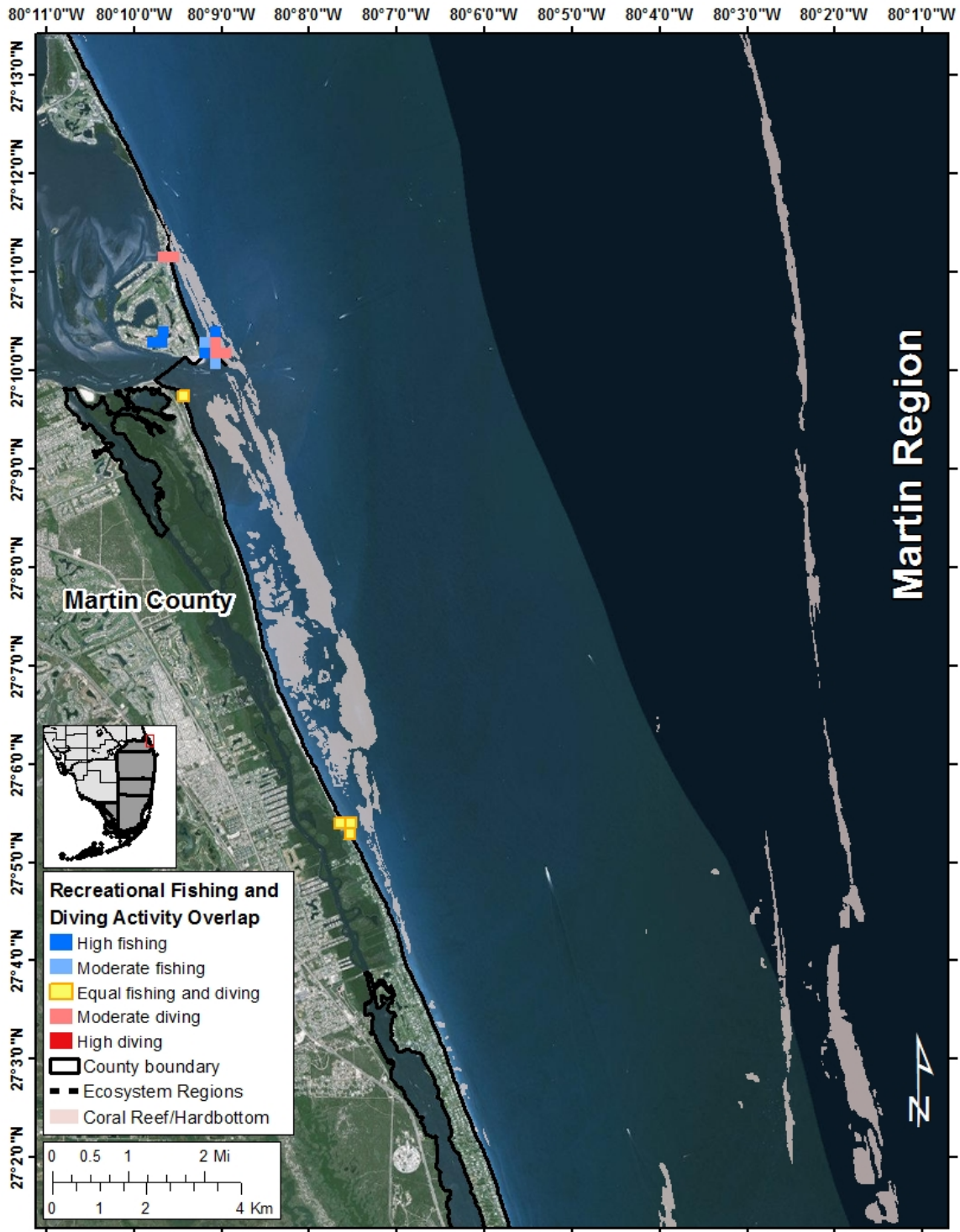


F- 4. Map of final survey results displaying the total number of activity-days per planning unit for watersport activities within the South Palm Beach, Deerfield, and Broward-Miami coral reef ecosystem regions.

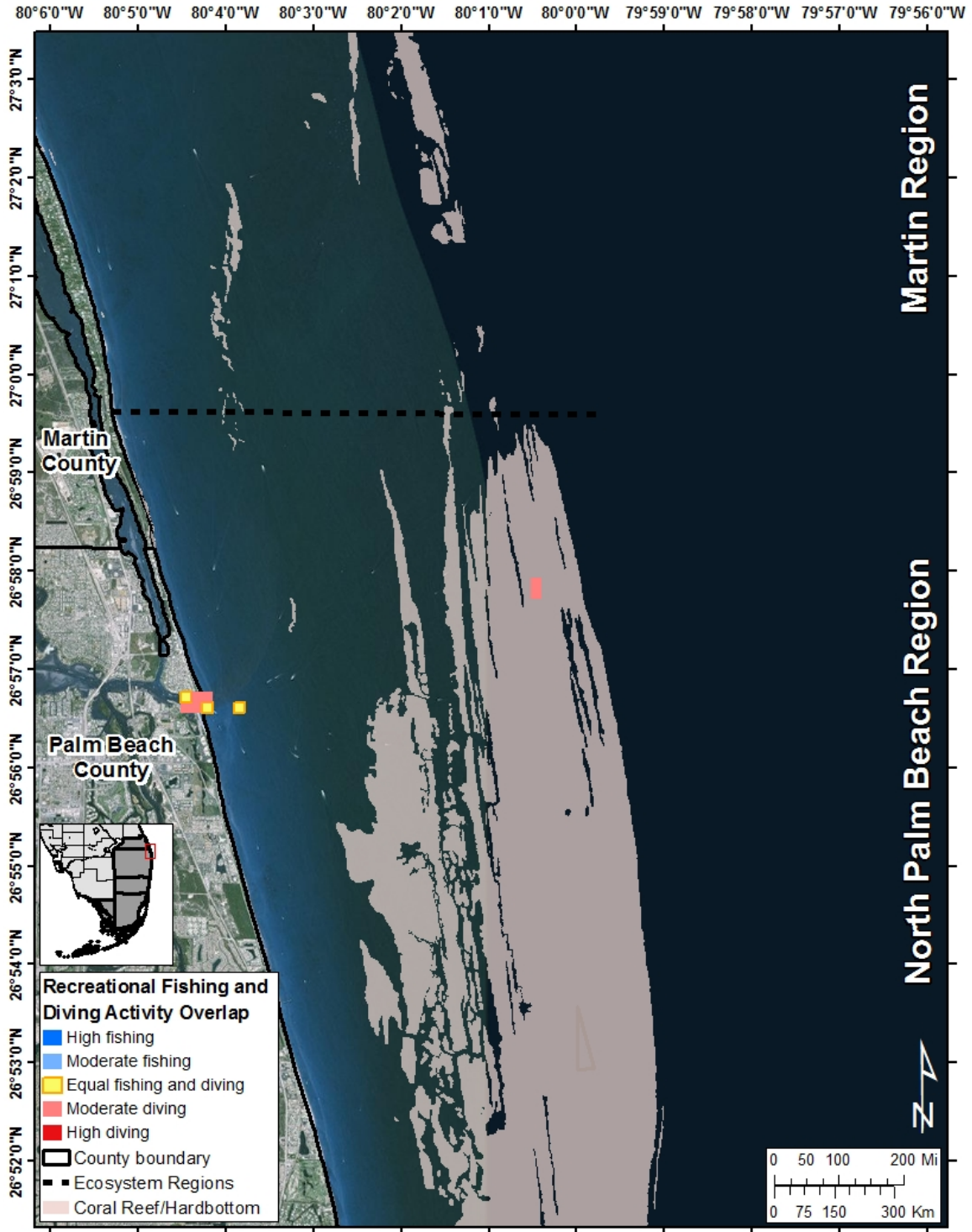


F- 5. Map of final survey results displaying the total number of activity-days per planning unit for watersport activities within the Broward-Miami and Biscayne coral reef ecosystem regions.

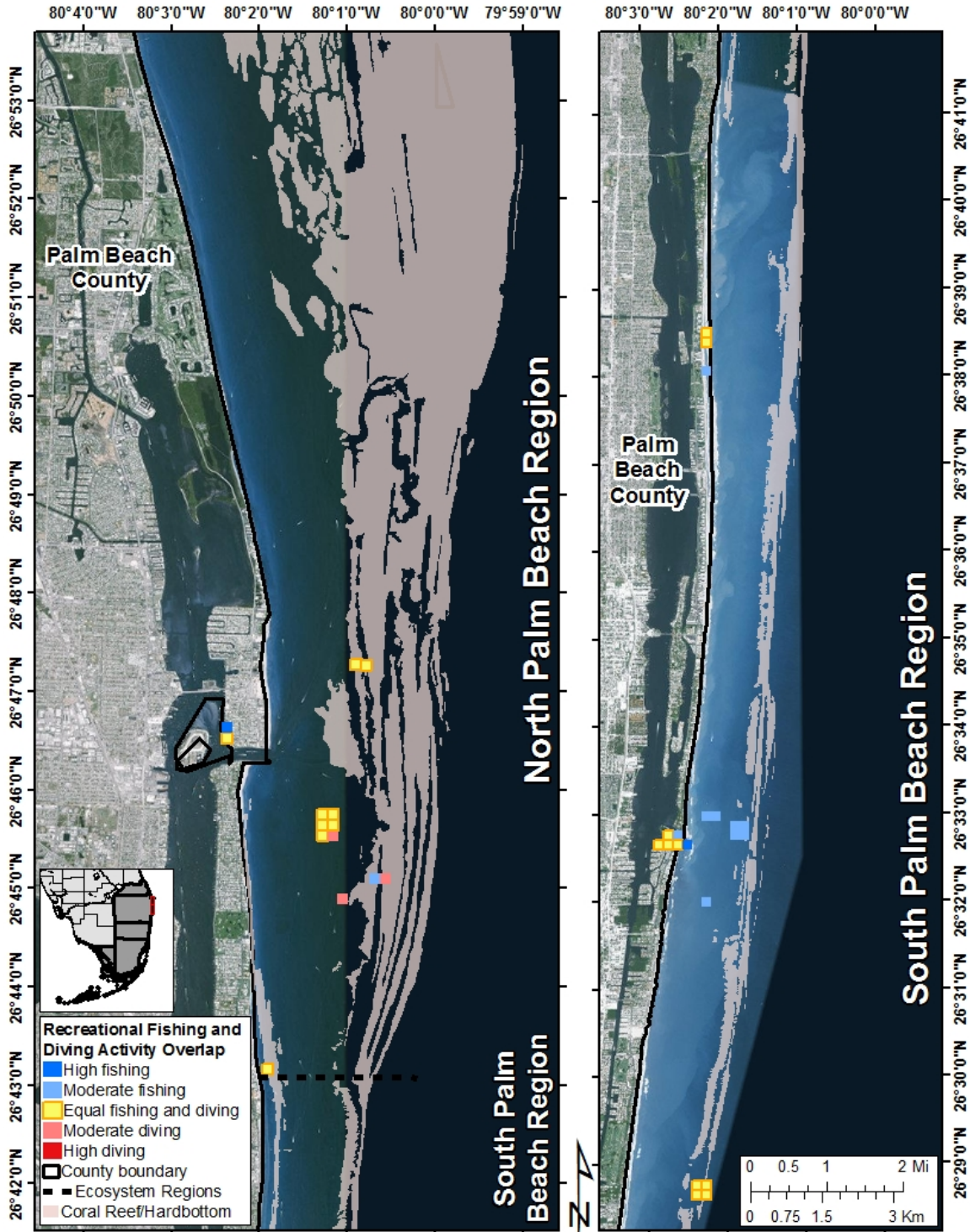
Appendix G Recreational fishing and diving use overlap maps.



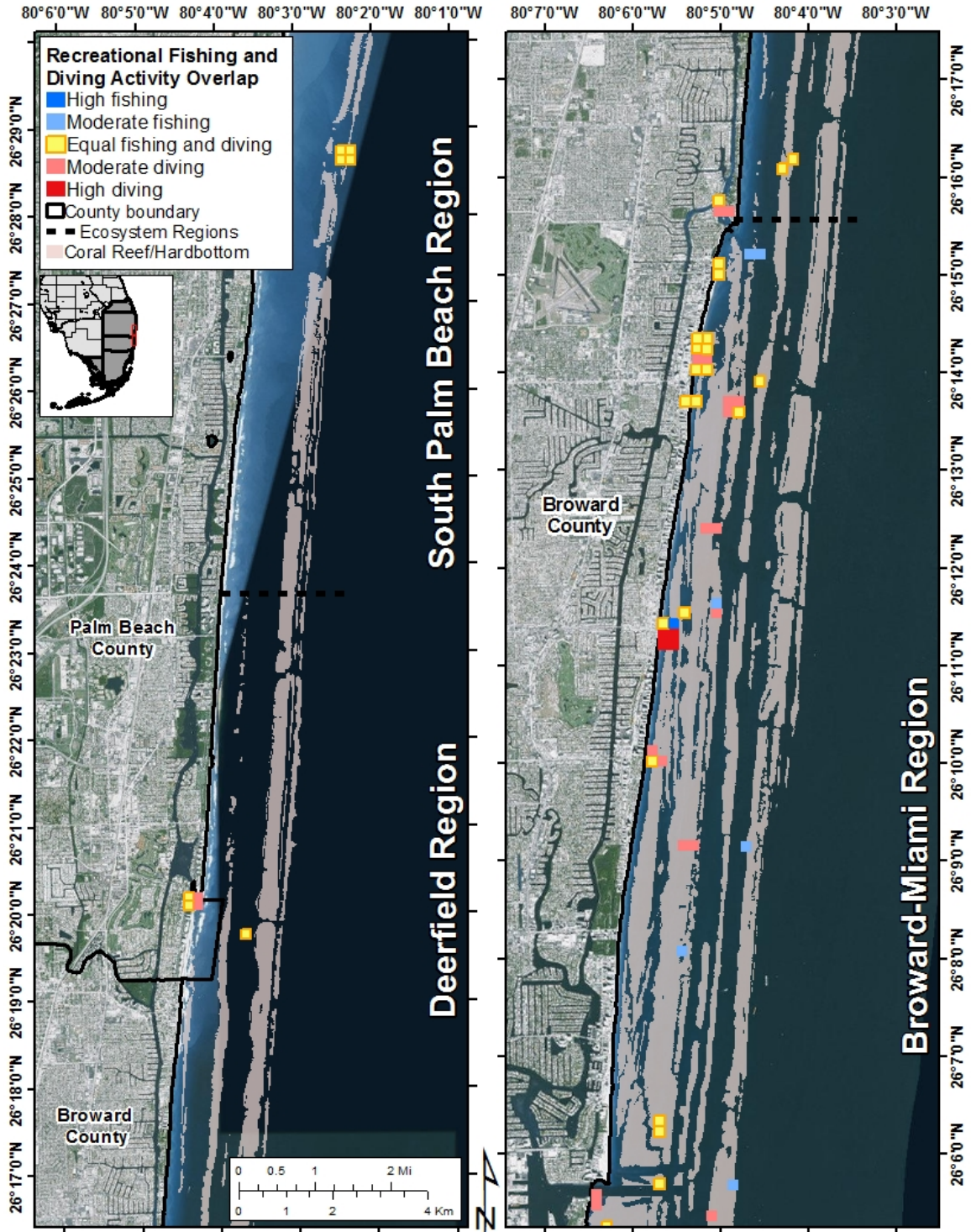
G-1. Survey results of recreational fishing and diving activity overlap in the Martin coral reef ecosystem region.



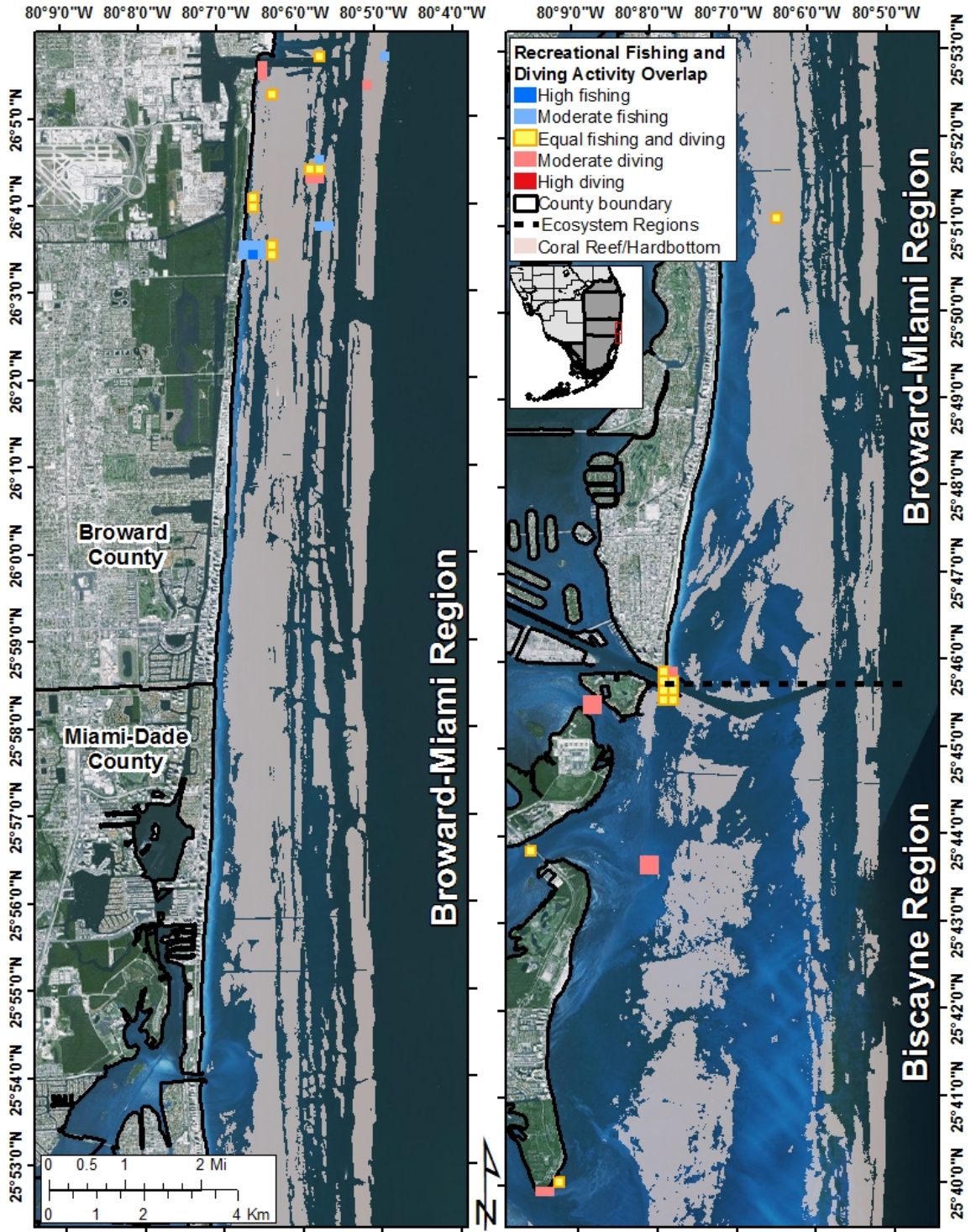
G- 2. Survey results of recreational fishing and diving activity overlap in the Martin and North Palm Beach coral reef ecosystem regions.



G- 3. Survey results of recreational fishing and diving activity overlap in the North Palm Beach and South Palm Beach coral reef ecosystem regions.



G- 4. Survey results of recreational fishing and diving activity overlap in the South Palm Beach, Deerfield, and Broward-Miami coral reef ecosystem regions.



G- 5. Survey results of recreational fishing and diving activity overlap in the Broward-Miami and Biscayne coral reef ecosystem regions.