NOAA Technical Memorandum NMFS-SEFSC-578

SOUTH FLORIDA SPORTFISHING GEODATABASE (SFSGEO) DESIGN DOCUMENT

By

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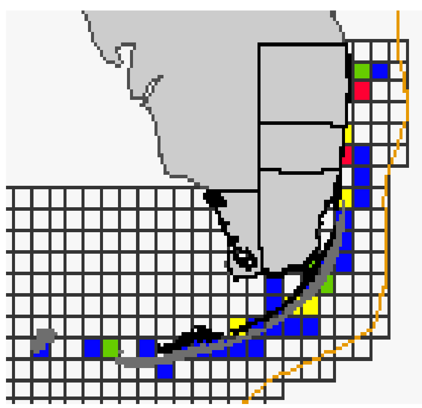

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1. Overview

Information on fishing locations is essential for effective socioeconomic analysis of spatial fishery management policies such as marine protected areas. Furthermore, information on the spatial distribution of fishing effort is required to adequately assess the impact of fishing on coral reef habitat and related ecosystems. Detailed information on fishing locations has not been consistently collected for recreational fisheries in the U.S. There are, however, a number of independent data sources that, taken together, can provide a more complete picture of the distribution of fishing effort. This document describes a database tool that integrates datasets related to sportfishing in South Florida to enable the exploration of spatial and temporal aspects of angling effort in the region.

The National Marine Fisheries Service Marine Recreational Fishing Statistics Survey (MRFSS), the Southeast Headboat Survey (HBS), the Southeast Fishery Science Center (SEFSC) Aerial Survey, and the Biscayne National Park (BNP) Recreational Creel Survey have been integrated into the South Florida Sportfishing Geodatabase (SFSGeo). Phase one of the SFSGeo focuses on the fishing effort location information in the database.[2] This version of the SFSGeo measures the monthly and annual counts of sportfishing vessels observed in ten minute square aggregated fishing areas (AFAs) off the coast of Palm Beach, Broward, Dade, and Monroe counties. The vessel counts are available for private and for-hire fishing modes from 1991 to 2003. Additional data and functionality will be incorporated into subsequent versions of the SFSGeo. The next section defines the structure and scope of the SFSGeo, with an emphasis

[2] The phase one version of the geodatabase is available at www.sefsc.noaa.gov/sfsgeo/. There is also a user guide available at the same location. Note that this version of the SFSGeo is a proof-of-concept project, primarily intended for research purposes. Caution should be exercised when attempting to use this version for policy considerations or analyses.

on the creation of common spatial units for the study area. Section three introduces the fisheries and environmental datasets used to populate the SFSGeo. The fourth section provides a summary of the final attribute data associated with the main spatial unit in the SFSGeo.

2. Spatial Structure of the Geodatabase

A geodatabase is a collection of data with functions that facilitate the storage, query, and manipulation of geographic information (MacDonald, 2001). The SFSGeo is designed to extend the spatial functionality of existing data sources on sportfishing effort in South Florida. Each of the data sources contained in the SFSGeo has a different spatial resolution. Therefore, the fundamental task in the SFSGeo design was creating a common spatial unit of sportfishing effort.

The common spatial unit for aggregate sportfishing effort in the SFSGeo is the aggregated fishing area (AFA). AFAs are square cells on a spatial grid that delineate counts of sportfishing effort. These cells form the common spatial unit that links datasets with different spatial resolutions at a common spatial level. Details on the choice of the specific size and scope of the AFAs used in this project are discussed in the next section. In what follows we document the general procedure created to assign an AFA to each record of sportfishing activity in the SFSGeo. The procedure involves two additional geographic definitions: estimated fishing location (EFL) and estimated fishing area (EFA). Figure 1 depicts the general relationship between these three geographic definitions.

The EFL represents the finest spatial resolution for any given dataset and is specified as a single point indicating the exact location of a sportfishing vessel. EFL points are represented by latitude and longitude coordinates. For some records, the EFL has to be calculated using other information in the data record. As part of this calculation the EFA is calculated first to determine the general area where a vessel fished. Once an EFA has been estimated, the missing EFL is given as the center point of the EFA. Table 1 of this report summarizes the processing steps necessary to reach a common AFA for each dataset. The detailed processing steps for each dataset are described in section three of this report.

The EFL for each record was used to assign the record to the AFA in which it was located. Note that the overlap of the EFA and AFA definitions in Figure 1 implies that the EFA size could be larger than the AFA. However, when the central point of the EFA is used as the EFL, sportfishing for these records is assumed to be contained within the AFA. The overall process of assigning an AFA to each data record is summarized in the algorithm outlined in Figure 2.

The final SFSGeo data tables summarize the vessel counts by year, month, mode (for-hire or private), and AFA. A field with the relative number of vessels in each AFA by year and mode was also created to display on vessel density maps. The relative vessel density in AFA *i* in mode *m* during year *t* was calculated as:

(1)
$$d_{m,t,i} = \frac{c_{m,t,i}}{\sum_{i=1}^{N_{m,t}} c_{m,t,i}}$$

where $c_{m,i,t}$ is the number of vessels observed in AFA *i* using mode *m* during year *t*, and $N_{m,t}$ is the total number of AFA cells in the study area grid with records for year *t* and mode *m*. Additional fields were created to report the average, median, minimum, maximum, and standard deviation of monthly vessel count for each year and mode combination.

3. Study Area and Data Description

The SFSGeo covers the southeast Florida region, including the area within the U.S. Exclusive Economic Zone off of the counties of Palm Beach, Broward, Dade, and Monroe (Figure 3). Based on a preliminary review of the data sources, AFAs were defined as ten by ten minute cells. The AFA grid for the South Florida study area is shown in Figure 3. All observations from the four South Florida sportfishing datasets were assigned to an AFA grid cell. This section introduces each dataset and describes the methods used to assign AFA cells.

3.1 Marine Recreational Fishing Statistics Survey

MRFSS was established in 1979 to generate estimates of recreational fishing effort and harvest in the United States.[3] The base MRFSS consists of a trip intercept interview and a random digit dial telephone survey. Charter boat captains are also interviewed via phone to collect additional information about for-hire effort. However, only information from the intercept survey is incorporated into the SFSGeo.[4] The intercept survey collects information about the number and composition of catch during personal interviews with anglers at fishing access sites such as piers, boat ramps, and marinas. Three modes of sportfishing are intercepted: shore-based, charter boat, and private boat.

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[3] See www.st.nmfs.gov/st1/recreational/index.html.
[4] This version of the SFSGeo focuses exclusively on sportfishing fishing effort defined in terms of angling parties or boats. Future versions will enable the display of MRFSS attributes such as catch and angler characteristics.

The MRFSS sampling is conducted to produce estimates of recreational fishing effort and catch that are representative at the state-level with fishing classified broadly as inshore and offshore.[5] There is no specific information about where anglers fish if they do not fish from the shore (i.e., a pier, dock, jetty, breakwater, breachway, bridge or causeway, or beach). Therefore, the private and charter boat observations in the MRFSS database required additional processing in order to link them to the common AFA grid.[6] Note that for this project we do not consider the shore-fishing records because the focus is on boat-based angling.

There were 29,578 observations corresponding to the number of boating parties sampled with the MRFSS in the study area from 1991 to 2003.[7] Of the total, 17,383 were classified as private vessels and 12,195 were classified as for-hire (charter) vessels (Table 2). An EFA, EFL, and AFA were calculated for each of these observations.

The first step in calculating the EFA was to determine the maximum travel range for each boat party. A maximum travel range *R* from the MRFSS intercept site was calculated for each private and charter fishing party interview as follows:

(2) $$R_{j,m} = \frac{r_m \cdot \left(h_j - f_j\right)}{2}$$

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[5] On the east cost inshore is defined as three miles or less from shore and offshore is greater than three miles from shore. The boundary is extended to nine miles for areas bordering Florida in the Gulf of Mexico.

[6] The MRFSS intercept data were obtained in Statistical Analysis Software (SAS) format from the Office of Science and Technology at NOAA Fisheries. The SAS database was converted to dBase files to use with ArcGIS. A MRFSS intercept site registry was also obtained from the Office of Science and Technology at NOAA Fisheries and the Atlantic States Marine Fisheries Commission. The registry has latitude-longitude coordinates for each intercept site used in the survey.

[7] The individual MRFSS interviews were aggregated into fishing parties defined as groups of anglers fishing together on the same vessel.

where h_j and f_j are the number of boating and fishing hours, respectively, for fishing party *j*, the quantity $(h - f_j)/2$ is one-way travel time (in hours) to the fishing site, and r_m is the estimated maximum vessel speed for mode *m* = (for-hire, private) of the fishing party. Maximum vessel speed was calculated using Crouch's formula for estimating speed (Gerr 2001 pp. 15-17):

$$r_m = \frac{k}{\sqrt{\frac{d_m + l_m}{p_m}}} \tag{3}$$

where d_m, l_m, and p_m are the average vessel displacement, load, and horsepower, respectively, for mode *m*, and *k* is a constant based on the type of vessel. The assumptions and calculations related to maximum vessel speed (max knots) for each mode are shown in Table 3.

Fishing hours are reported in the MRFSS intercept data, but the survey did not begin collecting boating hours until 2000 and they have never been collected for Florida or the Gulf of Mexico States. Missing observations for boat hours were calculated with the following expressions of boating hours as a function of hours fished for charter and private vessels:

$$\hat{h}_{j,charter} = \underset{(0.00201)}{1.60956} \cdot f_{j,charter} \qquad r^2 = 0.9720 \tag{4}$$

$$\hat{h}_{j,private} = \underset{(0.00182)}{1.29892} \cdot f_{j,private} \qquad r^2 = 0.9460 \tag{5}$$

where the standard errors are shown below the parameter estimates.[8] The equations were estimated via ordinary least squares (OLS) with data from the MRFSS in Georgia, South

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[8] The equations were estimated using SAS and the r^2 measures of fit are adjusted for the absence of an intercept. The regression coefficients where coded in ArcObjects using Visual Basic for Applications to predict the missing boating hours and calculate the maximum travel range for each observation.

Carolina and North Carolina from 2000 to 2003. Descriptive statistics for the MRFSS sample used in the regression are shown in Table 4.

The maximum travel range calculation was used to estimate the radius of the range of travel from the interview site. This circular area was used to create a travel range shapefile. The specific location of travel was further defined by using the general distance from shore fishing location information from the MRFSS intercept survey. One of the survey responses classified whether fishing took place up to three miles from shore, between three and ten miles from shore, or over ten miles from shore. This information was used to buffer the original travel range shapefile. In other words, the final EFA polygons were calculated as the intersection of the maximum travel range and the reported fishing area (inshore or offshore). The centroid of the EFA was used as the EFL and then assigned to the containing AFA. Figure 4 shows the final EFA polygons and EFL points calculated for the MRFSS data in the study area. The buffers calculated using the estimated maximum travel range for each MRFSS observation are shown as the green shaded polygons. These buffers are cut by the land in grey and by the ten mile buffer shown in yellow if the MRFSS trip record indicated fishing within the EEZ. The cut buffers result in the EFA polygons that represent the intersection of the travel range and ten mile buffers. The centroid of each EFA polygon is shown as EFL points in the Figure.

3.2 NMFS Southeast Headboat Survey

Headboats are defined as vessels that carry recreational fishing passengers for a per person fee. Since 1972, the Southeast HBS has collected catch and effort data in the southeast using trip reports or logs filled out by the headboat vessel operators (Dixon and Huntsman

1986).[9] The logbooks are collected dockside every other week by port agents, or are mailed in during off-seasons. The onsite collection is one way that the information is verified. Additional verification is made by onsite surveys that are done at the end of trips to gather sampling data to compare to the logbooks. The information collected in the logbooks includes boat permit number, date and time of trip, the number of anglers onboard, the distribution of catch, and the fishing location. For the SFSGeo, each trip was considered only once, regardless of the number of passengers on the trip. There were 64,388 such boat-trip observations from 1991 to 2003 incorporated into the SFSGeo as for-hire records (Table 2).

There were 54,052 head boat trips that recorded their fishing location using the 10x10 minute HBS grid as well as the HBS fishing area codes. The remaining 10,336 head boat trips only recorded the HBS fishing area code.[10] In this context, the cells on the HBS grid are the AFAs and the HBS fishing areas are the EFAs. Note that the 10x10 minute HBS grid is the same grid shown in Figure 3, however, the grid cells are different (smaller) than the HBS fishing areas. The HBS fishing areas are described in the HBS materials, but the absolute boundaries of each area were not explicitly defined. In order to define boundaries that would determine the EFA for a particular data point, we created area boundaries based on the distribution of trips that had both a HBS grid cell and fishing area recorded. In other words, the distribution of the 54,052 records with HBS grid cells and fishing area codes was used to determine the extent of a particular

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[9] The HBS data was obtained from the SEFSC Beaufort Laboratory and converted to dBase format for use in ArcGIS.

[10] There were 14 records that recorded fishing in a distance that was farther than feasible from the reported launch site and 54 records that recorded fishing on land. These records were considered invalid and the HBS fishing area was used to define the fishing location. Note that we also did not consider trips that launched from the study area, but recorded a latitude/longitude outside the study area.

fishing area, with the US EEZ as the outer boundary. Figure 5 demonstrates the clustering of the HBS grid cell center points and the EEZ border defining the boundaries for the HBS fishing areas in the Southeastern U.S. The centroid within each of these boundaries was used to define the EFLs for the 10,336 records without HBS grid cell data. The 54,052 trips that recorded particular HBS grid cell the EFL is defined as the centroid of the HBS (AFA) grid cell.

3.3 SEFSC Aerial Survey

Since 1992, periodic aerial surveys of the near-shore waters of the southeast Florida coast were conducted by SEFSC with the support of the U.S. Coast Guard Air Station in Miami. The surveys gathered spatial information on the position of marine animals and water birds along the southeast coast and vessel usage patterns in Biscayne National Park (BNP) and the Florida Keys National Marine Sanctuary (FKNMS).

For the aerial data a mobile GIS recording system collects real-time in-flight data on biological observations and marine vessel usage including position (latitude and longitude), time of sighting, number of individuals (animals or vessels), characterization, and behavior or disposition. These data are spatially robust because they provide instantaneous counts of boats engaged in fishing and their location from GPS. Boats engaged in recreational fishing are identified by visually verifying that there are fishing rods in the water and no commercial markings. The counts are adjusted for duplicate observations of boats by roving boat-access, shore roving-creel, and access-point surveys in the field.

The SEFSC Aerial Survey database was designed to capture and manage the information collected by the various surveys. Tables in the database store information on individual surveys, personnel, observations, effort, weather, trailers, and related comments. For the preliminary

SFSGeo only the effort and spatial information were further processed from the database into the geodatabase for mapping and analysis.

An individual record in the SEFSC Aerial Survey consisted of a single boat observation. Both private and charter boats were classified in this survey. The SEFSC Aerial Survey contained an individual latitude and longitude for each of the 37,409 observations from 1992 to 2003, with the exclusion of 2002 (Table 2). Of these observations, 7,053 were from for-hire vessels and 30,356 were from private vessels. These spatial points served as the EFLs and were directly linked to the corresponding AFA grid cell. An example of the distribution of vessels recorded in a single survey is shown in Figure 6.

3.4 BNP Recreational Creel Surveys

Biscayne National Park (BNP) is located in southeastern Florida just south of Miami. It has a variety of subtropical marine habitats and is known for its coral reef ecosystem and natural resources including a thriving recreational fishery. Since 1976, recreational creel surveys of anglers have been conducted in the BNP and surrounding waters (Harper *et al*., 2000), and are designed to provide estimates of recreational harvest and fishing effort.

Effort data are collected in the BNP Recreational Creel Survey (RCS) with a fishing party trip interview, and biological data are collected by sampling landings at the conclusion of a recreational fishing trip. Anglers are also asked to indicate where they fished based on a map showing zones used to partition BNP and the surrounding waters (Figure 7). For this version of the SFSGeo only the effort and spatial information were further processed from the database into the geodatabase for mapping and analysis. Specific effort data gathered include trip date, duration, anglers per vessel, hours fished, target species, and trip origin. These map zones were considered the EFAs in the preparation of the BNP RCS data for the SFSGeo. The EFL for each record was calculated as the centroid of the corresponding BNP RCS fishing zone and then assigned the containing AFA grid cell. The SFSGeo contains 4,800 BNP RCS records of private vessel trips collected from August 1991 to January 1999 (Table 2). There are no for-hire trips identified in the BNP RCS data.

3.5 Habitat and Bathymetry Data

Layers of bottom substrate from Key Biscayne, Florida south to Key West, Florida, as interpreted from aerial photographic surveys, were provided by the Florida Marine Research Institute (FMRI). Data for the study area north of Key Biscayne, Florida were not available at the time of the analysis. Bottom types in the FMRI data were divided into four main categories: coral reef, seagrass, hardbottom, and sand/rock substrates; and 24 subcategories including sparse seagrass and patch reef. These layers are mapped by ecologists at FMRI by outlining the boundaries of specific habitat types interpreted from the color patterns on the aerial photographs. These included the patch reef and platform margin reef substrates. An application was developed that created an intersection between the habitat data and the AFA grid resulting in the identification of grid cells with coral reef habitat. In addition, the area of reef habitat within each grid cell was quantified in square kilometers. This was used to determine the percent of the grid cell with coral reef habitat. The bathymetry isobaths layer was derived from digital elevation models using the best available soundings information. The depths range from 0 to 2500m in 500m intervals. For this version of the SFSGeo, only the bathymetries relating to coral reef were included in the geodatabase.

4. Summary of Agregated Fishing Area Attributes in the SFSGeo

The data tables containing the attribute information used to create the aggregated database are stored in an Oracle relational database management system. There is one table for each year and mode combination. The fields defining the attributes for each AFA record stored in each table are shown in Table 5.

The link between all tables is the GRID_ID that defines the unique AFA grid id. Each AFA GRID_ID is associated with an x- and a y-coordinate (X_COORD and Y_COORD) representing the center longitude and latitude of the AFA. The GEOMETRY field contains the Oracle SDO_GEOMETRY object that represents the AFA polygon.

All information describing the vessel counts is summarized by month for a given YEAR and MODE. MODE is either private boat or for-hire boat, depending on the nature of the trips summarized in the record. The summary statistics for each AFA/YEAR/MODE combination are based on <MONTH> CNT number of interviews/observations from the datasets described in Section 3.

<MONTH> SUM is the sum of the boats observed in the AFA during the month of <MONTH> for the given year and mode combination. <MONTH> MIN is the minimum number of boats observed in <MONTH> of the given year and mode. <MONTH> MAX is the maximum number of boats observed in <MONTH> of the given year and mode. <MONTH> STD is the standard deviation of the number of boats observed in <MONTH> of the given year and mode. <MONTH> MEDIAN is the median number of boats observed in <MONTH> of the given year and mode. The SUMYR and PERCENTYR fields describe the total number of boats for the year and the percentage of the total count, respectively, for the given year and mode.

There is also a field (NORMALMAX) that contains the annual vessel count divided by the count of vessels in the AFA with the largest number of vessels recored for that year and mode. AVGYR, MINYR, MAXYR, MEDIANYR, and STDYR are fields that contain the monthly average, monthly minimum, monthly maximum, monthly median, and monthly standard deviation, respectively, for the AFA in the given year and mode.

5. Project Summary and Extensions

This report described the design and construction of the SFSGeo database tool. The SFSGeo is designed to integrate datasets related to sportfishing in South Florida to enable the exploration of spatial and temporal aspects of angling effort in the region. It is intended to fill a gap in information on fishing locations. Such information is necessary for effective analysis of spatial fishery management policies and the assessment of the impact of fishing on coral reef habitat and related ecosystems.

The Phase of the SFSGeo development covered in this report focuses on the fishing effort location information on the monthly and annual counts of sportfishing vessels. Location information is summarized for private and for-hire sportfishing in ten minute square aggregated fishing areas off the coast of Palm Beach, Broward, Dade, and Monroe counties from 1991 to 2003. Additional data and functionality can be incorporated into subsequent versions of the SFSGeo. For example, most of the sportfishing records in SFSGeo have information on catch and harvest. This information could also be summarized and displayed on the fishing grid in the study area. In addition, the general framework and design procedure described in this report could be used to generate spatial information on sportfishing effort and harvest in other areas covered by the available datasets.

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Table 1. Processing Steps for each Dataset to Reach a Common Aggregated Fishing Area

	Estimated Fishing Area	Estimated Fishing Location	Aggregated Fishing Area
Marine Recreational Fishing Statistical Survey	Calculated	Calculated	Calculated
Southeast Headboat Survey	Survey Map	Calculated Latitude and Longitude	Calculated
Southeast Fishery Science Center Aerial Survey	N/A	Latitude and Longitude	Calculated
Biscayne National Park Recreation Creel Survey	Survey Map	Calculated	Calculated

Table 2. Number of Records per Dataset by Mode

Mode	Marine Recreational Fishing Statistical Survey	Southeast Headboat Survey	Southeast Fishery Science Center Aerial Survey	Biscayne National Park Recreational Creel Survey
For-hire	12,195	64,388	7,053	0
Private	17,383	0	30,356	4,800
Total	29,578	64,388	37,409	4,800

Table 3. Estimated Average Maximum Vessel Speed by Mode in Florida

Mode	Length	HP, p_m	k	Disp. (lbs), d_m	Max Pass.	Weight/ person (lbs)	Load (lbs), l_m	Max Knots, r_m	Source
Private	22.24	200.58	150	4000	4	175	700	31.0	Milon(1988), Table 1*
For-hire	34.4	421.91	150	20000	8.44	175	1477	21.0	Holland et al. (1999), Tables 4.2,4.7, and 4.27

Notes: The *k* value of 150 is a constant for average runabouts, cruisers, and passenger vessels. See, for example, pages 15 through 17 in Gerr (1989). *The maximum number of passengers is not taken from the Milon study. This is an educated guess.

Table 4. Descriptive Statistics for Boat Hours and Hours Fished

	Boat Hours		Hours Fished	
	Charter	Private	Charter	Private
Mean	8.31	5.53	5.09	4.07
Std Dev	2.22	2.06	1.38	1.74
Minimum	0.50	0.50	0.50	0.50
Maximum	23.50	23.50	16.00	21.50
Observations	18,503	29,232	18,503	29,232

Source: The MRFSS from NC, SC, and GA for the hook and line gear from 2000 to 2003. Only trips less than 24 hours are considered and missing observations for boat hours and hours fished have been deleted.

Table 5. Effort Attribute Table Field Definitions

Field	Description
GRID_ID	The unique identifier for each aggregated fishing area (AFA) grid cell.
X_COORD	The latitude ordinate of the AFA.
Y_COORD	The longitude ordinate of the AFA.
GEOMETRY	The Oracle SDO_GEOMETRY object that represents the AFA polygon.
MODE	The mode (for-hire or private boat) of the fishing trips in the AFA.
YEAR	The year of the fishing trips in the AFA.
<MONTH>SUM	The total number of vessels observed in the AFA in <MONTH>.
<MONTH>CNT	The number of unique observations and/or interviews in <MONTH>.
<MONTH>AVG	The average number of vessels in the AFA in <MONTH>.
<MONTH>MIN	The minimum number of vessels observed in the AFA in <MONTH>.
<MONTH>MAX	The maximum number of vessels observed in the AFA in <MONTH>.
<MONTH>STD	The standard deviation of the number of vessels observed in the AFA in <MONTH>.
<MONTH>MEDIAN	The median number of vessels observed in the AFA in <MONTH>.
SUMYR	Total number of vessels observed in the AFA for the given year and mode.
PERCENTYR	The percentage of the vessels observed in the AFA related to the total number of vessels observed in the study area for the given year and mode.
NORMALMAX	Total number of vessels observed in the AFA divided by the count of vessels in the AFA with the largest number of vessels recorded for the given year and mode.
AVGYR	The monthly average of vessels observed in the AFA for the given year and mode.
MINYR	The monthly minimum number of vessels observed in the AFA for the given year and mode.
MAXYR	The monthly maximum number of vessels observed in the AFA for the given year and mode.
MEDIANYR	The monthly median number of vessels observed in the AFA for the given year and mode.
STDYR	The monthly standard deviation of the number of vessels observed in the AFA for the given year and mode.

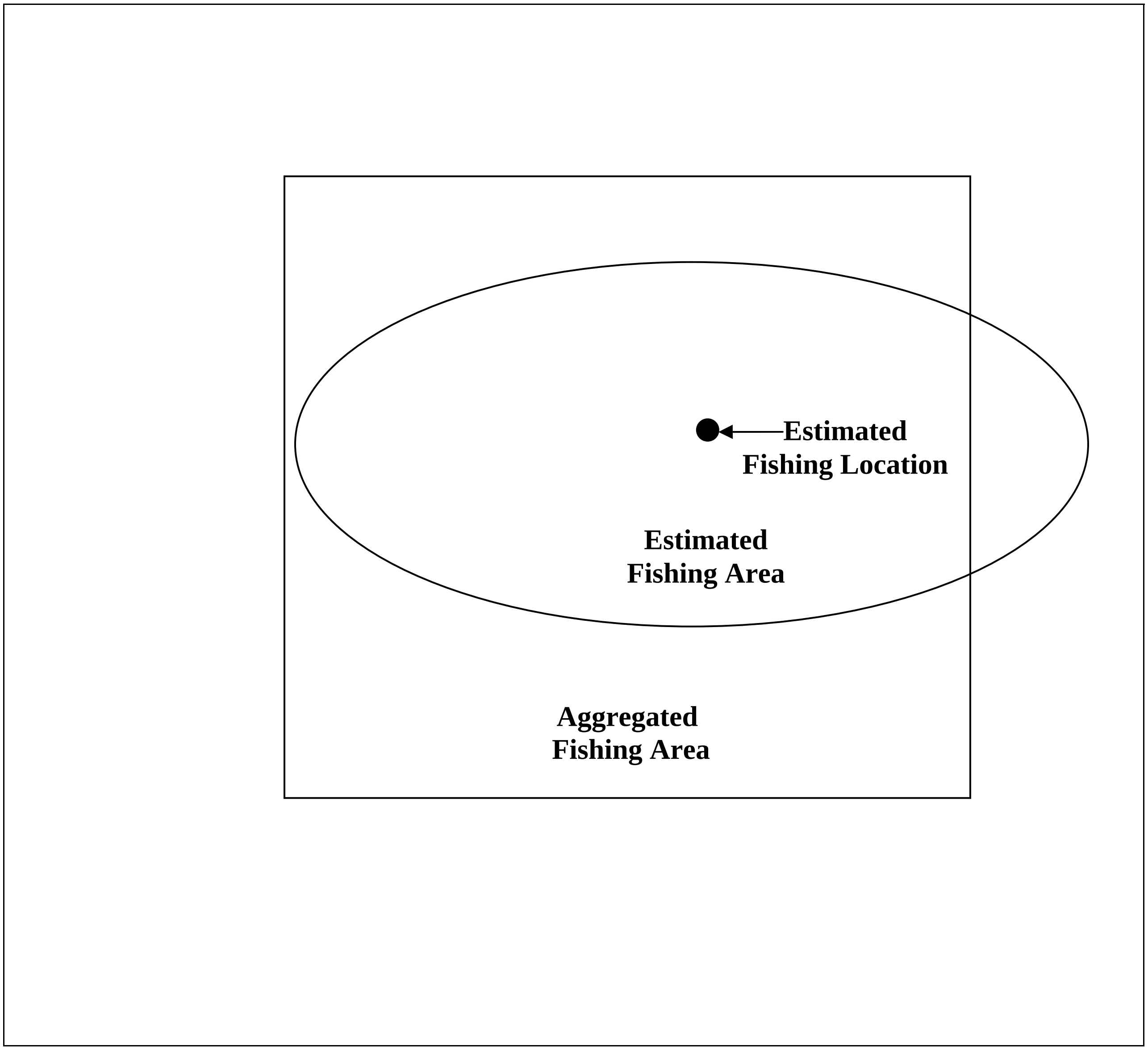

Figure 1. Geographic Definitions of Sportfishing Locations

```
Do over all datasets;
    Do over all observations;
        If observation has latitude-longitude, then set EFL to coordinates
        Otherwise do;
            Calculate the EFA;
            Set EFL to the central point of the EFA;
        End do;
        Set AFA containing the EFL;
    End do;
End do;
```

Figure 2. Algorithm to Set the Aggregated Fishing Area for each Record in the SFSGeo

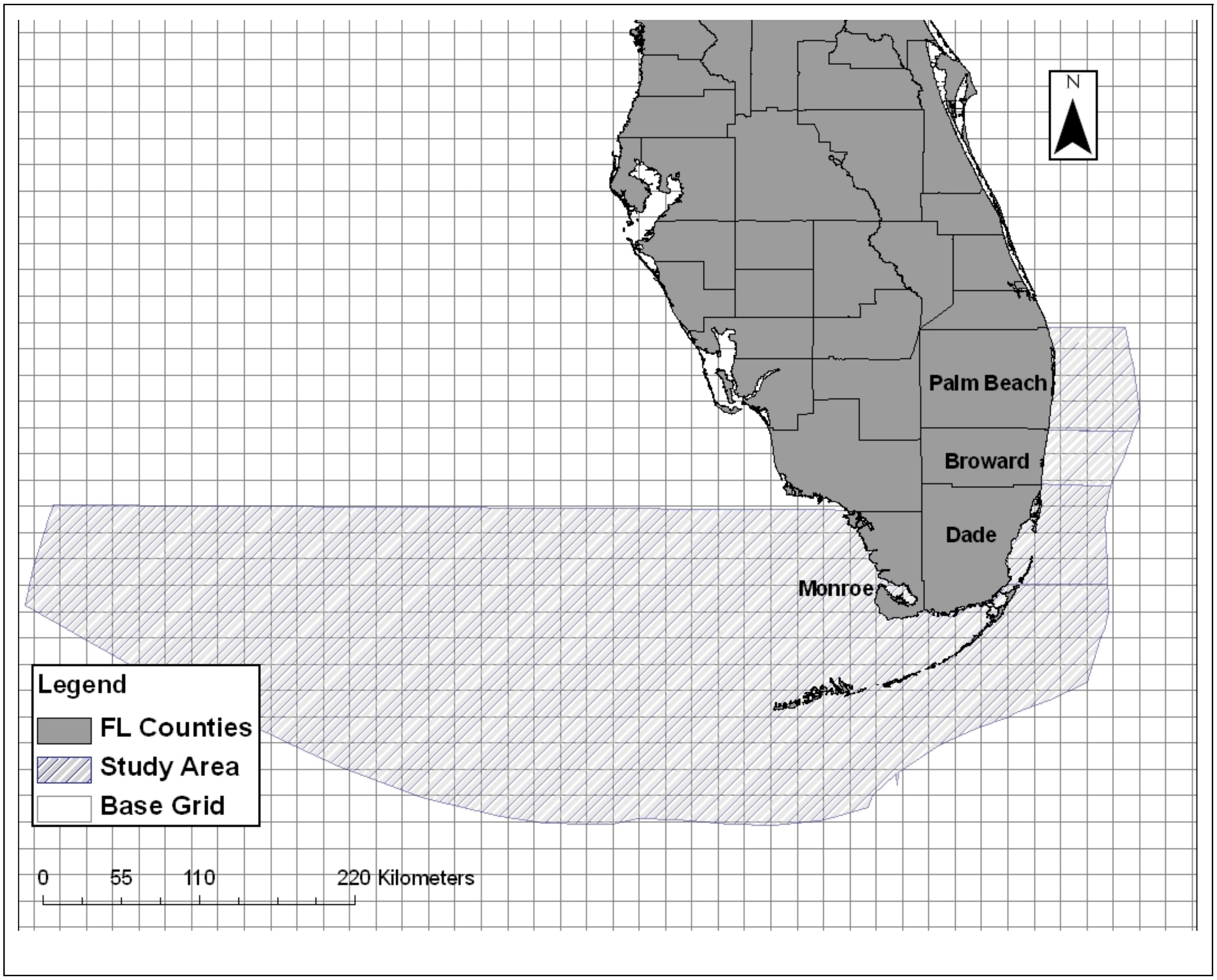

Figure 3. Aggregated Fishing Area Grid and Study Area

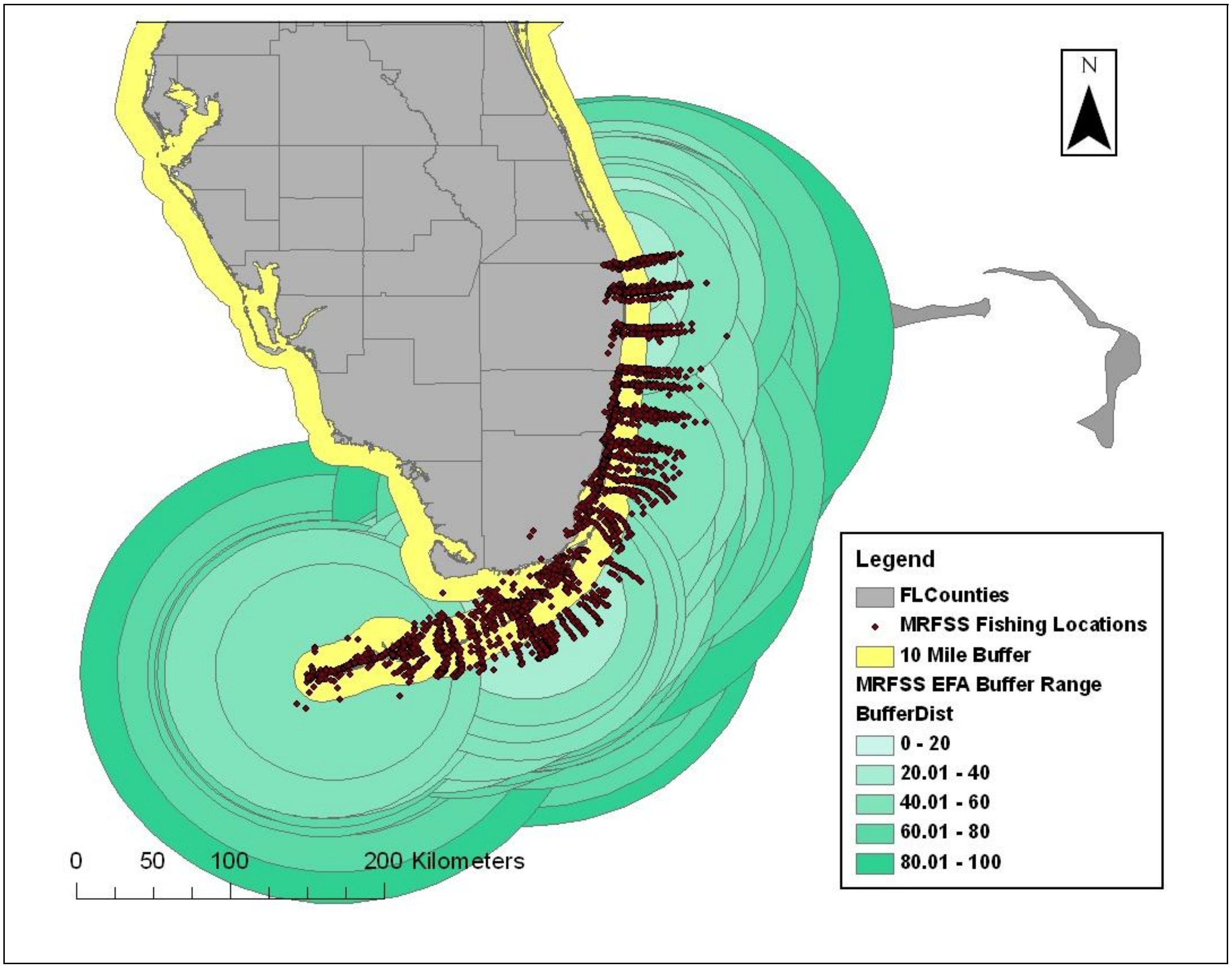

Figure 4. Estimated Fishing Area and Estimated Fishing Location Polygons for the Marine Recreational Fishing Statistical Survey Data: 1992 to 2003

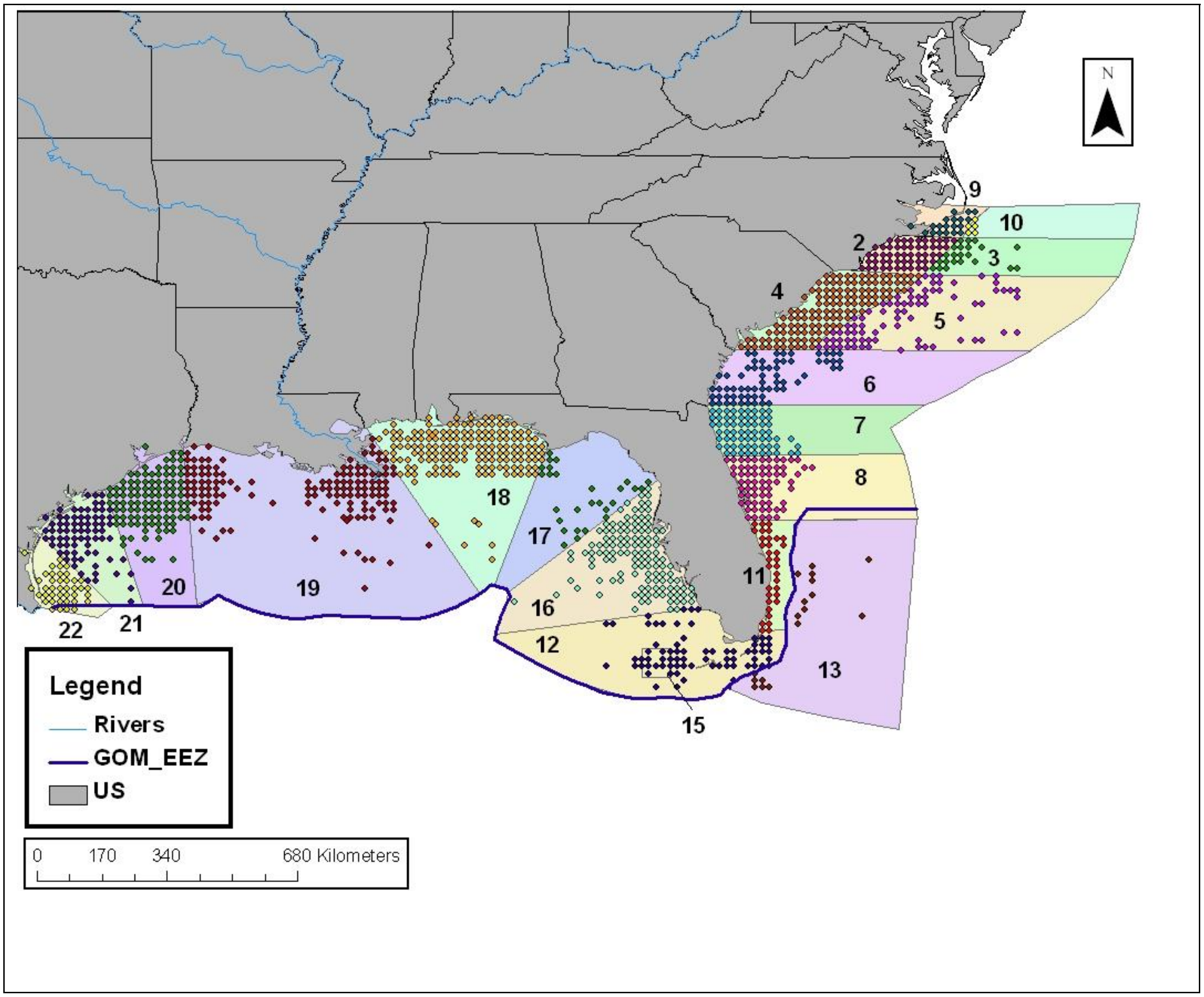

Figure 5. Clustering of Points and the EEZ Border Defining the Boundaries for the Head Boat Survey (HBS) Areas in the Southeastern United States.
Note: The dots indicate a trip with latitude-longitude information and the color of each dot indicates the HBS area marked in the trip record.

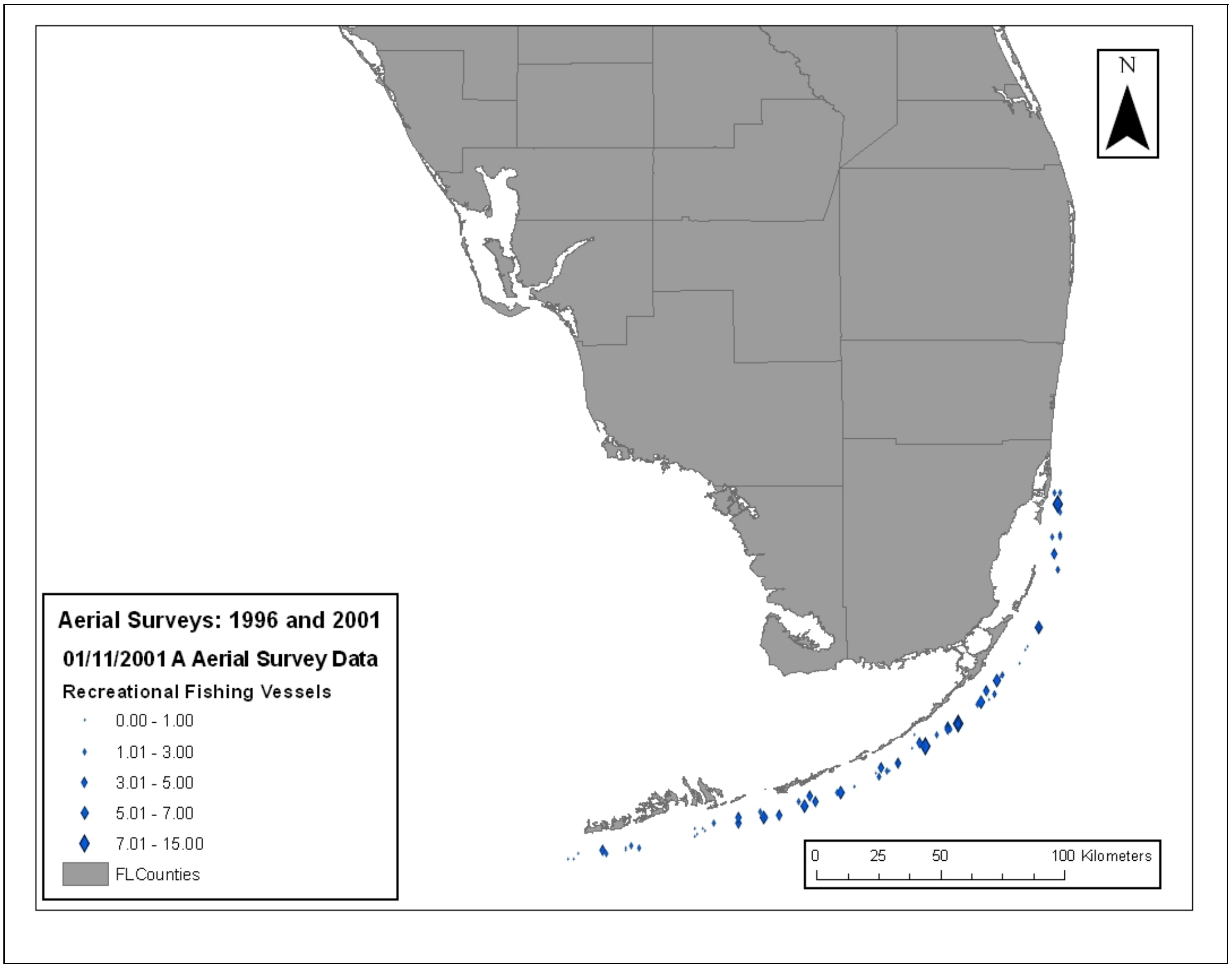

Figure 6. Example of the Distribution of Aerial Survey Data (Survey A, 01/11/2001)

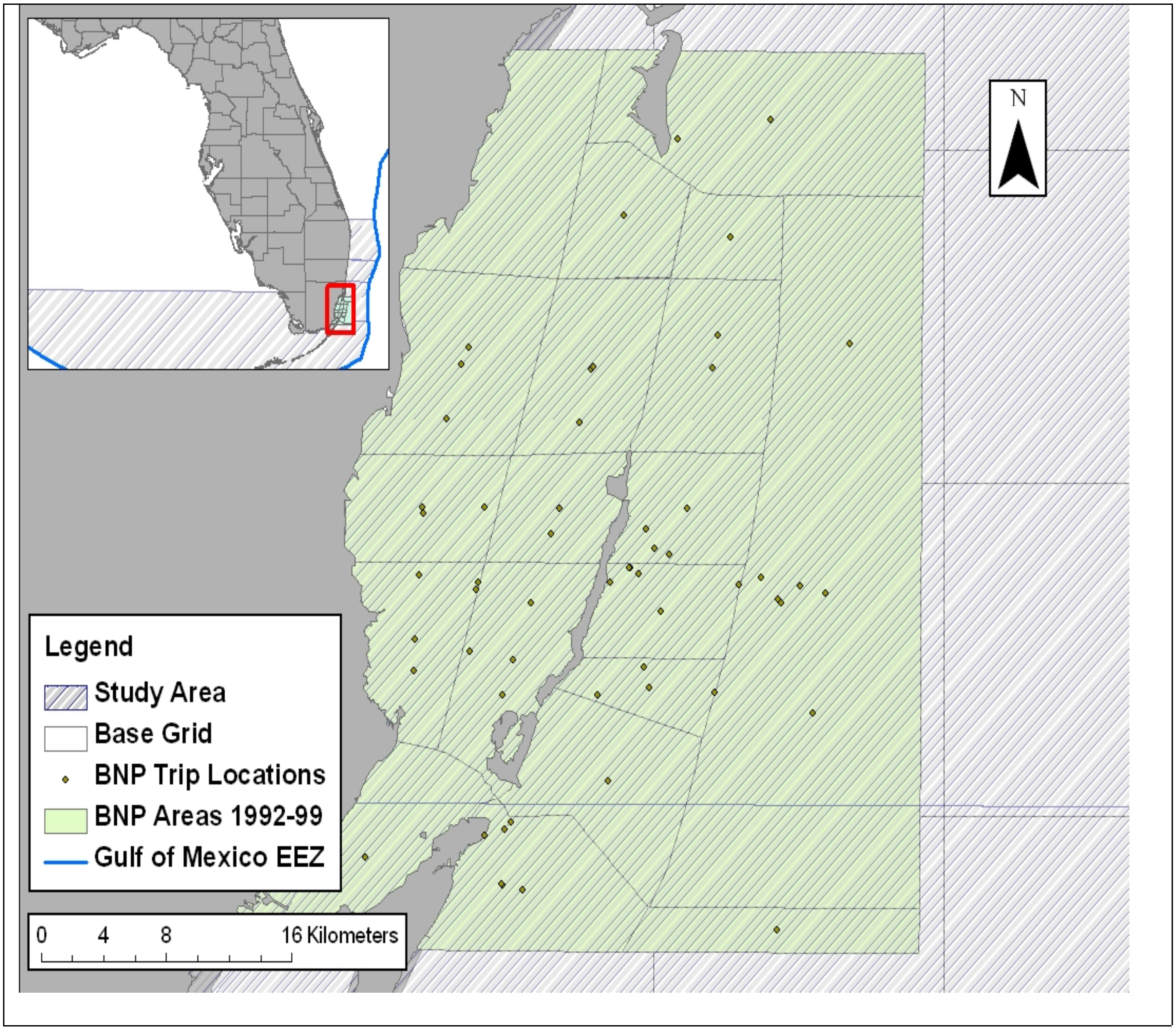

Figure 7. Biscayne National Park (BNP) Recreational Creel Survey Fishing Areas (1992-1999)