MARINE RESOURCES ASSESSMENT FOR THE GULF OF MEXICO

FINAL REPORT

Prepared For:
Department of the Navy,
U.S. Fleet Forces Command

Contract Number: N62470-02-D-9997
Task Order Number: 0030

FEBRUARY 2007

For More Information Contact:
Naval Facilities Engineering Command, Atlantic
Attention: Mr. Joel Bell, Code EV41JB
6506 Hampton Boulevard, Building B
Norfolk, Virginia 23508-1278
Joel.T.Bell@Navy.MIL
757.322.4854

Prepared By:
Geo-Marine, Inc.
2713 Magruder Boulevard, Suite D
Hampton, Virginia 23666-1572

Suggested Citation: Department of the Navy. 2007. Marine Resources Assessment for the Gulf of Mexico. Department of the Navy, U.S. Fleet Forces Command, Norfolk, Virginia. Contract #N62470-02-D-9997, CTO 0030. Prepared by Geo-Marine, Inc., Hampton, Virginia.

Cover Photograph: Courtesy of the National Oceanic and Atmospheric Administration/ Department of Commerce. Photographer: Jackie Reid.

Title Page Photograph: Courtesy of the National Oceanic and Atmospheric Administration/ Department of Commerce. Photographer: Heather Dine.

TABLE OF CONTENTS (cont'd)

Page

6.6 LITERATURE CITED 6-18

7.0 RECOMMENDATIONS 7-1

7.1 MARINE RESOURCES ASSESSMENTS 7-1

7.2 ENVIRONMENTAL DOCUMENTATIONS 7-3

7.3 LITERATURE CITED 7-7

8.0 LIST OF PREPARERS 8-1

9.0 GLOSSARY 9-1

APPENDICES

APPENDIX A: INTRODUCTION A-1

APPENDIX B: MARINE MAMMALS B-1

APPENDIX C: SEA TURTLES C-1

APPENDIX D: ESSENTIAL FISH HABITAT D-1

APPENDIX E: MYLAR TRANSPARENCIES E-1

APPENDIX A: INTRODUCTION

	Title
Appendix A-1	Data confidence and geographic information system (GIS) maps for the GOMEX MRA.
Appendix A-2	Map projections.
Appendix A-3	Overview of research efforts that provide occurrence information about marine mammals and sea turtles in the GOMEX study area.
	A-3.1 Protected Species Data Included in the GOMEX MRA.
Table A-1	Inventory of marine mammal and sea turtle data included in the GOMEX MRA.
Figure A-1a	Tracklines and transect coordinates, those planned and those that actually took place, for aerial and shipboard surveys for protected species during the winter in the GOMEX study area.
Figure A-1b	Tracklines and transect coordinates, those planned and those that actually took place, for aerial and shipboard surveys of protected species during the spring in the GOMEX study area.
Figure A-1c	Tracklines and transect coordinates, those planned and those that actually took place, for aerial and shipboard surveys of protected species during the summer in the GOMEX study area.
Figure A-1d	Tracklines and transect coordinates, those planned and those that actually took place, for aerial and shipboard surveys of protected species during the fall in the GOMEX study area.
Figure A-2a	Grid cells (10-minute by 10-minute) in which there were greater than 5-km of dedicated survey effort in the GOMEX study area during the winter and fall.
Figure A-2b	Grid cells (10-minute by 10-minute) in which there were greater than 5-km of dedicated survey effort in the GOMEX study area during the spring and summer.

This page intentionally left blank

Appendix A-1. Data confidence and geographic information system (GIS) maps for the GOMEX MRA.

The level of data confidence is dependent upon three factors: precision, accuracy, and currency. Each of these three factors are in turn affected by all the variables involved in obtaining data and putting the data into a GIS in order to display the data on a map. Following is a brief description of the three main factors and some of the subsequent variables that figure into overall level of confidence.

- ***Precision***—Refers to the level of detail or how specific is the description of the data. For instance, 5.12546732 is much more precise than 5.1. For geographic data, GPS (global positioning systems) offer the highest level of precision for recording locations.

- ***Accuracy***—Refers to how well the data reflect reality. An example of accuracy is an animal being identified as one species when it is really another—the identification was precise (i.e., it was specific) but it was not accurate because it didn't reflect the true species identity of the animal. Some variables that affect accuracy are: who originally recorded the data (source reliability), how many people have processed/altered the data since it originated (number of iterations), and the method used to record the data.

- ***Currency***—Refers to how recently the data were obtained. Since recent developments in equipment and methods have improved the precision and accuracy of data, the data confidence is higher for those data recorded more recently.

Precision differs from accuracy, and the two characteristics are often mutually exclusive. It is possible to have data recorded very precisely but with very low accuracy. It is true that the sum 2 + 2 = 5.12546732 is very precise but is at the same time very inaccurate.

GOMEX MRA Map Examples	Description of Map Data	Confidence Level
Bathymetry, Sea Surface Temperature, Chlorophyll *a*, Occurrence Maps for Protected Species, Essential Fish Habitat, Marine Managed Areas, Artificial Reefs, Fisheries	Data from original/reliable sources. Provided in a digital format with geographic coordinates given. Identified as "*source data*" in map captions.	**High** 138 maps (81% of total number of maps)
Essential Fish Habitat and Survey Tracklines	First- or second-hand data sources. Locations obtained through scanning geo-referenced* maps. Identified as "*source map(s) scanned*" in map captions.	**Medium** 13 maps (8% of total number of maps)
Surface Currents, Essential Fish Habitat, and Dead Zone	First- or second-hand data sources. Locations obtained by digitizing from written descriptions with no coordinate data or by altering and/or interpreting raw data. Identified respectively as "*source information*" or "*map adapted from*" in map captions.	**Low** 19 maps (11% of total number of maps)

* Geo-referenced–Refers to data, maps, and images with points that can be matched to real world coordinates so that the data can be accurately positioned in a GIS.

Appendix A-2. Map projections.

Since understanding the role map projections play in the creation of valid and usable maps is so critical, further explanation of this issue is provided. A geographic reference system (such as latitude and longitude) is based on the angles measured from the earth's center. A planar coordinate system, on the other hand, is based on measurements on the surface of the earth. To meaningfully transfer real world coordinates (in three dimensions) to planar coordinate (two dimensions), a transformation process has to be applied. This transformation process is called a projection. Such a transformation involves the distortion of one or more of the following elements: shape, area, distance, and/or direction. The user typically dictates the choice of a projection type to ensure the least distortion to one or more of the four elements. Choice of a particular projection is dictated by issues such as the location of the place on Earth, purpose of the project, user constraints, and others.

The length of one degree of longitude will vary depending on what latitude on Earth the measurement is taken. The geographic coordinate system measures the angles of longitude from the center of the Earth and not distance on the Earth's surface. One degree of longitude at the equator measures 111 km versus 0 km at the poles. Using a map projection mitigates this difference or seeming distortion when using geographic coordinates. However, when multiple data sources with multiple projection systems are used, the most flexible system to standardize the disparate data is to keep all data unprojected. Thus, the maps in this MRA are untransformed, meaning they are shown unprojected on the map figures and their associated geographic data are delivered unprojected.

Since the measurement units for unprojected, geographic coordinates are not associated with a standard length, they cannot be used as an accurate measure of distance. Since the maps in the assessment report are in geographic coordinates, the map figures should not be used for measurement and the scale information only provides approximate distances. The map scales and reference datum used on all maps in this MRA are presented in nautical miles (NM).

Appendix A-3. Overview of research efforts that provide occurrence information about marine mammals and sea turtles in the GOMEX study area.

Prior to 1977, there was no systematic effort to document cetacean records in the GOMEX (Würsig et al. 2000). Opportunistic reporting of sightings, strandings, occasional captures, and historic whaling records were the only information available. As noted by Würsig et al. (2000), it was researchers such as the Caldwells, Moore, Layne, Lowery, and Schmidly who accumulated these opportunistic records and published summaries for certain parts of the Gulf. These summaries (e.g., Moore 1953; Layne 1965; Schmidly 1981) provided a hint of the diversity of cetaceans in the northern GOMEX. Jefferson and Schiro (1997) compiled and reviewed all historic cetacean records (except for the bottlenose dolphin, *Tursiops truncatus*) in the northern Gulf and corrected any errors in species identification. The Southeast Fisheries Science Center of the National Marine Fisheries Service (NMFS-SEFSC) began the first offshore shipboard surveys for marine mammals in the northern GOMEX in 1990.

To derive seasonal occurrence patterns of marine mammals and sea turtles in the GOMEX, an investigation of the research efforts related to marine mammal and sea turtle occurrences was undertaken. The results of that investigation are described below, and are intended to provide a summary of the many directed research efforts in the GOMEX conducted and/or sponsored by federal, state, private and academic institutions, agencies, or organizations. Datasets were acquired from those research efforts that were deemed most appropriate and comprehensive for representing turtle and marine mammal occurrences in the study area.

AERIAL AND SHIPBOARD SURVEYS

Records from aerial and shipboard surveys constitute the majority of the data collected for this MRA (Table A-1; Figures A-1a through A-1d). Henwood and Epperly (1999) and Forney (2002) provide brief descriptions of how aerial and shipboard surveys are conducted. Aerial or shipboard observers collect line-transect data during daylight hours, weather permitting (i.e., no rain, Beaufort sea state <4). Surveys are conducted along pre-designated transect lines following established sampling methods that allow for abundance estimates in an area of interest. Any animal sightings that occur while the observation platform (e.g., ship or plane) is traveling along the transect line and observers are actively searching for animals are noted as “on-effort” sightings and can be included when estimating abundances or densities in an area. Animal sightings that occur while the observation platform is diverted from or is in transit to the transect line are recorded as “off-effort” sightings. While off-effort sightings may not be used for abundance or density estimates, they are nonetheless useful since they can provide additional sighting records for a species in areas where occurrence patterns may not be well known. It should be noted that aerial and shipboard surveys have been conducted over a large portion of the study area’s continental shelf and continental slope, with extensive and comprehensive survey effort having been expended during the summer. Only sighting effort from line-transect surveys meeting a set of minimum standards were used to determine the seasonal occurrence patterns for marine mammals and sea turtles (Figures A-2a and A-2b).

Aerial Visual Surveys

The typical goal of an aerial survey is to estimate the overall density or abundance of a given marine mammal or sea turtle population. Aerial surveys are appropriate when little is known about the distribution and abundance of a population or species over relatively large areas. Such surveys help identify “hot spots” for future studies. Surveys can then be conducted to monitor trends in seasonal or annual variations in distribution and abundance patterns. Aircraft are also used in fine-scale surveys over a subregion of a study area.

- Aerial surveys were conducted during the summers of 1974 and 1975 in northern GOMEX to test field procedures and analytical techniques for estimating bottlenose dolphin population densities and assist capture-release operations (Leatherwood and Platter 1975; Leatherwood et al. 1978). From **01 to 08 July 1974**, aerial surveys were flown over coastal waters of Alabama,

Mississippi, and eastern Louisiana to record bottlenose dolphin population counts, assess population distribution, estimate density estimates, and determine group composition (Leatherwood and Platter 1975; Leatherwood et al. 1978). A second set of aerial surveys was conducted in this area from **09 to 13 July 1974** to provide support to bottlenose dolphin capture-release operations by locating groups suitable for capture and directing capture vessels to the groups (Leatherwood and Platter 1975). Aerial surveys flown from **22 to 25 July 1975** off Atchafalaya Bay, LA and the Mississippi Sound were designed to test variables that may influence estimates of population counts, distribution, and density (Leatherwood et al. 1978).

- In order to estimate bottlenose dolphin population size and density along the Port Aransas Pass-Matagorda Peninsula region of southwest GOMEX, five aerial surveys were flown between **28 March and 01 April 1978** (Barham et al. 1980). Twenty-one east-west strip transects covered the bays, channels, and coastal waters extending from Matagorda, TX south to Aransas Pass, TX. These surveys aimed to estimate bottlenose dolphin density and compare density estimates to previous studies conducted in this region.

- From **21 to 30 September 1979**, aerial surveys were conducted along the southwestern region of GOMEX (Leatherwood and Reeves 1983b). Surveys extended from Aransas Pass, TX south to Brazos Santiago Pass, TX and covered inland waters, including Corpus Christi Bay, and coastal GOMEX waters out to the 18 m isobath. The purpose of these surveys was to assess local bottlenose dolphin distribution, density, and relative age composition (Leatherwood and Reeves 1983b), as well as determine sea turtle distribution and density (Reeves and Leatherwood 1983).

- The USFWS conducted systematic aerial surveys for the Bureau of Land Management (now the Minerals Management Service [MMS]) over the outer continental shelf and adjacent waters of the western North Atlantic and GOMEX from Cape Hatteras, NC to the U.S.-Mexico border near Brownsville, TX from **April 1980 through April 1981,** (Fritts et al. 1983a, 1983b). A pilot study was initiated in **June 1979** and data were collected in four areas of the GOMEX during **August and November 1980** (Fritts et al. 1983a). The purpose of these surveys was to determine the faunal composition, estimate faunal densities related to geographic and seasonal parameters, and identify areas of major biological importance for decision-making related to offshore oil and gas resource development (Fritts et al. 1983a). The primary concern when using this dataset is misidentification of many dolphin species (Würsig et al. 2000).

- From **April 1982 to March 1984**, the NMFS-SEFSC contracted Aero-Marine Surveys, Inc. to conduct aerial line-transect surveys to provide data for sea turtle population estimates in the southeastern U.S. (Shoop and Thompson 1983; Aero-Marine Surveys 1984; Thompson 1984; Thompson and Huang 1993). Pelagic surveys were flown from Cape Hatteras, NC to Key West, FL and offshore to the approximate edge of the Gulf Stream. Surveys flown off southern Florida extended into the GOMEX study area to 24˚32.6 'N and 81˚48.3' W. One additional survey measured the response of the sightings to time of day and sea state. Surveys were conducted for the Southeast Turtle Survey program (SETS) with the objectives of collecting information on spatial and temporal distribution, behavior, ecological correlates, and sightability of sea turtles. Marine mammal sighting data were also collected.

- Between **1983 and 1986,** NMFS-SEFSC conducted seasonal aerial surveys of the northern GOMEX (Carter and Derman 1986; Scott et al. 1989; Mullin et al. 1991). Surveys covered waters from the shoreline (including bays and sounds) out to the 200 m isobath from Brownsville, TX to Key West, FL (Thompson 1991). The purpose was to study the distribution, abundance, and diversity of bottlenose dolphins and other cetaceans as well as sea turtles in continental shelf waters of the GOMEX (Thompson 1986, 1991). Two study areas defined as northwestern Gulf and northeastern Gulf (west and east of the Mississippi River Delta) were sampled within three depth strata (bay, inshore, offshore) (Thompson 1991). Seven seasonal surveys were flown: four in the northwestern Gulf and three in northeastern Gulf. The northwestern Gulf surveys were flown in September to October 1983, January to February 1984,

April to May 1984, July to August 1985, September to October 1985, and January to February 1986 (Thompson 1991).

- In **1987**, NMFS-SEFSC conducted a set of aerial surveys to estimate the abundance of red drum (*Sciaenops ocellatus*) and monitor cetaceans in seven geographic regions of the northern GOMEX. Surveys covered coastal waters with a bottom depth less than 200 m from Key West, FL to the Rio Grande River, TX, with the exception of waters between Mobile Bay, AL and Cape San Blas, FL Mullin et al. 1990). Each of the seven geographic areas were surveyed during a 21-day period during April through July and a 21-day period during September through December, with the exception of the Louisiana area being surveyed twice during a 21-day period in the spring and the central Florida area being surveyed only during a 21-day period in the fall (Mullin et al. 1990). These surveys are included in the marine mammal historical database (Jefferson and Schiro 1997). Surveys conducted in 1995 and 1999 provided information on sea turtle occurrence (NMFS 2003h).

- The NMFS-SEFSC conducted aerial surveys to estimate sea turtle abundance and to study the spatial relationship between sea turtles sighted near the surface of the water and petroleum platforms from **June 1988 through June 1990** (Lohoefener et al. 1990). Bottlenose dolphin data were collected as well (Mullin et al. 1989). These surveys were supported by the MMS and sampled seven study areas with bottom depths ranging from 3 to 200 m in the oil and gas fields offshore of Louisiana.

- Between **1989 and 1990**, the MMS and NMFS conducted aerial surveys of the upper continental slope waters off Louisiana and Mississippi (Mullin et al. 1991, 1994a). These surveys were an extension of the sea turtle surveys initiated by Lohoefener et al. (1990). The objectives of this study were to determine cetacean species diversity, learn about the temporal and spatial distribution of the species, and estimate the relative abundance of each species.

- Estimating cetacean abundance and distribution in the GOMEX coastal and continental shelf waters was the goal of NMFS-SEFSC **1992 through 1996** aerial surveys (Blaylock and Hoggard 1994; McDaniel et al. 2000). This regional survey program is also known as the GOMEX surveys. Sea turtle sightings were collected as well. The first aerial survey was conducted 1**3 September to 24 October 1992** from Brownsville, TX to Lafayette, LA. Coverage during the second survey year, **17 September to 19 October 1993**, was from Lafayette, LA to Cedar Key, FL. The third survey was flown **28 September to 09 November 1994** from Cedar Key, FL to Key West, FL. Transects extended from the shoreline to approximately 9.3 km past the 193 m isobath. The fourth survey, flown in **1996** in the western Gulf, likely covered the same area as the 1992 surveys. No aerial surveys were flown during 1995.

- In **September 1992,** the NMFS and U.S. Coast Guard established a cooperative agreement to monitor marine mammals and vessel activity in the Florida Keys (McClellan 1996). The goals of these surveys were the documentation of sea turtle and marine mammal occurrence, seasonality, and distribution along the southeast coast of Florida and to describe vessel usage patterns in Biscayne National Park (NP) and the Florida Keys National Marine Sanctuary (NMS) (McClellan 1996; McClellan et al. 2000). The area surveyed was extended north to Melbourne, FL in April 1995, and vessel activity was also documented in the Oculina Bank Habitat of Particular Concern, off eastern Florida. In **March 1995,** a survey was initiated in collaboration with the Everglades NP during which the large fish-eating waters birds in Florida Bay were counted (McClellan et al. 2000); sightings of marine mammals and sea turtles were also recorded during the surveys. Survey effort continued from 1997 through 2001 and covered the same area as the 1992 through 1996 surveys.

NMFS-SEFSC Shipboard Visual Surveys

Shipboard surveys are designed to collect data to address many informational needs. To meet the mandate established in Section 117 of the amended Marine Mammal Protection Act (MMPA), the NMFS must prepare, in consultation with regional Scientific Review Groups, stock assessment reports for each marine mammal stock that occurs in U.S. waters. These stock assessment reports contain several items, including a description of the stock and its distribution, as well as a minimum population estimate (Wade and Angliss 1997). One of the primary ways the NMFS collects marine mammal population data to use in stock assessments is from shipboard surveys.

The NMFS is also responsible for assessing and monitoring sea turtle stocks, which requires distribution and population estimates for determining the status of stocks in relation to past and future human activities. While shipboard surveys are not the optimal survey technique to gain sea turtle population data, sighting data from shipboard surveys often provide valuable information that can be used to calculate turtle stocks. The NMFS-SEFSC conducts the majority of all shipboard surveys conducted in the GOMEX. Sea turtle surveys are often "piggybacked" onto marine mammal, fish, and oceanographic surveys in this region, as it is a cost-effective means for conducting multiple surveys on the same platform.

- Surveys aboard the NOAA ship R/V *Oregon II* in **spring (April to June) 1990**, represent the first shipboard offshore marine mammal surveys in the GOMEX (Würsig et al. 2000). The purpose of the surveys was to study the cetaceans in waters of the northern GOMEX. The transect lines included waters of the continental slope and all oceanic waters (bottom depth greater than 100 m).

- From **16 August to 09 September 1994**, R/V *Oregon II* Cruise OT-94-02 (212) was conducted with the purpose of studying marine mammal diversity, distribution, and abundance in the eastern GOMEX. Line-transect surveys took place between the 10 fm contour and 5 NM seaward the 1000 fm contour in the eastern GOMEX (NMFS-SEFSC 1994). The specific objectives of this cruise were to estimate abundance and define diversity of marine mammals in the eastern GOMEX, obtain biopsy samples of selected marine mammal species, collect data on abundance and distribution of sea turtles, sea birds, and other marine life, collect associated environmental data, and collect data on marine debris type and distribution.

- Cruise GU-98-01 (001) took place aboard the R/V *Gordon Gunter* between **03 and 30 September 1998**. This marine mammal sighting cruise, conducted in conjunction with ichthyoplankton sampling surveys, was designed to monitor the abundances of bottlenose and Atlantic spotted dolphins (*Stenella frontalis*) over time in shelf waters of the GOMEX (Mullin et al. 1998). Line-transect surveys were conducted in the outer continental shelf waters of the northern GOMEX from Brownsville, TX to Tampa Bay, FL. The specific objectives of these surveys were to use line-transect methods to estimate abundance and define distribution of cetacean species in continental shelf waters of the northern Gulf, collect ichthyoplankton samples for Gulf-wide estimates of abundance, frequency of occurrence, and distribution of larval and small juvenile king and Spanish mackerel (*Scomberomorus cavalla* and *S. maculatus*, respectively), red drum, snappers, and other taxa, collect associated environmental data in order to define cetacean habitats, and obtain biopsy samples of skin and blubber from selected cetacean species for genetic and contaminant analyses in order to study stock structure.

- R/V *Oregon II* Cruise OT-99-03 (234) occurred from **22 April to 02 June 1999** in conjunction with NMFS-SEFSC SEAMAP bluefin tuna (*Thunnus thynnus*) ichthyoplankton surveys in oceanic waters of the U.S. GOMEX. Specific objectives of the cruise were to collect ichthyoplankton samples, data to estimate the abundance and distribution of cetaceans; associated environmental data; data on the distribution of all sea turtles, seabirds, and other marine life; obtain biopsy samples from selected cetacean species; obtain photographs of selected cetacean species; and collect marine debris data (Hubbard and Mullin 1999).

- R/V *Gordon Gunter* Cruise GU-99-02 (003) took place from **31 August to 30 September 1999**. This cruise was conducted in conjunction with NMFS-SEFSC ichthyoplankton sampling surveys. The purpose of the cruise was to monitor the abundances of bottlenose and Atlantic spotted dolphins over time in shelf waters of the GOMEX (Mullin and Drass 1999). Line-transect surveys were conducted in the outer continental shelf waters of the northern GOMEX from Brownsville, TX to Tampa Bay, FL. The specific objectives of these surveys were to use line-transect methods to estimate abundance and define distribution of cetacean species; collect ichthyoplankton samples; collect associated environmental data; and obtain biopsy samples of skin and blubber from selected cetacean species.

- Occurring from **18 April to 30 May 2000**, R/V *Gordon Gunter* Cruise GU-00-02 (007), covering oceanic GOMEX waters, served the dual purpose of surveying marine mammals and collecting bluefin tuna ichthyoplankton for SEAMAP (Hubard and Mullin 2000). Data were collected on environmental parameters; sea turtle, seabird, and cetacean sightings; selected cetacean biopsy samples; photographs of selected cetacean species; and marine debris sightings.

- R/V *Oregon II* Cruise OT-00-06 (242) was conducted from **05 September to 02 October 2000** in conjunction with NMFS-SEFSC ichthyoplankton sampling surveys, with the purpose of monitoring the abundances of bottlenose and Atlantic spotted dolphins in shelf waters of the GOMEX (Mullin and Drass 2000). Line-transect surveys were conducted in the outer continental shelf waters of the northern GOMEX from Brownsville, TX to Tampa Bay, FL. The specific objectives of these surveys were to estimate abundance and define distribution of cetacean species; collect ichthyoplankton samples; collect associated environmental data; and obtain biopsy samples of skin and blubber from selected cetacean species.

- From **17 April to 31 May 2001**, marine mammal and bluefin tuna ichthyoplankton surveys occurred as R/V *Gordon Gunter* Cruise GU-01-01 (012). The waters of the northern GOMEX were covered by line-transect surveys for the purpose of examining cetacean abundances in the oceanic and shelf waters of the Gulf (NMFS-SEFSC 2001a). Biopsy samples and photographs from selected cetacean species were collected, as well as data on the presence of marine debris.

- The R/V *Gordon Gunter* Cruise GU-01-05 (014) took place from **28 August to 02 October 2001** with the purpose of estimating cetacean abundance in the outer continental shelf waters of the GOMEX. Line-transect surveys were conducted in the waters east and west of Mobile Bay, AL, between the 20 and 200 m isobaths (Fulling et al. 2003). Cetacean surveys were conducted in conjunction with fall ichthyoplankton surveys in the GOMEX.

- From **12 June through 18 August 2003**, R/V *Gordon Gunter* Cruise GU-03-02 (023) was conducted with the purpose of monitoring cetaceans in the northern GOMEX. Line-transect surveys were conducted in oceanic waters (>200 m) from Brownsville, TX to Key West, FL seaward to the Exclusive Economic Zone (EEZ) (NMFS-SEFSC 2003a). The objectives of the cruise were to use visual and acoustic line-transect survey methods for abundance estimation and distribution of cetaceans in the northern GOMEX; collect photographic identification of individual cetaceans including sperm whales; collect biopsies, sloughed skin, and fecal samples from select cetaceans; collect data on distribution and abundance of sea turtles and conduct limited physical oceanographic sampling.

- Cruise GU-04-01 (026) took place aboard the R/V *Gordon Gunter* from **14 January through 12 March 2004** in Silver Bank, approximately 52 NM north of the Dominican Republic. This cruise was a component of a North Atlantic humpback whale (*Megaptera novaeangliae*) assessment project, named More North Atlantic Humpbacks (MONAH), jointly conducted by the Northeast Fisheries Science Center (NEFSC) of the NMFS and NMFS-SEFSC. The objectives of this cruise were to obtain skin biopsies and tail fluke photographs of humpback whales as well as sighting data from line-transect surveys (Fulling and Clapham 2004). Data included in this report are from the two four-day transits in the GOMEX between port (Pascagoula, MS) and Silver Bank.

- The R/V *Gordon Gunter* Cruise GU-04-02 (027) was conducted from **13 April through 11 June 2004** with the purpose of monitoring sperm whales and other oceanic cetaceans in the northern GOMEX. This cruise departed from Pascagoula, MS and surveyed waters seaward of the 200 m isobath to the EEZ from Brownsville, TX east into the Florida Straits to 81˚W (NMFS-SEFSC 2004b). The objectives of the cruise were to conduct visual and acoustic line-transect surveys for abundance estimation and distribution of cetaceans and obtain unbiased estimates of sperm whale group size in the northern GOMEX; collect photographic identification of individual cetaceans; collect tissue samples of select cetaceans; and conduct limited physical oceanographic sampling.

- From **22 June though 19 August 2004**, R/V *Gordon Gunter* Cruise GU-04-03 (028) took place, with the purpose of monitoring the abundance and distribution of cetaceans in the U.S. Mid-Atlantic region (NMFS-SEFSC 2004c). Line-transect surveys were conducted in the waters from 50 m seaward to the EEZ, from the Maryland/Delaware border into southern Florida. On the return trip to Pascagoula, MS, additional surveys were conducted in the Florida Straits and the eastern GOMEX. The objectives for this cruise were to use visual line-transect survey methods and simultaneous acoustic surveys for abundance estimation and distribution of cetaceans; collect tissue samples of select cetaceans; collect photographic identification of select cetaceans; collect data on distribution and abundance of sea turtles, sea birds, and other marine life; and collect oceanographic and environmental data.

Visual and Acoustic Surveys

- From **November 1991 to June 1992**, the Mississippi State University Research Center conducted line-transect aerial surveys in an 81.5 x 110 km area approximately 50 km south of Mobile, AL (Esher et al. 1992). The purpose of the study was to determine the abundance of sea turtles and marine mammals in the area where the Navy's *Empress II* ship-shock trials would took place. Additional surveys were flown until June 1992 to test methods and equipment for subsequent studies. Passive acoustics were also employed to determine its feasibility to locate and identify whales and dolphins in shallow coastal waters. Although the sighting data are not included in the Esher et al. (1992) report, the Statistical Analysis Software® output file was obtained by the Navy from one of the report authors. This output file appears to be the only electronic copy of the Esher et al. (1992) data that exists.

- **Cetacean Distribution and Abundance Studies in the Northern GOMEX (GulfCet I and II)**

  - In 1991, the MMS contracted Texas A&M University (TAMU) and the NMFS-SEFSC to obtain detailed information on the distribution and abundance of cetaceans in the northwestern and north-central portion of the GOMEX (Davis and Fargion 1996). These surveys of GOMEX cetaceans are known as GulfCet I. The program consisted of 12 shipboard and eight aerial surveys covering all seasons (Davis and Fargion 1996). Shipboard surveys were conducted seasonally for two years from **April 1992 to May 1994**, and aerial surveys were conducted once each season for two years from **summer 1992 through spring 1994**. The study area was encompassed by the longitude of the Florida-Alabama border, the southernmost latitude of the Texas-Mexico border; and the 100 m and 2,000 m isobaths. Opportunistic sighting data of sea turtles and physical environmental parameters were also collected during the shipboard surveys.

  - In 1995, the MMS teamed with the National Biological Service (now the U.S. Geological Survey) to sponsor GulfCet II (Davis et al. 2000). TAMU and the NMFS-SEFSC were contracted to continue the work begun in GulfCet I with the extension of the study area farther eastward to waters off Florida. Data on sea turtle and seabird distribution and abundance were collected as well. Four shipboard and four aerial surveys were conducted from **spring 1996 through winter 1998** (Davis et al. 2000). The physical environment or habitat of the study area was characterized by incorporating the hydrographic and bathymetry measurements acquired for the study.

- **Sperm Whale Acoustic Programs**

  - The Sperm Whale Acoustic Monitoring Program (SWAMP) was a pilot study from **2000 and 2001** funded by the MMS; this study was designed to survey sperm whales (*Physeter macrocephalus*) in the GOMEX and to investigate how sperm whales are affected by man-made noise (Lang 2000; Jochens et al. 2006). The SWAMP involved the cooperative research efforts of the MMS with NMFS-SEFSC and the Office of Naval Research (ONR) (Lang 2000). The R/V *Gordon Gunter* Cruise GU-00-04 (009) of **28 June through 26 July 2000**, the R/V *Gordon Gunter* Cruise GU-01-01 (011), leg 3 of **16 March to 3 April 2001**, and the R/V *Gordon Gunter* Cruise GU-01-04 (013) of **17 July through 22 August 2001** were conducted to photo-identify and tag individual sperm whales; collect biopsy samples; and acoustically monitor and record ambient noise levels and cetacean vocalizations (Mullin 2001; Mullin et al. 2001; MMS 2002c; Thode et al. 2002; Biggs et al. 2005; Jochens et al. 2006).

  - The Littoral Acoustic Demonstration Center (LADC) deployed three Environmental Acoustic Recording System (EARS) buoys in the northern GOMEX during the summers of **2001 and 2002** to examine the ambient noise and marine mammals (Newcomb et al. 2004). The LADC, funded by the ONR, deployed buoys in waters with bottom depths ranging from 645 to 1034 m. Sperm whale acoustics were monitored during the presence of three storm systems and high wind speeds (Newcomb et al. 2004).

  - The Sperm Whale Seismic Study Program (SWSS) was a three-year follow-up study to the SWAMP, conducted from **2002 through 2005**. The geophysical industry through the International Association of Geophysical Contractors (IAGC) offered to provide a seismic source vessel as a sound source for controlled exposure experiments (CEEs) of sperm whale response to seismic exploration in the Gulf. With this contribution of the IAGC, MMS awarded the Cooperative Agreement for research on sperm whales and their response to seismic exploration in the Gulf to a multi-institutional, interdisciplinary research team under the program management of TAMU. In the second field year of the study, five major oil companies joined with IAGC to form the Industry Research Funders Coalition (IRFC) to allow a second summer of contribution of a seismic source vessel for CEEs. In field years 3 and 4, IRFC also provided contributions through MMS for additional sperm whale research under the Cooperative Agreement.

    The objectives of this study were to establish the normal behavior of sperm whales in the northern Gulf, characterize sperm whale habitat use in the northern Gulf, and determine possible changes in behavior of sperm whales when subjected to man-made noise, particularly from seismic airgun arrays used for offshore petroleum exploration and geological monitoring (Jochens et al. 2006). The study area encompassed the northern GOMEX waters offshore of the 200 m isobath between the DeSoto Canyon and Galveston, TX. SWSS cruise activities were focused along the 1,000 m isobath in the region off the Mississippi River Delta between 91°W and 86°W between the 800 and 1,200 m isobaths (Jochens et al. 2006). A total of nine cruises were conducted.

    Seven field cruises were conducted during the summers of 2002, 2003, and 2004. Two initial research cruises, an S-tag cruise from **19 June to 9 July 2002** and a D-tag cruise from **19 August through 15 September 2002**, were conducted aboard the TAMU R/V *Gyre*. Surveys took place south of Galveston, TX to approximately 97.4˚W and the 1000 m isobath and along the middle continental slope to approximately 86.4˚W (Jochens et al. 2006). Eighteen tags were placed on sperm whales (Jochens et al. 2006), DNA samples were obtained from 16 of the tagged whales along with photographs of their flukes, and oceanographic samples were also collected. Two follow-up cruises were conducted in the same area from the *Delta Dawn* and *Prime Time* sport fishing vessels on **6 through 8 December 2002** and on the *Prime Time* sport fishing vessel **18 January through 2 February 2003**; the purpose of these cruises were to relocate tagged sperm whales to observe the tag healing process, possible tag effects, and the

association between individuals during photo identification (Jochens et al. 2006). A D-tag/CEE cruise was conducted aboard the Lamont Dougherty Earth Observatory vessel R/V *Maurice Ewing* from **3 June through 24 June 2003** with the purpose of tagging sperm whales around the 1000 m isobath between 87˚W and 91˚W in the northern GOMEX (Jochens et al. 2006). The R/V *Gyre* 03G06 cruise was conducted from **31 May through 21 June 2003**, with the primary objective of collecting physical and biological oceanographic data for characterization of sperm whale habitat in the northern GOMEX (Jochens et al. 2006). Photo-identification data as well as biopsy and skin samples were also collected. An additional cruise was conducted aboard the R/V *Gyre* from **26 June through 14 July 2003**. The primary objectives of this cruise were to conduct visual and acoustic surveys for sperm whales, tag sperm whales with satellite-tracked radio tags, conduct associated video work, collect photo identification data, and collect biopsy samples (Jochens et al. 2006). The R/V *Gyre* 04G05 cruise of **25 May through 18 June 2004** was conducted with the purpose of tagging sperm whales with satellite-tracked radio tags (S-tags) in the Northern GOMEX (Jochens et al. 2006). The Photo-Id/Mesoscale Population Study cruise, consisting of visual and acoustic surveys, occurred from **20 June through 12 August 2004** aboard the *Summer Breeze* between 90.5˚W and 84.5˚W (Jaquet et al. 2004; Jochens et al. 2006). The primary objectives of this cruise were to collect data on sperm whale population size, habitat use, social organization, movements, and behavior and to determine variability and potential responses of sperm whales to anthropogenic activities. Photo-identification, photogrammetry, and behavioral data were collected, as well as biopsy samples.

During **3 through 30 June 2005**, the SWSS 2005 S-tag cruise was conducted aboard the R/V *Gyre* to study and tag sperm whales off Texas (Anonymous 2005b). This was done in conjunction with near-real-time altimetry and ocean color to study the distribution and abundance of sperm whales in the northwestern GOMEX.

Strandings

- Marine mammal stranding networks are under the jurisdiction of NMFS and are nominally based on the administrative regions of the NMFS (Geraci and Lounsbury 1993). Wilkinson and Worthy (1999) discuss the genesis of marine mammal stranding networks in the U.S. Legal authority for U.S. stranding networks is contained in the MMPA. In the Marine Mammal Health and Stranding Response Act (in the 1992 Amendments to the MMPA), Congress made it a national policy to monitor the various factors affecting the health of marine mammal populations; collection and analyses of stranded marine mammals have contributed much to what is known about each species (Becker et al. 1994). To respond to strandings, volunteer stranding networks were established in all coastal states of which the **Southeast Marine Mammal Stranding Network** (SEMMSN) is an example. The NMFS is responsible for cetacean strandings in the vicinity of the GOMEX study area, while manatee strandings are under the jurisdiction of the USFWS. The SEMMSN was established in 1977 to collect and archive stranding data (Odell 1991). SEMMSN data for 1978 through 2000 were received from Dr. Dan Odell while Dr. James Mead of the Smithsonian provided data for 1917 through 2000. The Smithsonian Institution traditionally has been the final repository of stranding data.

- The **Sea Turtle Stranding and Salvage Network** (STSSN) is a network of private citizens as well as state and federal agencies from the coastal states of the Atlantic and GOMEX established to document and collect important information on sea turtles that strand along the coast. The STSSN encompasses the coastal areas of the 18-state region from Maine through Texas, and includes portions of the U.S. Caribbean (Teas 1993). There are four regions (U.S. GOMEX, southeast U.S. Atlantic, northeast U.S. Atlantic, and Caribbean). Regions are further broken down into statistical zones originally designed by the NMFS for shrimp catch and effort data collection (Teas 1993). The STSSN is under the jurisdiction of the NMFS. Sea turtle strandings along the Atlantic coast have been recorded since 1980 (Shaver and Teas 1999). The Department of Natural Resources from each state collects the stranding data, which are then reported to the NMFS, and with permission of each state, releases the sea turtle stranding data. Species, size, location, condition, and final disposition of stressed or dead turtles are recorded. For this report, permission for the NMFS-SEFSC (specifically, Wendy Teas) to release turtle stranding data was requested from each state bordering

the GOMEX study area. Sea turtle stranding data for Florida are from multiple sources, including Florida Marine Research Institute's (FMRI) Atlas of Marine Resources (Flamm et al. 2000). More recent data were received directly from the FMRI (a unit of the Florida Fish and Wildlife Conservation Commission) (FFWCC) (1999 through 2003) (FFWCC-FMRI 2001; FFWCC-FMRI 2003). Sea turtle stranding data for Alabama (2002 through 2004) was received from the USFWS-BSNWR (USFWS 2004).

Incidental Fisheries Bycatch

NMFS-SEFSC longline fishery bycatch—The Pelagic Observer Program (POP) began in 1992 at the Miami Laboratory, when systematic sampling by scientific observers on board U.S. pelagic longline vessels (permitted to land and sell swordfish) was mandated by 1991 amendments to the U.S. Fishery Management Plan for Swordfish (Walsh and Garrison 2006). Since October 1995, the NMFS-SEFSC has fully assumed the implementation and data management of POP for the entire Atlantic longline fishery, which was previously shared with the NMFS-NEFSC (Walsh and Garrison 2006). The focus is on the pelagic longline fishery operating in the Atlantic Ocean, GOMEX, and Caribbean Sea. The target species are swordfish and tuna. Bycatch and incidental catch of undersized swordfish, Atlantic billfish (marlins, sailfish), sea turtles, marine mammals, and other non-target species by pelagic longline gear has been a major concern for several years. The program's mission is to collect data on-effort, directed catch and bycatch quantity, morphometrics, biological characteristics, and interaction with marine mammals, sea turtles, and birds (Scott and Brown 1997). Longline fisheries are known to cause injury and/or mortality to loggerhead (*Caretta caretta*) and leatherback turtles (*Dermochelys coriacea*) (NMFS-SEFSC 2001b), as well as small numbers of other turtle species. Data describing bycatch quantity, morphometrics, and biological characteristics (2000 through 2004) (NMFS-SEFSC 2004d) were obtained from NMFS-SEFSC and are included in this report.

Taggings

- The NMFS-SEFSC Galveston Laboratory has conducted sea turtle research **since 1978**, and sea turtle radio and satellite telemetry studies since 1988 on the northwest coast of the GOMEX. Sea turtle satellite and radio tagging data from the NMFS-SEFSC Galveston Laboratory were obtained for Kemp's ridleys (*Lepidochelys kempii*), loggerheads, and green turtles (*Chelonia mydas*). Turtles were tracked from **1988-1998** (NMFS-SEFSC 2005a), with the purpose of investigating sea turtle occurrence patterns.

- From **1991 through 1993**, TAMU conducted an inshore tagging study on green turtles at South Padre Island, TX (Coyne 1994) with the purpose of examining foraging ecology. The NMFS-SEFSC Galveston Laboratory conducted an inshore tagging study on green turtles, as well, in 1995, in order to investigate juvenile green turtle habitat utilization (Renaud et al. 1995).

- The Flower Garden Banks Sea Turtle Tracking Project, sponsored by TAMU and the Flower Garden Banks NMS (FGBNMS), has conducted satellite tagging of sub-adult loggerhead sea turtles at the FGBNMS **since 1995** (TAMU-FGBNMS 2003). The purpose of the project is to investigate the habitat utilization by sub-adult sea turtles of the FGBNMS as well as track their movements out of the sanctuary in order to aid in developing management plans for sea turtles in the GOMEX.
- The Texas Marine Mammal Stranding Network (TMMSN) has satellite-tagged and released several cetaceans in the GOMEX. Further information regarding the animals tagged by the TMMSN may be found at: http://www.tmmsn.org/strandings/strandings.html. Davis et al. (1996b) provides additional information regarding an Atlantic spotted dolphin, rehabilitated by the TMSSN and satellite-tracked in the northwestern GOMEX.
- The Tampa Bay Sea Turtle Tracking Program, sponsored by the U.S. Army Corps of Engineers (USACE 2003), was part of a year-long effort to investigate the movements of sea turtles in and around Tampa Bay as well as follow their movements into the GOMEX (USACE 2003). In **August**

and September 1997, three loggerhead and two Kemp's ridley turtles were satellite-tagged and released. In May and June 1998, two loggerheads were satellite tagged and released as well.

- Since **March 1998**, the Dolphin and Whale Hospital of Mote Marine Laboratory (MML) has rehabilitated several cetaceans and released them with satellite tags in the GOMEX. Further information regarding this program may be found at: http://isurus.mote.org/~cmanire/Welcome.phtml. Several publications have resulted from this work including Wells et al. (1999a,b).

- The 1999 Florida Gulf Coast Sea Turtle Tracking Project, sponsored by the NMFS-SEFSC and FFWCC, conducted satellite tagging of sea turtles at nesting beaches along the Gulf Coast of Florida during **July and August 1999**, with the purpose of investigating migratory routes and principal foraging habitats of nesting loggerheads (NMFS-FFWCC 2003). Transmitters were attached to nine turtles nesting in the Florida Panhandle at Cape San Blas, and the southwest Gulf Coast near Venice, FL.

- The Moss Landing Marine Laboratory and Ocean Resource Foundation tagged two female adult green turtles on a nesting beach in Lechuguillas, Veracruz, México (Kinzel and Carter 2004). The movements of these turtles to feeding grounds within the Florida Keys NMS were tracked between **August 2000 and April 200**1 (Kinzel et al. 2002). The purpose of the tagging study was to investigate habitat utilization of migrating green sea turtles.

- **Since 2001**, the National Park Service-Padre Island National Seashore (NPS-PINS) has conducted satellite-tracking studies on Kemp's ridley and green turtles. Satellite transmitters were attached to female Kemp's ridley turtles on PINS in order to determine post-nesting movements and foraging habits in the GOMEX (NPS-PINS 2004b). Future research will focus on satellite-tagging green turtles to investigate variations in seasonal movements and migratory patterns.

- The NPS Gulf Islands National Seashore Loggerhead Tracking Project sponsored a three-year tagging study of post-nesting loggerhead sea turtle movements (NPS 2002a-d). Turtles were tagged on nesting beaches within the Gulf Islands Seashore and Pensacola Beach, FL areas and tracked **from July 2000 to December 2002**. The purpose of the study was to determine the migration routes and feeding grounds of northwestern Florida female loggerhead sea turtles (NPS-GUIS 2003).

- In **January 2004,** the Florida Cooperative Fish and Wildlife Research Unit of the University of Florida deployed satellite and sonic transmitter tags on four juvenile green turtles in St. Joseph Bay, FL (UF-FCFWRU 2005a). The turtles had previously been stranded four days earlier in the bay due to abnormally low water temperatures. The purpose of the tagging study is to track the movements of the juveniles in order to examine the behavior of juvenile sea turtles in response to water temperature decreases.

- In coordination with the NMFS-SEFSC Sea Turtle Facility, TAMUG's Sea Turtle & Fisheries Ecology Research Laboratory (TAMUG-STFERL) deployed satellite tags on Kemp's ridley sea turtles in order to examine movement patterns and habitat use in the northwestern GOMEX (TAMUG-STFERL 2005). Since **September 2004**, eight juvenile Kemp's ridley turtles have been satellite-tagged and tracked within the GOMEX. The TAMUG-STFERL plans to tag and track at least six Kemp's ridley turtles per year from 2005 through 2007.

- In October 2004, the Florida Cooperative Fish and Wildlife Research Unit of the University of Florida deployed satellite transmitter tags on three juvenile green turtles, as a continuation to a previous tagging study in **January 2004** (UF-FCFWRU 2005b). The turtles, previously stranded in the St. Joseph Bay area, were released into waters of the GOMEX, south of St. Joseph Bay. The purpose of the tagging study is to track the movements of the juveniles in order to examine the behavior of juvenile sea turtles in response to decreases in water temperature.

- In **April 2005**, the Marine Animal Rescue Society released two rough-toothed dolphins, previously stranded in the March 2005 FL Keys mass stranding event, off Miami, FL. One dolphin was tagged with a satellite transmitter and moved along the coast as north as Charleston, SC (Wells 2007). In **May 2005**, an additional seven rough-toothed dolphins, previously stranded in the FL Keys mass

stranding event, were released with satellite and VHF tracking tags near Key Largo, FL (Wells 2007). All seven dolphins traveled to shallow water habitats off of Andros Island in the Bahamas. The tracking and release program was a cooperative effort between the Marine Mammal Conservancy, Dolphins Plus, and the Marine Animal Rescue Society. In **September 2005**, the Marine Mammal Conservancy satellite tagged and released an additional two rough-toothed dolphins, previously stranded during the FL Keys mass stranding event. Individuals were released east of the FL Keys and traveled to the northern coast of Cuba (Wells 2007). More information regarding satellite tracking efforts may be found at: http://www.sarasotadolphin.org/DolphinRescues/roughtooth2006.asp

- The Sea Turtle Conservation Program (STCP) of MML has conducted conservation efforts for 23 years along the Sarasota County shoreline (MML-STCP 2005). In **July 2005**, the STCP deployed satellite transmitters on four adult loggerhead turtles in Casey Key, Sarasota County, FL. The purpose of the tracking study was to investigate migratory behavior to identify movement patterns, critical habitat use, and responses to oceanic variables, such as temperature and currents.

- The Florida Fish and Wildlife Conservation Commission conducts in-water tagging of green, loggerhead, Kemp's ridley, and hawksbill turtles in Florida and adjacent waters. (FFWCC 2005g). Turtles are captured at sea, measured, tagged, and released. Blood samples are collected as well. Objectives are to characterize life history stages of Florida sea turtles as well as identify habitats and threats specific to life history stages.

Miscellaneous Data Sources

- From **15 through 17 March 1984**, opportunistic sea turtle sightings were collected from aboard the NMFS-SEFSC R/V *Delaware II* (Ogren 1984). Loggerhead sea turtles were sighted offshore in shelf waters as well as waters of the Loop Current.

- The Galveston laboratory of the NMFS maintains a database of marine mammal and sea turtle sightings by observers in its NMFS Platform Removal Observer Program (Klima et al. 1988; Gitschlag and Herczeg 1994; NMFS-SEFSC 2003b), however, species identification is neither always available nor reliable. The data were requested from Mr. Gregg Gitschlag at NMFS-SEFSC (**1986 through 2003**) and received for inclusion in this report.

- Between **February and June 1988**, beaches of St. Bernard Parish, Louisiana were surveyed for stranded sea turtles (Fuller 1988). Surveys were conducted by observers on foot and on small boats. Sea turtle stranding data were also collected, in conjunction with another study, on the Breton and Chandeleur barrier island chain. Interviews were also conducted with local fishermen to collect information on sea turtle distribution off coastal southeastern Louisiana (Fuller 1988).

- TAMU conducted oceanographic surveys in the northern GOMEX, on which trained observers opportunistically collected cetacean sighting data. Dr. Doug Biggs and Dr. Joel Ortegta-Ortiz provided this dataset, which is included in this report. Opportunistic sightings were also collected on a training cruise aboard TAMU's training ship, *Texas Clipper*, in **summer 1991**. This cruise was conducted in the GOMEX, Caribbean Sea, and a small portion of the southwestern North Atlantic Ocean (Jefferson and Lynn 1994).

- From **January 1991 through December 1992**, the Marine Recreational Fishery Statistics Survey (MRFSS) of NMFS surveyed recreational fishermen along the U.S. Atlantic and Gulf coasts regarding sea turtle sightings during fishing trips (Braun-McNeill and Epperly 2004). The MRFSS collected information on season and location of sightings in order to examine sea turtle spatial and temporal trends.

- Sea turtle nesting data for Texas were received from the NPS-PINS (**2000 through 2004**) (NPS-PINS 2004a); data were collected as part of a study to monitor sea turtle nesting at six national

seashores along the southeastern U.S. (NPS-PINS 2005). Data were received for Alabama sea turtle nesting (2002 through 2004) from the USFWS-BSNWR (USFWS-BSNWR 2004).

- The North Atlantic Right Whale Consortium (NARWC) provided data for opportunistic sightings of North Atlantic right whales in the GOMEX.

Published Literature and Reports

Oftentimes published papers and reports are the most useful media for presenting opportunistic sightings, strandings, and even whaling catches. The occurrence data contained within the following documents were especially useful for species that are not frequently seen during dedicated surveys (e.g., killer whales), that are not easily distinguished to species (e.g., beaked whales), or for which there is little information regarding their occurrence in the study area (e.g., bottlenose whales, smaller sea turtles).

- Data for Kemp's ridley occurrences on the northeast and central Texas coast from **late 1940s to April 1990** were extracted from Manzella and Williams (1992). These records included sightings, strandings, bycatch, nesting, recaptures, and taggings.

- Underwater sightings of sea turtles in the northern GOMEX were compiled from the published reports, data logs, and photos of eight scientific studies taking place from **1975-1985** (Rosman et al. 1987). Observations were made through the use of scuba diving, underwater video, and submersibles.

- From **1976 through 1979**, Rabalais and Rabalais (1980) compiled information on sea turtle sightings and strandings in coastal GOMEX. Occurrences were noted along the southeast Texas coast, spanning from Cedar Bayou to Brazos Santiago Pass, including St. Joseph's, Mustang, and Padre Islands (Rabalais and Rabalais 1980).

- Beaked whale life history, occurrence, and morphology information were compiled from worldwide stranding records (Mead 1989). Many stranding records provided insight into beaked whale anatomical characteristics, morphometrics, and distribution.

- Opportunistic sightings of spotted dolphins feeding in the GOMEX have provided information regarding nocturnal foraging and coordinated foraging behavior of this species. In **1991**, spotted dolphins (unidentified species) were observed foraging nocturnally on flying fish (Richard and Barbeau 1994). Coordinated foraging by Atlantic spotted dolphins on clupeid fishes was observed in 1986 (Fertl and Würsig 1995).

- All available historical, published, and unpublished cetacean records in the northern GOMEX were assembled and analyzed by Jefferson and Schiro (1997). These records included 1,223 sightings, strandings, and captures of all species, except for the bottlenose dolphin, from all sources but the GulfCet projects. Dates of the historical database span from **1921 to 1994**. The authors reviewed all records to verify species identifications. In addition to the data used in the Jefferson and Schiro (1997) paper, the historical database also included marine mammal occurrence data from the southern Gulf. All database records applicable to the area covered by this assessment were utilized in this MRA report (Jefferson 2002c). The database was provided by and is used with the permission of Dr. Tom Jefferson. This database supersedes all published records.

- MML conducted boat-based surveys for bottlenose dolphins and Atlantic spotted dolphins in an area on the west Florida continental shelf bounded by 81º to 86ºW and 24º to 29ºN (Griffin and Griffin 2003, 2004). Surveys were conducted between **November 1998 and November 2000**. Objectives were to estimate relative abundances of these two species, test for seasonality in distribution, and identify optimal habitat (Griffin and Griffin 2003, 2004). Survey design included three cross-shelf transects between the 10 m and 50 m isobaths, as well as one cross-shelf transect between the 10 m and 200 m isobaths.

- Worldwide sighting and stranding records of the Clymene dolphin (*Stenella clymene*) were compiled to update its status (Fertl et al. 2003).

A-3.1 Protected Species Data Included in the GOMEX MRA

Comprehensive datasets and occurrence records for aerial and shipboard sighting surveys, strandings, incidental fisheries bycatch, tagging, and miscellaneous and opportunistic encounters in the study area as well as those from published literature and reports were compiled for this MRA. The datasets compiled for this MRA report, acquired from federal, state, private, and academic institutions, agencies, and organizations, are not representative of all data records ever recorded for marine mammals or sea turtles in the study area. The compiled datasets (Table A-1) acquired for this MRA represent the datasets that were available for inclusion in this report; the compiled data, however, are sufficient to detail the protected species occurrences potentially occurring within the study area.

Datasets from aerial and shipboard sighting surveys represent the vast majority of the datasets obtained for inclusion in this MRA. While aerial and shipboard sighing surveys are designed to follow a pre-determined survey design consisting of transect lines, surveys often for many reasons deviate from the planned lines or do not follow the plan in straight line segments. Where possible, we have noted the actual survey track rather than the pre-determined track so that the extent of the study area covered by sighting surveys will be accurately depicted (Figures A-1a through A-1d).

Table A-1. Inventory of marine mammal and sea turtle data included in the GOMEX MRA.

DATA SOURCE	RECORD DATES	SPUE SOURCES
NMFS-SEFSC Aerial Surveys		
Southeast Turtle Surveys (SETS)—leatherback and loggerhead turtles only	1982-1984	
MMS Sea Turtle Surveys	1988-1990	√ (1990)
GOMEX Surveys	1992-1994, 1996	√
Southeast Florida	1997-2001	
NMFS-SEFSC Shipboard Surveys		
NOAA Ship R/V *Oregon II* Cruise OT-94-04 (212)	1994	√
NOAA Ship R/V *Gordon Gunter* Cruise GU-98-01 (001)	1998	√
NOAA Ship R/V *Gordon Gunter* Cruise GU-99-02 (003)	1999	√
NOAA Ship R/V *Oregon II* Cruise OT-99-03 (234)	1999	√
NOAA Ship R/V *Gordon Gunter* Cruise GU-00-02 (007)	2000	√
NOAA Ship R/V *Oregon II* Cruise OT-00-06 (242)	2000	√
NOAA Ship R/V *Gordon Gunter* Cruise GU-01-02 (012)	2001	√
NOAA Ship R/V *Gordon Gunter* Cruise GU-01-05 (014)	2001	√
NOAA Ship R/V *Gordon Gunter* Cruise GU-03-02 (023)	2003	√
NOAA Ship R/V *Gordon Gunter* Cruise GU-04-02 (027)	2004	√
Visual and Acoustic Surveys		
DoN *Empress II* (Esher et al. 1992)	1991-1992	
GulfCet I		
NMFS-SEFSC Aerial, summer and fall	1992	√
NMFS-SEFSC Aerial, winter	1993	√
NMFS-SEFSC Aerial, spring and summer	1993	√
NMFS-SEFSC Aerial, winter	1993	√
NMFS-SEFSC Aerial, winter and spring	1994	√
NOAA Ship R/V *Oregon II* Cruise OT-92-02 (199)	1992	√
TAMU R/V *Longhorn* Cruise 1	1992	

Table A-1. Inventory of marine mammal and sea turtle data included in the GOMEX MRA (cont').

Visual and Acoustic Surveys (cont'd)		
TAMU R/V *Pelican* Cruise 2	1992	
TAMU R/V *Pelican* Cruise 3	1992	
NOAA Ship R/V *Oregon II* Cruise OT-93-01 (203)	1993	√
TAMU R/V *Pelican* Cruise 4	1993	
NOAA Ship R/V *Oregon II* Cruise OT-93-02 (204)	1993	√
TAMU R/V *Pelican* Cruise 5	1993	
TAMU R/V *Pelican* Cruise 6	1993	
TAMU R/V *Pelican* Cruise 7	1993	
NOAA Ship *Oregon II* Cruise OT-94-01(209)	1994	√
GulfCet II		
NMFS-SEFSC Aerial, summer	1996	√
NMFS-SEFSC Aerial, winter and summer	1997	√
NMFS-SEFSC Aerial, winter	1998	√
NOAA Ship R/V *Oregon II* Cruise OT-96-02 (220)	1996	√
TAMU R/V *Gyre* Cruise 06	1996	
NOAA Ship R/V *Oregon II* Cruise OT-97-02 (225)	1997	√
TAMU R/V *Gyre* Cruise 08	1997	
SWAMP (Sperm Whale Acoustic Monitoring Program)		
NOAA Ship R/V *Gordon Gunter* Cruise GU-00-04 (009)	2000	√
NOAA Ship R/V *Gordon Gunter* Cruise GU-01-01(011), leg 3	2001	√
NOAA Ship R/V *Gordon Gunter* Cruise GU-01-04 (013)	2001	
SWSS (Sperm Whale Seismic Study) Program		
TAMU R/V *Gyre* S-tag Cruise	2002	
TAMU R/V *Gyre* D-tag Cruise	2002	
Delta Dawn/*Prime Time* Cruise	2002	
Prime Time Cruise	2003	
LDEO R/V *Maurice Ewing* Cruise	2003	
TAMU R/V *Gyre* Cruise 03G06	2003	
TAMU R/V *Gyre* Cruise, summer	2003	
TAMU R/V *Gyre* Cruise 04G05	2004	
Summer Breeze Cruise	2004	
Strandings		
Smithsonian Marine Mammal Stranding Database	1917-2000	
Southeast Marine Mammal Stranding Network	1978-2000	
Florida Sea Turtle Strandings (FFWCC)	1989-2003	
Alabama Sea Turtle Standings (USFWS)	2003-2004	
Incidental Fisheries Bycatch		
NMFS-SEFSC Pelagic Observer Program	2000-2004	
Taggings		
NMFS-SEFSC, Galveston Satellite-tracked Turtles	1988-1998	
Miscellaneous		
Opportunistic Cetacean Sightings		
NMFS-SEFSC *Oregon II* Cruise 198 **(off-effort)**	1992	
TAMU Opportunistic Cetacean Sightings	1997-1999	
NMFS-SEFSC *Relentless* Cruise 003 (**off-effort)**	1998	
NMFS-SEFSC *Gordon Gunter* Cruise 006 (**off-effort**)	2000	
NMFS-SEFSC *Gordon Gunter* Cruise 011, leg 3 (**off-effort**)	2001	
NMFS-Galveston Platform Removal Observer Program	1986-2003	

Table A-1. Inventory of marine mammal and sea turtle data included in the GOMEX MRA (cont'd).

Sea Turtle Nests	
Alabama (USFWS)	2002-2004
Florida (FFWCC)	2001-2003
Texas (NPS)	2000-2004
Unpublished North Atlantic Right Whale Consortium	2004
Published Literature and Reports	
Mead (1989)	1965-1984
Fertl and Würsig (1995)	1986
Richard and Barbeau (1994)	1991
Jefferson and Schiro (1997)	1997
Griffin and Griffin (2001)	1998-2000
Fertl et al. (2003)	1905-2001
Foley et al. (2003)	2003

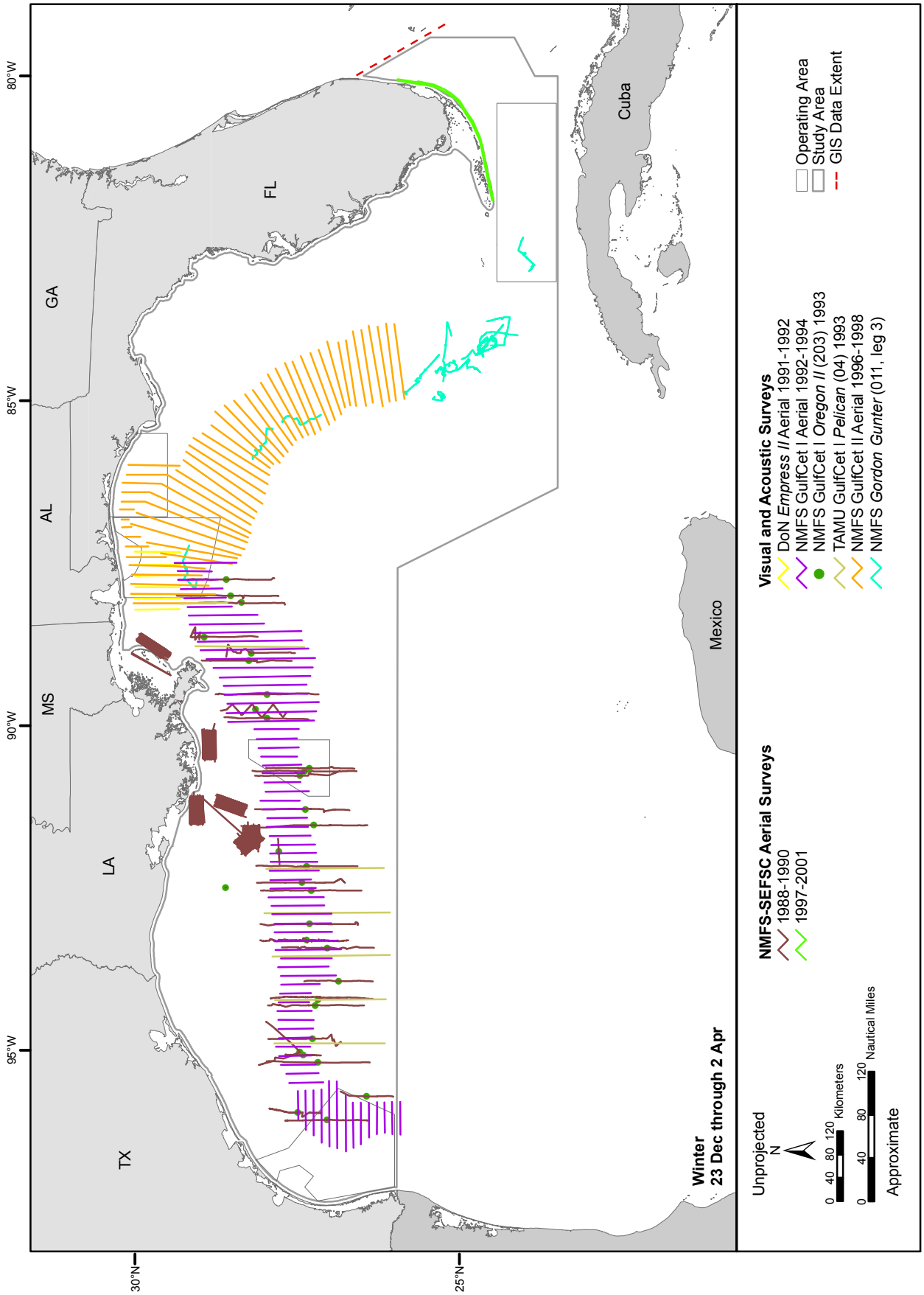

Figure A-1a. Tracklines and transect coordinates, those planned and those that actually took place, for aerial and shipboard surveys for protected species during the winter in the GOMEX study area. Source data: refer to Table A-1. Source maps (scanned): Davis and Fargion (1996), Davis et al. (2000), McClellan et al. (2000), and Mullin et al. (2001).

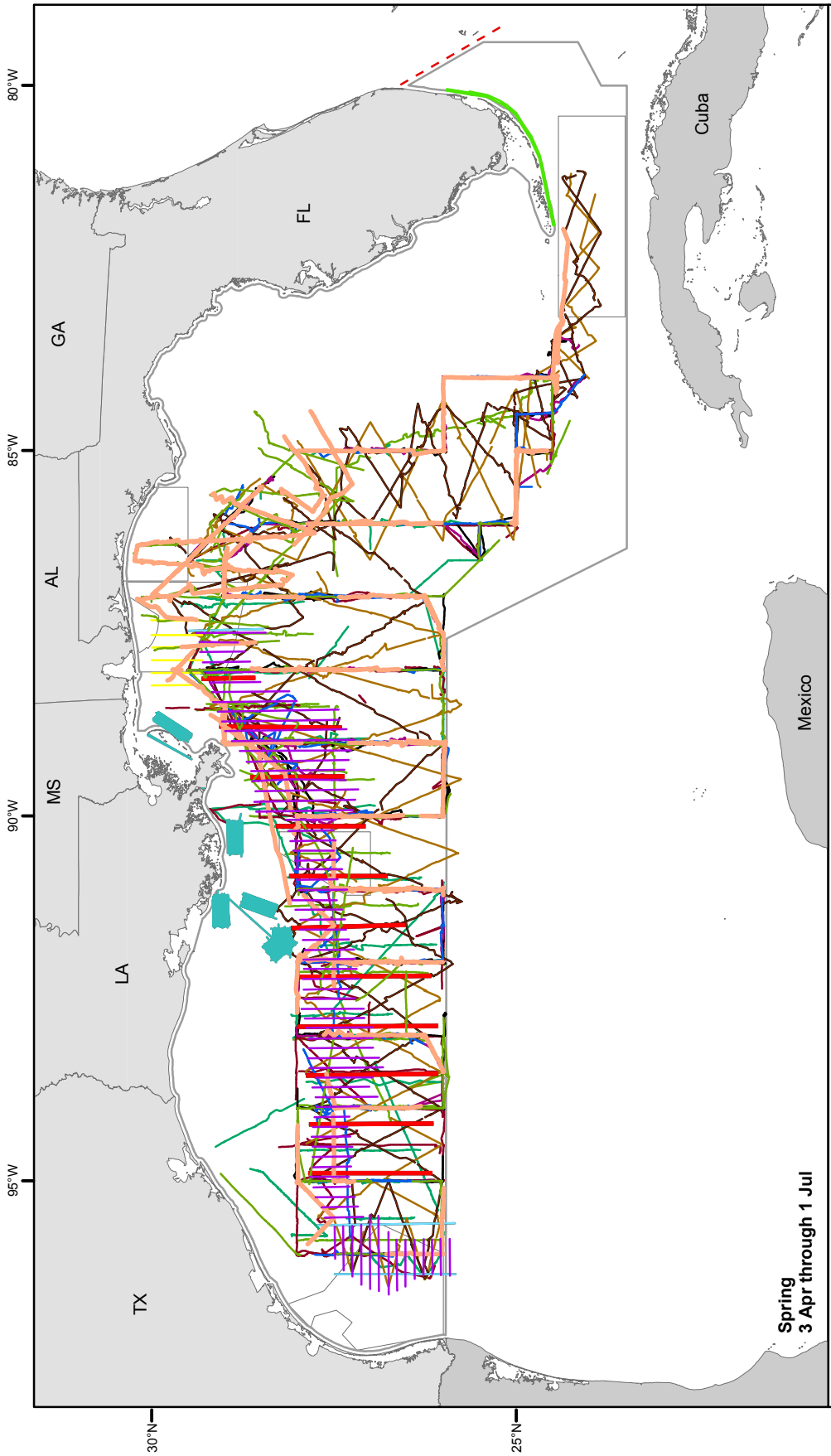

Figure A-1b. Tracklines and transect coordinates, those planned and those that actually took place, for aerial and shipboard surveys of protected species during the spring in the GOMEX study area. Source data: refer to Table A-1. Source maps (scanned): NMFS-SEFSC (2001, 2003, 2004b), Davis and Fargion (1996), Hubard and Mullin (1999), Hubard and Mullin (2000), and McClellan et al. (2000).

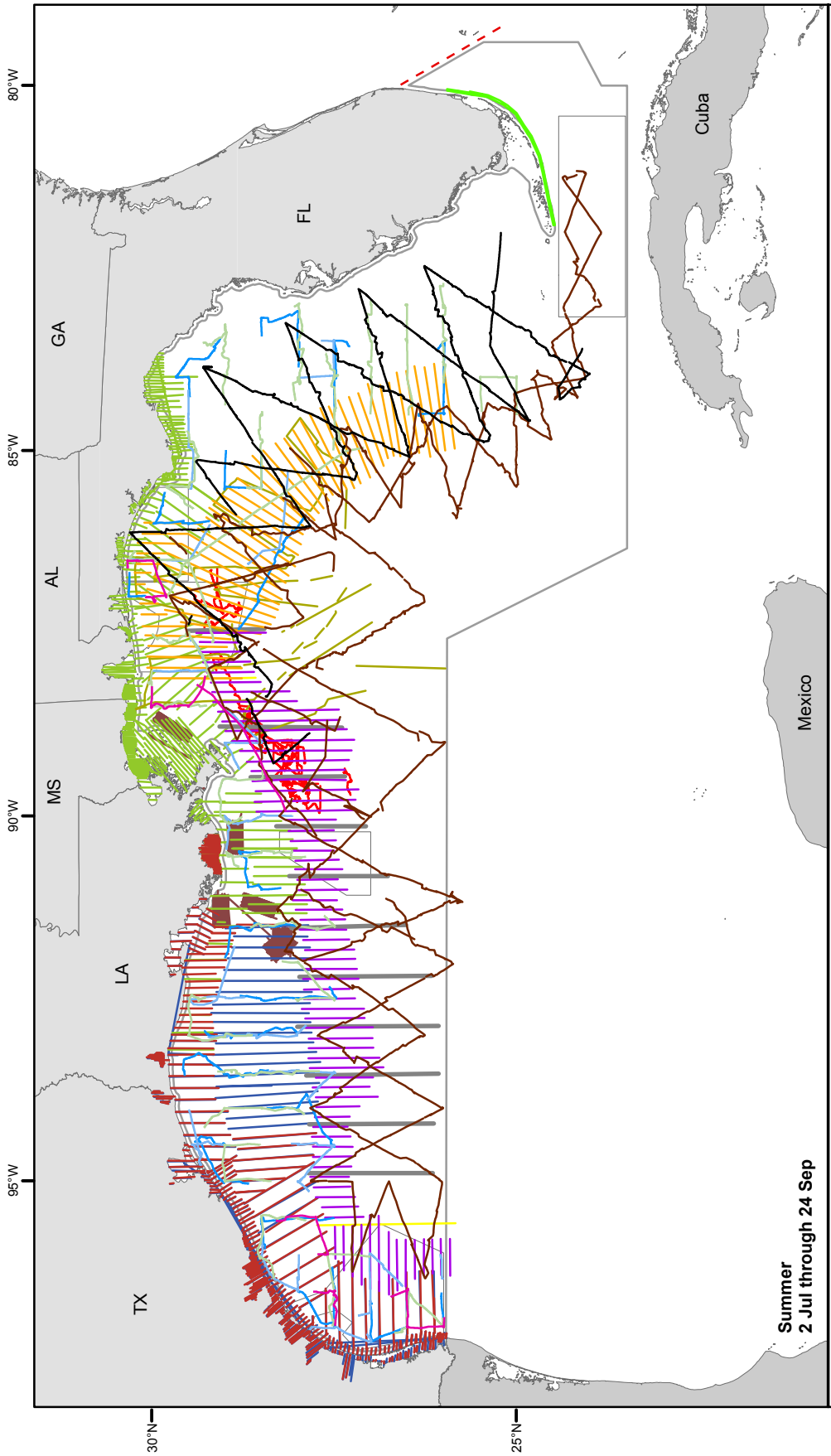

Figure A-1c. Tracklines and transect coordinates, those planned and those that actually took place, for aerial and shipboard surveys of protected species during the summer in the GOMEX study area. Source data: refer to Table A-1. Source maps (scanned): NMFS-SEFSC (1994, 2003), Davis and Fargion (1996), Mullin et al. (1998), Mullin and Drass (1999), Davis et al. (2000), McClellan et al. (2000), Mullin and Drass (2000), and Fulling et al. (2003).

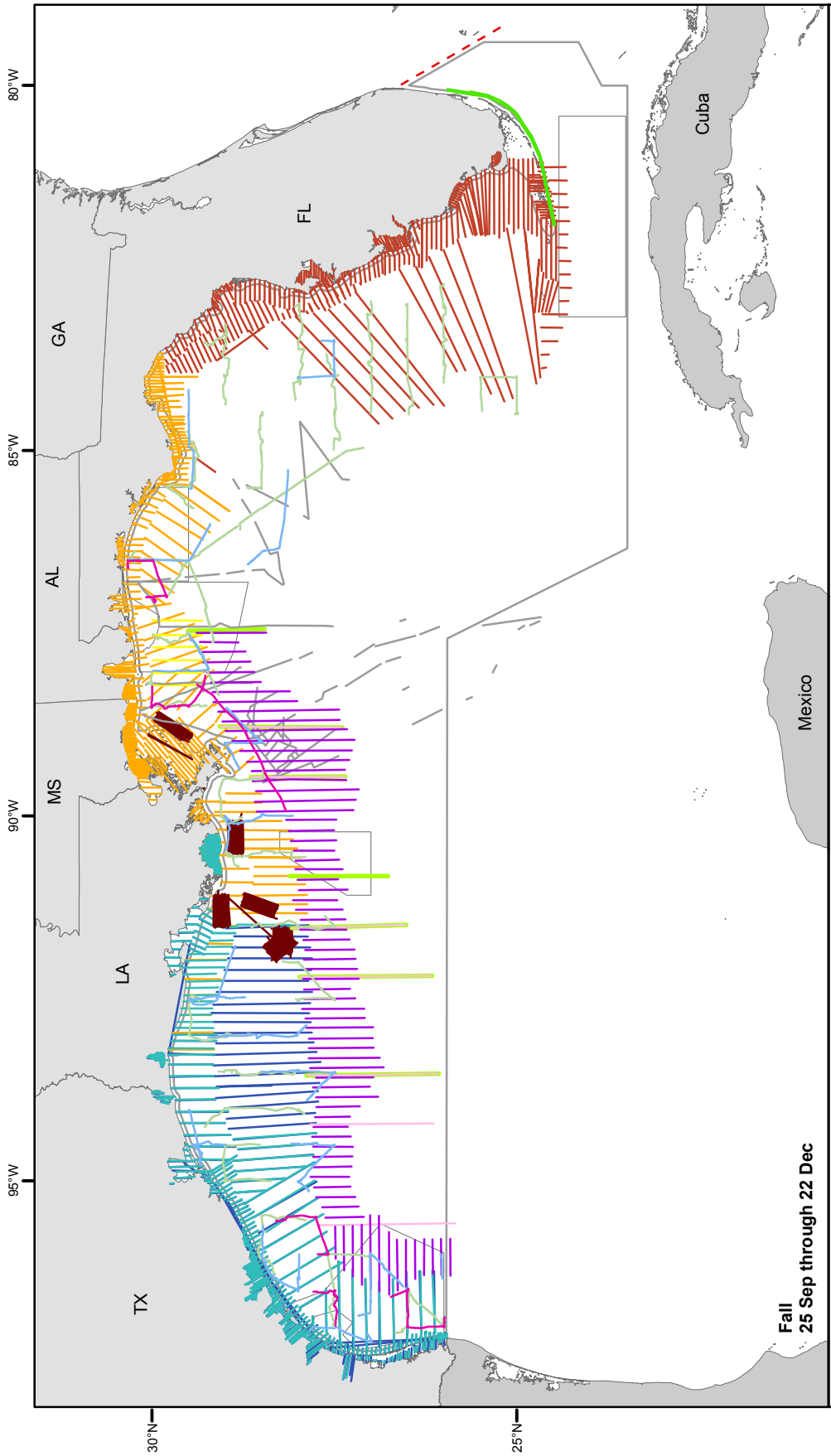

Figure A-1d. Tracklines and transect coordinates, those planned and those that actually took place, for aerial and shipboard surveys of protected species during the fall in the GOMEX study area. Source data: refer to Table A-1. Source maps (scanned): Davis and Fargion (1996), Mullin et al. (1998), Davis et al. (2000), McClellan et al. (2000), Mullin and Drass (2000), and Fulling et al. (2003).

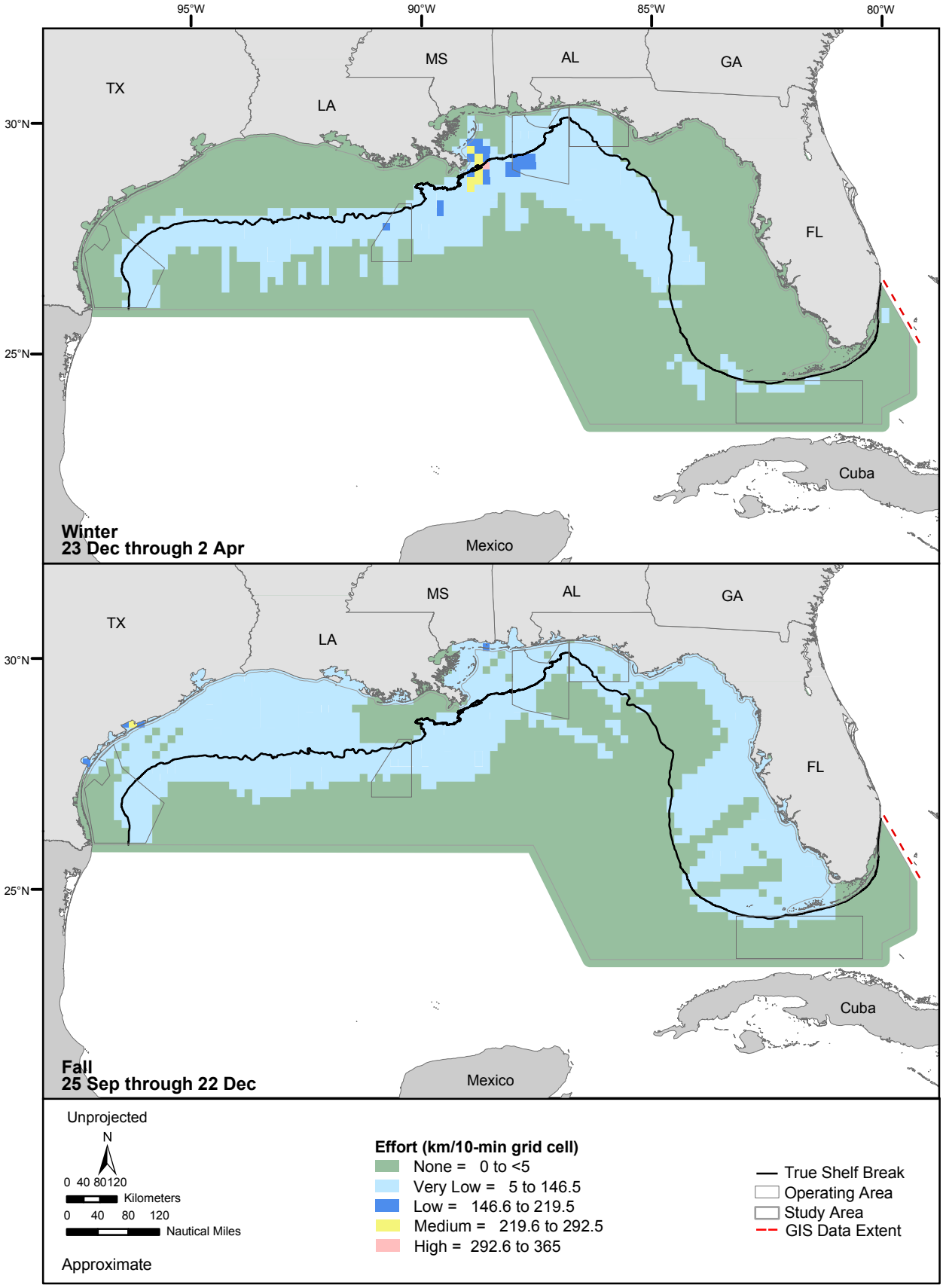

Figure A-2a. Grid cells (10-minute by 10-minute) in which there were greater than 5-km of dedicated survey effort in the GOMEX study area during the winter and fall. Survey effort was summed for all years of dedicated survey data in each grid cell; the summed effort was used to compute sightings-per-unit-effort values for each grid cell. Source data: refer to Table A-1.

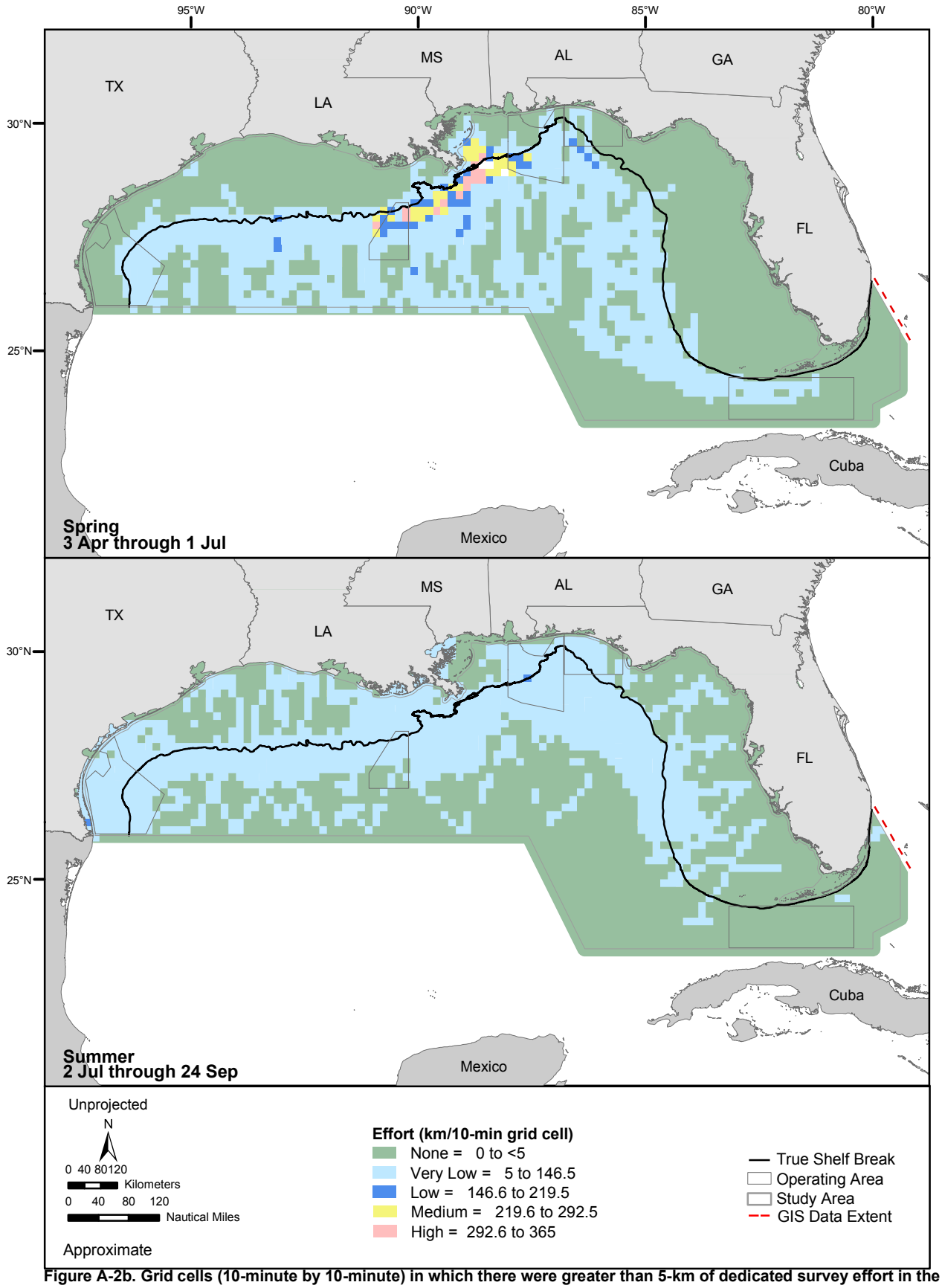

Figure A-2b. Grid cells (10-minute by 10-minute) in which there were greater than 5-km of dedicated survey effort in the GOMEX study area during the spring and summer. Survey effort was summed for all years of dedicated survey data in each grid cell; the summed effort was used to compute sightings-per-unit-effort values for each grid cell. Source data: refer to Table A-1.

Literature Cited

Aero-Marine Surveys, Inc. 1984. Final report - Southeast Turtle Survey (SETS): Pelagic aerial surveys V through VII including time of day / sea state special experiment. Inclusive dates of survey report: April 1983 - March 1984. NMFS-SEFC Contract number NA83-GA-C-00017. Prepared for the Southeast Fisheries Science Center, Miami, Florida by Aero-Marine Surveys Inc., Groton, Connecticut .

Anonymous. 2005b. Sperm whale seismic study (SWSS) cruise report for S-tag 2005 cruise (R/V Gyre Cruise 05G09) 3-30 June 2005. Unpublished cruise report. College Station, Texas: Texas A&M University.

Barham, E.G., J.C. Sweeney, S. Leatherwood, R.K. Beggs, and C.L. Barham. 1980. Aerial census of the bottlenose dolphin, Tursiops truncatus, in a region of the Texas coast. Fishery Bulletin 77(3):585-595.

Becker, P.R., D. Wilkinson, and T.I. Lillestolen. 1994. Marine mammal health and stranding response program: Program development plan. NOAA Technical Memorandum NMFS-OPR-94-2:1-35.

Biggs, D.C., Jochens, A.E., Howard, M.K., DiMarco, S.F., Mullin, K.D., Leben, R.R., Muller-Karger, F.E., and C. Hu. 2005. Eddy forced variations in on- and off-margin summertime circulation along the 1000-m isobath of the northern Gulf of Mexico, 2000-2003, and links with sperm whale distributions along the middle slope. Geophysical Monograph 161:71-85.

Blaylock, R.A., and W. Hoggard. 1994. Preliminary estimates of bottlenose dolphin abundance in southern U.S. Atlantic and Gulf of Mexico continental shelf waters. NOAA Technical Memorandum NMFS-SEFSC-356:1-10.

Braun-McNeill, J. and S.P. Epperly. 2004. Spatial and temporal distribution of sea turtles in the western North Atlantic and the U.S. Gulf of Mexico from Marine Recreational Fishery Statistics Survey (MRFSS). Marine Fisheries Review 64(4): 50-56.

Carter, G., and J. Derman. 1986. Aircraft and data collection services in support of aerial surveys of Tursiops truncatus and other cetaceans in the Gulf of Mexico, January 10–March 2, 1986. Contract report NA84-WC-C-06082. Miami, Florida: National Marine Fisheries Service.

Coyne, M.S. 1994. Feeding ecology of subadult green turtles in South Texas waters. Master's thesis, Texas A&M University.

Davis, R.W., and G.S. Fargion, eds. 1996. Distribution and abundance of cetaceans in the north-central and western Gulf of Mexico, final report. Volume II: Technical report. OCS Study MMS 96-0027. New Orleans, Louisiana: Minerals Management Service.

Davis, R.W., W.E. Evans, and B. Würsig, eds. 2000. Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat associations. Volume II: Technical report. USGS/BRD/CR-1999-0015 and OCS Study MMS 2000-003. New Orleans, Louisiana: Minerals Management Service.

Davis, R.W., G.A.J. Worthy, B. Würsig, and S.K. Lynn. 1996b. Diving behavior and at-sea movements of an Atlantic spotted dolphin in the Gulf of Mexico. Marine Mammal Science 12(4):569-581.

Esher, R.J., C. Levenson, and T.D. Drummer. 1992. Aerial surveys of endangered and protected species in the Empress II ship trial operating area in the Gulf of Mexico. Final report. NRL/MR/7174-92-7002. Stennis Space Center, Mississippi: Naval Research Laboratory.

Fertl, D., T.A. Jefferson, I.B. Moreno, A.N. Zerbini, and K.D. Mullin. 2003. Distribution of the Clymene dolphin Stenella clymene. Mammal Review 33:253-271.

FFWCC (Florida Fish and Wildlife Conservation Commission) 2005g. In-water research studies: To successfully recover populations, the complex life histories of long-lived marine turtles must be understood. Accessed 24 January 2007. http://research.myfwc.com/features/view_article .asp?id=3635.

FFWCC-FMRI (Florida Fish and Wildlife Conservation Commission-Florida Marine Research Institute). 2001. Geographic coordinates for Florida sea turtle strandings. Data received May 2002 from Tony Redlow. St. Petersburg, Florida: Florida Fish and Wildlife Conservation Commission-Florida Marine Research Institute.

FFWCC-FMRI (Florida Fish and Wildlife Conservation Commission/Florida Marine Research Institute). 2003. Geographic coordinates for Florida sea turtle strandings. Data received November 2004 from Allen Foley. Jacksonville, Florida: Florida Fish and Wildlife Conservation Commission-Florida Marine Research Institute.

Flamm, R.O., L.I. Ward, and M. White, eds. 2000. Atlas of marine resources, Version 1.3 [CDROM]. St. Petersburg: Florida Marine Research Institute.

Foley, A.M., P.H. Dutton, K.E. Singel, A.E. Redlow and W.G. Teas. 2003. The first records of olive ridleys in Florida, USA. Marine Turtle Newsletter 101:23-25.

Forney, K.A. 2002. Surveys. Pages 1203-1205 in W.F. Perrin, B. Würsig, and J.G.M. Thewissen, eds. Encyclopedia of marine mammals. San Diego, California: Academic Press.

Fritts, T.H., A.B. Irvine, R.D. Jennings, L.A. Collum, W. Hoffman, and M.A. McGehee. 1983a. Turtles, birds, and mammals in the northern Gulf of Mexico and nearby Atlantic waters. FWS/OBS-82/65. Washington, D.C.: U.S. Fish and Wildlife Service.

Fritts, T.H., W. Hoffman, and M.A. McGehee. 1983b. The distribution and abundance of marine turtles in the Gulf of Mexico and nearby Atlantic waters. Journal of Herpetology 17(4):327-344.

Fuller, D.A. 1988. Occurrences of sea turtles in eastern Louisiana. LSU-CFI-88-12. Baton Rouge, Louisiana: Louisiana State University. Prepared for Southeast Fisheries Center, Panama City Laboratory, Panama City, Florida.

Fulling, G.L., K.D. Mullin, and C.W. Hubard. 2003. Abundance and distribution of cetaceans in outer continental shelf waters of the U.S. Gulf of Mexico. Fishery Bulletin 101:923-932

Fulling, G., and P. Clapham. 2004. Cruise report, NOAA ship Gordon Gunter cruise GU-04-01(26), MONAH project humpback whale survey, Silver Bank. Unpublished cruise report. Pascagoula, Mississippi and Woods Hole, Massachusetts: National Marine Fisheries Service.

Geraci, J.R., and V.J. Lounsbury. 1993. Marine mammals ashore: A field guide for strandings. Galveston, Texas: Texas A&M Sea Grant.

Gitschlag, G.R. and B.A. Herczeg. 1994. Sea turtle observations at explosive removals of energy structures. Marine Fisheries Review 56(2):1-8.

Griffin, R.B. and N.J. Griffin. 2003. Distribution, habitat partitioning, and abundance of Atlantic spotted dolphins, bottlenose dolphins, and loggerhead sea turtles on the eastern Gulf of Mexico continental shelf. Gulf of Mexico Science 21(1):23-34.

Griffin, R.B. and N.J. Griffin. 2004. Temporal variation in Atlantic spotted dolphin (Stenella frontalis) and bottlenose dolphin (Tursiops truncatus) densities on the west Florida continental shelf. Aquatic Mammals 30(3):380-390.

Henwood, T.A., and S.P. Epperly. 1999. Aerial surveys in foraging habitats. Pages 65-66 in K.L. Eckert, K.A. Bjorndal, F.A. Abreu-Grobois, and M. Donnelly, eds. Research and management techniques for the conservation of sea turtles. IUCN/SSC Marine Turtle Specialist Group Publication No. 4. Washington, D.C.: IUCN/SSC Marine Turtle Specialist Group

Hubard, C.W., and K.D. Mullin. 1999. Report of a cetacean survey of oceanic waters of the northern Gulf of Mexico aboard NOAA ship Oregon II (cruise 234) 22 April-2 June 1999. Unpublished cruise report. Pascagoula, Mississippi: National Marine Fisheries Service.

Hubard, C.W., and K.D. Mullin. 2000. Report of a cetacean survey of oceanic waters of the northern Gulf of Mexico aboard NOAA ship Gordon Gunter (cruise 007) 18 April-30 May 2000. Unpublished cruise report. Pascagoula, Mississippi: National Marine Fisheries Service.

Jaquet, N., J. Gordon, and B. Würsig. 2004. Cruise report for Summer Breeze cruise 2004: Sperm Whale Seismic Study, PHOTO-ID/mesoscale population study cruise (20 June - 15 August 2004).

Jefferson, T.A. 2002c. Geographic coordinates for cetacean records in the northern Gulf of Mexico. Data received April 2002 from Dr. Thomas Jefferson. La Jolla, California: National Marine Fisheries Service-Southwest Fisheries Science Center.

Jefferson, T.A., and S.K. Lynn. 1994. Marine mammal sightings in the Caribbean Sea and Gulf of Mexico, summer 1991. Caribbean Journal of Science 30(1-2):83-89.

Jefferson, T.A., and A.J. Schiro. 1997. Distribution of cetaceans in the offshore Gulf of Mexico. Mammal Review 27(1):27-50.

Jochens, A., D. Biggs, D. Engelhaupt, J. Gordon, N. Jaquet, M. Johnson, R. Leben, B. Mate, P. Miller, J. Ortega-Ortiz, A. Thode, P. Tyack, J. Wormuth, and B. Würsig. 2006. Sperm whale seismic study in the Gulf of Mexico, Summary Report, 2002-2004. OCS Study MMS 2006-034. New Orleans, Louisiana: Minerals Management Service.

Kenney, R.D. 2005. Personal communication via email between Dr. Robert Kenney, University of Rhode Island, Narragansett, Rhode Island, and Ms. Cheryl Schroeder, Geo-Marine, Inc., Hampton, Virginia, 21 September.

Kinzel, M.R., Carter, G., Pintos, G.T., and R. Bravo. 2002. Home range and habitat analysis of green turtles, Chelonia Mydas, in the Gulf of Mexico. Pages 289-290 in Proceedings of the Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC 503.

Kinzel, M.R. and G. Carter. 2004. ARGOS data files and location class information for Roberta and Zyanya. Data received 25 and 28 December 2004 from Michelle Kinzel, Moss Landing Marine Laboratories, Bonita, California, and Greg Carter, Oceanic Resource Foundation, San Francisco, California.

Klima, E.F., G.R. Gitschlag, and M.L. Renaud. 1988. Impacts of the explosive removal of offshore petroleum platforms on sea turtles and dolphins. Marine Fisheries Review 50(3):33-42.

Lang, W. 2000. MMS acoustic studies in the Gulf of Mexico, FY 2000. The Leading Edge 19(8):907-909.

Layne, J.N. 1965. Observations on marine mammals in Florida waters. Bulletin of the Florida State Museum 9:131-181.

Leatherwood, S., and M.F. Platter. 1975. Aerial assessment of bottlenosed dolphins off Alabama, Mississippi and Louisiana. Pages 49-86 in D.K. Odell, D.B. Siniff and G.H. Waring, eds. Tursiops truncatus workshop. Miami, Florida: Rosentiel School of Marine and Atmospheric Science, University of Miami.

Leatherwood, S., J.R. Gilbert, and D.G. Chapman. 1978. An evaluation of some techniques for aerial censuses of bottlenosed dolphins. Journal of Wildlife Management 42(2):239-250.

Leatherwood, S., and R. R. Reeves 1983b. Abundance of bottlenose dolphins in Corpus Christi Bay and coastal southern Texas. Contributions in Marine Science 26:179-199.

Lohoefener, R., W. Hoggard, K. Mullin, C. Roden, and C. Rogers. 1990. Association of sea turtles with petroleum platforms in the north-central Gulf of Mexico. OCS Study MMS 90-0025. New Orleans, Louisiana: Minerals Management Service.

Manzella, S.A., and J.A. Williams. 1992. The distribution of Kemp's ridley sea turtles (Lepidochelys kempi) along the Texas coast: An atlas. NOAA Technical Report NMFS 110:1-52.

McClellan, D.B. 1996. Aerial surveys for sea turtles, marine mammals, and vessel activity along the southeast Florida coast: 1992-1996. NOAA Technical Memorandum NMFS-SEFSC-390:1-42.

McClellan, D.B., J.A. Browder, J.L. Tobias, G.J. Konoval, M.D. Hearon, O. Bass, and J. Osborne. 2000. Opportunistic sightings of bottlenose dolphin, Tursiops truncatus, along the southeast Florida coast and Florida Bay 1992-1997. NOAA Technical Memorandum NMFS-SEFSC-435:1-18.

McDaniel, C.J., L.B. Crowder, and J.A. Priddy. 2000. Spatial dynamics of sea turtle abundance and shrimping intensity in the U.S. Gulf of Mexico. Conservation Ecology 4(1):15. Accessed 6 September 2005.http://www.ecologyandsociety.org/vol4/iss1/art15/inline.html.

Mead, J.G. 1989. Beaked whales of the genus-Mesoplodon. Pages 349-430 in S.H. Ridgway and R. Harrison, eds. Handbook of marine mammals. Volume 4: River dolphins and the larger toothed whales. San Diego, California: Academic Press.

MML-STCP (Mote Marine Lab, Sea Turtle Conservation Program). 2005. 2005 Loggerheads in SW Florida-Casey Key. Accessed 24 January 2007. http://www.seaturtle.org/tracking/?project_id=67&dyn=1169671999.

MMS (Minerals Management Service). 2002c. Gulf of Mexico sperm whale research. Accessed 24 January 2007. http://www.gomr.mms.gov/homepg/regulate/environ/marmam/sperm_research .html.Moore, J.C. 1953. Distribution of marine mammals to Florida waters. American Midland Naturalist 49:117-158.

Mullin, K.D. 2001. NOAA ship Gordon Gunter cruise GU-01-04 (13), 17 July- 22 August 2001: A study of sperm whales in the north-central Gulf of Mexico. Unpublished cruise report. Pascagoula, Mississippi: National Marine Fisheries Service.

Mullin, K.D., and D.M. Drass. 1999. Report of a cetacean survey of continental shelf waters of the northern Gulf of Mexico aboard NOAA ship Gordon Gunter (Cruise 99-02) 31 August-30 September 1999. Unpublished cruise report. Pascagoula, Mississippi: National Marine Fisheries Service.

Mullin, K.D., and D.M. Drass. 2000. Report of a cetacean survey of continental shelf waters of the northern Gulf of Mexico aboard NOAA ship Oregon II (Cruise 99-02) 5 September - 2 October 2000. Unpublished cruise report. Pascagoula, Mississippi: National Marine Fisheries Service.

Mullin, K., R. Lohoefener, W. Hoggard, C. Roden, and C. Rogers. 1989. Is the spatial distribution of bottlenose dolphin herds affected by petroleum platforms. Page 45 in Abstracts, Eighth Biennial Conference on the Biology of Marine Mammals. 7-11 December 1989. Pacific Grove, California.

Mullin, K.D., R.R. Lohoefener, W. Hoggard, C.L. Roden, and C.M. Rogers. 1990. Abundance of bottlenose dolphins, Tursiops truncatus, in the coastal Gulf of Mexico. Northeast Gulf Science 11(2):113-122.

Mullin, K., W. Hoggard, C. Roden, R. Lohoefener, C. Rogers, and B. Taggart. 1991. Cetaceans on the upper continental slope in the north-central Gulf of Mexico. OCS Study MMS 91-0027. New Orleans, Louisiana: Minerals Management Service.

Mullin, K., W. Hoggard, C.L. Roden, R.R. Lohoefener, C.M. Rogers, and B. Taggart. 1994a. Cetaceans on the upper continental slope in the north-central Gulf of Mexico. Fishery Bulletin 92:773-786.

Mullin, K.D., K.S. Maze, and C.W. Hubard. 1998. Report of a cetacean survey of continental shelf waters of the northern Gulf of Mexico aboard NOAA ship Gordon Gunter (Cruise 001) 3-30 September 1998. Unpublished cruise report. Pascagoula, Mississippi: National Marine Fisheries Service.

Mullin, K.D., K.S. Maze Foley, A. Martinez, and C. Burks. 2001. NOAA ship Gordon Gunter Cruise GU-01-01 (11, Leg 3), 16 March- 3 April 2001: A study of sperm whales in the southeastern Gulf of Mexico. Unpublished cruise report. Pascagoula, Mississippi: National Marine Fisheries Service.

Newcomb, J.J., A.J. Wright, S. Kuczaj, R. Thames, W.R. Hillstrom, and R. Goodman. 2004. Underwater ambient noise and sperm whale click detection during extreme wind speed conditions. AIP Conference Proceedings 728:296-306.

NMFS (National Marine Fisheries Service). 2003h. Endangered and threatened wildlife; sea turtle conservation requirements--Final rule. Federal Register 68(35):8456-8471.

NMFS-FFWCC (National Marine Fisheries Service, Fish and Wildlife Conservation Commission). 2003. 1999 Florida Gulf Coast Sea Turtle Tracking Project. Accessed 09 September 2005. http://www.cccturtle.org/sat16.htm.

NMFS-SEFSC (National Marine Fisheries Service, Southeast Fisheries Science Center). 1992. Oregon II Cruise 92-01 (198), 3 January–11 February 1992. Unpublished cruise report. Pascagoula, Mississippi: National Marine Fisheries Service.

NMFS-SEFSC (National Marine Fisheries Service, Southeast Fisheries Science Center). 1994. Summer eastern Gulf of Mexico marine mammal survey: Oregon II Cruise 212 (94-04), 16 August- 9 September 1994. Unpublished cruise report. Pascagoula, Mississippi: National Marine Fisheries Service.

NMFS-SEFSC (National Marine Fisheries Service, Southeast Fisheries Science Center). 2001a. Cruise Results, spring southeast area monitoring and assessment program (SEAMAP) ichthyoplankton survey and cetacean survey: NOAA ship Gordon Gunter cruise GU-01-02, 17 April- 31 May 2001. Unpublished cruise report. Pascagoula, Mississippi: National Marine Fisheries Service.

NMFS-SEFSC (National Marine Fisheries Service-Southeast Fisheries Science Center). 2001b. Stock assessments of loggerhead and leatherback sea turtles and an assessment of the impact of the pelagic longline fishery on the loggerhead and leatherback sea turtles of the western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-455:1-343.

NMFS-SEFSC (National Marine Fisheries Service, Southeast Fisheries Science Center). 2003a. Cruise Results, NOAA Ship Gordon Gunter Cruise GU-03-02, 12 June - 18 August 2003: A study of oceanic cetaceans in the Northern Gulf of Mexico. Unpublished cruise report. Pascagoula, Mississippi: National Marine Fisheries Service.

NMFS-SEFSC (National Marine Fisheries Service, Southeast Fisheries Science Center) 2003b. Geographic coordinates for marine mammal and sea turtle sightings of the Oil Platform Removal Observer Program. Data received January 2005 from Gregg Gitschlag. Galveston, Texas: National Marine Fisheries Service, Southeast Fisheries Science Center.

NMFS-SEFSC (National Marine Fisheries Service, Southeast Fisheries Science Center) 2004b. Cruise Results, NOAA Ship Gordon Gunter Cruise GU-04-02 (027), 13 April-11 June 2004: A study of sperm whales and other oceanic cetaceans in the northern Gulf of Mexico. Unpublished cruise report. Pascagoula, Mississippi: National Marine Fisheries Service.

NMFS-SEFSC (National Marine Fisheries Service, Southeast Fisheries Science Center) 2004c. Cruise Results, NOAA Ship Gordon Gunter Cruise GU-04-03 (28), 22 June-19 August 2004: A survey for abundance and distribution of cetaceans in the U.S. Mid-Atlantic with an emphasis on pilot whales. Unpublished cruise report. Pascagoula, Mississippi: National Marine Fisheries Service.

NMFS-SEFSC (National Marine Fisheries Service, Southeast Fisheries Science Center) 2004d. Incidental fisheries bycatch quantity, morphometrics, and biological characteristics. Data received December 2004 from Susan Molina. Miami, Florida: National Marine Fisheries Service, Southeast Fisheries Science Center.

NMFS-SEFSC (National Marine Fisheries Service, Southeast Fisheries Science Center) 2005a. Sea turtle occurrence records. Data received January 2005 from Jo Anne Williams. National Marine Fisheries Service, Southeast Fisheries Science Center.

NMFS-SEFSC (National Marine Fisheries Service, Southeast Fisheries Science Center) 2005b. Kemp's ridley occurrences on the Texas Coast. Data received January 2005 from Jo Anne Williams. National Marine Fisheries Service, Southeast Fisheries Science Center.

NPS (National Park Service). 2002a. Green sea turtle ("Halie") satellite tag coordinates. Gulf Islands National Seashore loggerhead tracking project: Beroe. Data received 20 September 2002 from Mark Nicholas, Biologist. National Park Service, Gulf Islands National Seashore, Florida.

NPS (National Park Service). 2002b. Loggerhead sea turtle ("Beroe") satellite tag coordinates. Gulf Islands National Seashore loggerhead tracking project: Beroe. Data received 20 September 2002 from Mark Nicholas, Biologist. National Park Service, Gulf Islands National Seashore, Florida.

NPS (National Park Service). 2002c. Loggerhead sea turtle ("Kendi") satellite tag coordinates. Gulf Islands National Seashore loggerhead tracking project: Beroe. Data received 20 September 2002 from Mark Nicholas, Biologist. National Park Service, Gulf Islands National Seashore, Florida.

NPS (National Park Service). 2002d. Loggerhead sea turtle ("Sandy") satellite tag coordinates. Gulf Islands National Seashore loggerhead tracking project: Beroe. Data received 20 September 2002 from Mark Nicholas, Biologist. National Park Service, Gulf Islands National Seashore, Florida.

NPS-GUIS (National Park Service-Gulf Islands National Seashore). 2003. Gulf Islands National Seashore loggerhead tracking project. Accessed 9 September 2005. http://www.cccturtle .org/sat18.htm.

NPS-PINS (National Park Service-Padre Island National Seashore). 2005. Nesting trends of sea turtles in the U.S. Accessed on 15 September 2005. http://www.nps.gov/pais/myweb2 /new_page_23.htm.

NPS-PINS (National Park Service-Padre Island National Seashore). 2004a. Data received November 2004 from Donna Shaver. Corpus Christi, TX: National Park Service, Padre Island National Seashore.

NPS-PINS (National Park Service-Padre Island National Seashore) 2004b. Kemp's ridley sea turtle research. Accessed on 13 September 2005. http://www.nps.gov/pais/myweb2/kemp's_ridley 1.htm.

Odell, D.K. 1991. A review of the Southeastern United States Marine Mammal Stranding Network: 1978-1987. Pages 19-23 in J.E. Reynolds III and D.K. Odell, eds. Marine mammal strandings in the United States: Proceedings of the Second Marine Mammal Stranding Workshop, 3-5 December 1987, Miami, Florida. NOAA Technical Report NMFS 98.

Ogren, L. 1984. Sea turtle sightings--R/V Delaware II cruise, March 11-22, 1984. Unpublished cruise report. Panama City, Florida: National Marine Fisheries Service.

Rabalais, S.C., and N.N. Rabalais. 1980. The occurrence of sea turtles on the South Texas coast. Contributions in Marine Science 23:123-129.

Reeves, R.R. and S. Leatherwood. 1983. Autumn sightings of marine turtles (Cheloniidae) off south Texas. Southwestern Naturalist 28(3):281-288.

Renaud, M.L., Carpenter, J.A., and J.A. Williams. 1995. Activities of juvenile green turtles, Chelonia mydas, at a jettied pass in South Texas. Fishery Bulletin 93: 586-593.

Rosman, I., G.S. Boland, L. Martin, and C. Chandler. 1987. Underwater sightings of sea turtles in the northern Gulf of Mexico. OCS Study MMS 87-0107. New Orleans, Louisiana: Minerals Management Service.

Schmidly, D.J. 1981. Marine mammals of the southeastern United States coast and the Gulf of Mexico. FWS/OBS-80/41. Washington, D.C.: U.S. Fish and Wildlife Service.

Scott, G.P., and C.A. Brown. 1997. Estimates of marine mammal and marine turtle catch by the US Atlantic pelagic longline fleet in 1994-1995. Contribution MIA-96/97-28. Miami, Florida: National Marine Fisheries Service.

Scott, G.P., D.M. Burn, L.J. Hansen, and R.E. Owen. 1989. Estimates of bottlenose dolphin abundance in the Gulf of Mexico from regional aerial surveys. Contribution Number CRD-88/89-07. Miami: National Marine Fisheries Service.

Shaver, D.J. and W.G. Teas. 1999. Stranding and salvage networks. Pages 152-155 in Eckert, K.L., K.A. Bjorndal, F.A. Abreu-Grobois, and M. Donnelly, eds. Research and management techniques for the conservation of sea turtles. Publication No. 4. Washington, D.C.: IUCN/SSC Marine Turtle Specialist Group.

Swartz, S.L., and C. Burks. 2000. Cruise results, Windwards humpback (Megaptera novaeangliae) survey, NOAA ship Gordon Gunter Cruise GU-00-01, 9 February to 3 April 2000. NOAA Technical Memorandum NMFS-SEFSC-438:1-31.

Swartz, S.L., T. Cole, M. McDonald, J. Hildebrand, E. Oleson, C. Burks, P.J. Clapham, J. Barlow, and A. Martinez. 2001. Visual and acoustic survey of humpback whales (Megaptera novaeangliae) in the eastern and southern Caribbean Sea: Preliminary findings. NOAA Technical Memorandum NMFS-SEFSC-456:1-37.

Swartz, S.L., A. Martinez, J. Stamates, C. Burks, and A.A. Mignucci-Giannoni. 2002. Acoustic and visual survey of cetaceans in the waters of Puerto Rico and the Virgin Islands: February-March 2001. NOAA Technical Memorandum NMFS-SEFSC-463:1-62.

TAMU-FGBNMS (Texas A&M University-Flower Garden Banks National Marine Sanctuary). 2003. Flower Garden Banks Sea Turtle Tracking Project. Accessed 9 September 2005. http://www.ccc turtle.org/sat9.htm.

TAMUG-STFERL (Texas A&M University Galveston-Sea Turtle Fisheries Ecology Research Laboratory). 2005. TAMUG Kemp's ridley tracking. Accessed 12 September 2005. http://www.seaturtle.org /tracking/index.shtml?project_id=45.

Teas, W.G. 1993. Species composition and size class distribution of marine turtle strandings on the Gulf of Mexico and southeast United States coasts, 1985-1991. NOAA Technical Memorandum NMFS-SEFSC-315:1-43.

Thode, A., D. K. Mellinger, and A. Martinez. 2002. Passive three-dimensional tracking of sperm whales using two towed arrays during the 2001 SWAMP cruise. Journal of the Acoustical Society of America 112(5, Part 2): 2399.

Thompson, N.B. 1984. Progress report on estimating density and abundance of marine turtles: Results of first year pelagic surveys in the southeast U.S. Unpublished report. Miami: National Marine Fisheries Service.

Thompson, N.B. 1986. A summary of marine turtle sightings from NMFS/SEFC aerial census surveys for cetaceans and turtles in the Gulf of Mexico, 1983-1986. Miami, Florida: National Marine Fisheries Service-Southeast Fisheries Science Center.

Thompson, N.B. 1991. Loggerhead turtles in the Gulf of Mexico: Pelagic distributions. Miami, Florida: National Marine Fisheries Service-Southeast Fisheries Science Center.

Thompson, N.B., and H. Huang. 1993. Leatherback turtles in southeast U.S. waters. NOAA Technical Memorandum NMFS-SEFSC-318:1-25.

Tucker and Associates, Inc. 1990. Sea turtles and marine mammals of the Gulf of Mexico, proceedings of a workshop held in New Orleans, August 1-3, 1989. OCS Study MMS 90-0009. New Orleans, Louisiana: Minerals Management Service.

UF-FCFWRU (University of Florida/Florida Cooperative Fish and Wildlife Research Unit). 2005a. Juvenile green turtles in Northwest Florida. Accessed 9 September 2005. http://www.seaturtle.org/ tracking/index.shtml?project id=16.

UF-FCFWRU (University of Florida/Florida Cooperative Fish and Wildlife Research Unit) 2005b. Juvenile green turtles in Northwest Florida II. Accessed 9 September 2005. http://www.seaturtle.org /tracking/index.shtml?project id=50.

USACE (United States Army Corps of Engineers). 2003. Tampa Bay sea turtle tracking project. Accessed 9 September 2005. http://www.cccturtle.org/sat6.htm.

USFWS-BSNWR (U.S. Fish and Wildlife Service-Bon Secour National Wildlife Refuge). 2004. Geographic coordinates for Alabama sea turtle strandings. Data received January 2005 from Jereme Phillips. Gulf Shores, Alabama: U.S. and Wildlife Service, Bon Secour National Wildlife Refuge.

Wade, P.R., and R.P. Angliss. 1997. Guidelines for assessing marine mammal stocks. Report of the GAMMS (Guidelines for Assessing Marine Mammal Stocks) Workshop, 3-5 April 1996, Seattle, Washington. NOAA Technical Memorandum NMFS-OPR-12:1-93.

Walsh, C.F., and L.P. Garrison. 2006. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2005. NOAA Technical Memorandum NMFS-SEFSC-539:1-51.

Wells, R. 2007. Personal communication via email between Dr. Randall Wells, Mote Marine Laboratory, Sarasota, Florida, and Ms. Dagmar Fertl, Geo-Marine Inc., Plano, Texas, 29 January.

Wells, R.S., H.L. Rhinehart, P. Cunningham, J. Whaley, M. Baran, C. Koberna, and D.P. Costa. 1999. Long distance offshore movements of bottlenose dolphins. Marine Mammal Science 15(4):1098-1114.

Wells, R., C. Mainire, H. Rhinehart, D. Smith, A. Westgate, F. Townsend, T. Rowles, A. Hohn, and L. Hansen. 1999. Ranging patterns of rehabilitated rough-toothed dolphins, Steno bredanensis, released in the northeastern Gulf of Mexico. Page 199 in Abstracts, Thirteenth Biennial Conference on the Biology of Marine Mammals. 28 November-3 December 1999. Wailea, Hawaii.

Wilkinson, D., and G.A. Worthy. 1999. Marine mammal stranding networks. Pages 396-411 in J.R. Twiss, Jr. and R.R. Reeves, eds. Conservation and management of marine mammals. Washington, D.C.: Smithsonian Institution Press.

Würsig, B., T.A. Jefferson, and D.J. Schmidly. 2000. The marine mammals of the Gulf of Mexico. College Station, Texas: Texas A&M University Press.

This page intentionally left blank

APPENDIX B: MARINE MAMMALS

List of Figures

Figure	Title
B-1	Occurrence of endangered marine mammals in the GOMEX study area.
B-2	Occurrence of the sperm whale in the GOMEX study area.
B-3	Occurrence records for the minke whale in the GOMEX study area.
B-4	Occurrence of the Bryde's whale in the GOMEX study area.
B-5	Occurrence of *Kogia* spp. in the GOMEX study area.
B-6	Occurrence of beaked whales in the GOMEX study area.
B-7	Occurrence of the rough-toothed dolphin in the GOMEX study area.
B-8	Occurrence of the bottlenose dolphin in the GOMEX study area.
B-9	Occurrence of the pantropical spotted dolphin in the GOMEX study area.
B-10	Occurrence of the Atlantic spotted dolphin in the GOMEX study area.
B-11	Occurrence of the spinner dolphin in the GOMEX study area.
B-12	Occurrence of the Clymene dolphin in the GOMEX study area.
B-13	Occurrence of the striped dolphin in the GOMEX study area.
B-14	Occurrence records for the Fraser's dolphin in the GOMEX study area.
B-15	Occurrence of the Risso's dolphin in the GOMEX study area.
B-16	Occurrence records for the melon-headed whale in the GOMEX study area.
B-17	Occurrence records for the pygmy killer whale in the GOMEX study area.
B-18	Occurrence records for the false killer whale in the GOMEX study area.
B-19	Occurrence of the killer whale in the GOMEX study area.
B-20	Occurrence of the short-finned pilot whale in the GOMEX study area.

This page intentionally left blank

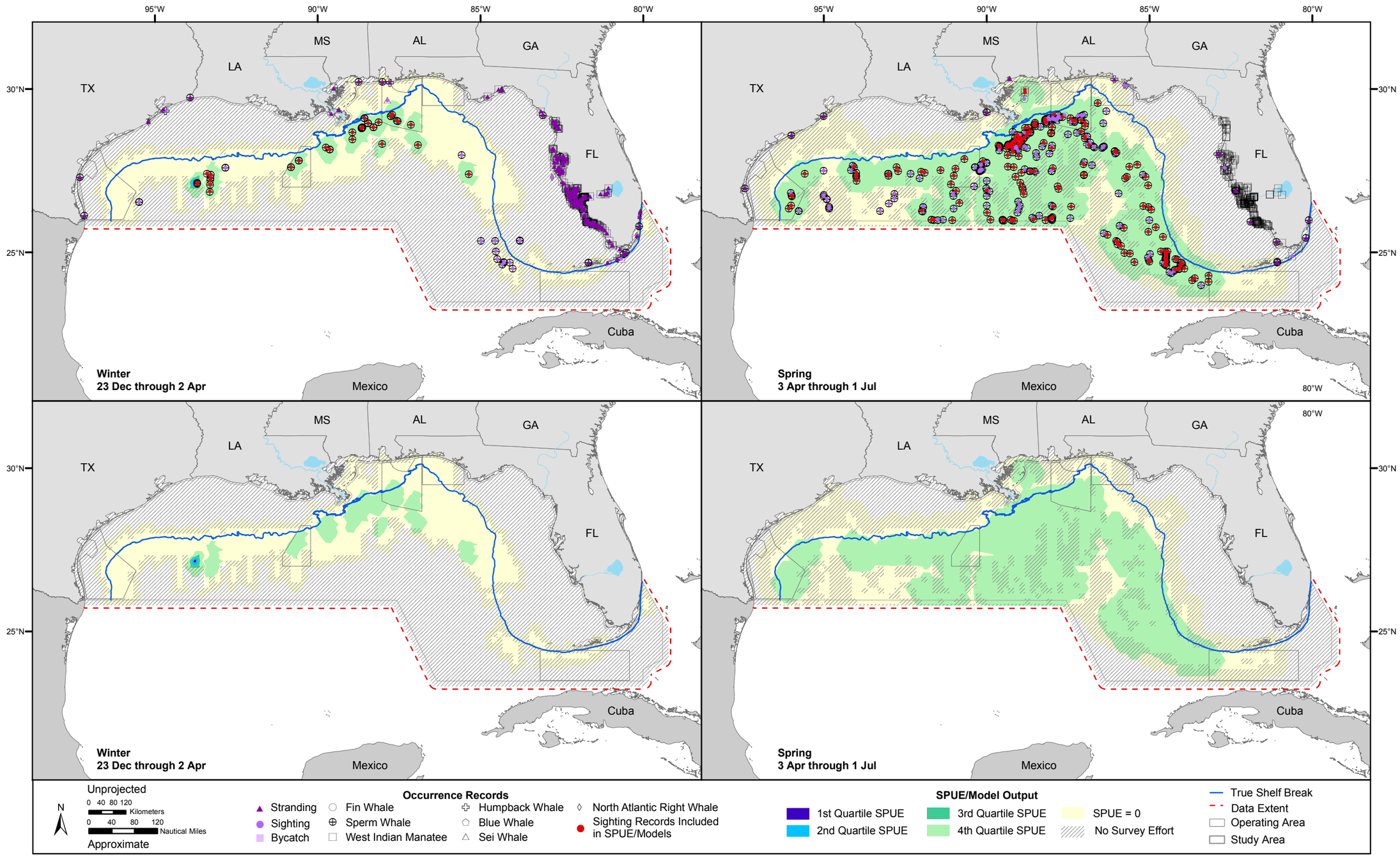

Figure B-1. Occurrence of endangered marine mammals in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1.

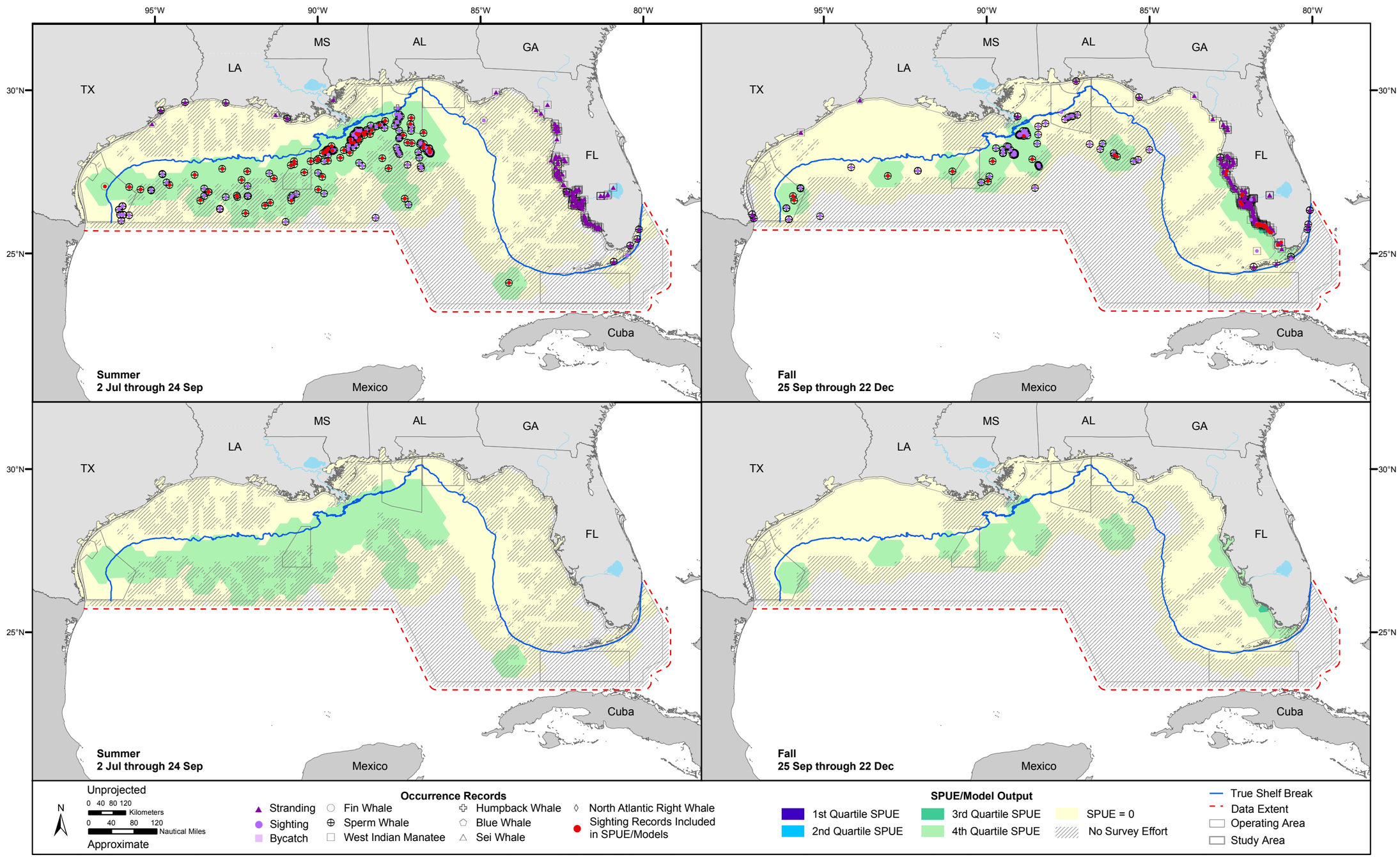

Figure B-1. Occurrence of endangered marine mammals in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1. (Cont'd)

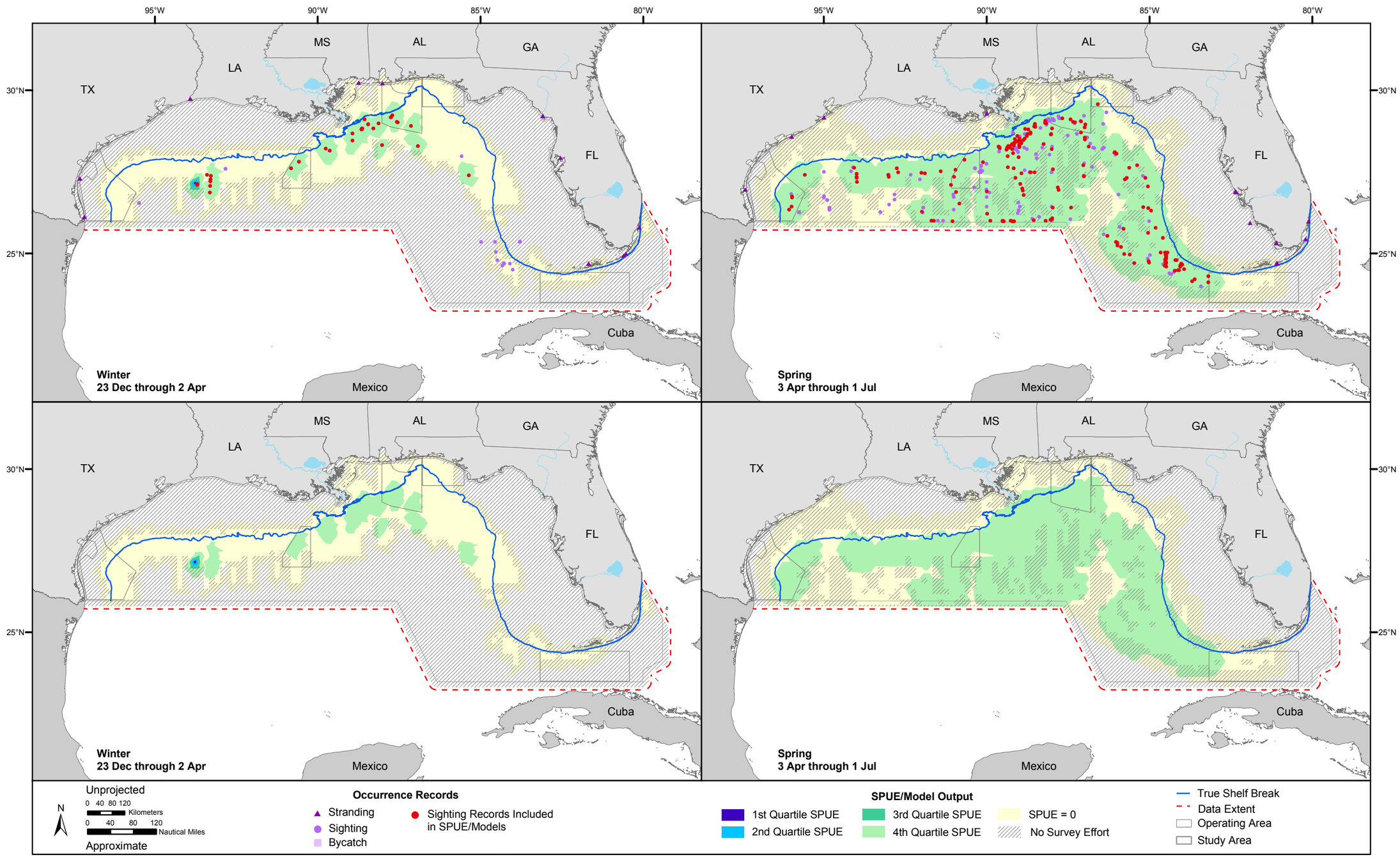

Figure B-2. Occurrence of the sperm whale in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1.

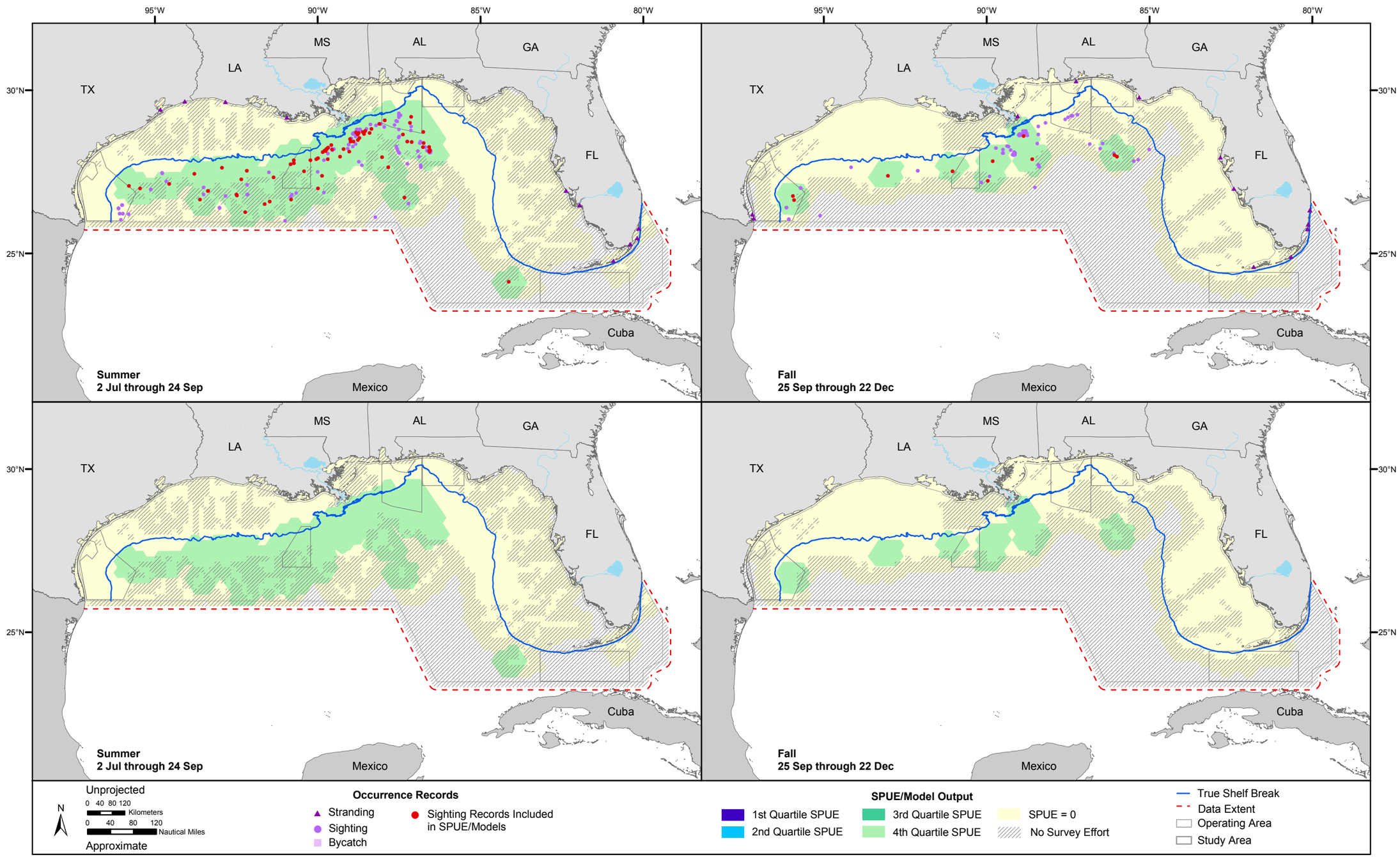

Figure B-2. Occurrence of the sperm whale in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1. (Cont'd)

This page intentionally left blank

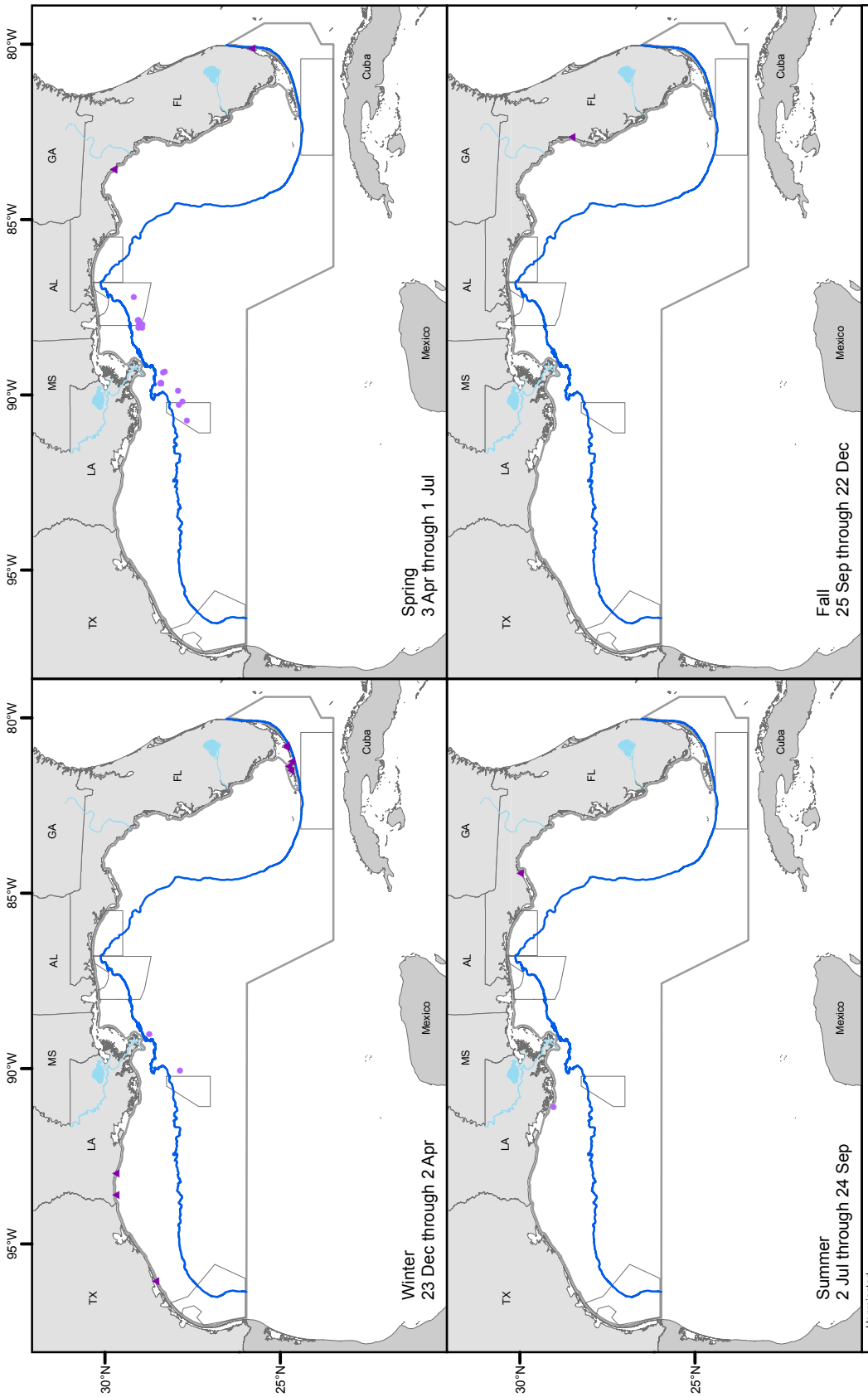

Figure B-3. Occurrence records for the minke whale in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Source data: refer to Table A-1.

This page intentionally left blank

This page intentionally left blank

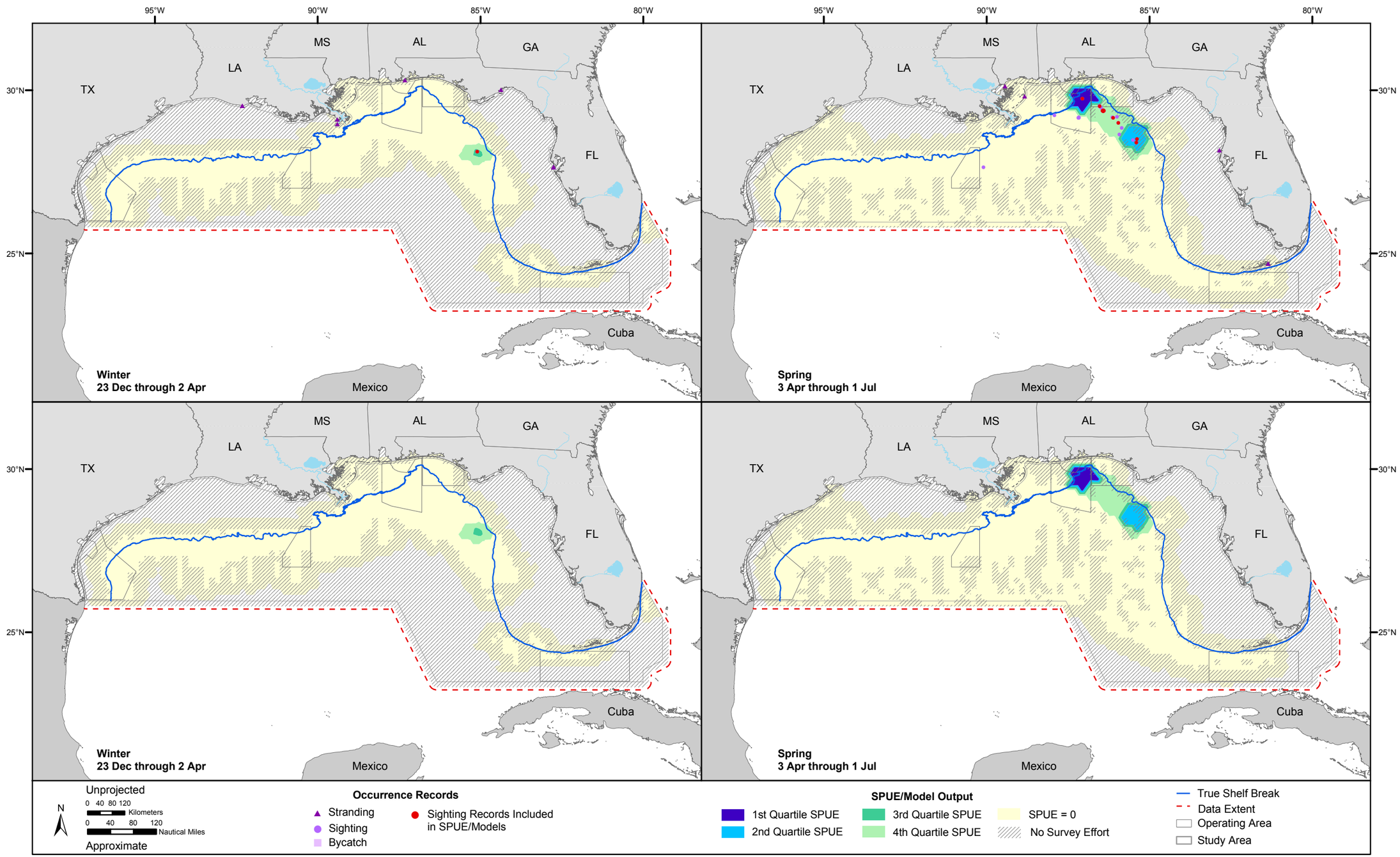

Figure B-4. Occurrence of the Bryde's whale in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1.

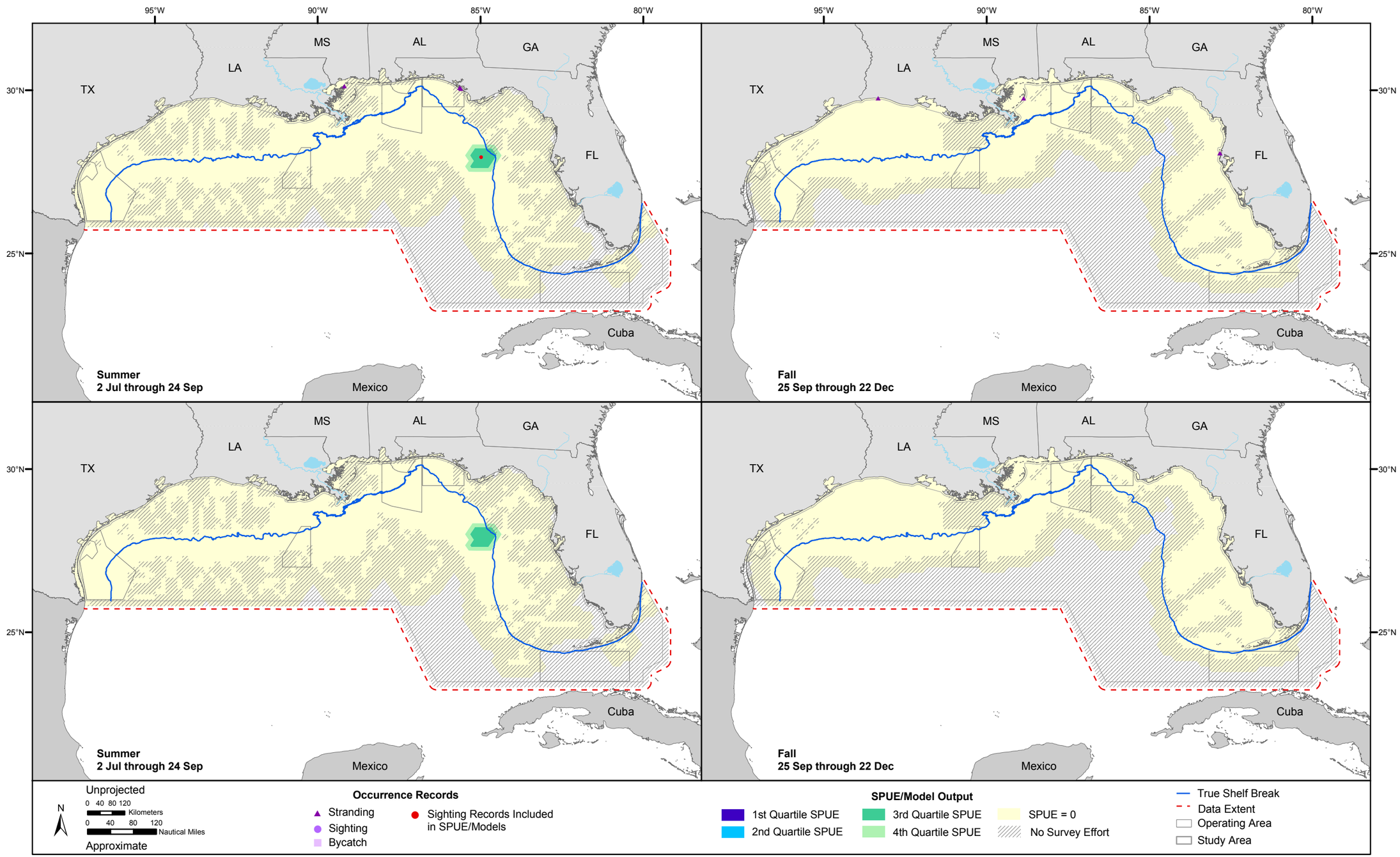

Figure B-4. Occurrence of the Bryde's whale in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1. (Cont'd)

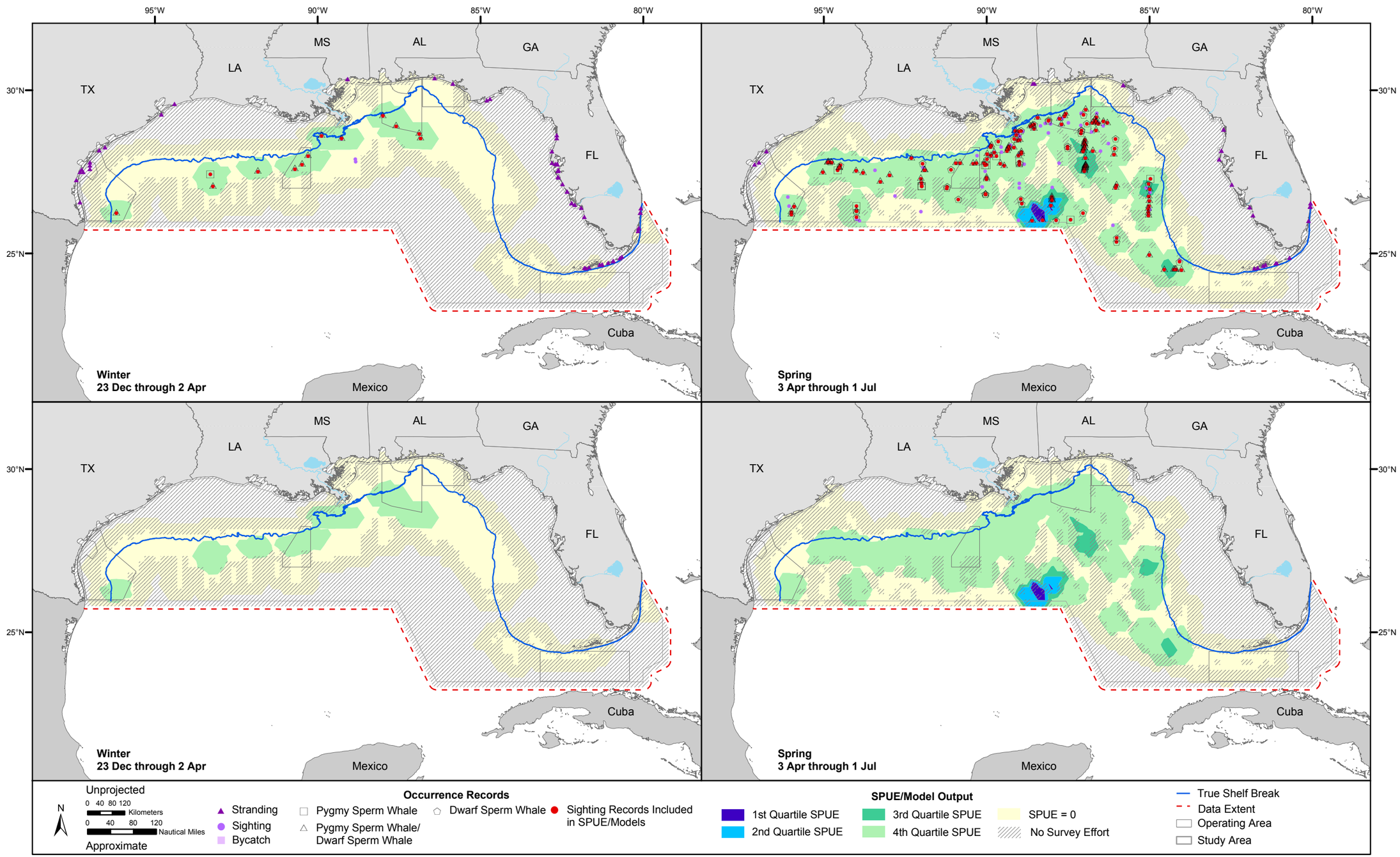

Figure B-5. Occurrence of *Kogia* spp. in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1.

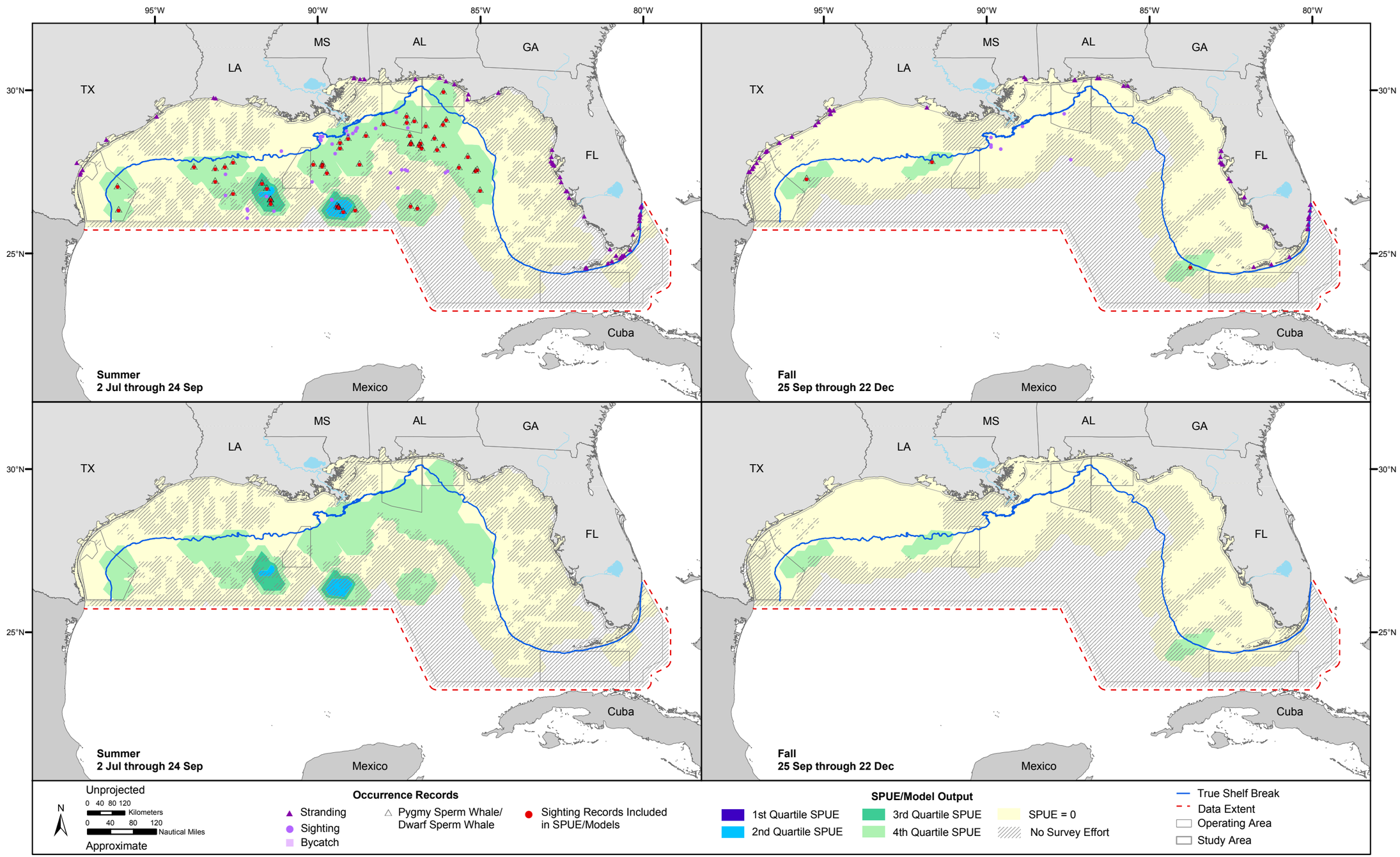

Figure B-5. Occurrence of *Kogia* spp. in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1. (Cont'd)

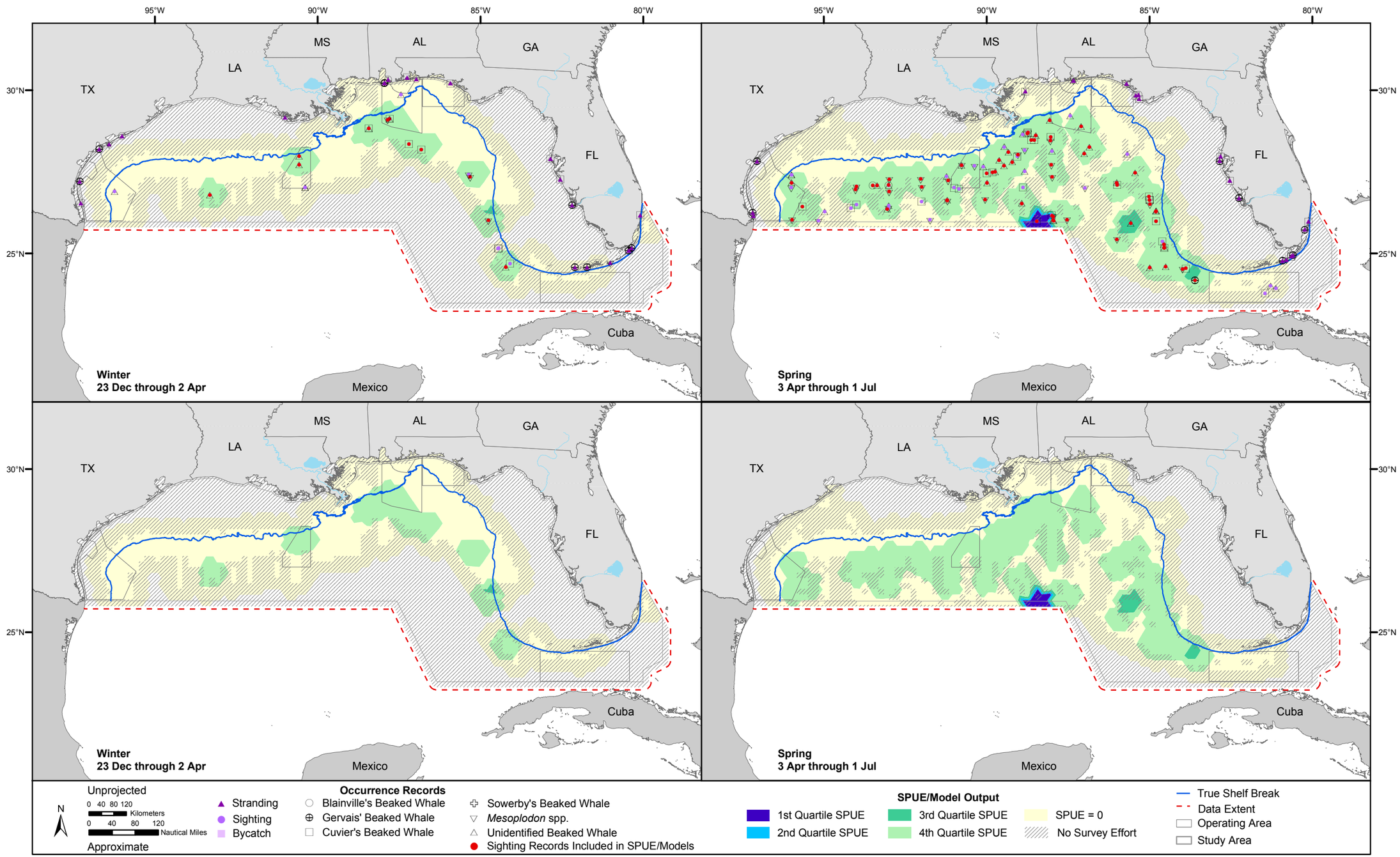

Figure B-6. Occurrence of beaked whales in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1.

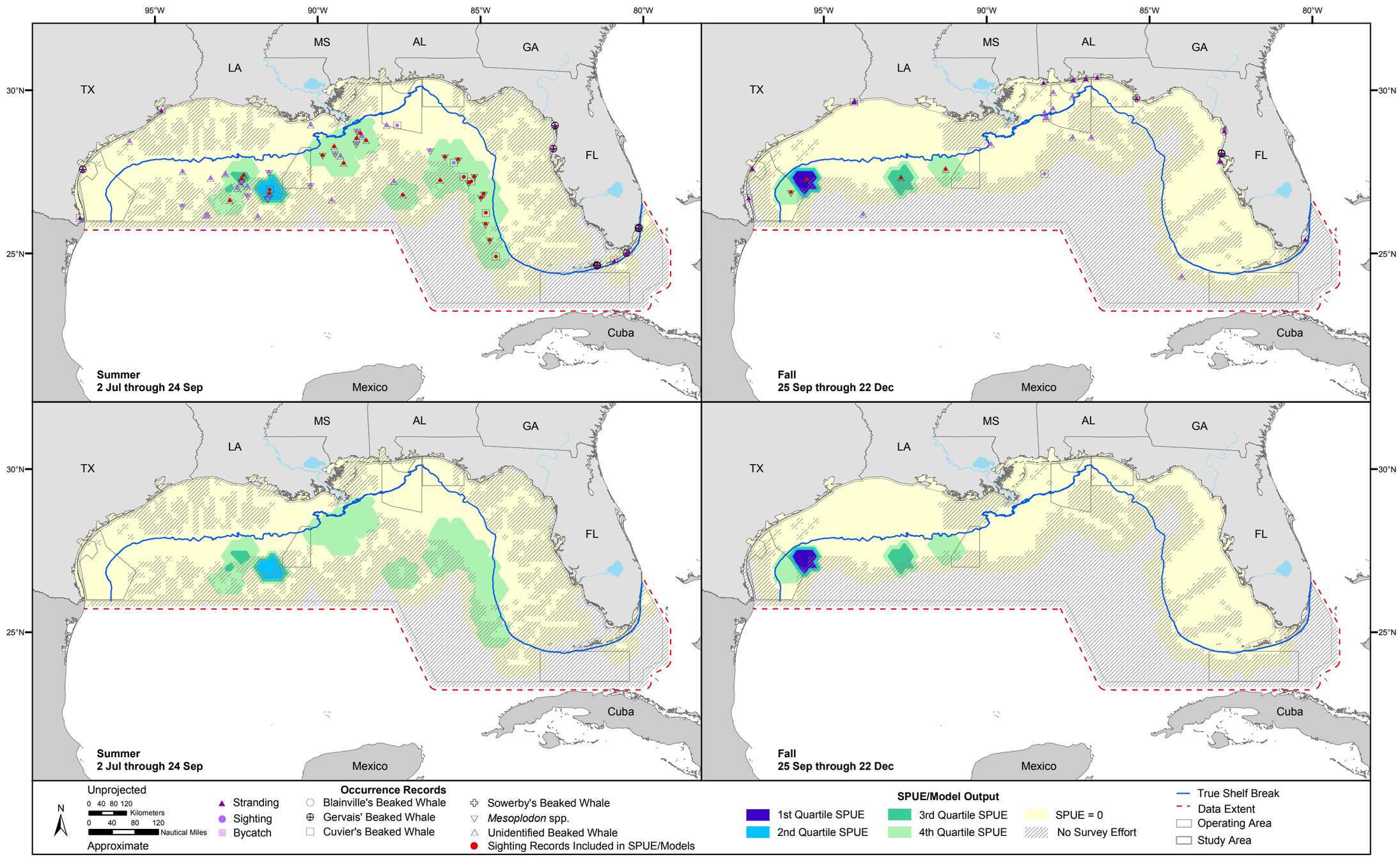

Figure B-6. Occurrence of beaked whales in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1. (Cont'd)

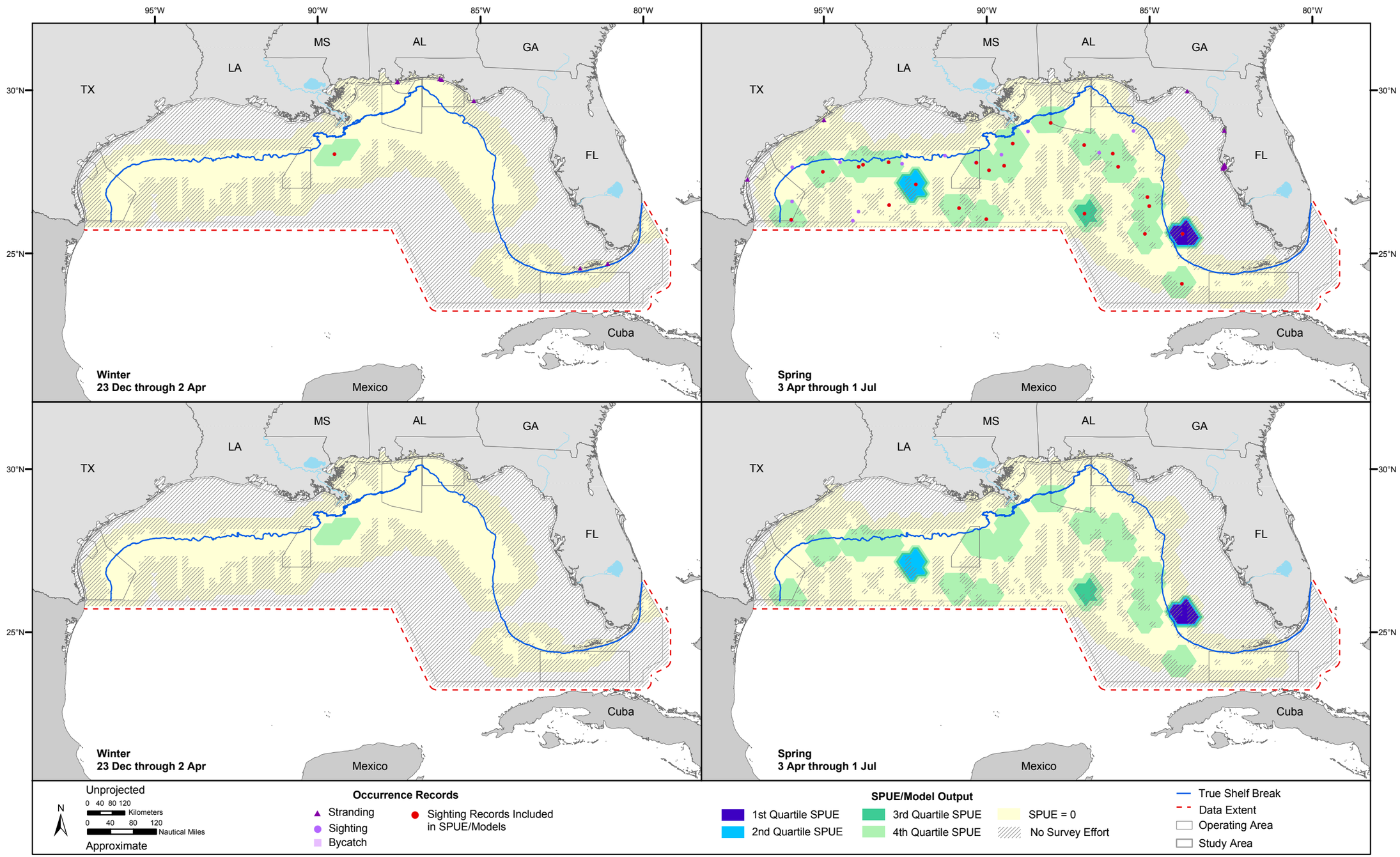

Figure B-7. Occurrence of the rough-toothed dolphin in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1.

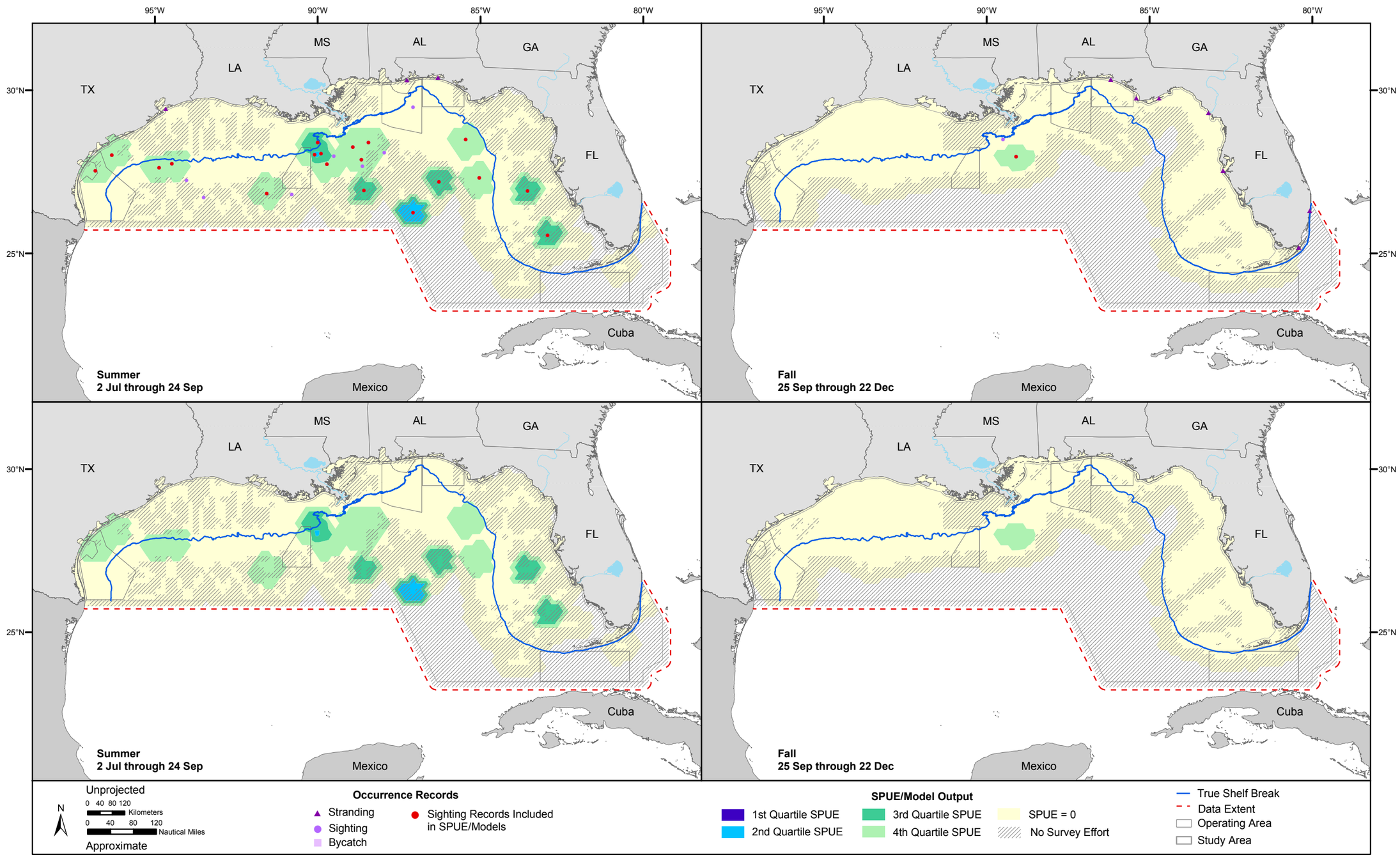

Figure B-7. Occurrence of the rough-toothed dolphin in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1. (Cont'd)

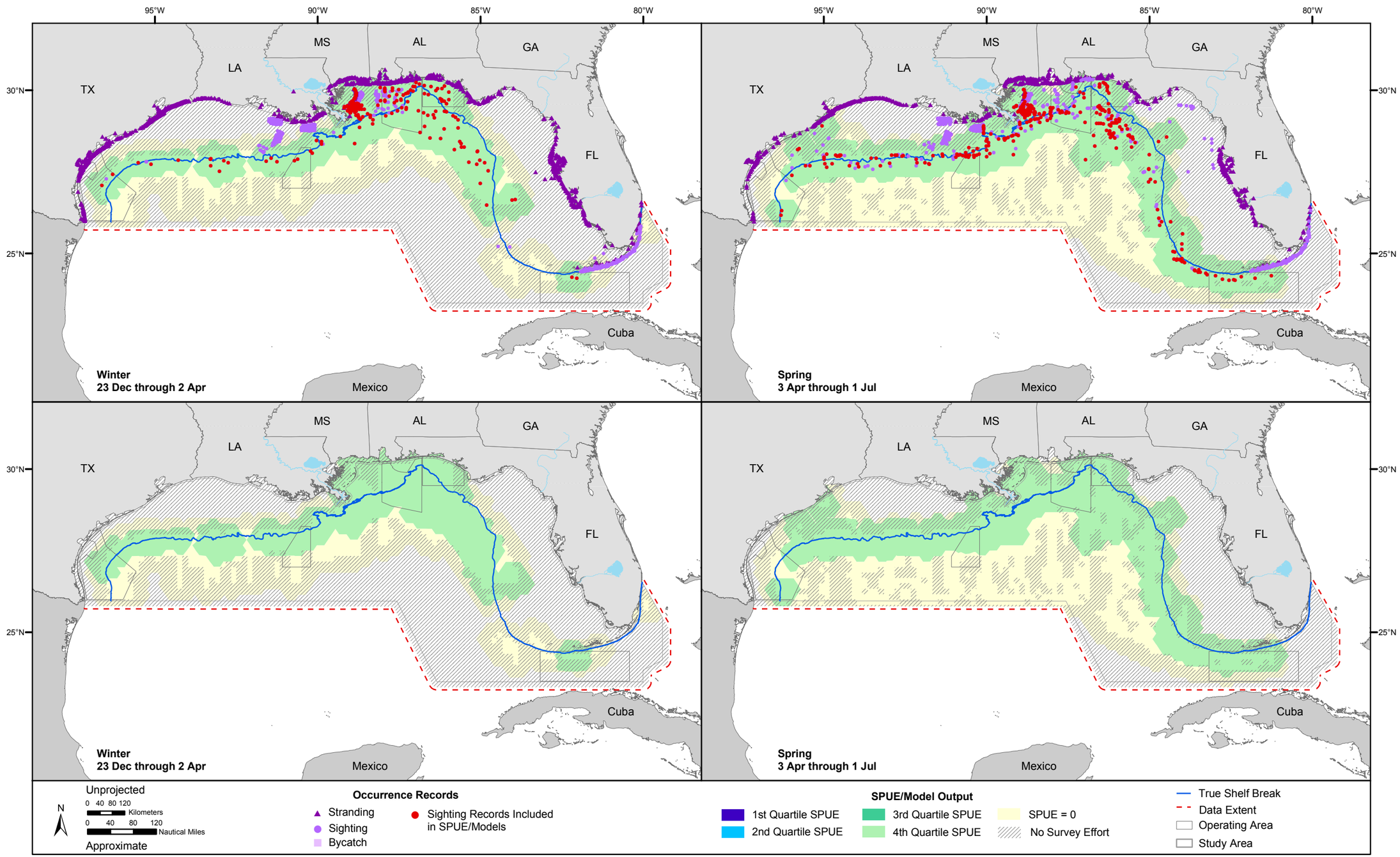

Figure B-8. Occurrence of the bottlenose dolphin in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1.

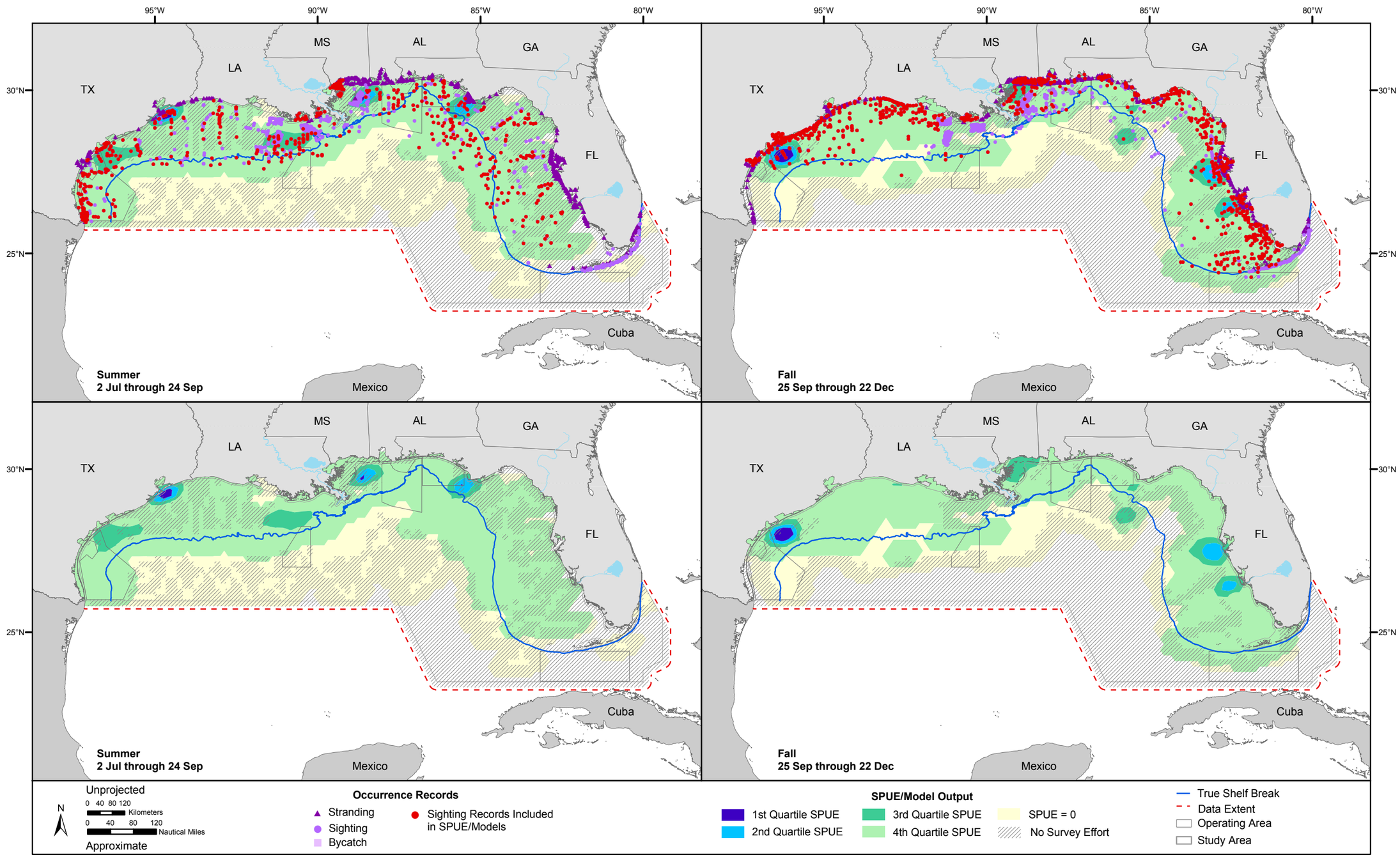

Figure B-8. Occurrence of the bottlenose dolphin in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1. (Cont'd)

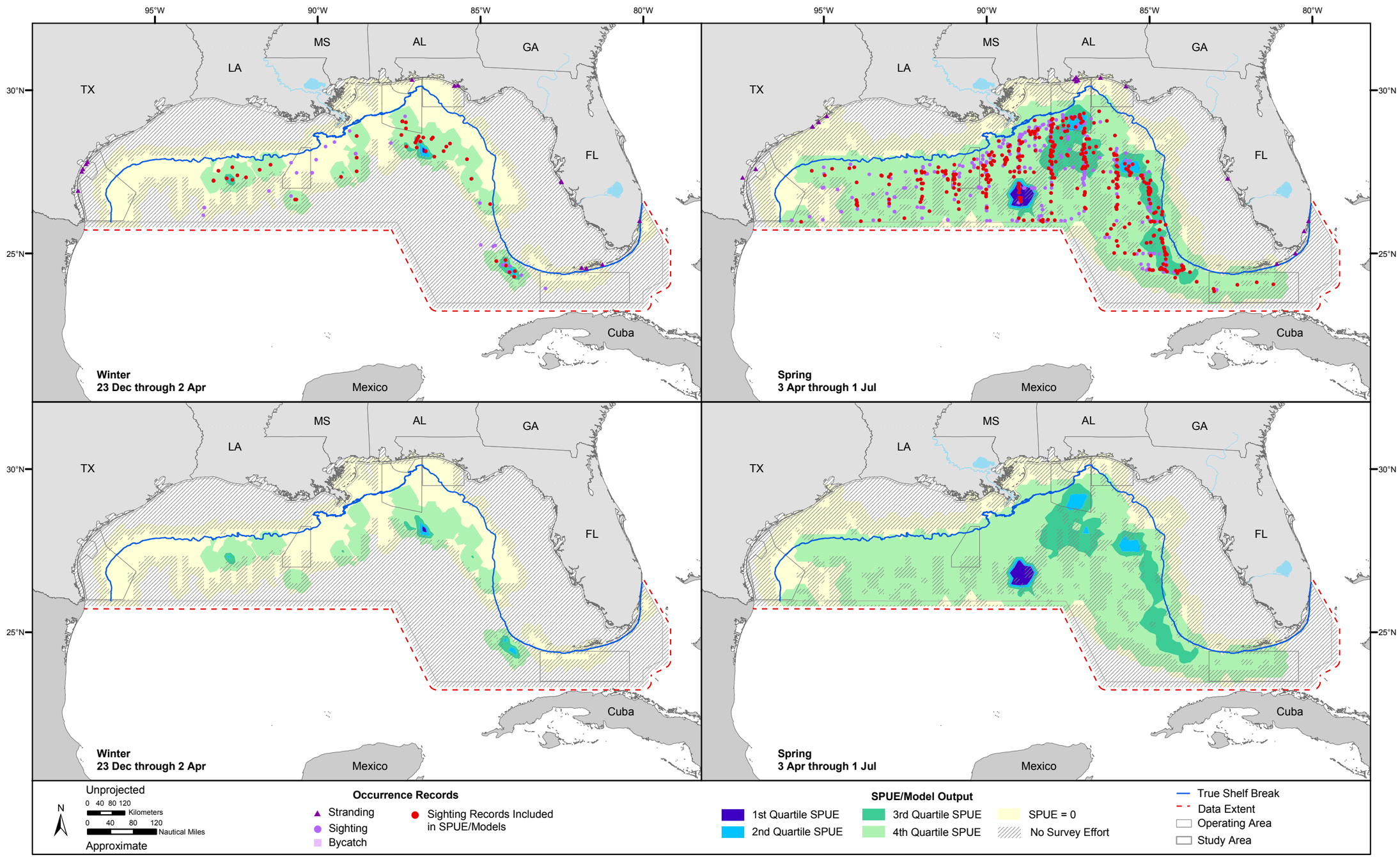

Figure B-9. Occurrence of the pantropical spotted dolphin in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1.

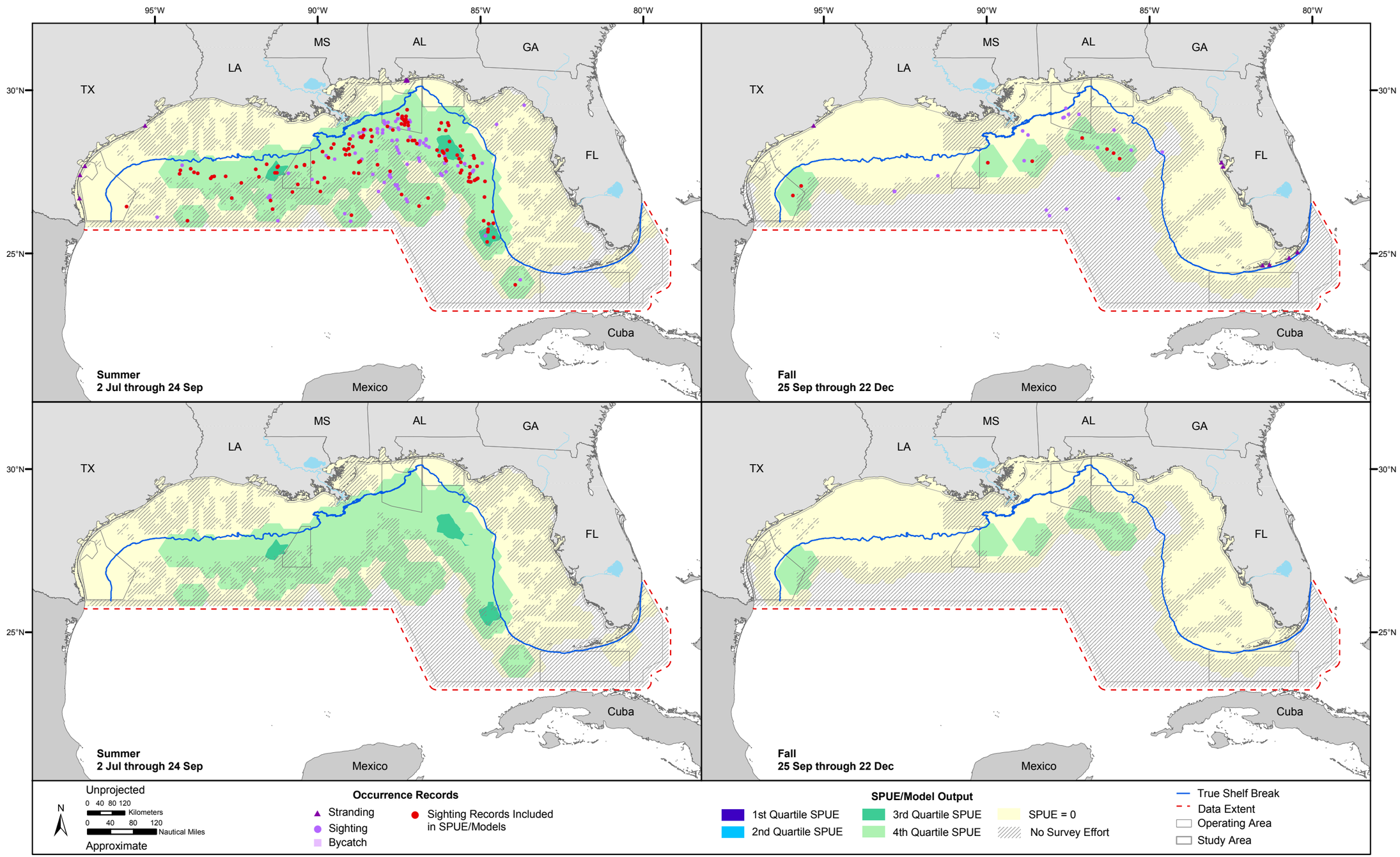

Figure B-9. Occurrence of the pantropical spotted dolphin in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1. (Cont'd)

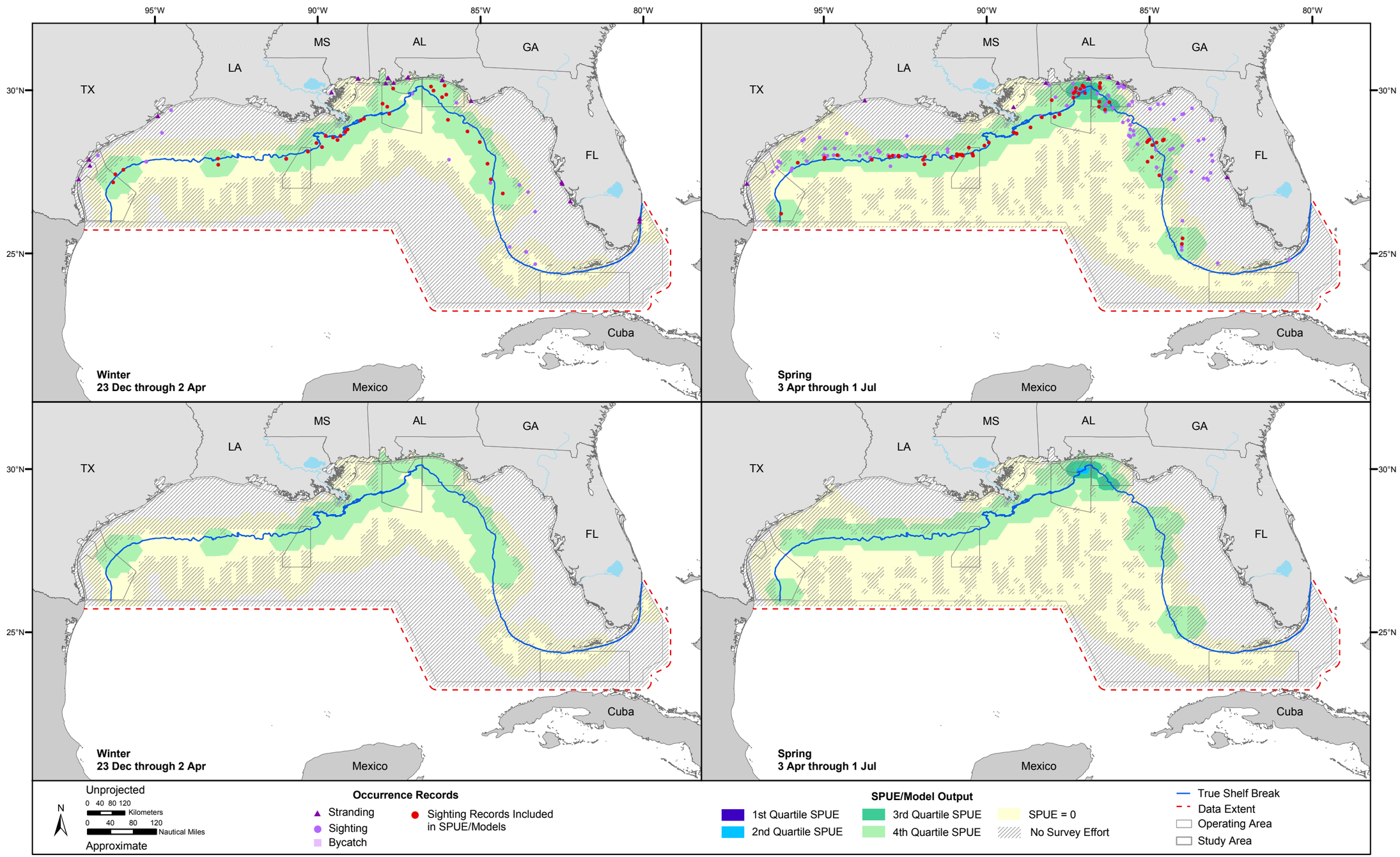

Figure B-10. Occurrence of the Atlantic spotted dolphin in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1.

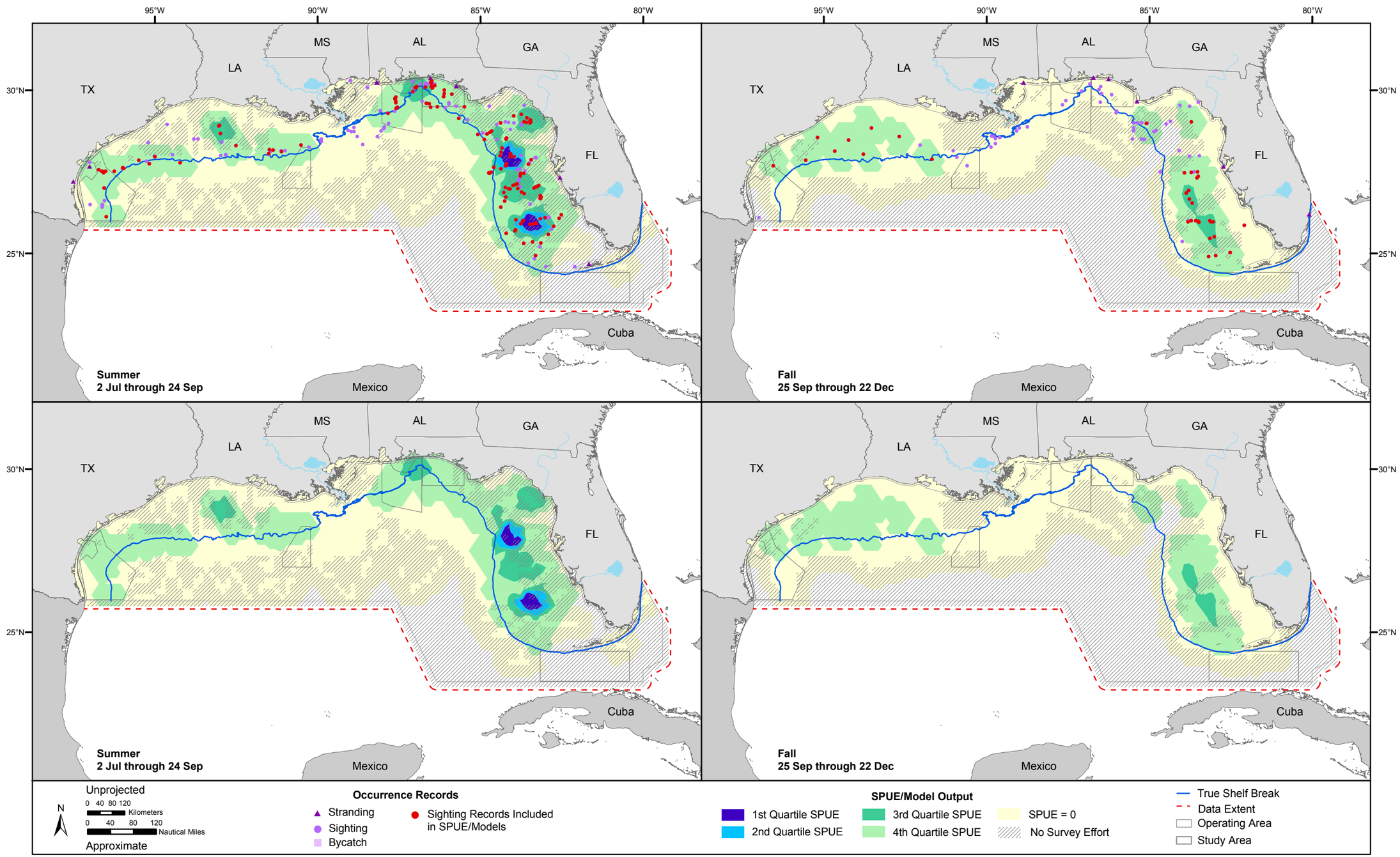

Figure B-10. Occurrence of the Atlantic spotted dolphin in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1. (Cont'd)

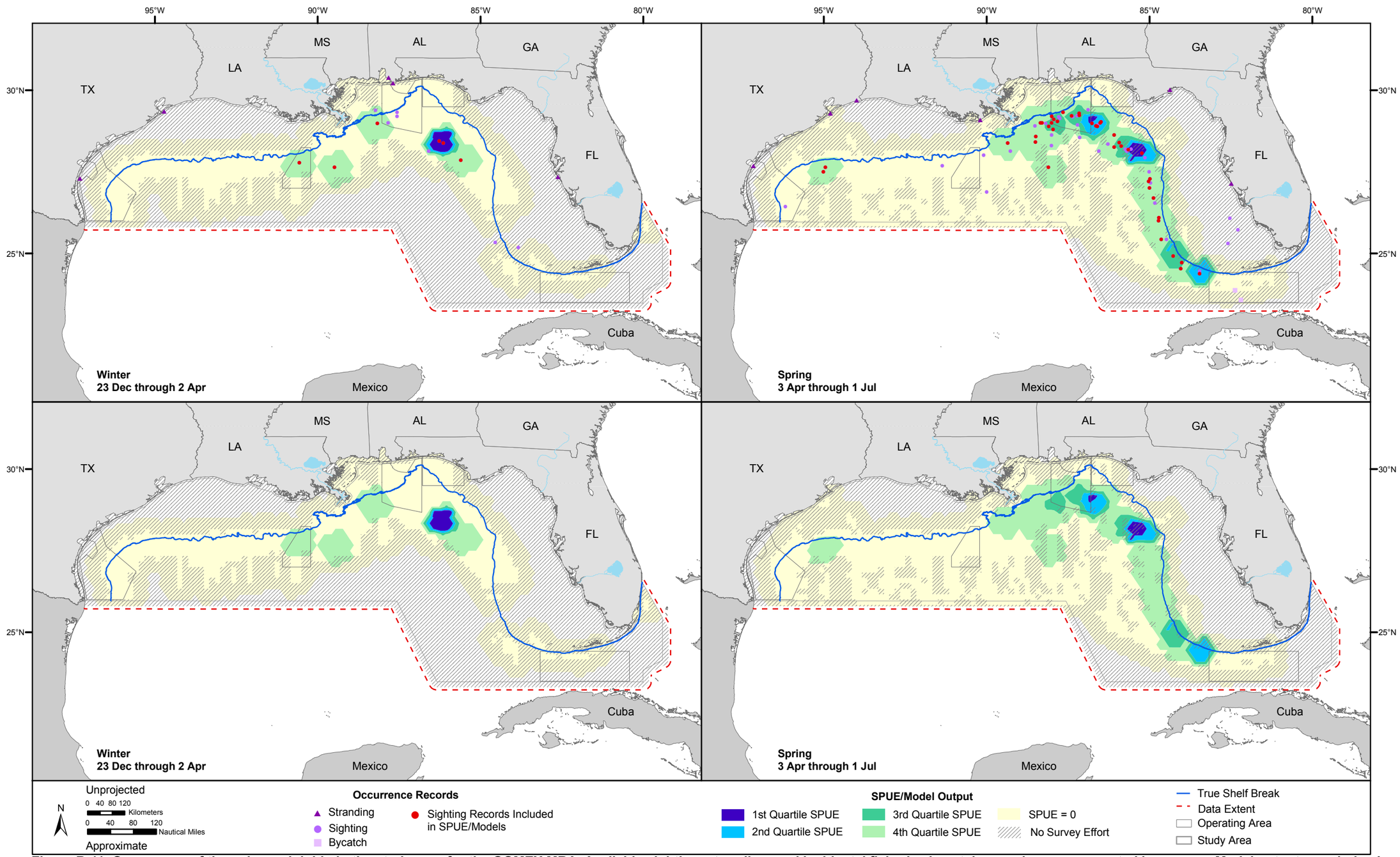

Figure B-11. Occurrence of the spinner dolphin in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1.

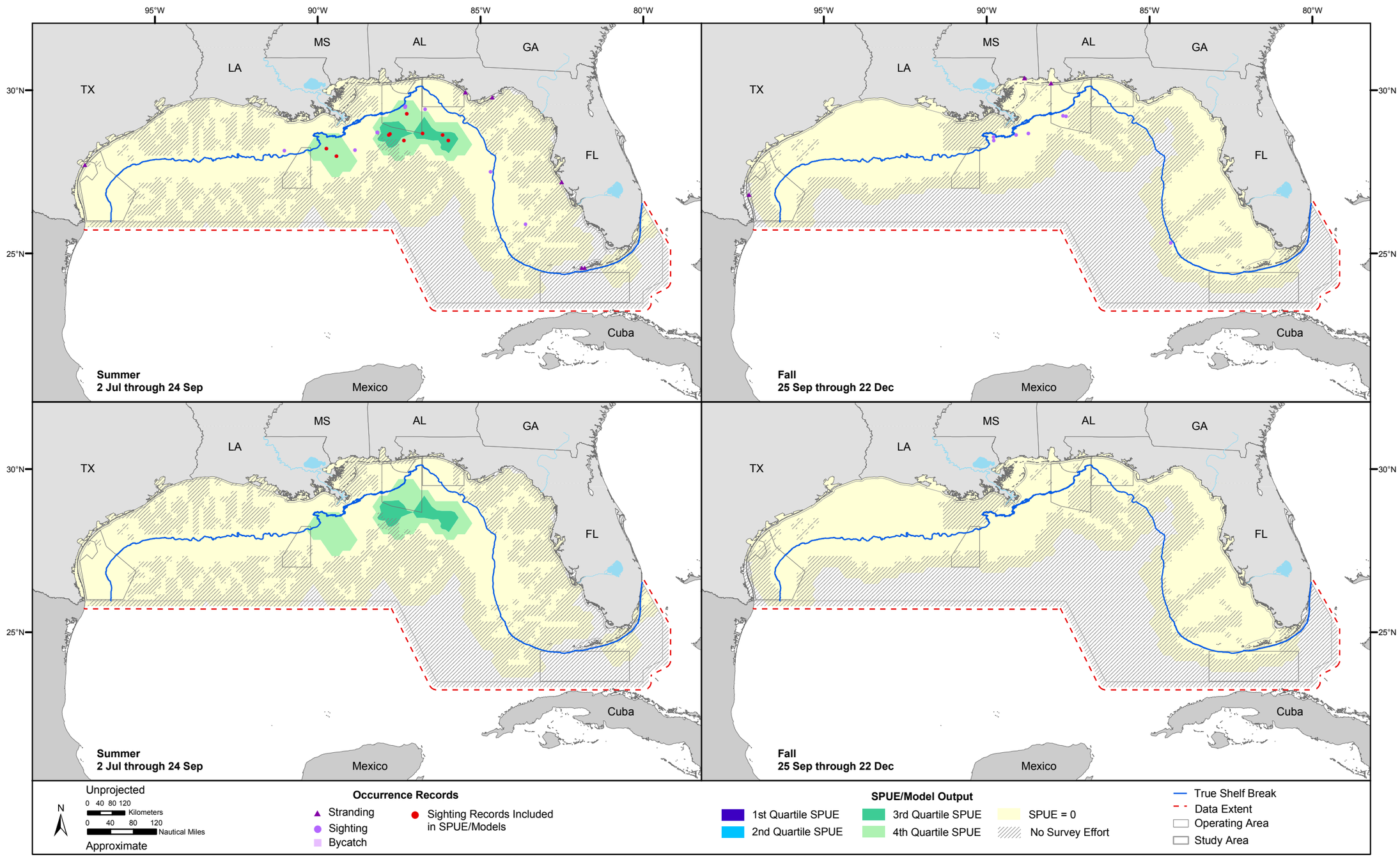

Figure B-11. Occurrence of the spinner dolphin in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1. (Cont'd)

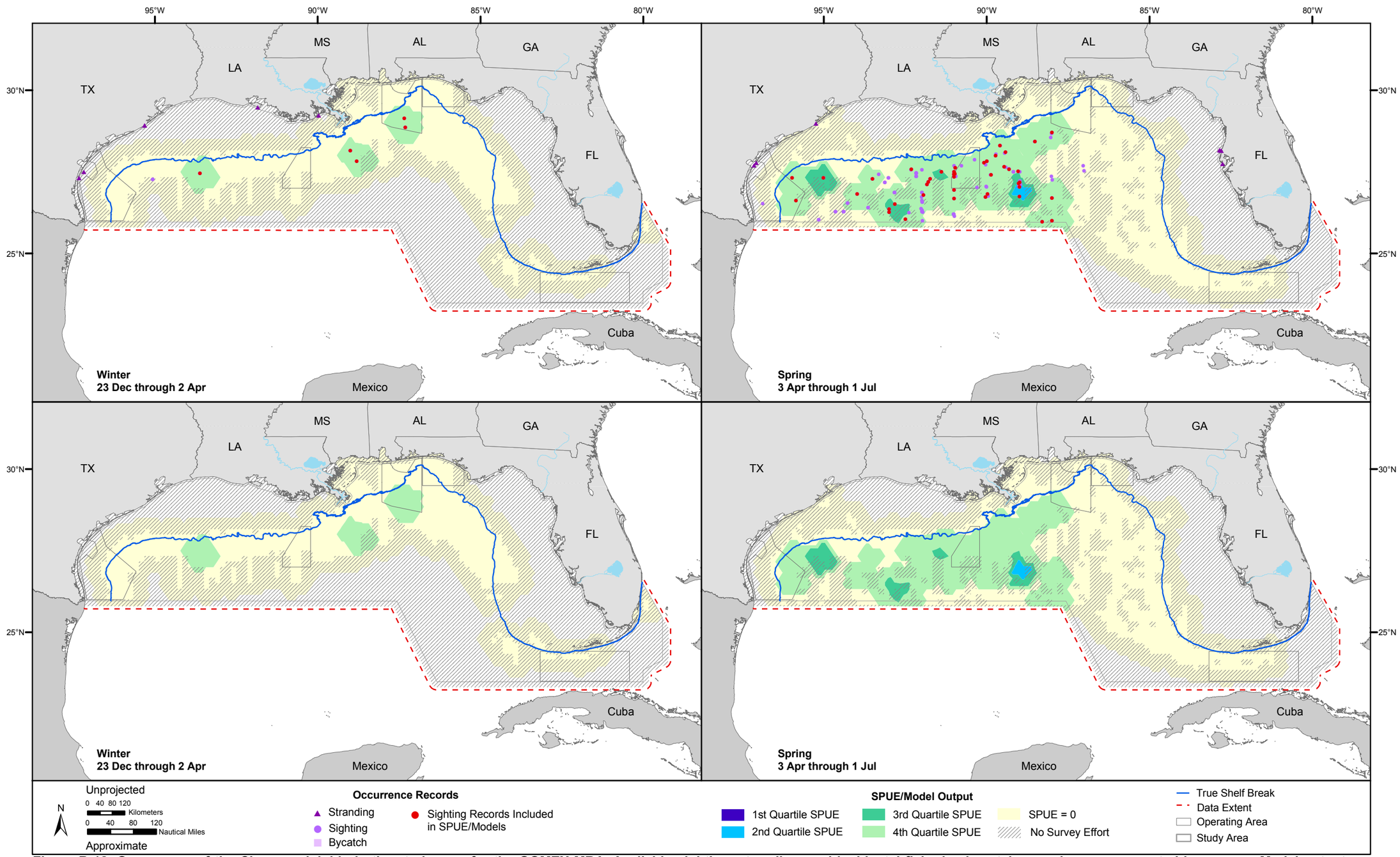

Figure B-12. Occurrence of the Clymene dolphin in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1.

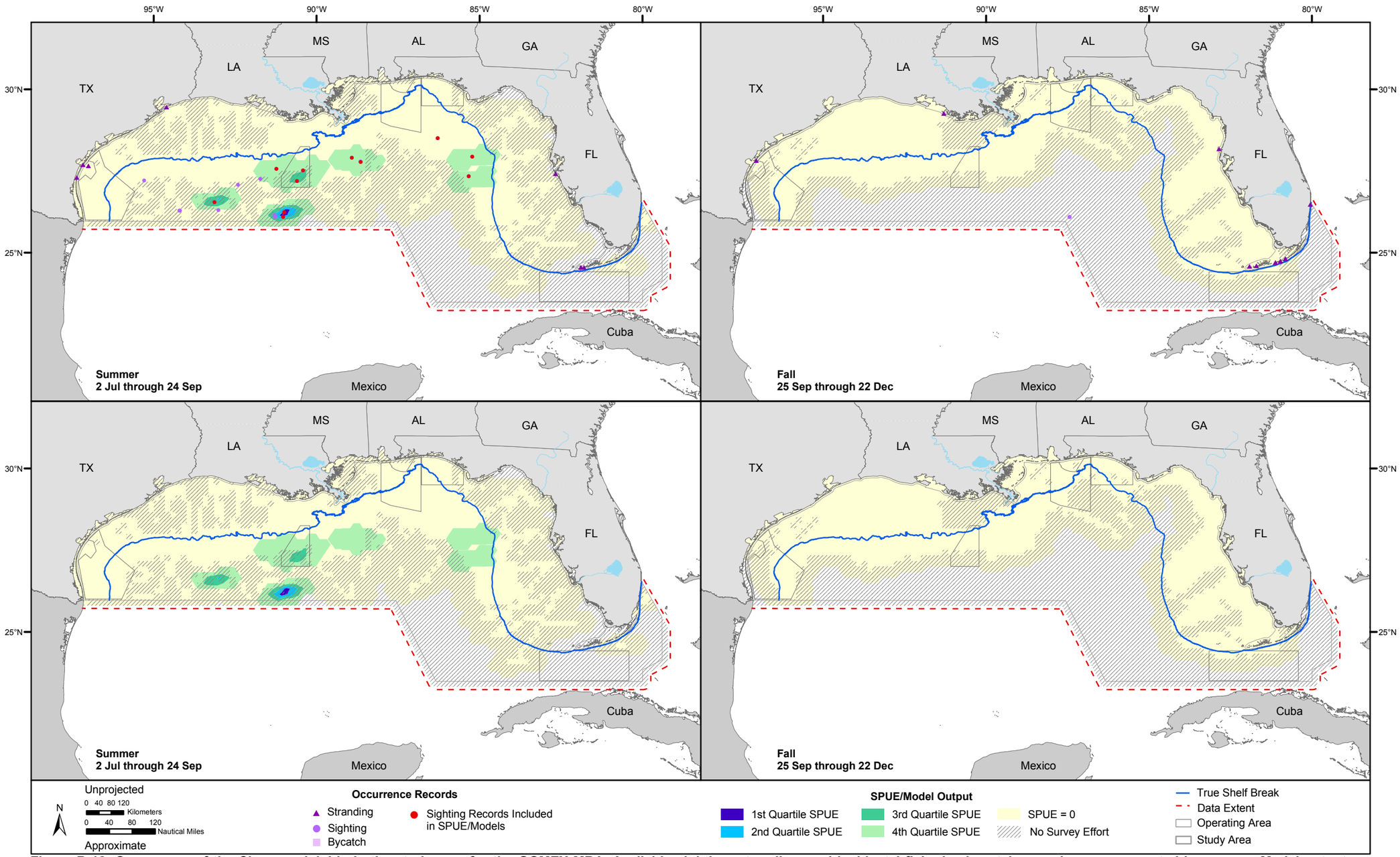

Figure B-12. Occurrence of the Clymene dolphin in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1. (Cont'd)

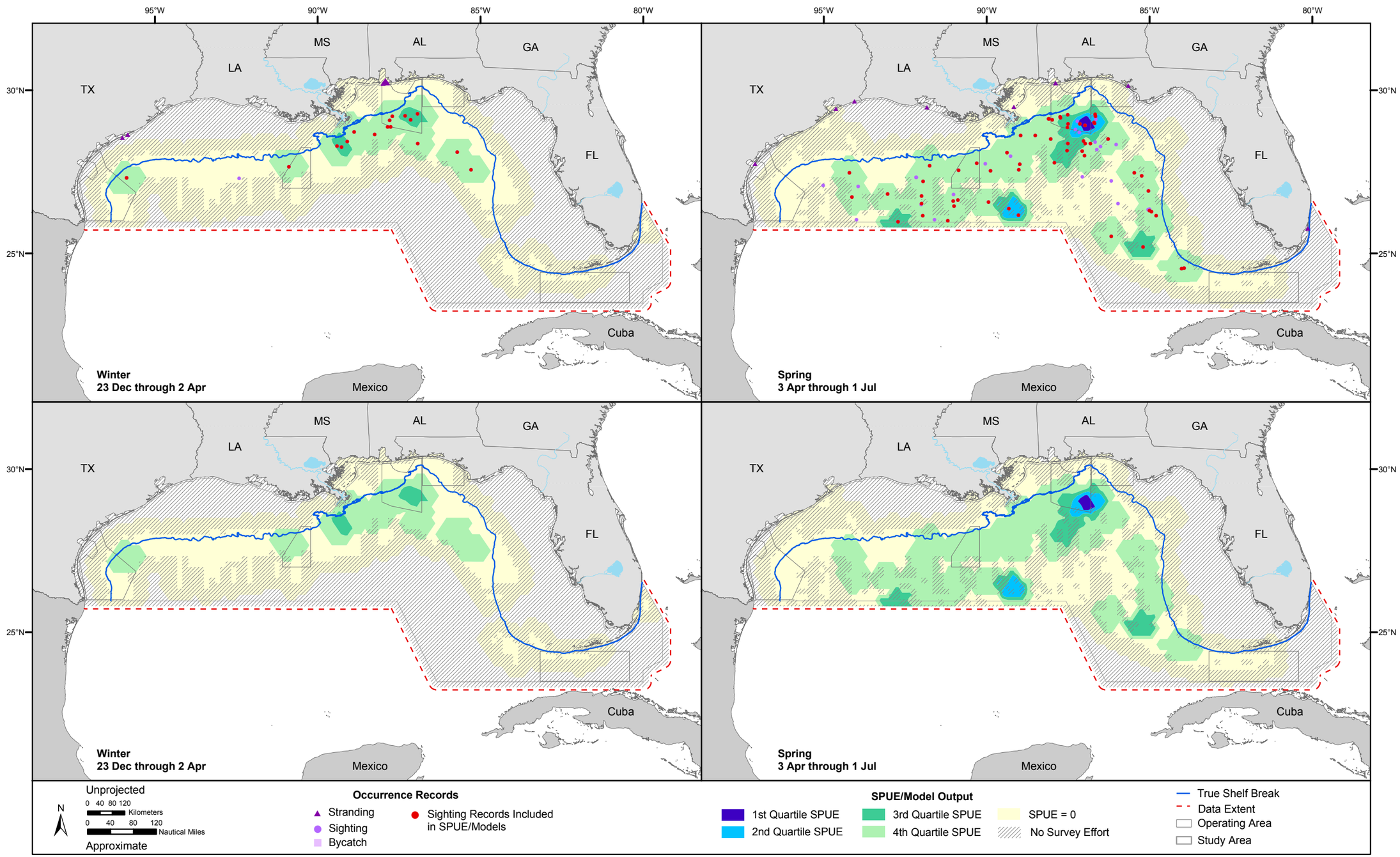

Figure B-13. Occurrence of the striped dolphin in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1.

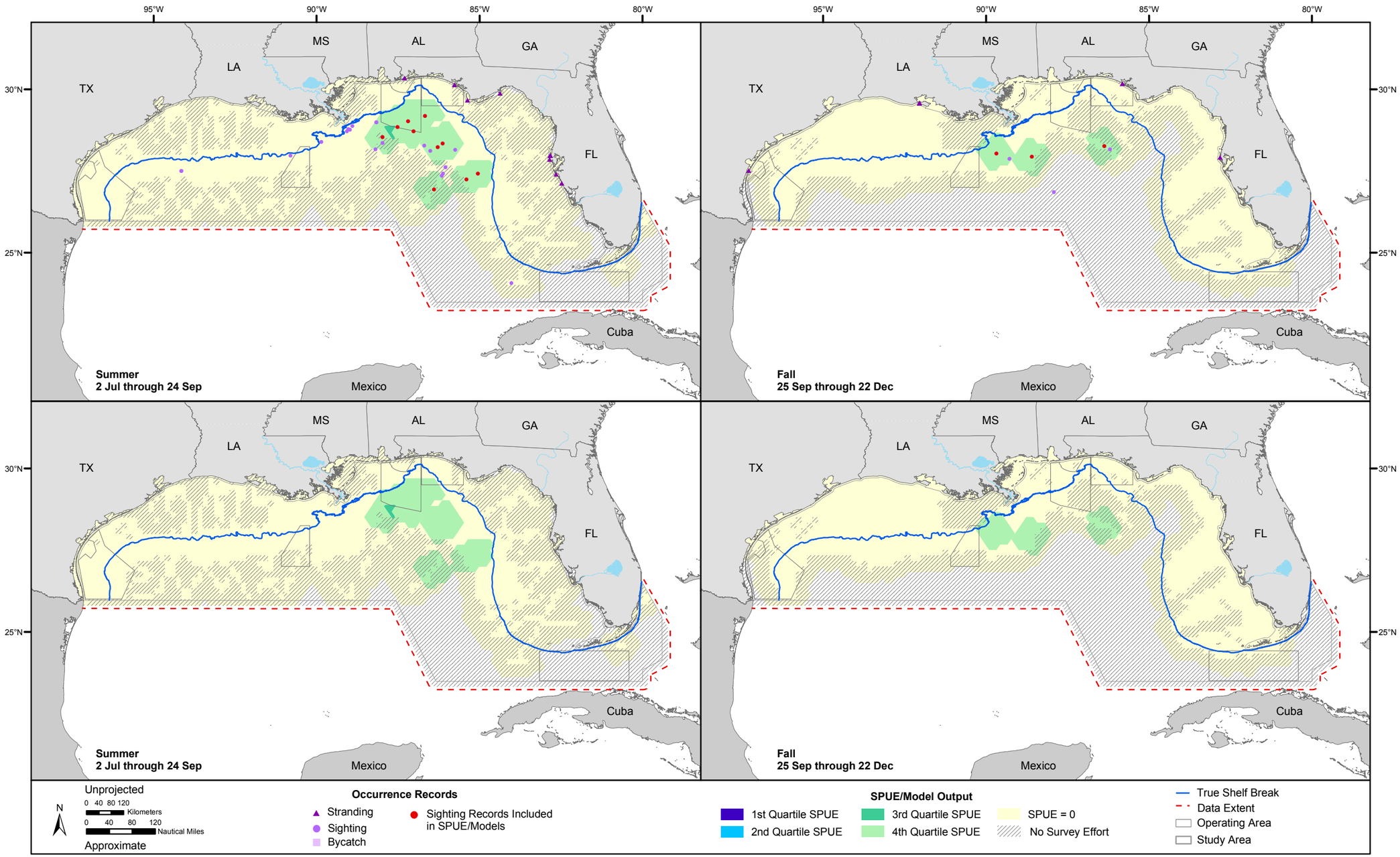

Figure B-13. Occurrence of the striped dolphin in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1. (Cont'd)

This page intentionally left blank

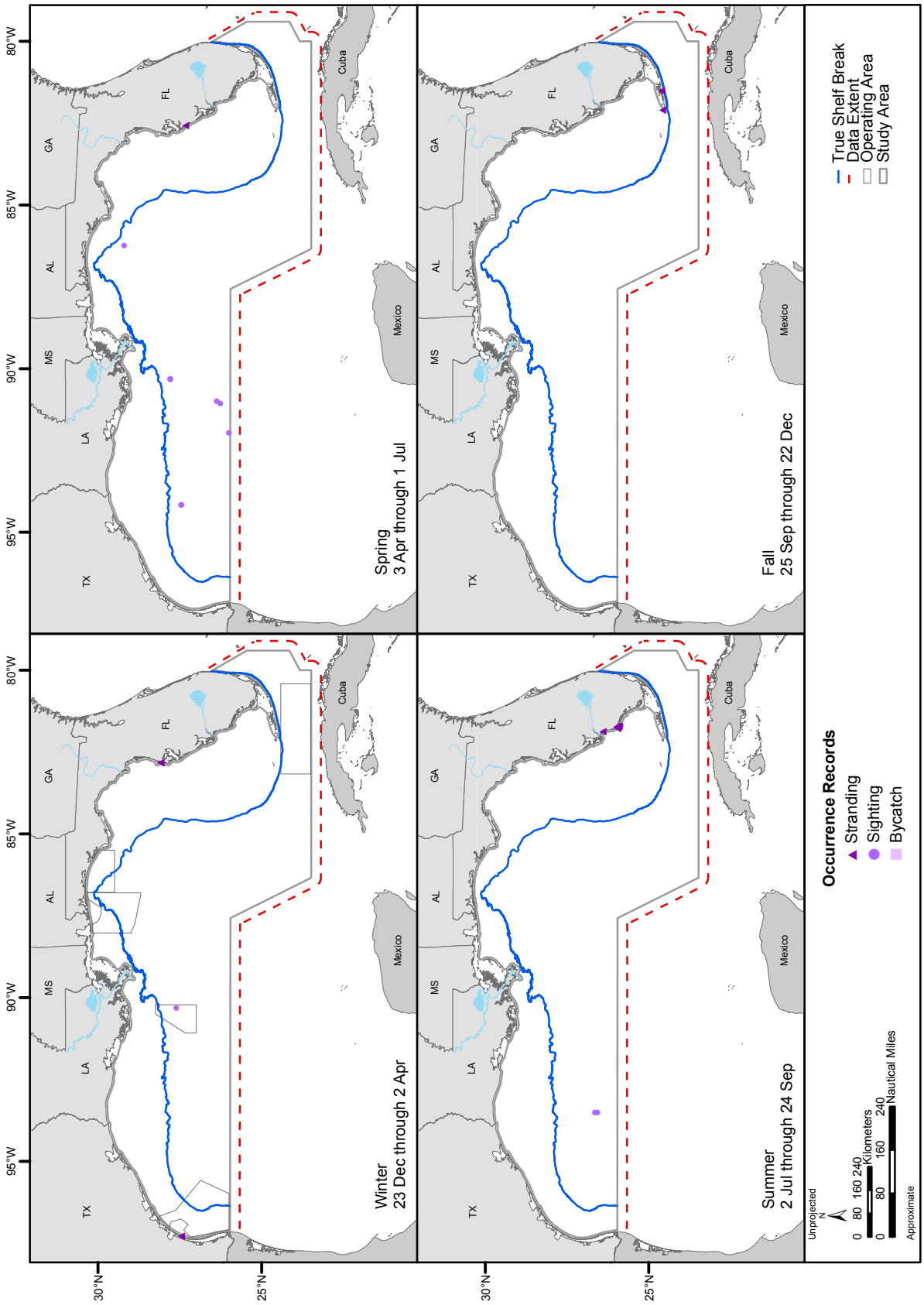

Figure B-14. Occurrence records for the Fraser's dolphin in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Source data: refer to Table A-1.

This page intentionally left blank

This page intentionally left blank

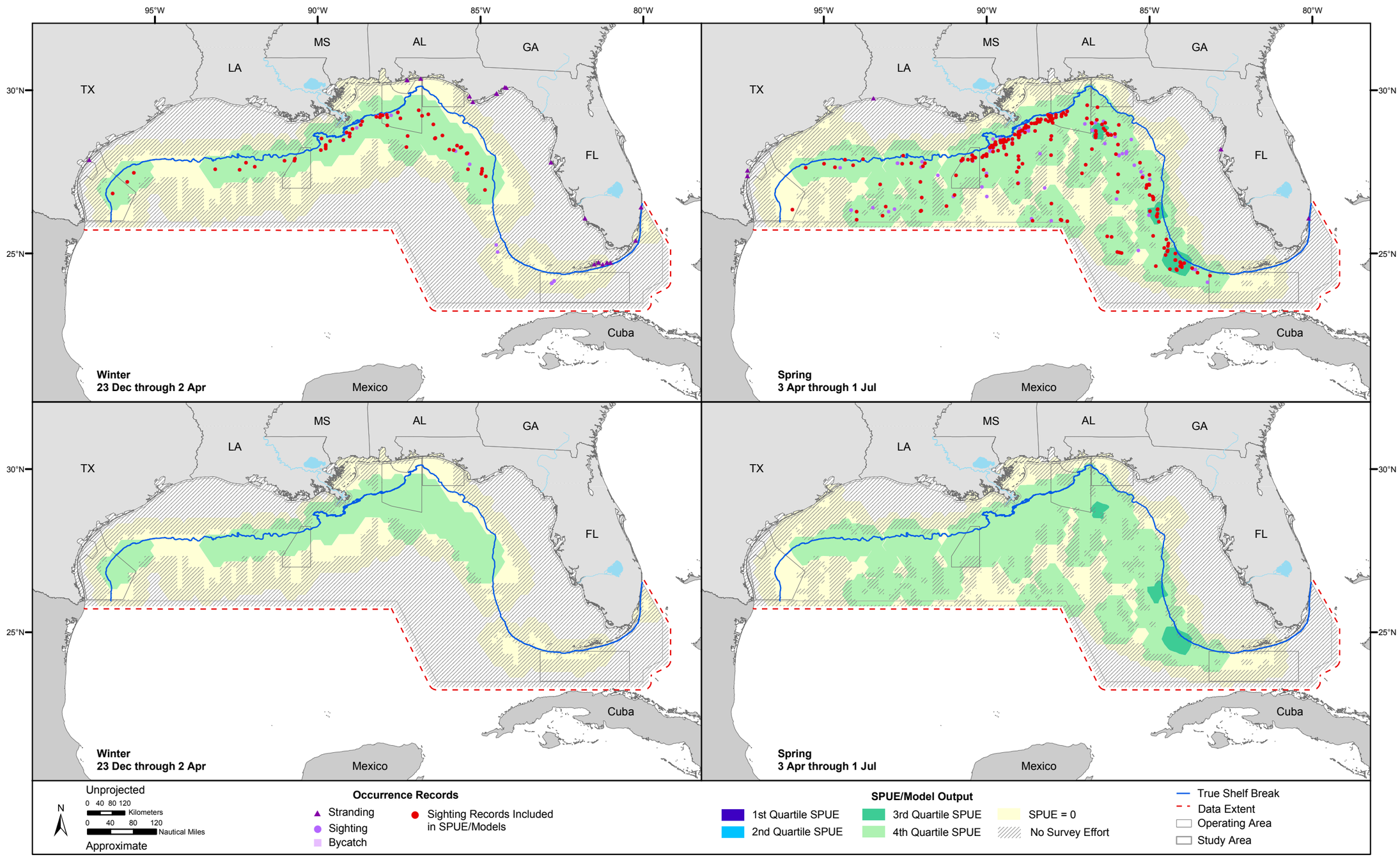

Figure B-15. Occurrence of the Risso's dolphin in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1.

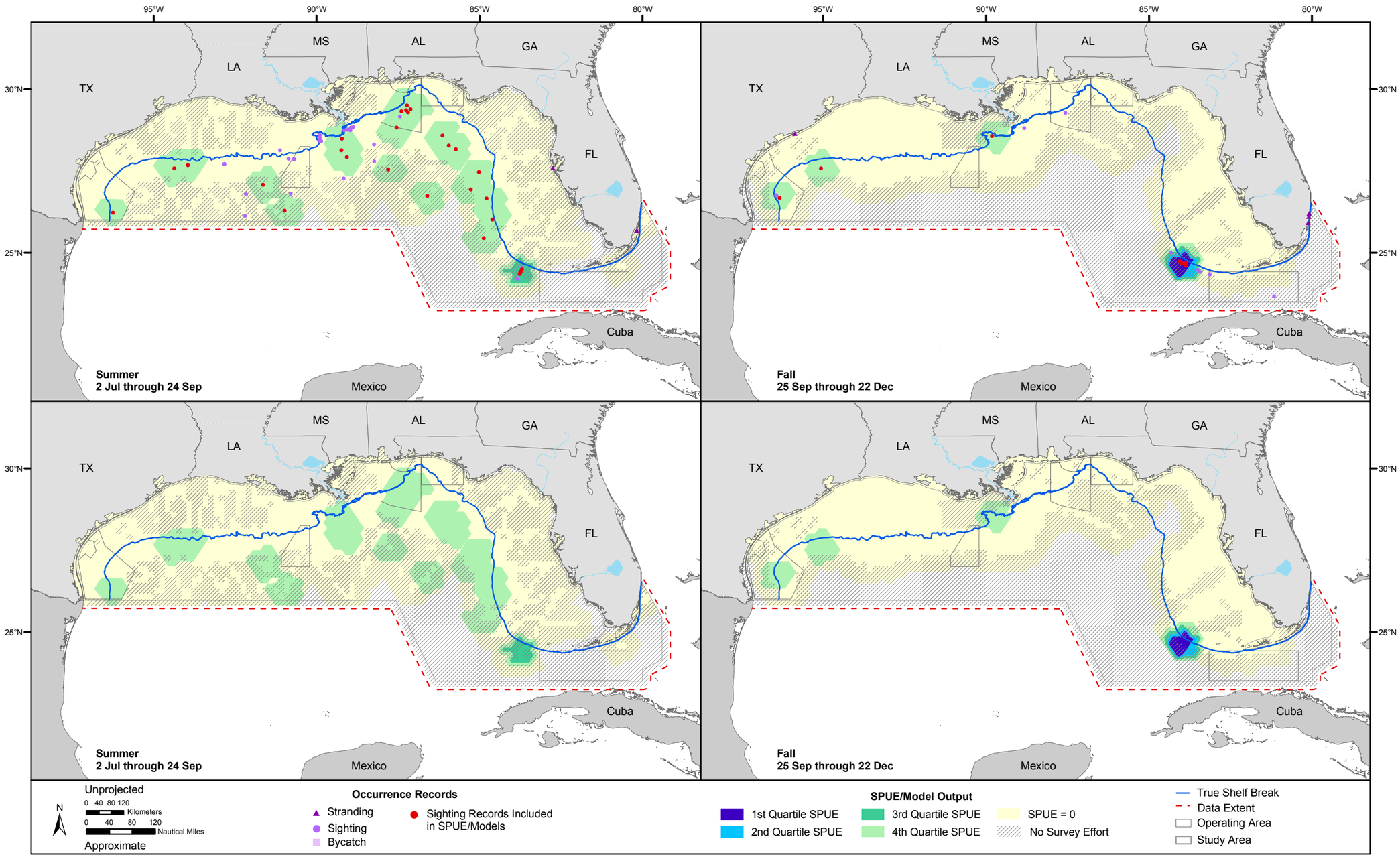

Figure B-15. Occurrence of the Risso's dolphin in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1. (Cont'd)

This page intentionally left blank

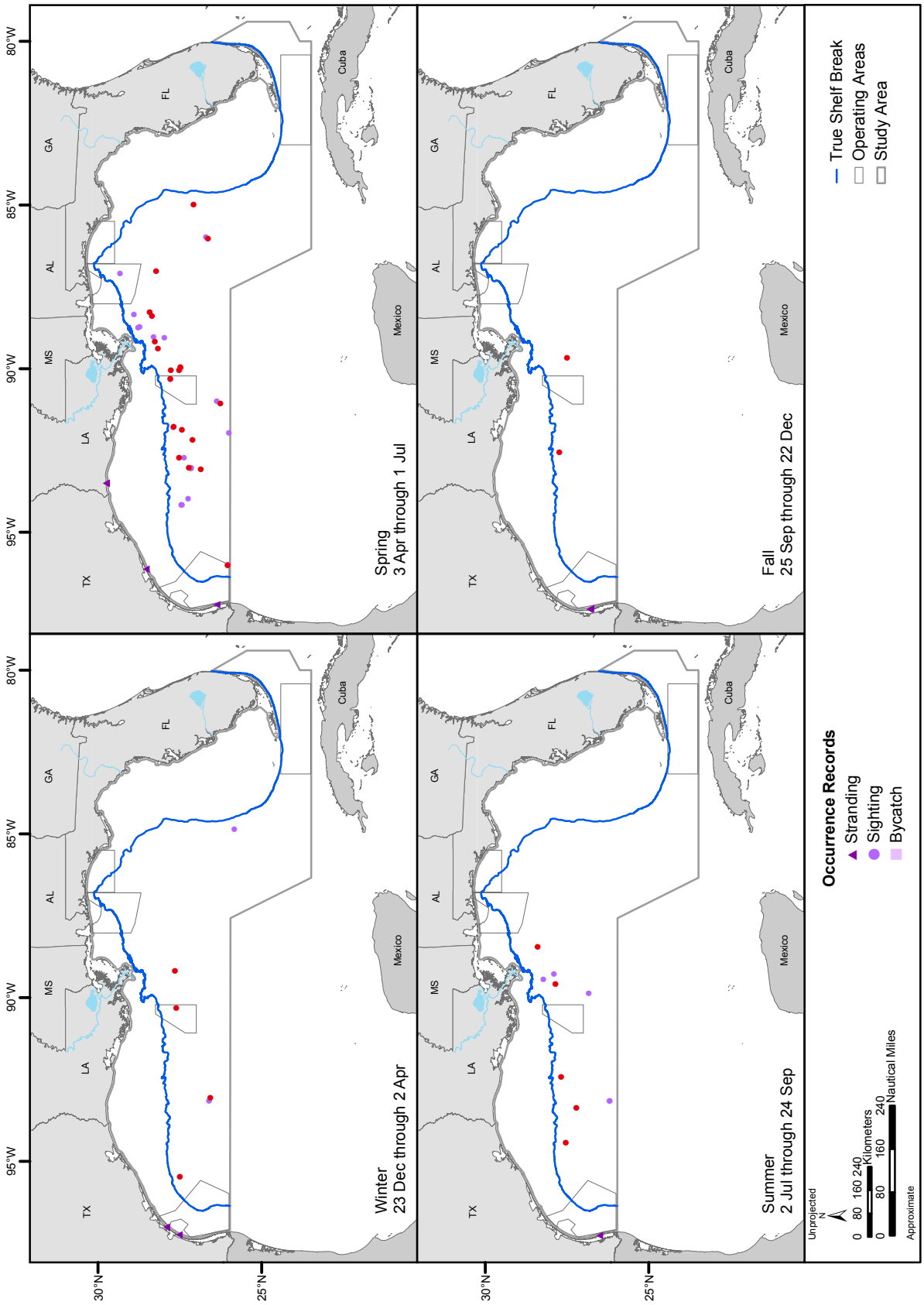

Figure B-16. Occurrence records for the melon-headed whale in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Source data: refer to Table A-1.

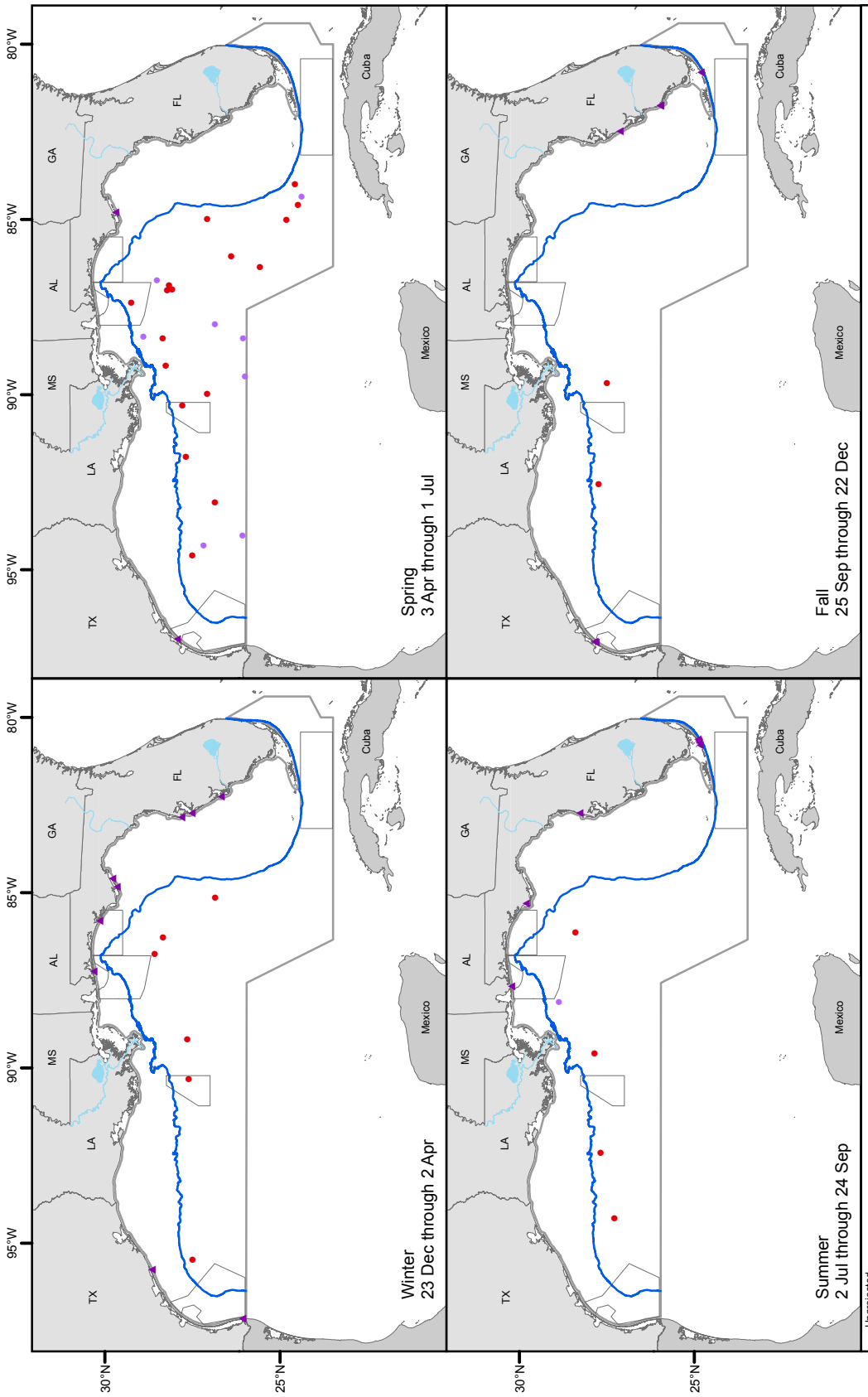

Figure B-17. Occurrence records for the pygmy killer whale in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Source data: refer to Table A-1.

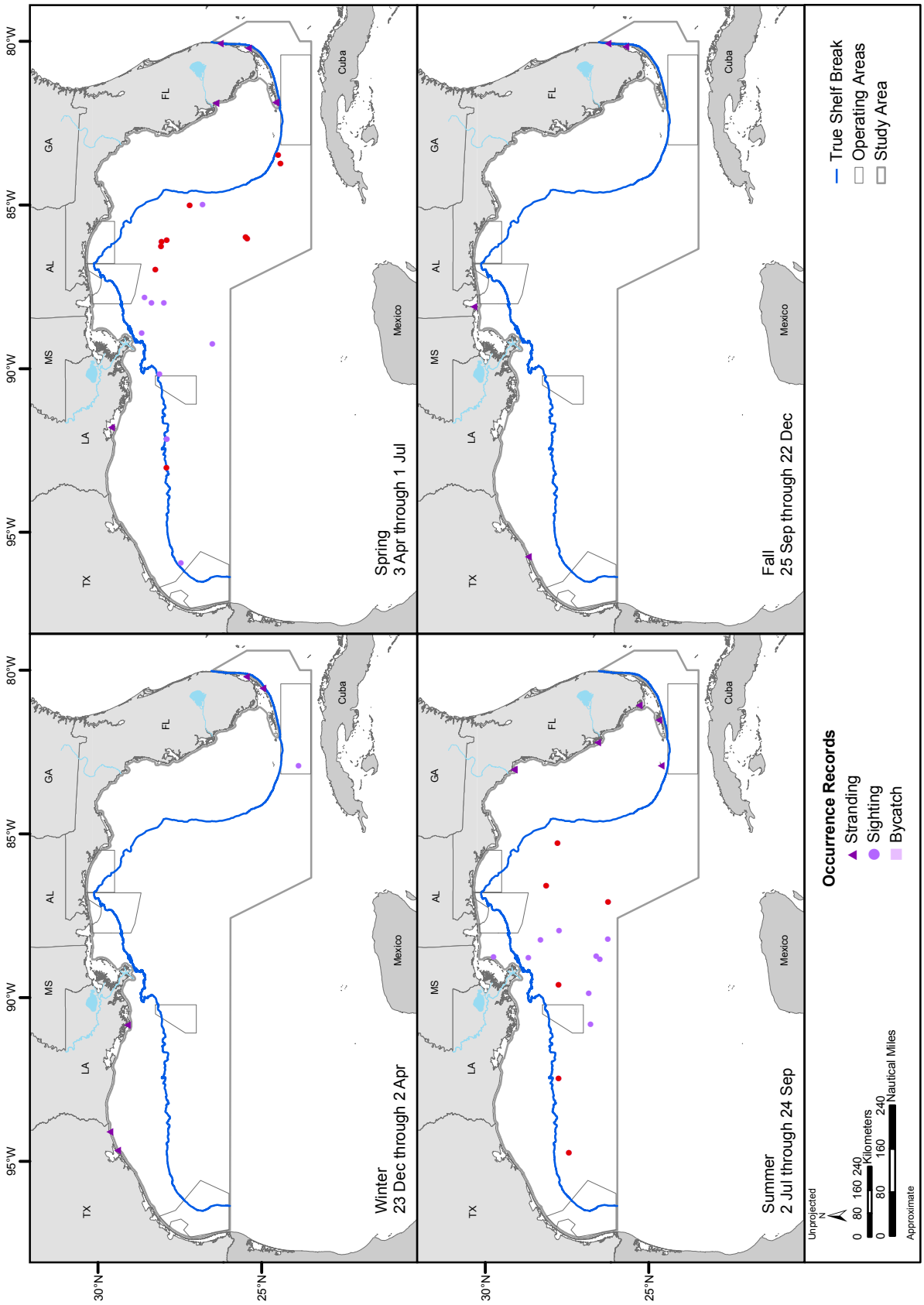

Figure B-18. Occurrence records for the false killer whale in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Source data: refer to Table A-1.

This page intentionally left blank

This page intentionally left blank

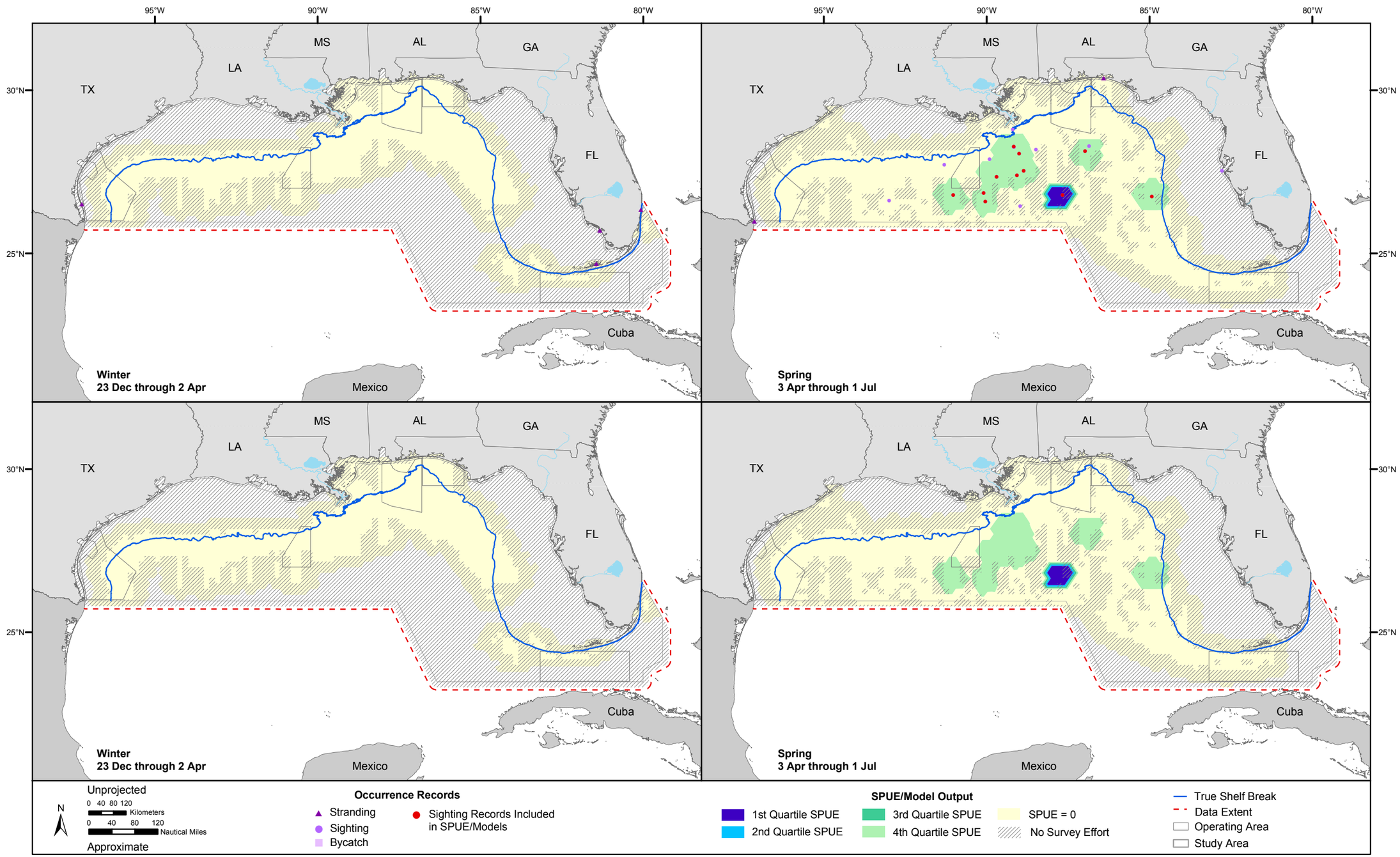

Figure B-19. Occurrence of the killer whale in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1.

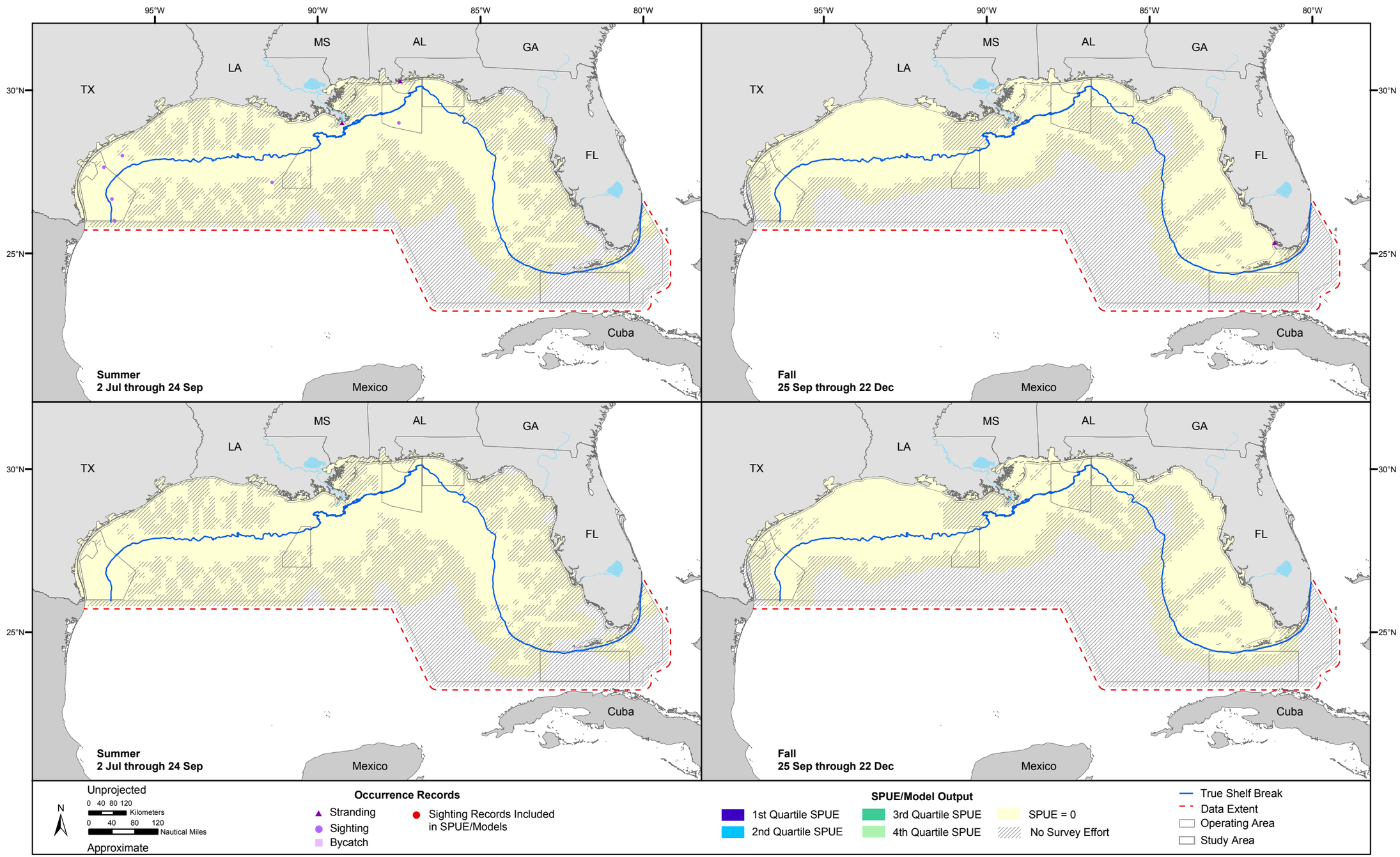

Figure B-19. Occurrence of the killer whale in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1. (Cont'd)

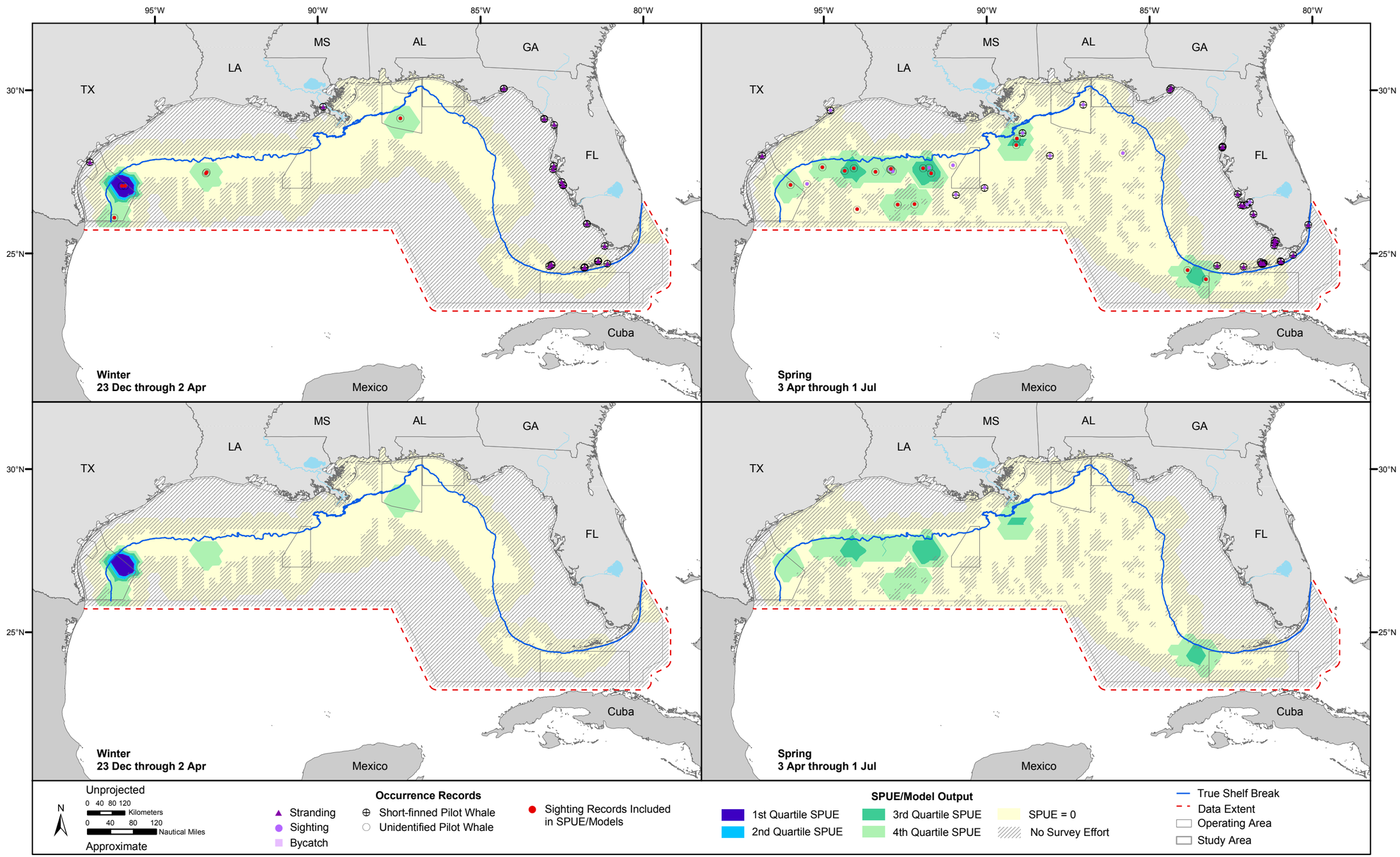

Figure B-20. Occurrence of pilot whales in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1.

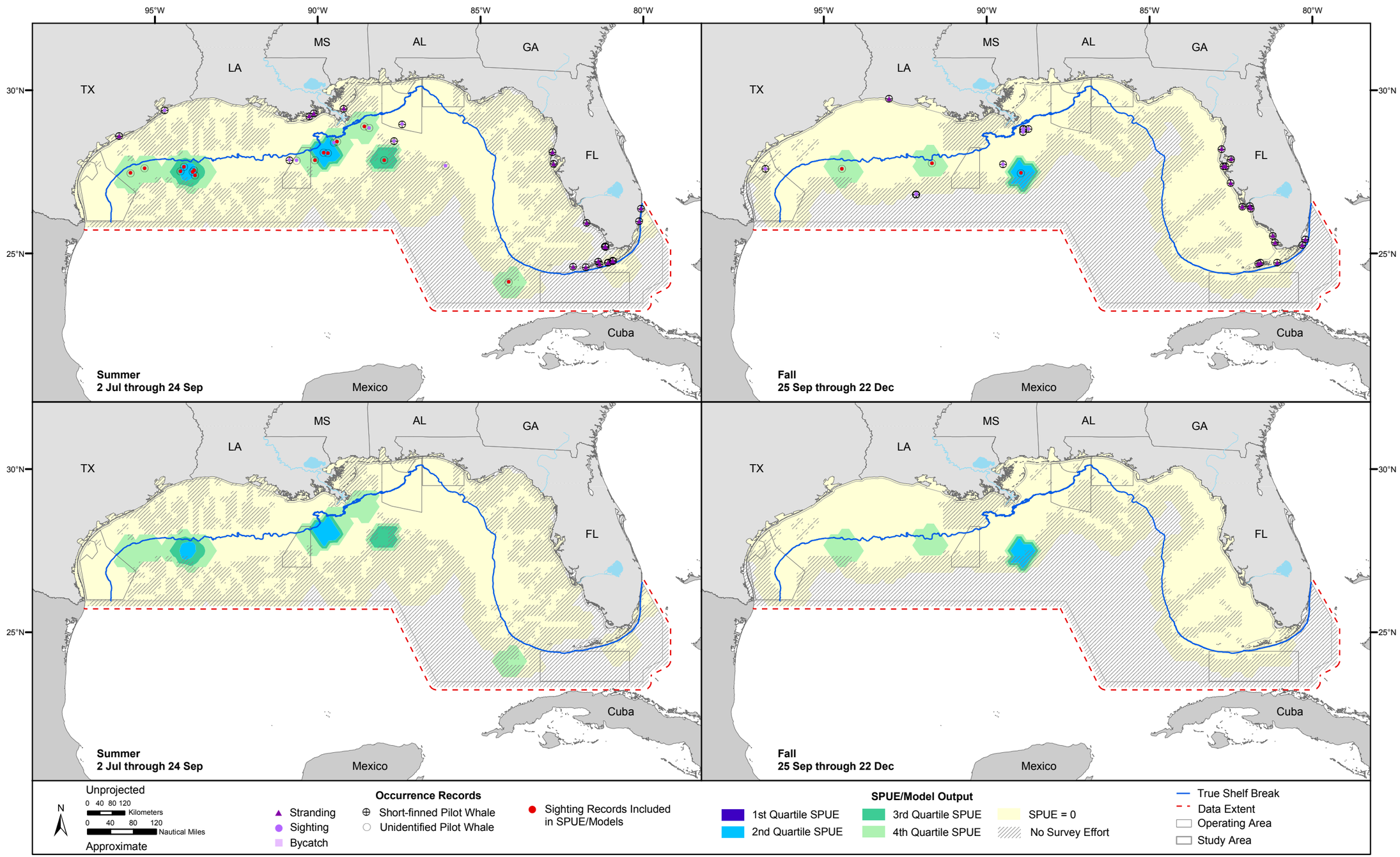

Figure B-20. Occurrence of pilot whales in the study area for the GOMEX MRA. Available sighting, stranding, and incidental fisheries bycatch records are represented by season. Model output was derived using sighting-per-unit-effort (SPUE) data, which were calculated from only dedicated sighting data. Source data: refer to Table A-1. (Cont'd)

This page intentionally left blank