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Chris Eaton, Erin McMichael, Blair Witherington, Allen Foley,
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U.S. Department of Commerce
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NOAA Technical Memorandum NMFS-OPR-38
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Florida Fish and Wildlife Conservation Commission
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100 Eighth Avenue, SE
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U.S. Department of Commerce
Carlos M. Gutiérrez, Secretary

National Oceanic and Atmospheric Administration
Vice Admiral Conrad C. Lautenbacher, Jr., USN (Ret.)
Under Secretary for Oceans and Atmosphere

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LIST OF ACRONYMS

ACCSTR – Archie Carr Center for Sea Turtle Research
AFB – U.S. Air Force Base
Cc – *Caretta caretta*
CCL – Curved Carapace Length
Cm – *Chelonia mydas*
CPUE – Catch per Unit Effort
CREC - Crystal River Energy Complex
Dc – *Dermochelys coriacea*
DEP – Department of Environmental Protection
DERM – Department of Environmental Resource Management
DNR – Department of Natural Resources
DOI – Department of the Interior
DOQQ – Digital Orthophoto Quarter Quadrangle
DOT – Department of Transportation
DPEP – Department of Planning and Environmental Protection
ECB – East Coast Biologists, Inc.
Ei – *Eretmochelys imbricata*
FAU – Florida Atlantic University
FGDL – Florida Geographic Data Library
FKNMS – Florida Keys National Marine Sanctuary
FMRI – Florida Marine Research Institute (former name of FWRI)
FNAI – Florida Natural Areas Inventory
FP – Fibropapillomatosis
FPC – Florida Power Corporation
FWC – Florida Fish & Wildlife Conservation Commission
FWRI – Fish & Wildlife Research Institute
GIS – Geographic Information System
HUNT – Haphazard Unmarked Nonlinear Transect
IRG – Inwater Research Group, Inc.
IRL – Indian River Lagoon
Lk – *Lepidochelys kempii*
MMS – Minerals Management Service
NMFS – National Marine Fisheries Service
NOAA – National Oceanic and Atmospheric Administration
NP – National Park
NWFWMD – Northwest Florida Water Management District
NWR – National Wildlife Refuge
OCL – Over-the-Curve Carapace Length
PIT – Passive Integrated Transponder
RIA – Radioimmunoassay
SAV – Submerged Aquatic Vegetation
SCDNR – South Carolina Department of Natural Resources
SEAMAP – South East Area Monitoring and Assessment Program
SEFSC – Southeast Fisheries Science Center
SFWMD – South Florida Water Management District

SJRWMD – St. Johns River Water Management District
SRWMD – Suwannee River Water Management District
SSCL – Standard Straight Carapace Length
SST – Sea Surface Temperature
SWFWMD – Southwest Florida Water Management District
TAMUG – Texas A&M University at Galveston
UCF – University of Central Florida
UF – University of Florida
USACE – U.S. Army Corps of Engineers
USAF – U.S. Air Force
USCB – U.S. Census Bureau
USFWS – U.S. Fish & Wildlife Service
USGS – U.S. Geological Survey
VIMS – Virginia Institute of Marine Science

EXECUTIVE SUMMARY

This work provides an overview of historical and current research and monitoring projects investigating the occurrence, distribution, abundance, and representation of life stages of sea turtles in Florida waters. This report provides a framework for a cooperative network from which regional-population estimates could be produced. Because sea turtles in the water are difficult to count, status and trends assessments have considered the in-water abundance and distribution of sea turtles only in a rudimentary way. In contrast, counts of sea turtle nests on Florida beaches have provided detailed measures of abundance and distribution for reproductively active females. The need for assessing populations of both immature and mature sea turtles in the water to complement nesting beach-based assessments has been widely recognized (Magnuson *et al.*, 1990; National Marine Fisheries Service and U.S. Fish and Wildlife Service, 1991a, 1991b, 1992; Turtle Expert Working Group, 1998, 2000; U.S. Fish and Wildlife Service and National Marine Fisheries Service, 1992).

In-water studies of sea turtles in Florida began in 1955 when Carr and Caldwell collaborated with turtle fishermen in Cedar Key to obtain information on sea turtles in that area. Since then, 41 other in-water sea turtle research projects have taken place or are taking place in Florida. These projects have produced valuable information concerning the biology, distribution, and abundance of Florida's sea turtles, but this information is scattered and often difficult to access. Data from many of the current in-water projects have the potential to contribute to composite, population-trend assessments on a statewide level. However, such assessments should only be made following an understanding of variation in project methods. Our objectives were to summarize past and present in-water sea turtle monitoring and research activities throughout the state (including the results of these studies), identify gaps where additional in-water projects are needed, and provide recommendations on how to structure a statewide program to coordinate and standardize certain aspects of in-water sea turtle research in Florida with particular regard to producing statewide population-trend assessments.

We identified 25 active and 17 inactive in-water sea turtle research projects in Florida, with the majority (18 active, 10 inactive) taking place on the Atlantic coast. Projects on the Atlantic coast were mainly conducted in inshore lagoons or nearshore hardbottom reefs, and those on the gulf coast were conducted mostly in shallow bays and nearshore seagrass meadows. We collected detailed information on each project through published literature, annual reports, questionnaires directed to principal investigators, and other modes of communication, including personal interviews. This information, including capture methods, sampling protocols, and numbers of captured sea turtles by species and size, was entered into a Microsoft Access database. A "General Findings" section for each project was compiled based on the collected information. Geographic Information Systems (GIS) maps were created overlaying each project's study area on habitat layers of potential interest to researchers.

Cataloging existing projects allowed us to determine the overall geographic coverage of the current in-water sea turtle research projects in Florida and to build a comprehensive picture of the species and life stages studied. This catalog also allowed us to identify gaps in the

geographic coverage of studies and to determine representation of species and life stages. Green turtles (*Chelonia mydas*) and loggerheads (*Caretta caretta*) made up the majority of captures for in-water projects throughout the state. Kemp's ridleys (*Lepidochelys kempii*) were rarely captured on the Atlantic coast but were the most common species captured along the gulf coast. Hawksbills (*Eretmochelys imbricata*) and leatherbacks *(Dermochelys coriacea*) were rarely captured by in-water researchers. Green turtles larger than juveniles were captured more frequently in Key West National Wildlife Refuge than in any other in-water project. Projects found immature and adult life stages of loggerheads to occur in similar proportions, but slightly more projects found subadults than other stages. All Kemp's ridley life stages were captured by in-water researchers, with neritic-stage juveniles and subadults being encountered most frequently. Immature, neritic-stage juveniles and adult hawksbills were captured at Key West NWR and The Breakers projects. Too few data were available on leatherbacks from in-water studies to make generalizations about the distribution of their life stages throughout the state.

In addition to in-water sea turtle research projects, we also compiled a list of available databases that provided information on sea turtles in Florida waters. These included

- Aerial Surveys for Sea Turtles,
- Sea Turtle Strandings,
- Fishery Interactions with Sea Turtles,
- Trawling Activities Targeting Sea Turtles,
- Incidental Takes Associated with Renourishment and Dredging Projects,
- Incidental Sightings in Aerial Surveys Targeting Other Species,
- Satellite Telemetry Tracking of Sea Turtles from Florida, and
- Satellite Telemetry Tracking of Turtles into Florida from Outside the State.

We reviewed all 25 of the current in-water research projects to determine which would provide the best index of trends in the abundances of the various sea turtles species in Florida. Taking into consideration the likelihood of a project's continuing into the foreseeable future, the ability of a project to provide data on trends in abundances and the need for all projects combined to adequately represent the various habitats known to be associated with sea turtles and the species and life stages of each species found in Florida, we recommended 12 of the active projects for inclusion into an index-monitoring network. These included

- St. Joseph Bay,
- Charlotte Harbor,
- Key West NWR,
- Florida Bay,
- The Breakers,
- St. Lucie Power Plant,
- Jenning's Cove,
- Northern Indian River County Reefs,
- Central Indian River Lagoon,
- Central Brevard County Reefs,
- Trident Submarine Basin,
- Mosquito Lagoon.

Our analyses also revealed 11 specific areas in Florida where no in-water studies were being conducted but where sea turtles were thought likely to occur based on the presence of habitats known to be associated with sea turtles; where sea turtles were known to occur based on records of dead, sick, or injured sea turtles (i.e., strandings); or where sea turtles were known to occur based on reported observations. These geographic gaps were

- Northwest Bays and Nearshore Habitat,
- Southern Big Bend Nearshore Habitat,
- Ten Thousand Islands,
- Southwest Offshore Habitat,
- Western Everglades Inshore Habitat,
- Keys Offshore Coral Reef Habitat,
- Biscayne Bay,
- Southeast Nearshore Hardbottom Habitat,
- Northeast Offshore Habitat,
- Northeast Inshore and Estuarine Habitat,
- Artificial Reefs throughout Florida Waters.

INTRODUCTION

Five species of sea turtles regularly occur in Florida waters: loggerhead (*Caretta caretta*), green turtle (*Chelonia mydas*), Kemp's ridley (*Lepidochelys kempii*), hawksbill (*Eretmochelys imbricata*), and leatherback (*Dermochelys coriacea*). Loggerheads are listed as a "Threatened" species on the state and federal level, whereas the other four species are classified as "Endangered". Actions necessary to successfully help these species recover must be based on an adequate understanding of the overall range of these animals, the spatial and temporal distributions of various life stages, and the spatiotemporal interactions of sea turtles and the significant threats to them. Continuous monitoring of the status of these sea turtle populations is also necessary to evaluate the efficacy of the recovery actions.

The Florida Fish and Wildlife Conservation Commission (FWC) monitors the status of adult female sea turtles and reproductive effort through nest-count and hatchling-production data collected by FWC-permitted projects throughout Florida. The research is undertaken by various organizations with the funding provided mostly from outside FWC. However, FWC's permitting role allows the agency to coordinate this composite monitoring effort. Coordination takes place within two complementary FWC programs—the Statewide Nesting Beach Survey Program (SNBS) and the Index Nesting Beach Survey Program (INBS). The two programs have different objectives, providing either 1) a near-complete census at the expense of strict consistency in survey frequency and boundaries (SNBS) or 2) consistent temporal and spatial effort at the expense of complete spatial or temporal survey coverage (INBS). These survey programs have provided useful measures of abundance, distribution, and trends in nest counts (Meylan *et al*. 1995; Witherington *et al*. submitted), but they do not address the need for assessments elsewhere in sea turtle life histories. This need for monitoring populations of both immature and mature sea turtles in the water has been widely recognized (Magnuson *et al*., 1990; National Marine Fisheries Service and U.S. Fish and Wildlife Service, 1991a, 1991b, 1992; Turtle Expert Working Group, 1998, 2000; U.S. Fish and Wildlife Service and National Marine Fisheries Service, 1992). There is currently no structured coordination or organization of any aspect of the many in-water research projects in Florida and no mechanism for examining the overall in-water populations of both immature and mature sea turtles in Florida.

Initially, most information on the distribution and status of sea turtle populations in Florida was derived from turtle-fishery reports and from interviews with local fishermen and owners of seafood restaurants (Witzell, 1994a). In-water sea turtle research projects in Florida began in 1955, when Carr and Caldwell (1956) collaborated with turtle fishermen in the Cedar Key area to capture and tag sea turtles in order to assess local aggregations as well as to examine possible overwintering behavior. Since that time, many individual in-water sea turtle research projects have been conducted throughout the state. These projects have targeted various sea turtle species and life stages, have been conducted in various types of habitats, and have employed a number of different capture methodologies that are usually tailored to local environmental conditions. These projects have produced valuable information concerning the biology, distribution, and abundance

of Florida's sea turtles, but this information is scattered and often difficult to access. Establishing some level of coordination among these projects could allow at least some of these currently discrete studies to contribute to composite trend assessments of in-water sea turtle populations in Florida. This type of coordinated program could also create and maintain a database of summary information on all of the projects. Managers and other interested parties could use such a centralized database as a resource for information and contacts for Florida's in-water sea turtle populations.

The principal purpose of this study was to summarize information on all of the in-water sea turtle research projects that have been conducted in Florida and to evaluate the potential for using a subset of current projects to produce composite trend assessments. Although Florida is one of the best studied areas in the world, we identified several gaps where additional in-water sea turtle research is needed. Evidence of gaps included underrepresentation of species or life stages observed and geographic locations where potential sea turtle habitat occurs but no research is taking place. In a synthesis of this information on in-water research, species information, and gaps, we provide recommendations on how to structure a statewide program to coordinate and standardize in-water sea turtle research in Florida to accommodate statewide population-trend assessments.

METHODS

We began identifying Florida's existing in-water sea turtle research projects by examining the Florida Marine Turtle Permit Holder database and associated paper files, which are maintained by FWC. An FWC permit is required for research involving human interactions with sea turtles in Florida, and associated permit records include project descriptions, annual reports, and associated publications. We also conducted literature searches and consulted proceedings of past International Sea Turtle Symposia, as well as other gray literature, to find information on Florida in-water sea turtle research that did not require an FWC permit (e.g., visual sea turtle surveys).

We created a list of data that would provide a synopsis of Florida's in-water sea turtle research projects (Appendix A). We attempted to contact the principal investigator(s) of each project to request these data. If we were unable to contact at least one of the principal investigators of a project, we obtained these data from files, reports, or publications related to that particular study. All data were entered into a Microsoft Access database.

To assess the geographic distribution of projects, we assigned each project to one of four regions: northwest, southwest, southeast, and northeast (Figure 1). If a project spanned more than one region, we assigned it to the region containing the majority of the study area. We determined life stages found in each study based on the size ranges for each species reported by principal investigators. We defined four life stages for the hard-shelled species (oceanic-stage juvenile, neritic-stage juvenile, subadult, and adult) and two life stages for leatherbacks (immature and mature). Life stages and associated size ranges were defined according to available information from the literature and personal communication with researchers in Florida and the Caribbean (Appendix A).

We digitized the geographic extent of each study to generate detailed site maps using ArcGIS version 9.1 (ESRI, 2005). Bathymetric values for each study area were derived from the Coastal Relief Model which is compiled and distributed by the National Oceanic and Atmospheric Administration (NOAA) National Geophysical Data Center (NGDC). The data were downloaded from the NGDC website (www.ngdc.noaa.gov) in ASCII format and converted to raster format within ArcGIS. The data describe bathymetric values to the nearest 1/10 meter at a spatial resolution of three arc-seconds (Divins and Metzger, 2007). Bathymetric values for projects conducted specifically within channels of known depth (e.g., Canaveral Ship Channel) were obtained directly from NOAA nautical charts. If available, we obtained GIS layers that were spatially associated with in-water projects from FWC's Fish and Wildlife Research Institute (FWRI); if not available from FWRI, these layers were acquired from other agencies. The site maps were sent along with initial study descriptions to principal investigators for feedback and approval.

To identify the in-water sea turtle research projects that could best contribute to composite trend analyses in Florida, we sent a questionnaire (Appendix B) to the principal investigators who planned to continue sampling during 2006 (i.e., active

projects). Our primary objectives were 1) to learn which studies currently or could in the future determine abundances (either relative or absolute) and 2) to obtain more detailed information regarding each project's measure of abundance. We rated these projects on their duration and sampling consistency and sought to assemble a broad representation of habitats, regions, species and life stages.

In addition to information on in-water research projects that target sea turtles, we compiled data on sea turtle strandings in Florida (provided by the Sea Turtle Stranding and Salvage Network), and we compiled pertinent data obtained by projects where in-water sea turtle data have been collected incidentally. We investigated aerial-survey studies conducted over Florida waters for records of turtle sightings. Reports on fisheries bycatch and databases on channel-dredging and beach-renourishment projects were also queried for records of sea turtles. We consulted state and county management agencies to identify fishery surveys, artificial-reef monitoring, and other monitoring efforts that may have noted sea turtle presence. Other marine researchers within FWRI and Mote Marine Laboratory also provided us with regular reports of sea turtle encounters during their research projects. We searched both the literature and the internet for records of sea turtles that have been tracked by satellite in Florida waters. The sea turtle data we gathered from each of the ancillary sources (Appendix C) were also entered into our Microsoft Access and geospatial databases.

We used data gathered from the in-water sea turtle research projects and from our additional data sources to delineate habitats and general areas commonly inhabited by sea turtles in Florida. We integrated this with the geographic coverages of active in-water sea turtle research projects to identify geographic gaps in Florida where future in-water sea turtle research might prove fruitful (Figure 57). We also determined the species and life stages that are underrepresented in active studies.

We sent contributing researchers a comprehensive report summarizing information on all the in-water projects we assessed, which was to acknowledge the participation of researchers and to facilitate collaboration in their studies. This summary of research showed how each project fit into a proposed network of in-water sea turtle research in Florida. The report included maps displaying each project's study area overlaid with habitat layers that may be of interest to principal investigators. These maps were included as examples of the potential value of incorporating GIS into in-water research projects.

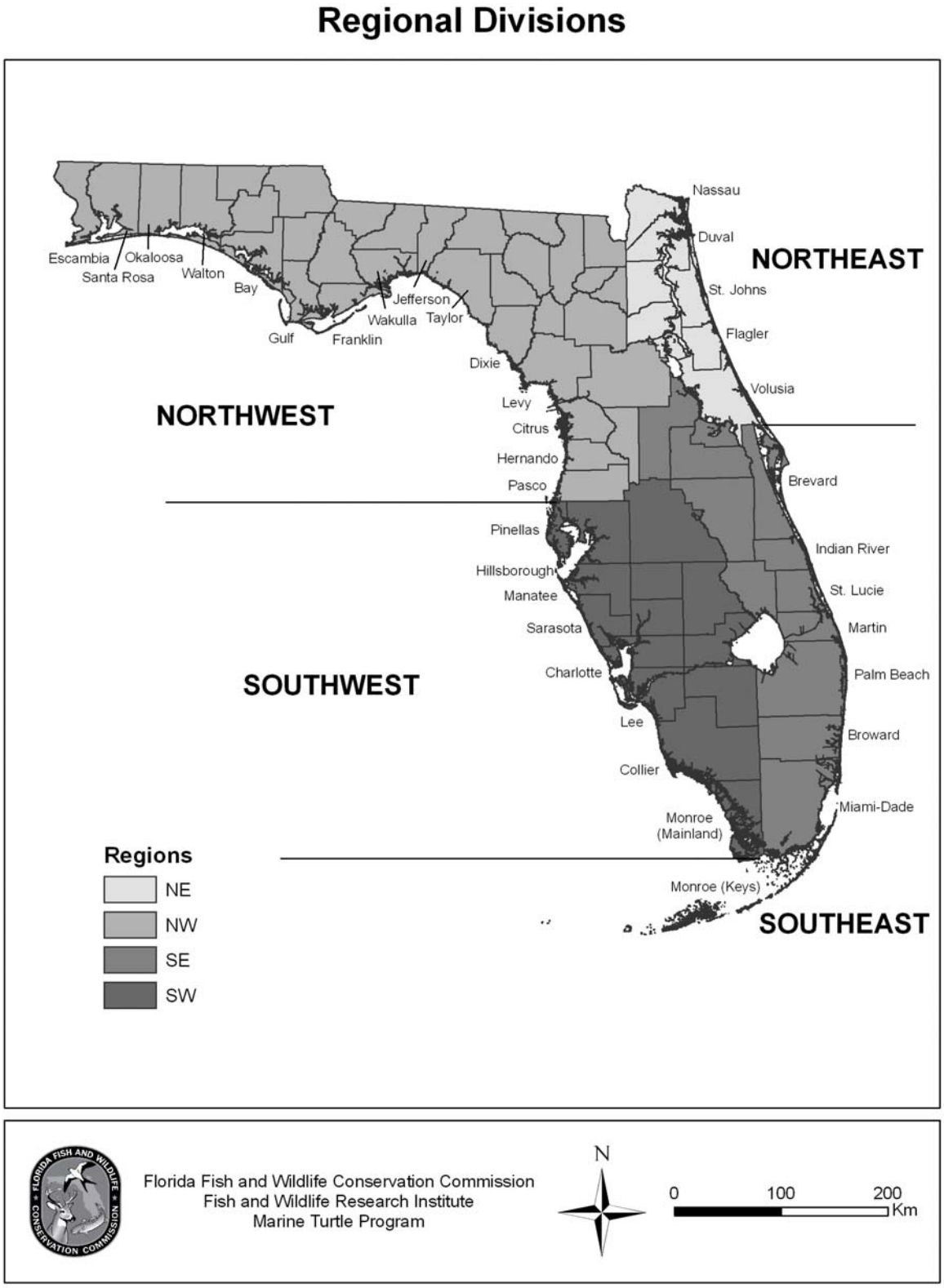

Figure 1 - Regional divisions of the state.

RESULTS

Distribution of Projects

We identified 42 in-water sea turtle research projects that have been conducted in Florida (Table 1). Twenty-five of these were active as of December 2006 (Figure 2), whereas sampling had ended in the other 17 studies (Figure 3). Research projects began as far back as 1955, although few studies were conducted prior to the 1980s. Currently active studies lasted from 6 months to 31 years, with a median duration of 6 years.

The majority of in-water research has been conducted in the southeastern part of the state from the Florida Keys north through Brevard County; the percentage of studies occurring in this region has varied annually from 50 - 67%. As of 2006, 14 projects were active in the southeast region, compared to four in the northwest, three in the southwest, and four in the northeast. Consequently, the habitats receiving the most study were those most represented in the southeastern part of the state. Benthic-habitat types consisting of sand (present in 43% of study areas) and seagrass (38%) were most prevalent in study areas. This was consistent with the prevalence of these two habitat types throughout the neritic waters of Florida. Worm-rock reefs (14%) and other hardbottom substrates (22%) were also common in project study areas and are characteristic of the southeastern part of the state. Other benthic habitats observed in east-coast surveys included dredged channels, coral, algae mats, and shell. Aside from sand and seagrass, the bottom types (in descending order of prevalence) present in gulf-coast study areas were mud, oyster beds, dredged channels, algal mats, and mangroves.

In-water research on sea turtles in Florida tended to be focused on near-shore shallow habitats, where capture techniques can be more easily employed and sea turtles are more likely to forage. The vast majority of projects (34) were conducted exclusively in neritic habitats, and an additional four study areas spanned neritic and oceanic areas; only four projects were carried out entirely in oceanic waters. Of the 38 projects conducted in neritic waters, 13 study areas were in estuarine waters, 23 were in marine waters, and 2 were in both areas. Study-area depths ranged 0 - 737 meters, but the mean study-area depth was less than 10 meters for 64% of projects. Thirty-one percent of projects were carried out in areas with a mean depth less than 2 meters.

Detailed accounts of each in-water research project, arranged from St. Joseph Bay (northwest) to Fernandina Harbor (northeast), are presented below. Each project account contains general information, methodology, summarized results, findings, literature produced, and a geographic representation of the study area. Maps describing regional distributions of these projects precede each group of site accounts.

Table 1 - Summary of all in-water sea turtle projects conducted in Florida (listed west to east).

Site	PI	Region	County	Status	Start Date	End Date
St. Joseph Bay	R. Carthy and E. McMichael	Northwest	Gulf	active	May 2001	n/a
Epipelagic Drift Community – Northwest	B. Witherington	Northwest	Outside county boundaries	active	August 2005	n/a
Apalachee Bay	J. Rudloe *et al.*	Northwest	Franklin, Wakulla	active	June 1984	n/a
Apalachee Bay	C. Campbell *et al.*	Northwest	Wakulla	inactive	August 1995	July 1997
Deadman Bay	J. Barichivich	Northwest	Taylor, Dixie	inactive	April 1996	June 1999
Cedar Key	A. Carr and D. Caldwell	Northwest	Levy, Citrus	inactive	April 1955	November 1955
Cedar Key	J. Schmid	Northwest	Levy	inactive	June 1985	1996
Crystal River Energy Complex	D. Bruzek	Northwest	Citrus	active	1999	n/a
Tampa Bay	A. Meylan *et al.*	Southwest	Hillsborough, Pinellas, Manatee	inactive	October 1993	June 1998
Tampa Bay Entrance Channel	D. Nelson	Southwest	Pinellas, Manatee	inactive	February 1997	June 1998
Epipelagic Drift Community – Southwest	B. Witherington	Southwest	Outside county boundaries	active	August 2005	n/a
Charlotte Harbor	T. Tucker *et al.*	Southwest	Charlotte, Lee	active	March 2003	n/a
Ten Thousand Islands	W. Witzell and J. Schmid	Southwest	Collier	inactive	June 1997	August 2004
Big Sable Creek Complex	K. Hart	Southwest	Monroe	active	November 2006	n/a

Table 1 Cont'd

Site	PI	Region	County	Status	Start Date	End Date
Key West National Wildlife Refuge	M. Bresette *et al.*	Southeast	Monroe	active	May 2002	n/a
Florida Bay	B. Schroeder *et al.*	Southeast	Monroe	active	1990	n/a
Broward County Reefs	C. Makowski	Southeast	Broward	active	May 2003	n/a
Galt Ocean Mile/ Lauderdale-by-the-Sea	R. Wershoven and J. Wershoven	Southeast	Broward, Palm Beach, Martin	inactive	March 1986	March 1991
The Breakers Central Reef Tract	M. Salmon and C. Makowski	Southeast	Palm Beach	inactive	July 2001	November 2003
Lake Worth Lagoon	M. Bresette *et al.*	Southeast	Palm Beach	active	March 2005	n/a
The Breakers	L. Wood	Southeast	Palm Beach	active	April 2003	n/a
Hutchinson Island Hardbottom Surveys	M. Bresette *et al.*	Southeast	St. Lucie, Martin	inactive	June 2004	April 2005
St. Lucie Power Plant	M. Bresette *et al.*	Southeast	St. Lucie	active	1976	n/a
Jenning's Cove	M. Bresette *et al.*	Southeast	St. Lucie	active	September 1998	n/a
Indian River County Hardbottom Surveys	M. Bresette *et al.*	Southeast	Indian River	active	June 2001	n/a
Northern Indian River County Reefs	L. Ehrhart	Southeast	Indian River	active	1988	n/a
Central Indian River Lagoon	L. Ehrhart	Southeast	Indian River, Brevard	active	May 1982	n/a
Central Brevard County Reefs	K. Holloway-Adkins	Southeast	Brevard	active	2003	n/a

Table 1 Cont'd

Site	PI	Region	County	Status	Start Date	End Date
Epipelagic Drift Community – Southeast	B. Witherington	Southeast	Outside county boundaries	active	August 1992	n/a
Port Canaveral Ship Channel	A. Carr *et al.*	Southeast	Brevard	inactive	February 1978	March 1978
Cape Canaveral	T. Henwood	Southeast	Brevard	inactive	January 1978	December 1984
Port Canaveral Ship Channel	A. Bolten *et al.*	Southeast	Brevard	inactive	March 1992	February 1993
Cape Canaveral	E. Standora *et al.*	Southeast	Brevard	inactive	March 1993	April 1993
Cape Canaveral	A. Segars *et al.*	Southeast	Brevard	active	April 2006	n/a
Trident Submarine Basin	L. Ehrhart	Southeast	Brevard	active	1993	n/a
Cape Canaveral & Northeast Coast	J. Schmid	Northeast	Brevard, Volusia, Flagler, St. Johns, Duval, Nassau	inactive	May 1986	December 1991
Mosquito Lagoon	L. Ehrhart	Northeast	Brevard, Volusia	inactive	July 1976	April 1979
Mosquito Lagoon	J. Provancha	Northeast	Brevard, Volusia	active	1994	n/a
Northeast Coast	A. Segars *et al.*	Northeast	St. Johns, Duval, Nassau	inactive	July 2000	2003
Northeast Coast	E. Wenner *et al.*	Northeast	Volusia, Flagler, St. Johns, Duval, Nassau	active	April 1989	n/a
Epipelagic Drift Community – Northeast	B. Witherington	Northeast	Outside county boundaries	active	September 2005	n/a
Fernandina Harbor	D. Dickerson *et al.*	Northeast	Nassau	inactive	October 1991	March 1993

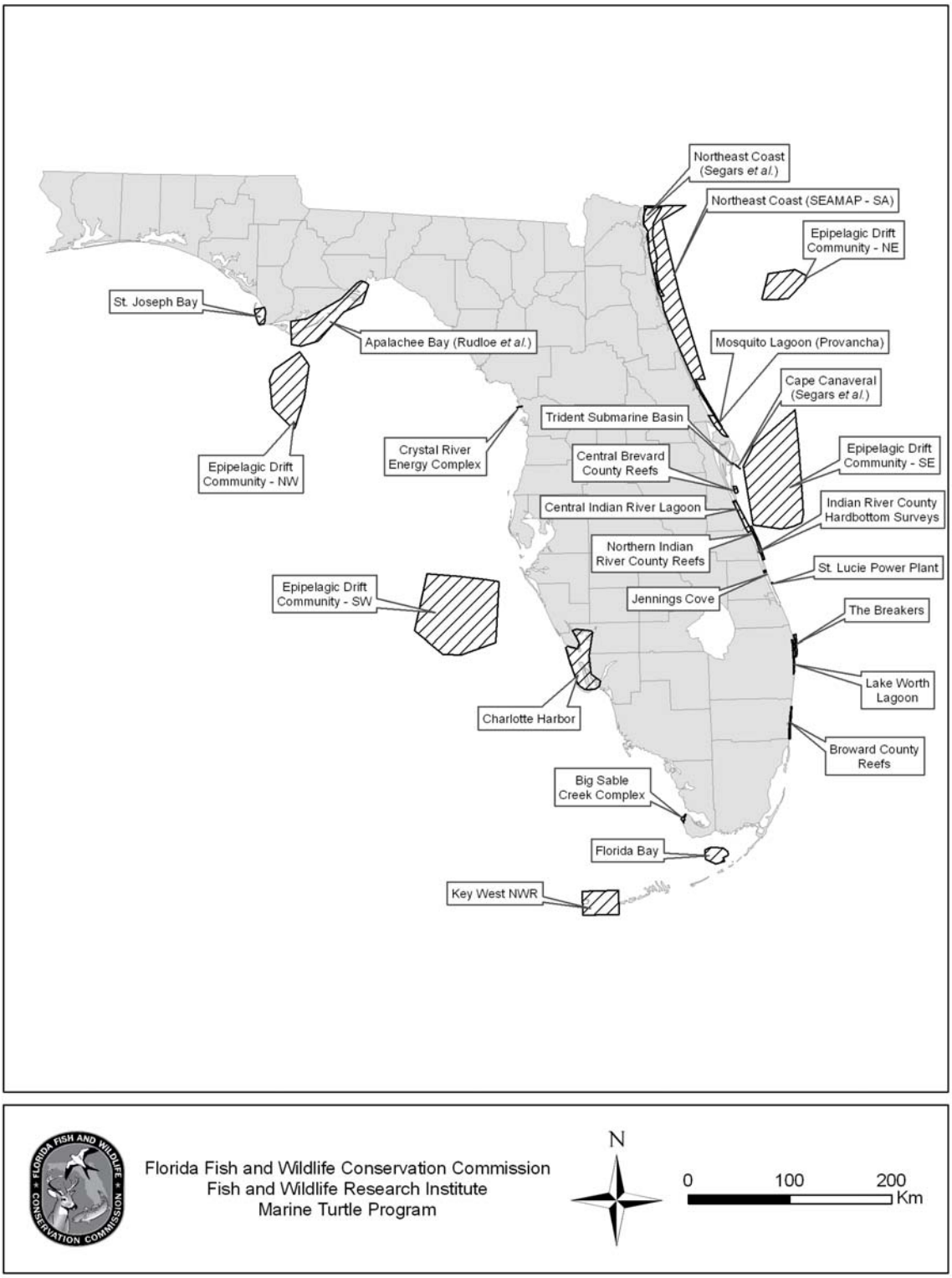

Figure 2 - Active in-water projects in Florida.

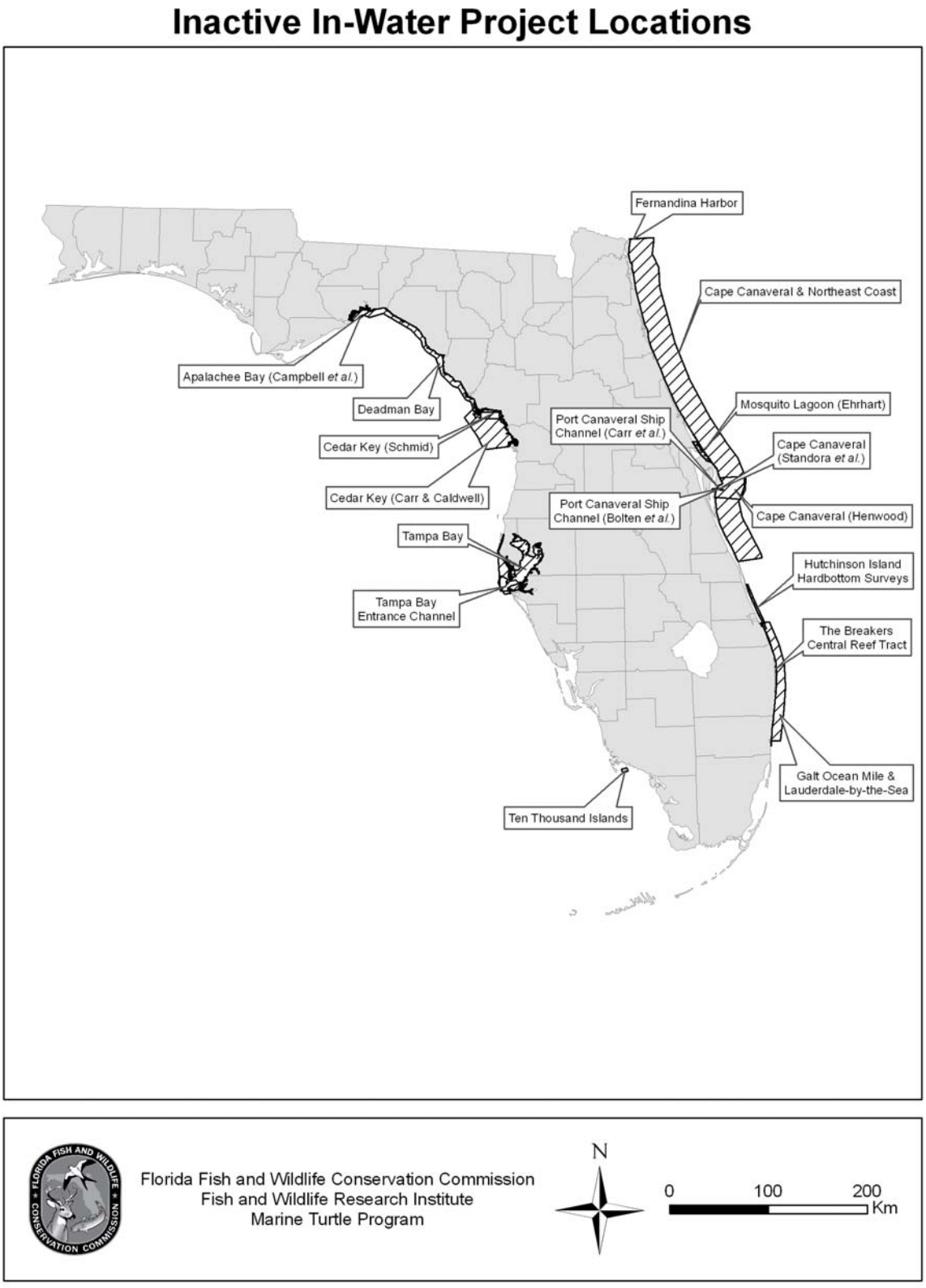

Figure 3 - Inactive in-water projects in Florida.

Site Descriptions by Region

Northwest

In the Northwest region of Florida (Escambia through Pasco County), there have been a total of eight studies, four of which are still active (Figure 4).

St. Joseph Bay – Carthy & McMichael (2001-active)
Epipelagic Drift Community – Northwest – Witherington (2005-active)
Apalachee Bay – Rudloe *et al*. (1984-active)
Apalachee Bay – Campbell *et al.* (1995-1997)
Deadman Bay – Barichivich (1996-1999)
Cedar Key – Carr & Caldwell (1955)
Cedar Key – Schmid (1985-1996)
Crystal River Energy Complex – Bruzek (1999-active)

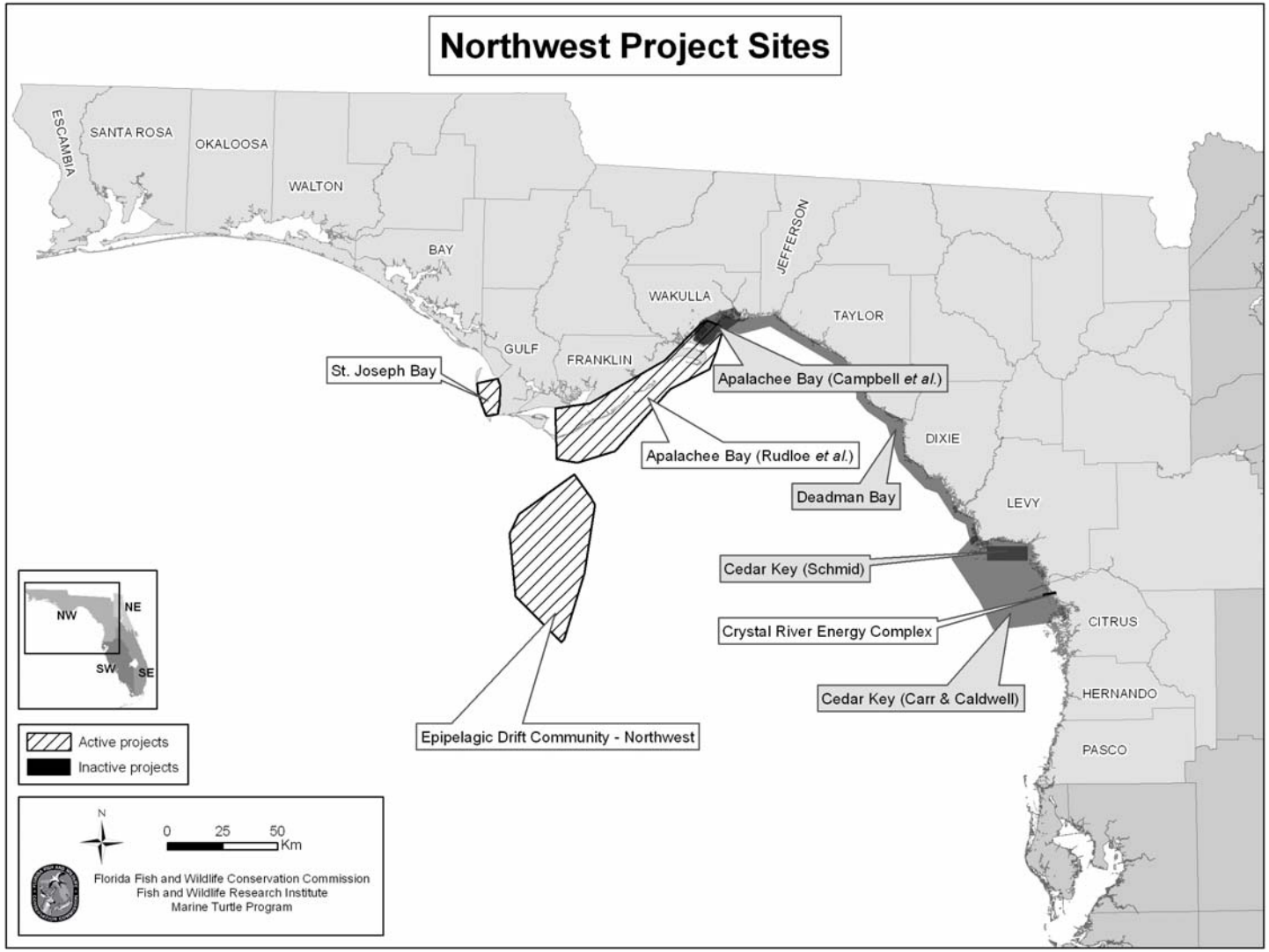

Figure 4 - Northwest Florida in-water projects. Inactive projects described with shaded callout boxes.

Site Name: **St. Joseph Bay**

General Information

Site Name: St. Joseph Bay
Site Reference Number: 1
Region: Northwest ***County:*** Gulf
Approximate Latitude: 29.76° N ***Approximate Longitude:*** 85.35° W
Principal Investigator (s): Raymond R. Carthy, Erin McMichael, Russell Scarpino
Contact Address: P.O. Box 110485, Gainesville, FL 32611
Contact Email: rayc@zoo.ufl.edu
Organizations Involved: Florida Cooperative Fish & Wildlife Research Unit, University of Florida, USGS
Organization Type: university, federal agency
Project Status: active
Active Years: 2001, 2002, 2003, 2004, 2005

Start Date: May 2001
End Date: n/a

Equipment and Methods

General Method Used: capture, tracking
Visual-Survey Method: n/a
Capture Method: set-netting, strike-netting
Net Type: tangle net ***Net Length:*** 150 m
Mesh Size: 8 inch ***Net Depth:*** 2 m

Sampling and Effort

Sampling Regime: opportunistically
Sampling Locations: focus in southern portion near seagrass beds

Sampling-Area Description: lagoon
Bottom Type: seagrass, sand
Water Type: estuarine
Mean Depth (m): 5.0
Depth Range (m): 0.0 -11.1
Effort-Data Availability: yes
Years for which CPUE Calculated: 2002, 2003, 2004

Method of Calculating CPUE: turtles/km net hr
Species Found: Cm, Cc, Lk

Site Name: **St. Joseph Bay**

Capture Information *Data current through 2004*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	220	n/a	26.2	67.4	40.2	N
Loggerhead	11	n/a	31.7	96.7	57.0	N, S, A
Kemp's Ridley	44	n/a	29.5	49.5	37.1	N, S
Hawksbill	0	n/a	n/a	n/a	n/a	n/a
Leatherback	0	n/a	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag, PIT tag, sonic tag, radio tag, satellite tag

Species Exhibiting FP: none

Genetic-Sample Collection: yes
Laparoscopy Performed: no
Growth-Rate Determination: yes
Sex-Ratio Determination: no
Tracking Studies Conducted: yes
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

Recapture data suggest that the juvenile green turtle population in St. Joseph Bay is composed, at least in part, of resident turtles. It appears that turtles enter St. Joseph Bay at just under 30 cm SCL, and the majority of turtles remain in this habitat until they reach just over 60 cm SCL. The estimated mean time of residency within St. Joseph Bay is 7 years (± 1.5 years). Carr suggested that juvenile turtles undergo developmental migration, or ontogenic shifts in habitat preference. As juveniles get larger, they move to different habitats and use resources present within these areas**.** These life-stage-based changes in resource needs and use may very well be affecting the size classes of juvenile green turtles found in St. Joseph Bay. Although no turtles were net-captured at water temperatures below 20º C, repeated cold-stunning events have resulted in mass strandings of juvenile green turtles in this area. It is likely that these turtles did not partake in seasonal movements over the winter but instead remained in the area. Comparison of body condition indices of stunned and unstunned turtles indicates that cold-stunned turtles had significantly poorer body condition (less mass per cm of SCL). Turtles may be foraging less in the winter, conserving energy, and perhaps surviving using the fat stores they have accumulated during the warmer foraging months. There was a noticeable, yet not statistically significant, negative correlation between growth rate and

the number of cold-stunning episodes a turtle experienced. Several turtles from St. Joseph Bay were found to return to specific sites following displacement, suggesting site fidelity.

Literature/ Reports Produced:

McMichael, E., R.R. Carthy, and J.A. Seminoff. 2003. Evidence of homing behavior and site fidelity in juvenile green sea turtles of the northeastern Gulf of Mexico. In: Seminoff, J.A. (comp.). Proceedings of the Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-503, pp. 223-224.

McMichael, E., R.R. Carthy, and J.A. Seminoff. 2006. Ecology of juvenile sea turtles in the northeastern Gulf of Mexico. In: Pilcher, N.J. (comp.). Proceedings of the Twenty-Third Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-536, pp. 20-21.

McMichael, E., A. Turner, R.R. Carthy, and T.M. Summers. 2006. Summary of 2002 cold stun turtles in St. Joseph Bay, Florida. In: Pilcher, N.J. (comp.). Proceedings of the Twenty-Third Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-536, pp. 184-186.

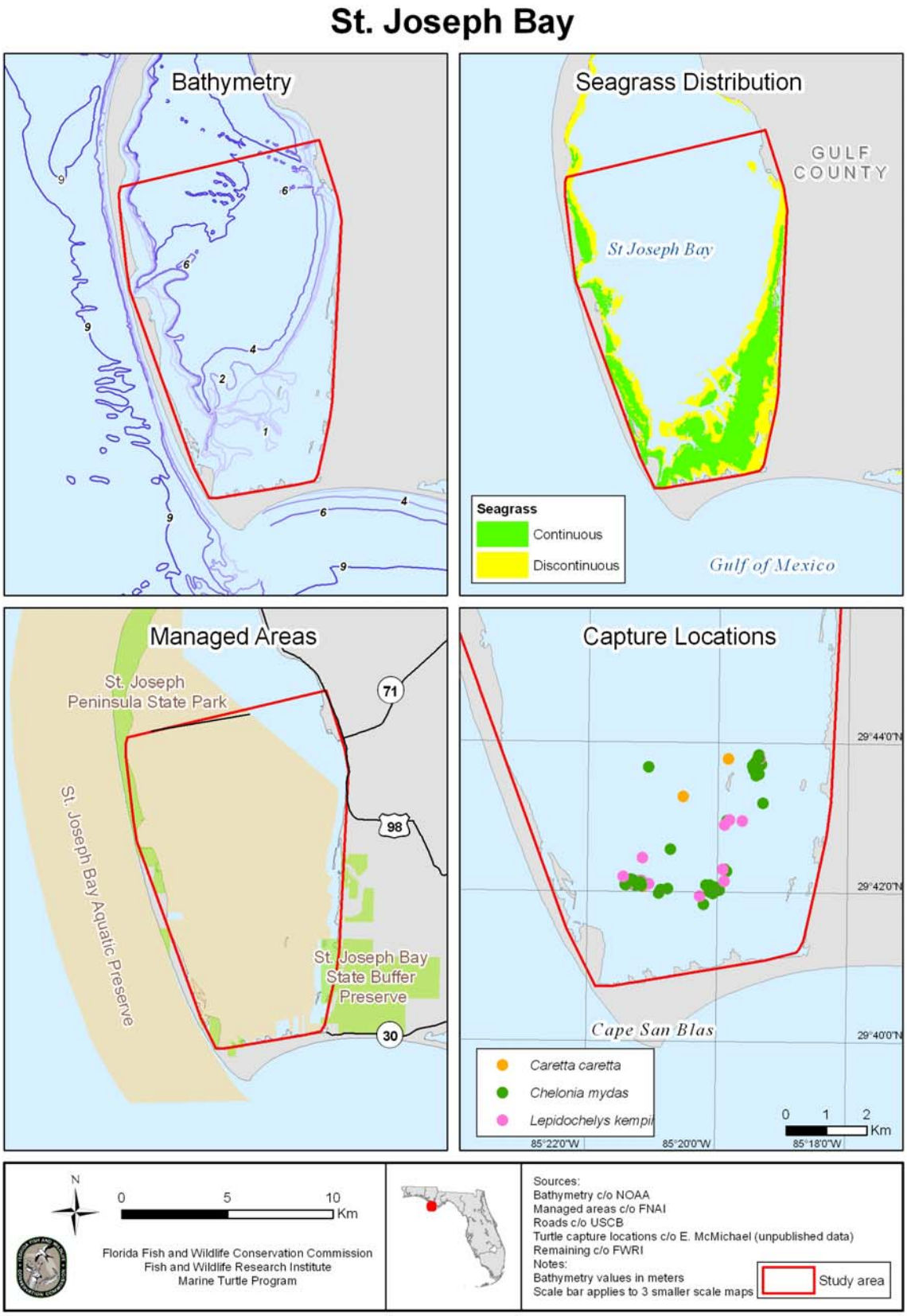

Figure 5 - St. Joseph Bay study area.

Site Name: **Epipelagic Drift Community - Northwest**

General Information

Site Name: Epipelagic Drift Community - Northwest
Site Reference Number: 2
Region: Northwest ***County:*** Outside county boundaries
Approximate Latitude: 29.12° N ***Approximate Longitude:*** 85.05° W
Principal Investigator (s): Blair Witherington
Contact Address: 9700 South A1A, Melbourne Beach, FL 32951
Contact Email: witherington@cfl.rr.com
Organizations Involved: FWC/FWRI
Organization Type: state agency
Project Status: active
Active Years: 2005, 2006

Start Date: August 2005
End Date: n/a

Equipment and Methods

General Method Used: capture, visual surveys
Visual-Survey Method: boat-based transects through linear drift habitat
Capture Method: dip-netting from surface
Net Type: dip net ***Net Length:*** n/a
Mesh Size: 0.25-1.5 in. ***Net Depth:*** n/a

Sampling and Effort

Sampling Regime: opportunistic
Sampling Locations: various locations within study area

Sampling-Area Description: pelagic downwelling zones, drift lines, *Sargassum* patches
Bottom Type: n/a
Water Type: marine
Mean Depth (m): 37.9
Depth Range (m): 14.6-62.1
Effort-Data Availability: yes
Years for which CPUE Calculated: 2005

Method of Calculating CPUE: turtles/km^2 transect
Species Found: Cm, Cc, Lk, Ei

Site Name: **Epipelagic Drift Community - Northwest**

Capture Information *Data current through 2006*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	6	7	19.4	22.7	20.6	O
Loggerhead	0	1	n/a	n/a	n/a	n/a
Kemp's Ridley	4	4	24.9	25.4	25.1	O, N
Hawksbill	2	0	19.4	23.7	21.8	O
Leatherback	0	0	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: n/a

Species Exhibiting FP: none

Genetic-Sample Collection: no
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: no
Tracking Studies Conducted: no
Evidence of Site Fidelity: no

General Findings/ Miscellaneous:

This study site lies 20-60 km south of Apalachicola and is part of a larger four-region study of sea turtles in epipelagic drift communities in Florida. Posthatchling turtles inhabit surface drift-lines located in the eastern Gulf of Mexico and near the western Gulf Stream front off Florida. They are observed and captured during linear transects through oceanic fronts, slicks, windrows, *Sargassum* patches, and other drift material. Transects take place seasonally, principally July to October, during periods of calm sea state (Beaufort force 0-3). Capture rates (turtles per time, distance, or area) of posthatchling turtles are highest for transects in Atlantic shelf waters near the Gulf Stream. Capture rates of small juveniles are highest for transects in the Gulf of Mexico 40-70 NM from Florida. All Kemp's ridleys captured so far have been from the Gulf of Mexico. Behavioral measurements and diet analysis suggest that loggerhead posthatchlings are float-and-wait foragers of mainly animal material, with a diet that includes mostly neuston from the *Sargassum* community, pleuston, jellies, and drift carrion.

Literature/ Reports Produced:

Witherington, B. 1994a. Some "lost-year" turtles found. In: Schroeder, B.A., and B.E. Witherington (comps.). Proceedings of the Thirteenth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-341, pp. 194-196.

Witherington, B. 1994b. Flotsam, jetsam, post-hatchling loggerheads, and the advecting surface smorgasbord. In: Bjorndal, K.A., A.B. Bolten, D.A. Johnson, and P.J. Eliazar (comps.). Proceedings of the Fourteenth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-351, pp. 166-168.

Witherington, B. 2000. Habitats and bad habits of young loggerhead turtles in the open ocean. In: Abreu-Grobois, F.A., R. Briseno Duenas, R. Marquez, and L. Sarti (comps.). Proceedings of the Eighteenth International Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFWC-436, pp. 34-35.

Witherington, B.E. 2002. Ecology of neonate loggerhead turtles inhabiting lines of downwelling near a Gulf Stream front. Marine Biology 140:843-853.

Witherington, B., and S. Hirama. 2006. Little loggerheads packed with pelagic plastic. In: Pilcher, N.J. (comp.). Proceedings of the Twenty-Third Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-536, pp 137-138.

Witherington, B., and S. Hirama. 2006. Sea turtles of the epi-pelagic *Sargassum* drift community. In: Frick, M., A. Panagopoulou, A. Rees, and K. Williams (comps.). Book of abstracts. Twenty-Sixth Annual Symposium on Sea Turtle Biology and Conservation. International Sea Turtle Society, Athens, Greece, pp. 209.

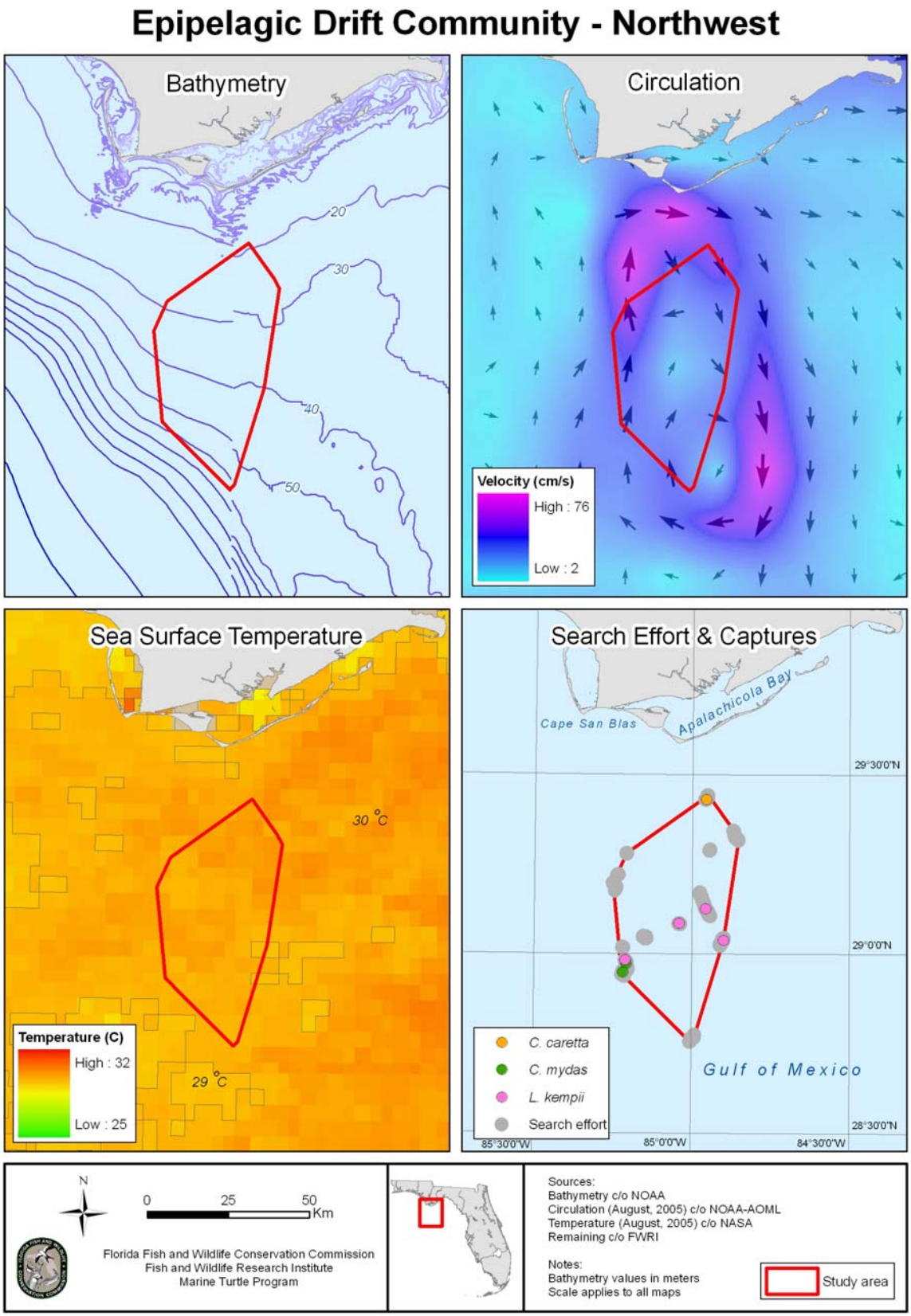

Figure 6 - Epipelagic Drift Community - Northwest study area.

Site Name: **Apalachee Bay (Rudloe *et al.*)**

General Information

Site Name: Apalachee Bay (Rudloe *et al.*)
Site Reference Number: 3
Region: Northwest ***County:*** Franklin, Wakulla
Approximate Latitude: 29.73° N ***Approximate Longitude:*** 84.70° W
Principal Investigator (s): Jack Rudloe, Anne Rudloe, Larry Ogren
Contact Address: P.O. Box 237, 222 Clark Dr., Panacea, FL 32346
Contact Email: gspecimen@sprintmail.com
Organizations Involved: Gulf Specimens Laboratory, NMFS
Organization Type: nonprofit, federal agency
Project Status: active
Active Years: 1984, 1985, 1986, 1987, 1988, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006

Start Date: June 1984
End Date: n/a

Equipment and Methods

General Method Used: capture, incidental capture
Visual-Survey Method: n/a
Capture Method: trawl, incidental (hook & line, gill net, seine fishing, trawling)
Net Type: trawl net, seine net, gill net ***Net Length:*** variable
Mesh Size: variable ***Net Depth:*** variable

Sampling and Effort

Sampling Regime: opportunistic
Sampling Locations: trawling focused on Levy & Dickerson Bays, incidental captures at various locations
Sampling-Area Description: bay
Bottom Type: seagrass, sand, mud
Water Type: estuarine
Mean Depth (m): 6.7
Depth Range (m): 0.0-20.5
Effort-Data Availability: yes (for trawling)
Years for which CPUE Calculated: n/a

Method of Calculating CPUE: turtles/trawl hr
Species Found: Cm, Cc, Lk, Ei

Site Name: **Apalachee Bay (Rudloe *et al*.)**

Capture Information *Data current through 2004*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	4	n/a	26.9	98.0	n/r	N, S, A
Loggerhead	7	n/a	n/r	n/r	n/r	n/r
Kemp's Ridley	195	n/a	20.3	57.9	36.7	O, N, S
Hawksbill	1	n/a	n/r	n/a	n/a	n/r
Leatherback	0	n/a	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag

Species Exhibiting FP: none

Genetic-Sample Collection: no
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: no
Tracking Studies Conducted: no
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

Fishermen in the area bring in turtles that have been taken incidentally during shrimp-trawling, gill-netting, and seine-fishing for other species. Information is obtained regarding locality, depth, bottom type, and gear use at the time of capture. Turtles are released into nearby Dickerson Bay after processing and within a period of no longer than seven days in rehabilitation. Turtles have been collected from 17 locations over a 60-mile stretch of coast. Those caught during the winter are significantly larger than those taken during the summer months. The peak number of individuals is collected in December and May, which coincide with the peaks in local shrimping efforts.

Researchers conducted monthly trawl-sampling for turtles from June 1990 through May 1991 for 12 hours per month with a 40-ft trawl at Alligator Point, Franklin County, FL. Eight sites were sampled; one site in Levy Bay and one in Dickerson Bay became primary net-sampling locations. Thirty-two Kemp's ridleys and one green turtle were captured during the course of the study. The researchers also recaptured five headstarted Kemp's ridleys from Texas, enabling them to determine site fidelity, rates of travel between recapture locations, and growth rates for these turtles.

The number of captures does not necessarily reflect relative species abundances because researchers did not request that fishermen bring in representative proportions of each species.

Literature/ Reports Produced:

Rudloe, A., and J. Rudloe. 1992. Characterization of an inshore population of Kemp's ridley sea turtle in the northeastern Gulf of Mexico. In: Richardson J.I., and T.H. Richardson (comps.). Proceedings of the Twelfth Annual Workshop on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-361, pp. 103-107.

Rudloe, A., J. Rudloe, and L.H. Ogren. 1991. Occurrence of immature Kemp's ridley turtles, *Lepidochelys kempi*, in coastal waters of northwest Florida. Northeast Gulf Science 1:49-53.

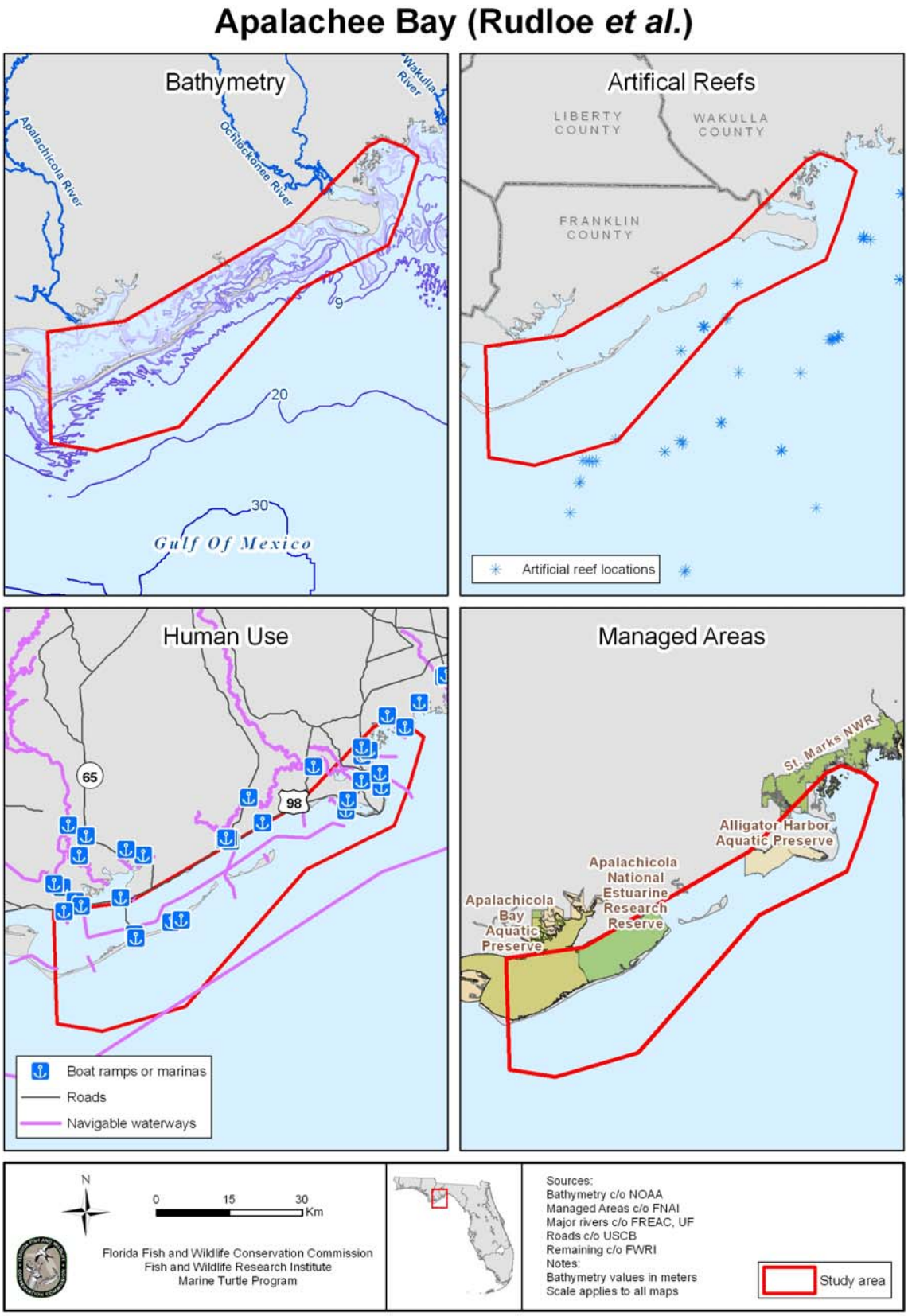

Figure 7 – Rudloe *et al.* Apalachee Bay study area.

Site Name: **Apalachee Bay (Campbell *et al.*)**

General Information

Site Name: Apalachee Bay (Campbell *et al.*)
Site Reference Number: 4
Region: Northwest ***County:*** Wakulla
Approximate Latitude: 30.04° N ***Approximate Longitude:*** 84.29° W
Principal Investigator (s): Cathi Campbell, Kenneth Sulak, William J. Barichivich
Contact Address: P.O. Box 488, Gainesville, FL 32602
Contact Email: ccampbell@wcs.org
Organizations Involved: USGS, NMFS, University of Florida
Organization Type: federal agencies, university
Project Status: inactive
Active Years: 1995, 1996, 1997

Start Date: August 1995
End Date: July 1997

Equipment and Methods

General Method Used: capture
Visual-Survey Method: n/a
Capture Method: set-netting, strike-netting
Net Type: tangle net ***Net Length:*** unknown
Mesh Size: unknown ***Net Depth:*** unknown

Sampling and Effort

Sampling Regime: opportunistic
Sampling Locations: variable within study area

Sampling-Area Description: bay
Bottom Type: seagrass, sand, oyster, beds, mud
Water Type: estuarine
Mean Depth (m): 0.9
Depth Range (m): 0.0-6.0
Effort-Data Availability: yes
Years for which CPUE Calculated: n/a

Method of Calculating CPUE: turtles/km net hr (set net)
Species Found: Cm, Lk

Site Name: **Apalachee Bay (Campbell *et al*.)**

Capture Information *Data current through 1997*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	1	n/a	37.3	98.0	37.3	N
Loggerhead	0	n/a	n/a	n/a	n/a	n/a
Kemp's Ridley	5	n/a	28.6	38.4	34.0	N
Hawksbill	0	n/a	n/a	n/a	n/a	n/a
Leatherback	0	n/a	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag, PIT tag

Species Exhibiting FP: none

Genetic-Sample Collection: no
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: no
Tracking Studies Conducted: no
Evidence of Site Fidelity: no

General Findings/ Miscellaneous:

Researchers deployed set nets across narrow channels or over shallow seagrass beds. Four of the Kemp's ridleys captured were headstarted turtles, and capture data indicate that this area functions as important development habitat for juvenile Kemp's ridleys.

Strike-netting proved to be the most effective method for capturing Kemp's ridleys.

Literature/ Reports Produced:

Barichivich, W.J., K.J. Sulak, and R.R. Carthy. 1997. Characterization of Kemp's Ridley sea turtles in the Florida Big Bend area during 1997. Annual report submitted to NMFS and FDEP, 11 pp.

Campbell, C.L. 1996. Capture of juvenile Kemp's ridleys in the nearshore waters of Apalachee Bay, Florida. In: Byles, R., and Y. Fernandez (comps.). Proceedings of the Sixteenth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-412, pp. 28-30.

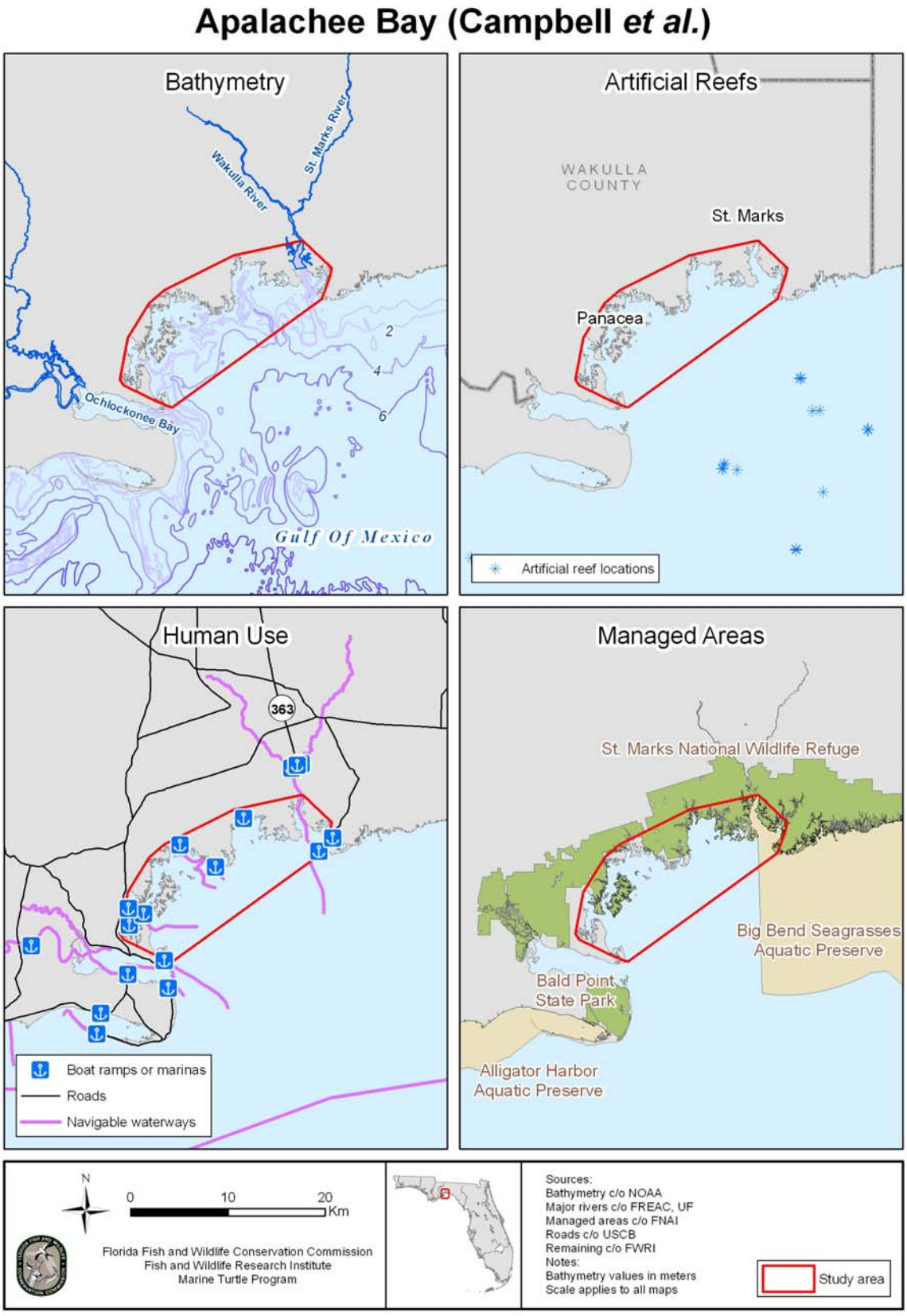

Figure 8 – Campbell *et al.* Apalachee Bay study area.

Site Name: **Deadman Bay**

General Information

Site Name: Deadman Bay
Site Reference Number: 5
Region: Northwest ***County:*** Taylor, Dixie
Approximate Latitude: 29.75° N ***Approximate Longitude:*** 83.68° W
Principal Investigator (s): William J. Barichivich
Contact Address: 7920 NW 71st St., Gainesville, FL 32653
Contact Email: jamie_barichivich@usgs.gov
Organizations Involved: USGS, University of Florida, Florida Cooperative Fish & Wildlife Research Unit, NMFS

Organization Type: federal agencies, university
Project Status: inactive
Active Years: 1996, 1997, 1998, 1999

Start Date: April 1996
End Date: June 1999

Equipment and Methods

General Method Used: capture
Visual-Survey Method: n/a
Capture Method: set-netting, strike-netting, hand-capture from boat
Net Type: tangle net ***Net Length:*** 100 m
Mesh Size: 8 cm ***Net Depth:*** 2.5 m

Sampling and Effort

Sampling Regime: monthly
Sampling Locations: focus on "The Bars" just north of Steinhatchee River Channel

Sampling-Area Description: bay
Bottom Type: seagrass
Water Type: estuarine
Mean Depth (m): 0.7
Depth Range (m): 0.0-5.9
Effort-Data Availability: yes
Years for which CPUE Calculated: n/a

Method of Calculating CPUE: turtles/km net hr (set net)
Species Found: Cm, Cc, Lk

Site Name: **Deadman Bay**

Capture Information *Data current through 1999*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	28	n/a	27.9	70.7	42.0	N, S
Loggerhead	11	n/a	23.7	66.9	49.6	O, N
Kemp's Ridley	139	n/a	22.2	51.8	34.9	O, N, S
Hawksbill	0	n/a	n/a	n/a	n/a	n/a
Leatherback	0	n/a	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag, PIT tag

Species Exhibiting FP: Cm

Genetic-Sample Collection: yes
Laparoscopy Performed: no
Growth-Rate Determination: yes
Sex-Ratio Determination: yes
Tracking Studies Conducted: no
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

The shallow seagrass flats and associated channels of the Florida Big Bend support at least three species of marine turtles, principally Kemp's ridley turtles. Growth rates gathered from Deadman Bay supported a polyphasic growth model by showing a slower growth in the 20 to 29 cm size class than in larger size classes. This is one of the few studies that have documented postpelagic sizes of both Kemp's ridleys and loggerhead turtles. Kemp's ridley turtles at this site were smaller than those found near Cedar Key by Schmid (2000; see below). Testosterone radioimmunoassays revealed a female-biased sex ratio in ridleys of 3.7:1. Fecal samples from Kemp's ridleys showed that the diet of the turtles consisted mainly of crabs and that prey diversity was low. Researchers found netting over seagrass beds and channels to be the most effective method of capturing Kemp's ridleys. An area known as 'The Bars,' just north of the Steinhatchee River Channel, proved to be very productive for netting efforts. Strike-netting was limited to use in areas of good-water quality and was effective when set-netting could not be conducted due to unfavorable conditions, such as strong tides or high boat traffic. The low number of green and loggerhead captures was not so much a reflection of their abundance as a consequence of sampling microhabitats that would maximize Kemp's ridley captures.

Literature/ Reports Produced:

Barichivich, W.J., K.J. Sulak, and R.R. Carthy. 1998. Feeding ecology and habitat affinities of Kemp's Ridley sea turtles in the Big Bend, Florida. Annual report submitted to NMFS and FDEP, 18pp.

Barichivich, W.J., K.J. Sulak, and R.R. Carthy. 1999. Feeding ecology and habitat affinities of Kemp's Ridley sea turtles in the Big Bend, Florida. Annual report submitted to NMFS and FDEP, 18pp.

Geis, A.A., W.J. Barichivich, T. Wibbels, M. Coyne, A.M. Landry Jr., and D. Owens. 2005. Predicted sex ratio of juvenile Kemp’s ridley sea turtles captured near Steinhatchee, Florida. Copeia 2005:393-398.

Schmid, J.R. 2000. Characterizing the developmental habitats and habitat utilization by Kemp’s ridley turtles using GIS. In: Kalb, H.I., and T. Wibbels (comps.). Proceedings of the Nineteenth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-443, pp. 185.

Schmid, J.R., and W.J. Barichivich. 2004. Developmental biology and ecology of Kemp's ridley turtles, *Lepidochelys kempii*, in the eastern Gulf of Mexico. Chelonian Conservation and Biology 4(4):826-832.

Schmid, J.R., and W.J. Barichivich. *In press*. The Kemp's ridley (*Lepidochelys kempii*). In: Meylan, P.A. (ed.). The Biology and Conservation of Florida Turtles. Chelonian Research Monographs 3.

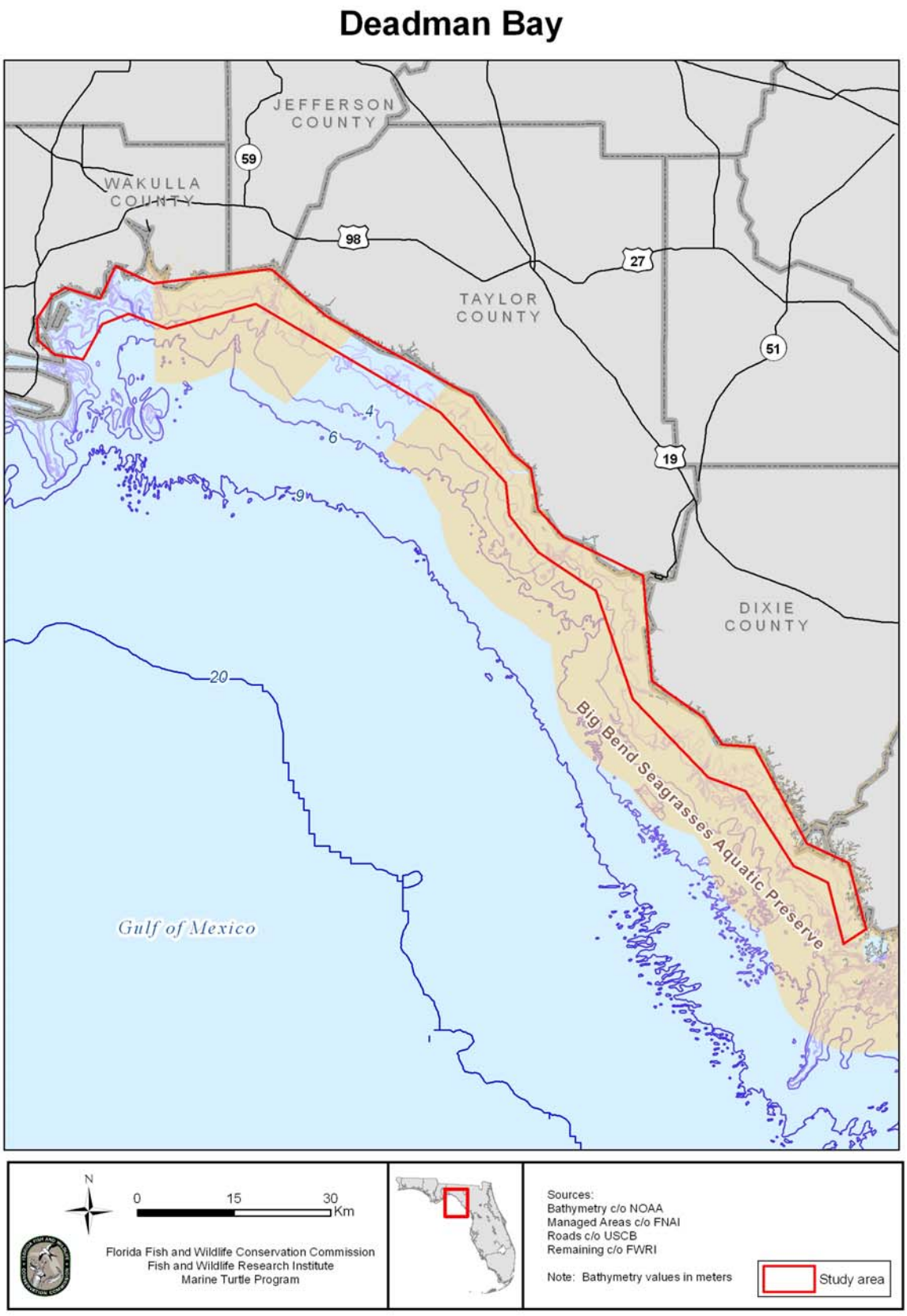

Figure 9 - Deadman Bay study area.

Site Name: **Cedar Key (Carr and Caldwell)**

General Information

Site Name: Cedar Key (Carr and Caldwell)
Site Reference Number: 6
Region: Northwest ***County:*** Levy, Citrus
Approximate Latitude: 29.00° N ***Approximate Longitude:*** 82.92° W
Principal Investigator (s): Archie Carr, David Caldwell
Contact Address: n/a
Contact Email: n/a
Organizations Involved: University of Florida, American Museum of Natural History, Florida State Museum
Organization Type: university, museum
Project Status: inactive
Active Years: 1955

Start Date: April 1955
End Date: November 1955

Equipment and Methods

General Method Used: capture
Visual-Survey Method: n/a
Capture Method: turtle fishery
Net Type: tangle net ***Net Length:*** 91.4-189.2 m
Mesh Size: 8-12 inch bar ***Net Depth:*** 2.4-3.1 m

Sampling and Effort

Sampling Regime: opportunistic
Sampling Locations: various locations within study area

Sampling-Area Description: bay
Bottom Type: channels in seagrass flats
Water Type: estuarine
Mean Depth (m): 2.7
Depth Range (m): 0.0-10.7
Effort-Data Availability: no
Years for which CPUE Calculated: n/a

Method of Calculating CPUE: n/a
Species Found: Cm, Lk

Site Name: **Cedar Key (Carr and Caldwell)**

Capture Information *Data current through 1955*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	43	n/a	41.3	57.8	59.8	N
Loggerhead	0	n/a	n/a	n/a	n/a	n/a
Kemp's Ridley	25	n/a	38.1	63.5	52.4	N, S, A
Hawksbill	0	n/a	n/a	n/a	n/a	n/a
Leatherback	0	n/a	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: flipper (oval), cow ear monel

Species Exhibiting FP: none

Genetic-Sample Collection: no
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: no
Tracking Studies Conducted: no
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

Data in this study came from commercial turtle catches in the Cedar Key area. Green turtle and Kemp's ridley commercial catch decreased in the fall and resumed in late spring. The larger-sized turtles of both species were caught early in the season, whereas turtles were smaller late in the season. Local fishermen observed mud-covered turtles in the spring and "bunching" (temporary increases in catch) at the beginning and end of the season, providing some evidence of possible overwintering behavior. Fishermen also found small green turtles in the area, particularly near rivers, but they were not taken commercially.

Literature/ Reports Produced:

Carr A., and D.K. Caldwell. 1956. The ecology and migrations of sea turtles. 1, Results of field work in Florida, 1955. American Museum Novitates 1793:31-24.

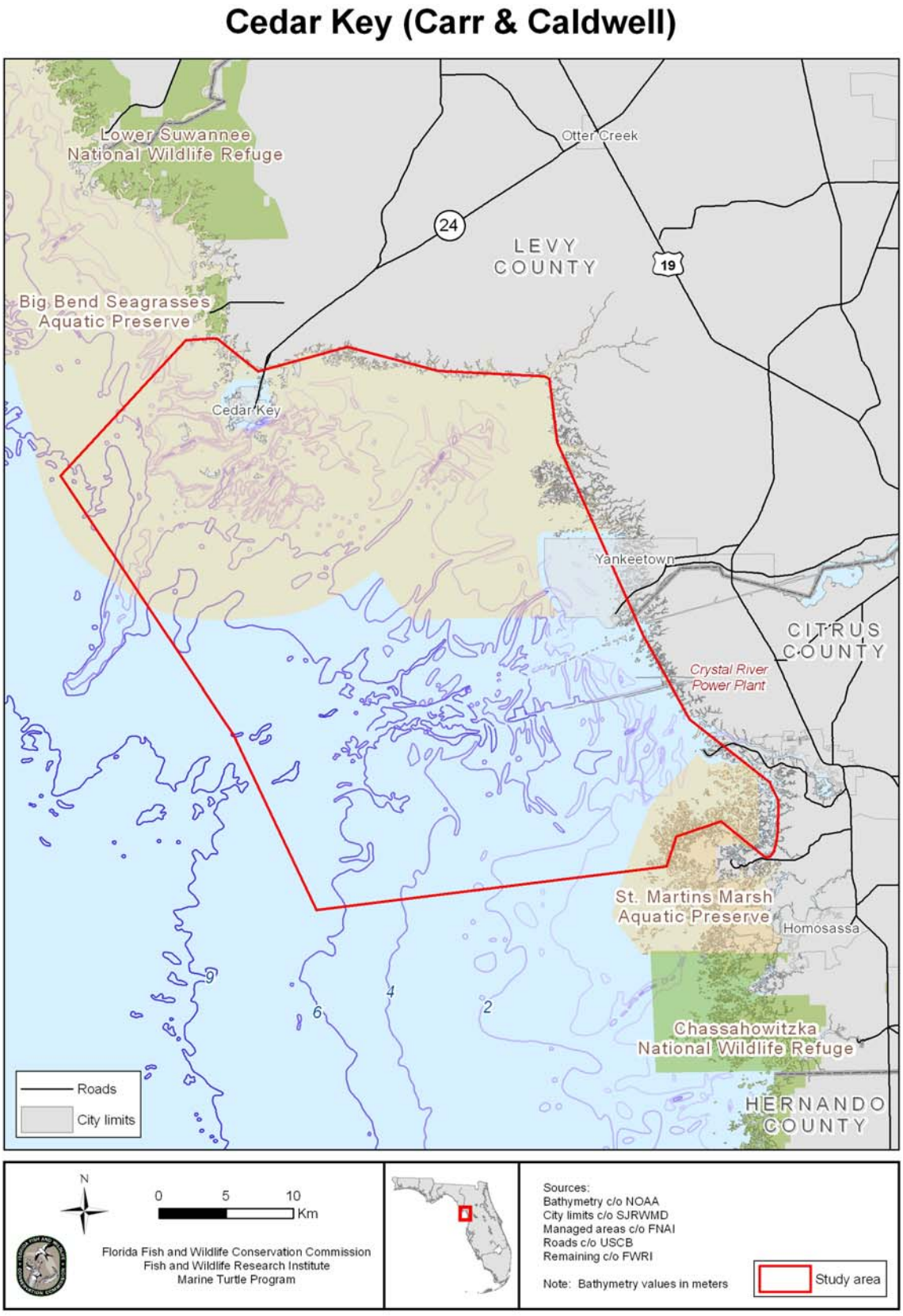

Figure 10 - Carr & Caldwell Cedar Key study area.

Site Name: **Cedar Key (Schmid)**

General Information

Site Name: Cedar Key (Schmid)
Site Reference Number: 7
Region: Northwest ***County:*** Levy
Approximate Latitude: 29.12° N ***Approximate Longitude:*** 82.92° W
Principal Investigator (s): Jeffrey Schmid, Larry Ogren
Contact Address: 1450 Merrihue Dr., Naples, FL 34102
Contact Email: jeffs@conservancy.org
Organizations Involved: University of Florida, NMFS
Organization Type: federal agency, university
Project Status: inactive
Active Years: 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996

Start Date: June 1985
End Date: 1996

Equipment and Methods

General Method Used: capture, tracking
Visual-Survey Method: n/a
Capture Method: set-netting, strike-netting
Net Type: tangle net ***Net Length:*** 65 m
Mesh Size: 51-61 cm stretch ***Net Depth:*** 20 meshes

Sampling and Effort

Sampling Regime: seasonally, as needed
Sampling Locations: various locations within study area

Sampling-Area Description: bay
Bottom Type: oyster bars, seagrass, sand flats
Water Type: estuarine
Mean Depth (m): 0.5
Depth Range (m): 0.0-1.2
Effort-Data Availability: yes
Years for which CPUE Calculated: 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993

Method of Calculating CPUE: turtles/km net hr (set net)
Species Found: Cm, Cc, Lk

Site Name: **Cedar Key (Schmid)**

Capture Information *Data current through 1996*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	10	n/a	42.9	70.9	63.5	N, S
Loggerhead	20	n/a	50.0	86.4	66.1	N, S, A
Kemp's Ridley	269	n/a	26.8	58.6	44.5	N, S
Hawksbill	0	n/a	n/a	n/a	n/a	n/a
Leatherback	0	n/a	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Rototag, Inconel tag, PIT tag, radio tag, sonic tag, post-marginal holes

Species Exhibiting FP: Cm

Genetic-Sample Collection: no
Laparoscopy Performed: no
Growth-Rate Determination: yes
Sex-Ratio Determination: yes
Tracking Studies Conducted: yes
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

Kemp's ridley and loggerhead turtles were captured during April through November, and green turtles were captured during June to September. The main capture site, Corrigan Reef, is a series of oyster reefs and sand bars on rocky bottom where loggerheads and Kemp's ridleys were found. Recapture data indicated that this area may have long-term Kemp's ridley residents. Green turtles (mid- to late-subadults) were found on the seagrass shoals in the eastern portion of Waccassassa Bay. Examination of Kemp's ridley surfacing behavior revealed that the turtles were submerged longer at night. Home-range sizes were also determined for Kemp's ridleys: their movements were oriented with the direction of prevailing tide but also showed extended periods of time with no directed movement. This is believed to be stationary maintenance, or rather an optimization of swimming energetics and foraging during these periods. The rate of movement was not correlated with size of the turtle, and reduced nocturnal activity was observed in some turtles. Although Kemp's ridleys used seagrass beds, they mostly used live bottom on rock outcroppings (nearshore hardbottom communities) and showed fidelity to these sites. The research further suggested that smaller Kemp's ridley turtles use seagrass and larger ones use hardbottom substrate types.

Blood-hormone assays performed over the course of the study showed that capture induces hypothalamus-pituitary-adrenal and hyperglycemic stress responses in Kemp's ridleys.

Literature / Reports Produced:

Gregory, L.F., and J.R. Schmid. 1998. Stress, sex, and steroids in Kemp's ridley turtles (*Lepidochelys kempii*). In: Epperly, S. P., and J. Braun. (comps.). Proceedings of the Seventeenth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-415, pp. 65-66.

Gregory, L. F., and J.R. Schmid. 2001. Stress responses and sex ratio of wild Kemp's ridley turtles (*Lepidochelys kempi*) in the northeastern Gulf of Mexico. General and Comparative Endocrinology 124:66-74.

Schmid, J.R. 1998. Marine turtle populations on the west-central coast of Florida: results of tagging studies at the Cedar Keys, FL, 1986-1995. Fishery Bulletin 96:589-602.

Schmid, J.R. 2000. Activity Patterns and Habitat Associations of Kemp's Ridley Turtles, *Lepidochelys kempi*, in the Coast Waters of the Cedar Keys, Florida. Doctoral dissertation, University of Florida, Gainesville, Florida, 184 pp.

Schmid, J.R., and L.H. Ogren. 1990. Results of a tagging study at Cedar Key, FL, with comments on Kemp's ridley distribution in the southeastern U.S. In: Richardson, T.H., J.I. Richardson, and M. Donnelly (comps.). Proceedings of the Tenth Annual Workshop on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFC-278, pp. 129.

Schmid, J.R., and W.N. Witzell. 1997. Age and growth of wild Kemp's ridley turtles (*Lepidochelys kempi*): Cumulative results of tagging studies in Florida. Chelonian Conservation and Biology 2(4):532-537.

Schmid, J.R., A.B. Bolten, K.A. Bjorndal, and W.J. Lindberg. 2002. Activity patterns of Kemp's ridley turtles, *Lepidochelys kempii*, in the coastal waters of the Cedar Keys, Florida. Marine Biology 140:215-228.

Schmid, J.R., A.B. Bolten, K.A. Bjorndal, W.J. Lindberg, H.F. Percival, and P.D. Zwick. 2003. Home range and habitat use by Kemp's ridley turtles in west-central Florida. Journal of Wildlife Management 67:196-206.

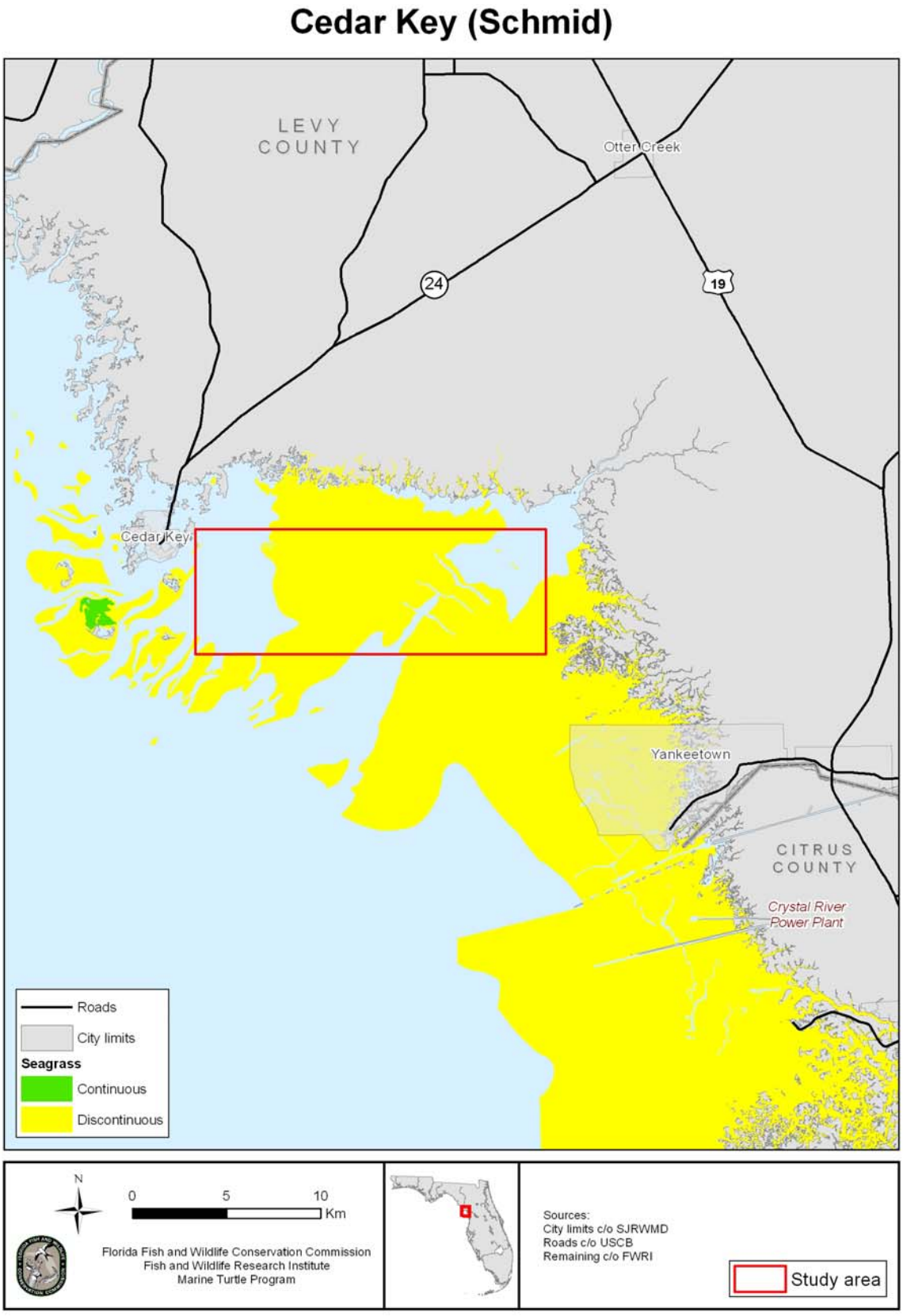

Figure 11 - Schmid Cedar Key study area.

Site Name: **Crystal River Energy Complex**

General Information

Site Name: Crystal River Energy Complex
Site Reference Number: 8
Region: Northwest ***County:*** Citrus
Approximate Latitude: 28.95° N ***Approximate Longitude:*** 82.75° W
Principal Investigator (s): Dave Bruzek
Contact Address: P.O. Box 14042 - CX1B, St. Petersburg, FL 33733
Contact Email: david.bruzek@pgnmail.com
Organizations Involved: Progress Energy Florida
Organization Type: investor-owned electric-utility power plant
Project Status: active
Active Years: 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006

Start Date: 1999
End Date: n/a

Equipment and Methods

General Method Used: capture
Visual-Survey Method: n/a
Capture Method: incidental in intake canal
Net Type: n/a ***Net Length:*** n/a
Mesh Size: n/a ***Net Depth:*** n/a

Sampling and Effort

Sampling Regime: consistent
Sampling Locations: consistent

Sampling-Area Description: bay
Bottom Type: sand, mud, channel
Water Type: marine
Mean Depth (m): 6.0 (from nautical charts)
Depth Range (m): 0.0-6.0 (from nautical charts)
Effort-Data Availability: yes
Years for which CPUE Calculated: n/a

Method of Calculating CPUE: turtles/yr
Species Found: Cm, Cc, Lk, Ei

Site Name: **Crystal River Energy Complex**

Capture Information *Data current through 2004*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	38	n/a	24	50	n/r	O, N
Loggerhead	8	n/a	40	90	n/r	N, S, A
Kemp's Ridley	92	n/a	23.2	60.0	n/r	O, N, S, A
Hawksbill	1	n/a	n/r	n/a	n/a	n/r
Leatherback	0	n/a	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag

Species Exhibiting FP: Cm

Genetic-Sample Collection: no
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: no
Tracking Studies Conducted: no
Evidence of Site Fidelity: no

General Findings/ Miscellaneous:

The Crystal River Energy Complex (CREC) contains five separate power plants that began commercial operations in October 1966, November 1969, March 1977, December 1982, and December 1984, respectively. The Gulf of Mexico provides cooling and receiving waters for various units through an intake canal, which is a 14-mile-long dredged canal with an average minimum depth of 20 feet. It extends 3 miles westward into the Gulf from the plant, and then continues another 11 miles out into the gulf (Figure 13). Sea turtle protection measures were implemented in 1998, when Florida Power Corporation (FPC) observed a significant increase in the number of Kemp's ridleys stranded on the intake bar racks of the power plants. Data on the number and sizes of turtles stranded on the racks have been collected ever since that time.

Literature/ Reports Produced:

Florida Power Corporation. 1999. Crystal River Energy Complex intake screens monitoring sea turtle program – 1999. Annual report submitted to FWC.

Florida Power Corporation. 2000. Crystal River Energy Complex intake screens monitoring sea turtle program – 2000. Annual report submitted to FWC, 8 pp.

Florida Power Corporation. 2001. Crystal River Energy Complex intake screens monitoring sea turtle program – 2001. Annual report submitted to FWC, 12 pp.

Florida Power Corporation. 2002. Crystal River Energy Complex sea turtle program summary. Annual report submitted to FWC, 4 pp.

Florida Power Corporation. 2003. Crystal River Energy Complex intake screens monitoring sea turtle program 2003. Annual report submitted to FWC, 8 pp.

Progress Energy Florida. 2004. Crystal River Energy Complex intake screens monitoring sea turtle program 2004. Annual report submitted to FWC, 9 pp.

Progress Energy Florida. 2005. Crystal River Energy Complex sea turtle rescue and recovery summary 2005. Annual report submitted to FWC, 1 pp.

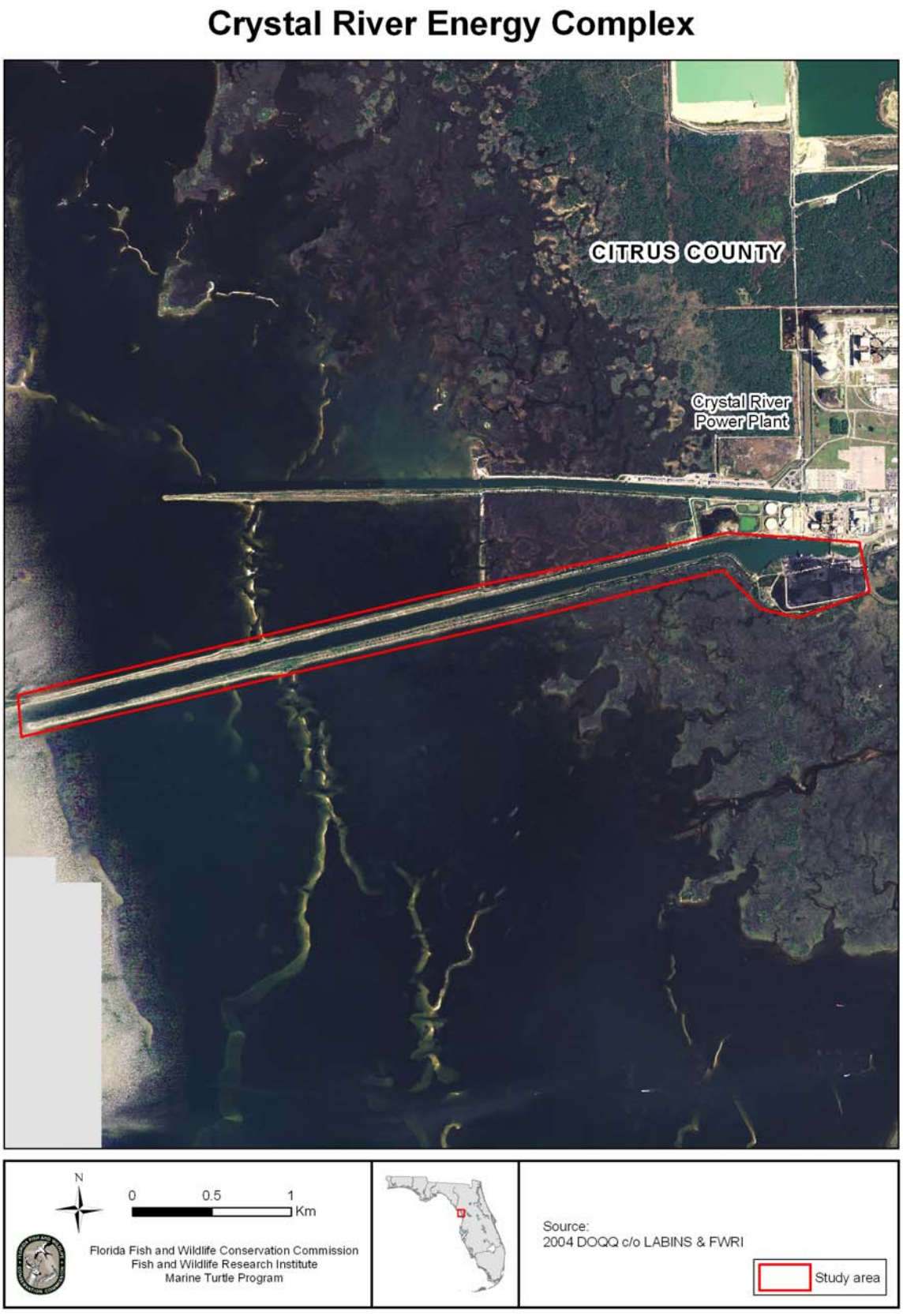

Figure 12 - Crystal River Energy Complex study area.

Southwest

In the Southwest region (Pinellas through the mainland portion of Monroe County) six studies have been conducted, three of which are still in progress (Figure 13).

Tampa Bay – Meylan *et al*. (1993-1998)
Tampa Bay Entrance Channel – Nelson (1997-1998)
Epipelagic Drift Community – Southwest – Witherington (2005-active)
Charlotte Harbor – Tucker *et al.* (2003-active)
Ten Thousand Islands – Witzell & Schmid (1997-2004)
Big Sable Creek Complex – Hart (2006-active)

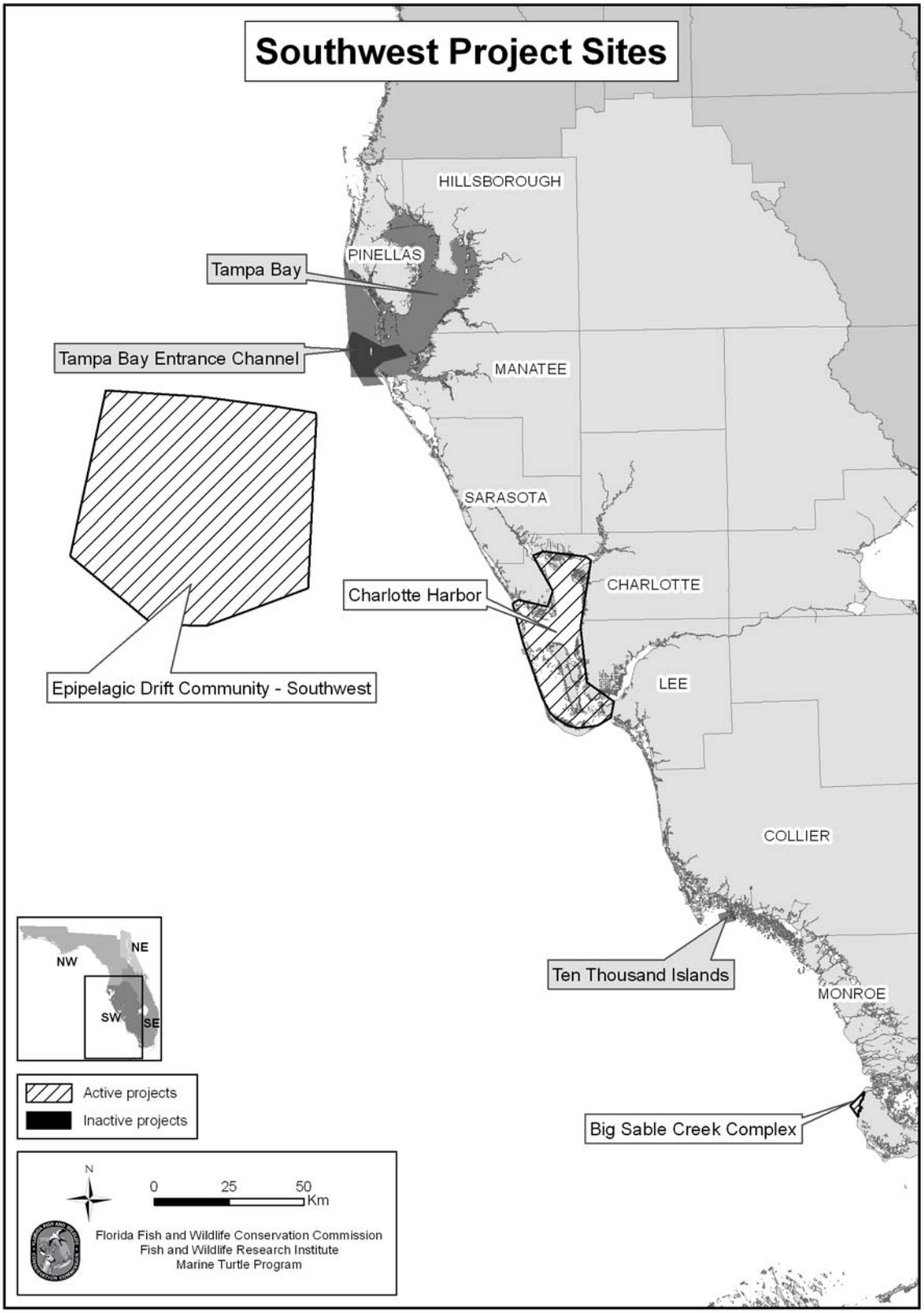

Figure 13 - Southwest Florida in-water projects. Inactive projects are indicated by shaded callout boxes.

Site Name: **Tampa Bay**

General Information

Site Name: Tampa Bay
Site Reference Number: 9
Region: Southwest ***County:*** Hillsborough, Pinellas, Manatee
Approximate Latitude: 27.73° N ***Approximate Longitude:*** 82.65° W
Principal Investigator (s): Anne Meylan, Allen Foley
Contact Address: 100 8th Ave. SE, St. Petersburg, FL 33701
Contact Email: anne.meylan@MyFWC.com
Organizations Involved: FWC/FWRI
Organization Type: state agency
Project Status: inactive
Active Years: 1993, 1994, 1995, 1996, 1997, 1998

Start Date: 1993
End Date: 1998

Equipment and Methods

General Method Used: capture, visual sightings
Visual-Survey Method: random sightings from boat
Capture Method: trawling, set-netting
Net Type: trawl net, tangle net ***Net Length:*** 55-114 m set nets, 2 trawl nets @ 7.6 m ea
Mesh Size: 8-12 inch bar ***Net Depth:*** 3 m

Sampling and Effort

Sampling Regime: opportunistic
Sampling Locations: netting & trawling at various locations throughout bay
Sampling-Area Description: bay and adjacent marine waters
Bottom Type: seagrass, sand, mud
Water Type: estuarine, marine
Mean Depth (m): 3.7
Depth Range (m): 0.0-15.7
Effort-Data Availability: yes
Years for which CPUE Calculated: n/a

Method of Calculating CPUE: turtles/km net hr (set net); turtles/trawl hr (trawling)
Species Found: Cc, Lk

Site Name: **Tampa Bay**

Capture Information *Data current through 1998*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	0	0	n/a	n/a	n/a	n/a
Loggerhead	2	1	89.6 SCL_{min}	97.4 SCL_{min}	93.5 SCL_{min}	A
Kemp's Ridley	0	2	n/a	n/a	n/a	n/a
Hawksbill	0	0	n/a	n/a	n/a	n/a
Leatherback	0	0	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult.***
For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: titanium tag, plastic tag

Species Exhibiting FP: none

Genetic-Sample Collection: yes
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: no
Tracking Studies Conducted: no
Evidence of Site Fidelity: no

General Findings/ Miscellaneous:

FWRI staff conducted visual surveys and set tangle nets for marine turtles between 1993 and 1997. Trawl netting was used to sample for turtles in May and June of 1995. Thirty 30-minute paired tows yielded only a single loggerhead.

This compilation of data suggests that marine turtles are relatively inconspicuous in Tampa Bay. Although only two species were found in this study, four species have been reported in the bay: loggerheads, Kemp's ridleys, green turtles, and hawksbills (in order of decreasing abundance). It appears that ridleys and loggerheads may be year-round residents.

The bay supports a range of life stages: neritic juveniles, subadults, and adults (including nesting female loggerheads). Historical data suggest marine turtle populations were more robust prior to pressures from the turtle fishery.

Literature/ Reports Produced:

Meylan, A., A. Redlow, A. Mosier, K. Moody, and A. Foley. 1999. Sea turtles in Tampa Bay, Florida. In: Pribble, J.R., A.J. Janicki, and H. Greening (eds.). Baywide Environmental Monitoring Report, 1993-1998, Tampa Bay, Florida. Tampa Bay Estuary Program, Technical Publication #07-99, 13-1 to 13-15.

Meylan, A., A. Redlow, A. Mosier, K. Moody, A. Foley, and B. Brost. 2003. Sea turtles in Tampa Bay, Florida. In: Pribble, J.R., A.J. Janicki, and H. Greening (eds.). Baywide Environmental Monitoring Report, 1998-2001, Tampa Bay, Florida. Tampa Bay Estuary Program, Technical Publication #06-02 pp. 18-1 to 18-13.

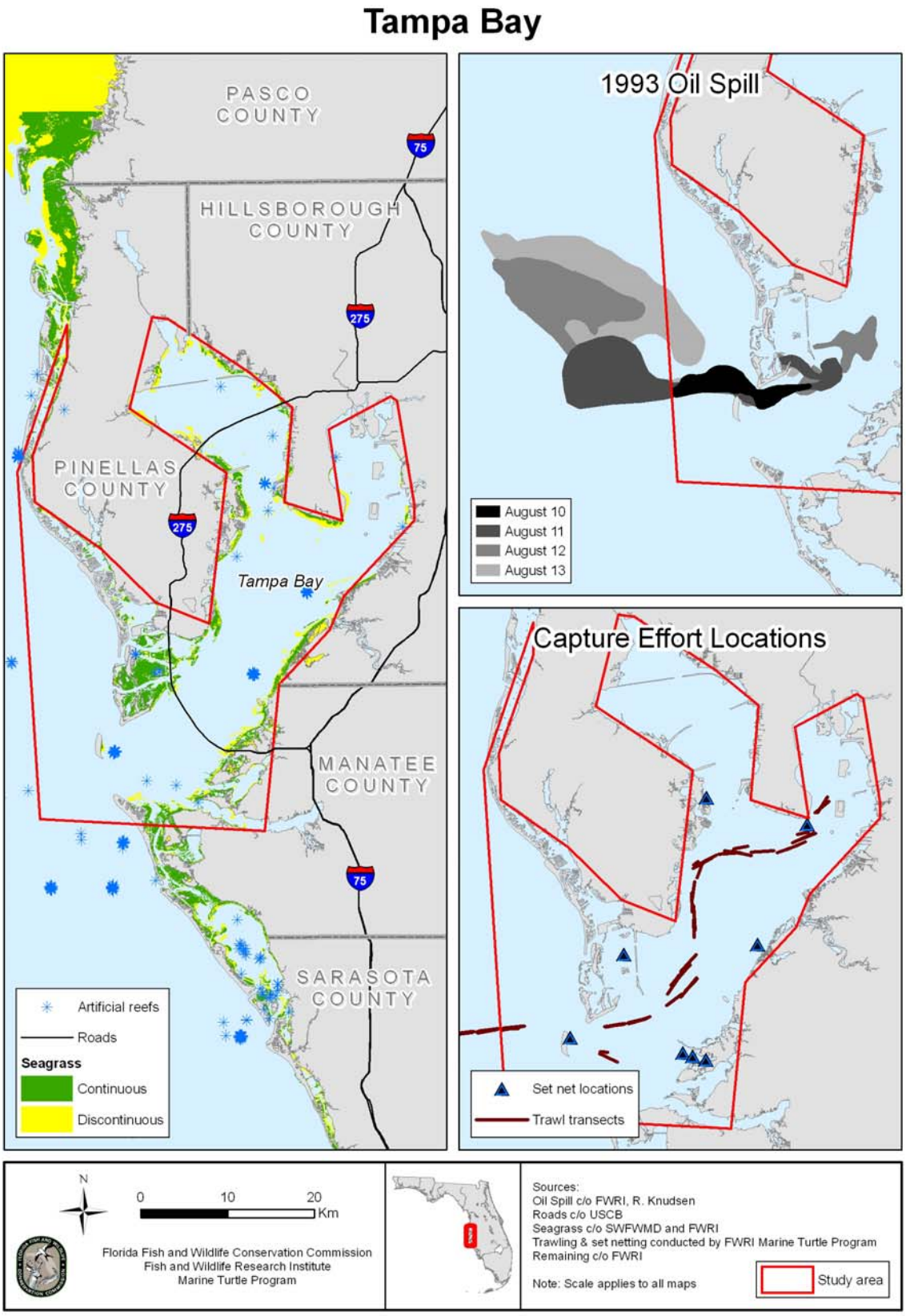

Figure 14 - Tampa Bay study area.

Site Name: **Tampa Bay Entrance Channel**

General Information

Site Name: Tampa Bay Entrance Channel
Site Reference Number: 10
Region: Southwest ***County:*** Pinellas, Manatee
Approximate Latitude: 27.57° N ***Approximate Longitude:*** 82.77° W
Principal Investigator (s): David Nelson
Contact Address: 4104 Freetown Rd., Vicksburg, MS 39183
Contact Email: drdavenelson@msn.com
Organizations Involved: U.S. Army Corps of Engineers
Organization Type: federal agency
Project Status: inactive
Active Years: 1997, 1998

Start Date: February 1997
End Date: June 1998

Equipment and Methods

General Method Used: capture, tracking
Visual-Survey Method: n/a
Capture Method: trawling
Net Type: trawl net ***Net Length:*** 2 60-ft nets
Mesh Size: 8 inch mesh ***Net Depth:*** n/a

Sampling and Effort

Sampling Regime: seasonally
Sampling Locations: various locations throughout channel

Sampling-Area Description: dredged channel
Bottom Type: channel
Water Type: marine
Mean Depth (m): 6.5
Depth Range (m): 0.0-28.5
Effort-Data Availability: yes
Years for which CPUE Calculated: 1997, 1998

Method of Calculating CPUE: turtles/trawl hr; turtles/trawl nm
Species Found: Cm, Cc, Lk

Site Name: **Tampa Bay Entrance Channel**

Capture Information *Data current through 1998*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	1	n/a	83.7	n/a	n/a	S
Loggerhead	5	n/a	62.0	99.3	86.6	N, S, A
Kemp's Ridley	3	n/a	53.4	54.9	54.4	S
Hawksbill	0	n/a	n/a	n/a	n/a	n/a
Leatherback	0	n/a	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag, satellite tag

Species Exhibiting FP: none

Genetic-Sample Collection: no
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: no
Tracking Studies Conducted: yes
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

This study included four seasonal trawl surveys within the Tampa Bay Entrance Channel in the spring, summer, and fall of 1997, and the spring of 1998. The Army Corps of Engineers conducted relative-abundance surveys for ten days each season by using trawl nets to assess sea turtle spatial occurrence relative to the channel bottom. There were only a small number of turtles captured at any time of the year, suggesting that the number of turtles in the channel throughout the year is low. Seasonal abundance was documented to be somewhat higher in the fall.

USACE fit two adult male loggerheads, one adult female loggerhead, two subadult loggerheads, and two subadult Kemp's ridleys with satellite transmitters during 1997 and 1998. Turtles were tracked for 13 to 376 days. Tracking revealed that sea turtles remained in the general study area for days or months at a time and eventually moved in response to changing water temperatures. Turtle densities were higher when water temperatures were above 15° C and lower when the temperature fell below that threshold. Turtles moved either offshore or southward as water temperatures decreased, and returned to their original location when water temperatures warmed. The researchers recommended that dredging activities in the Tampa Bay Entrance Channel be conducted during water-temperature extremes in either winter or summer. Cool winter temperatures force sea turtles offshore, and turtles move farther inshore and to the north of the channel when temperatures warm in the summer.

Literature/ Reports Produced:

Nelson, D.A. 1999. Sea turtle relative abundance and seasonal movements in Tampa Bay Entrance Channel. Report prepared for U.S. Army Corps of Engineers, Jacksonville District, 40 pp.

Nelson, D.A. 2000. Winter Movements of Sea Turtles. In: Kalb. H., and T. Wibbels (comps.). Proceedings of the Nineteenth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-443, pp. 26.

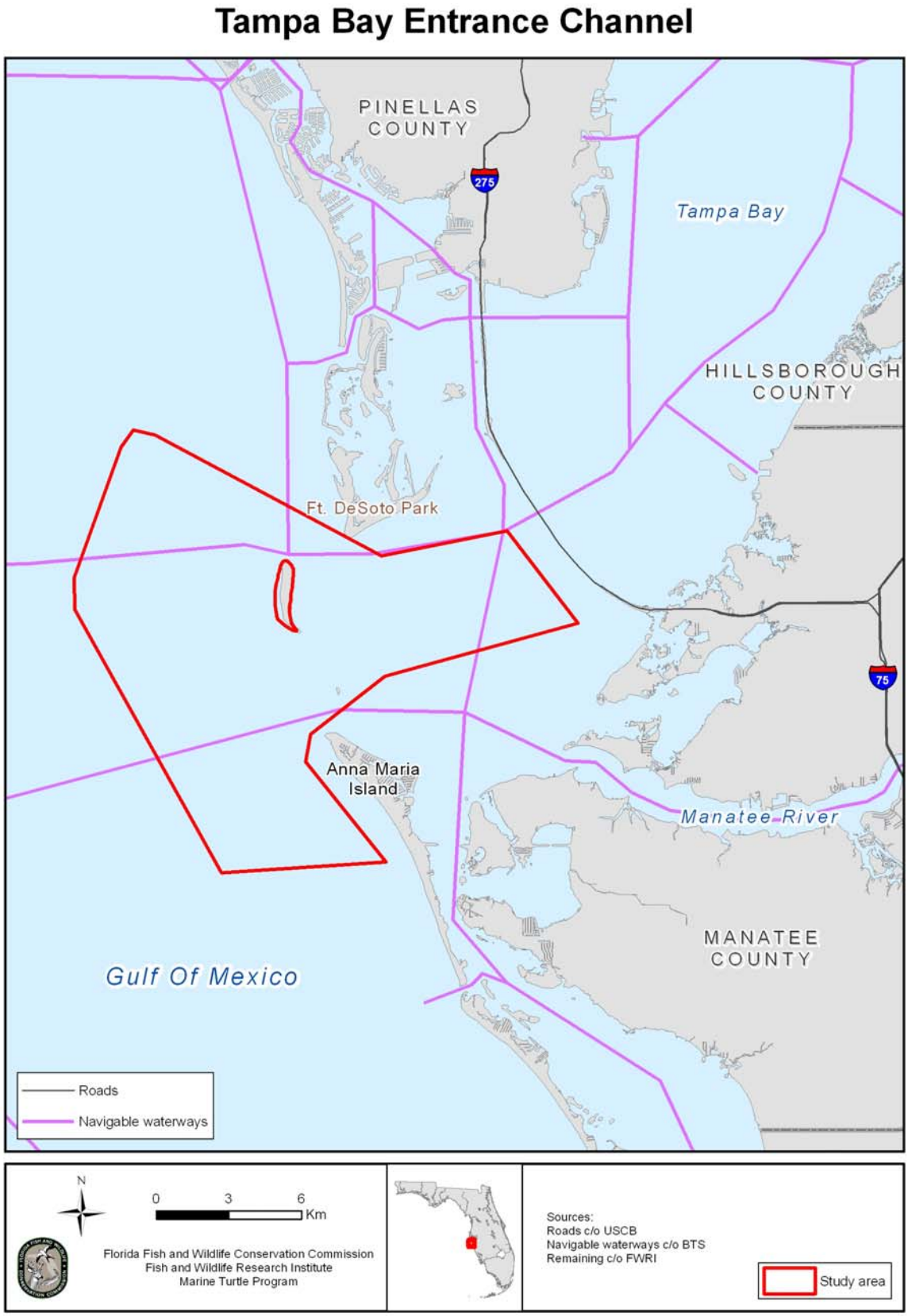

Figure 15 - Tampa Bay Entrance Channel study area.

Site Name: **Epipelagic Drift Community - Southwest**

General Information

Site Name: Epipelagic Drift Community - Southwest
Site Reference Number: 11
Region: Southwest ***County:*** Outside county boundaries
Approximate Latitude: 27.13° N ***Approximate Longitude:*** 83.36° W
Principal Investigator (s): Blair Witherington
Contact Address: 9700 South A1A, Melbourne Beach, FL 32951
Contact Email: witherington@cfl.rr.com
Organizations Involved: FWC/FWRI
Organization Type: state agency
Project Status: active
Active Years: 2005

Start Date: August 2005
End Date: n/a

Equipment and Methods

General Method Used: capture, visual surveys
Visual-Survey Method: boat-based transects through linear drift habitat
Capture Method: dip-netting from surface
Net Type: dip net ***Net Length:*** n/a
Mesh Size: 0.25-1.5 in. ***Net Depth:*** n/a

Sampling and Effort

Sampling Regime: opportunistic
Sampling Locations: various locations within study area

Sampling-Area Description: pelagic downwelling zones, drift lines, *Sargassum* patches
Bottom Type: n/a
Water Type: marine
Mean Depth (m): 43.8
Depth Range (m): 16.9-64.0
Effort-Data Availability: yes
Years for which CPUE Calculated: 2005

Method of Calculating CPUE: turtles/km^2 transect
Species Found: Cm, Cc, Lk, Ei

Site Name: **Epipelagic Drift Community - Southwest**

Capture Information *Data current through 2006*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	1	1	23.0	n/a	n/a	O
Loggerhead	6	0	4.6	6.3	5.4	O
Kemp's Ridley	1	4	23.7	n/a	n/a	O
Hawksbill	1	0	21.0	n/a	n/a	O
Leatherback	0	0	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: n/a

Species Exhibiting FP: none

Genetic-Sample Collection: no
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: no
Tracking Studies Conducted: no
Evidence of Site Fidelity: no

General Findings/ Miscellaneous:

This study site is located 20-100 km west of Sarasota and represents the southwest site of the broader epipelagic drift community project. See the narrative under Epipelagic Drift Community – Northwest for more information and literature produced.

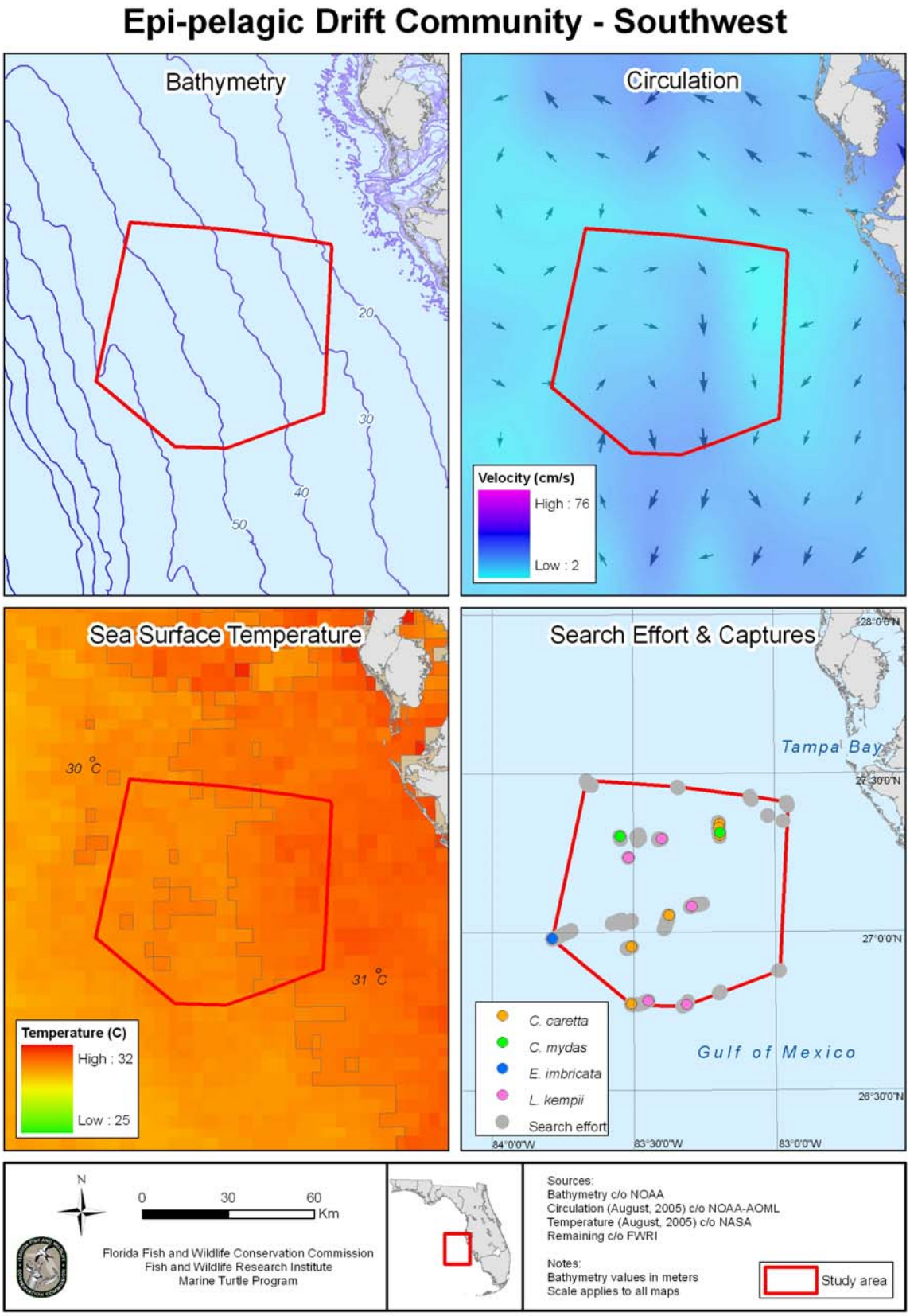

Figure 16 - Epipelagic Drift Community - Southwest study area.

Site Name: **Charlotte Harbor**

General Information

Site Name: Charlotte Harbor
Site Reference Number: 12
Region: Southwest ***County:*** Charlotte, Lee
Approximate Latitude: 26.70° N ***Approximate Longitude:*** 82.14° W
Principal Investigator (s): Tony Tucker, Jerris Foote, Jeffrey Schmid, Anne Meylan
Contact Address: 1600 Ken Thompson Parkway, Sarasota, FL 34236
Contact Email: tucker@mote.org
Organizations Involved: Mote Marine Laboratory, Conservancy of SW FL, Ding Darling NWR, Charlotte Harbor NEP, FWC/FWRI
Organization Type: nonprofit, federal agency, state agency
Project Status: active
Active Years: 2003, 2004

Start Date: March 2003
End Date: n/a

Equipment and Methods

General Method Used: capture, visual sightings
Visual-Survey Method: random sightings from boat
Capture Method: set-netting
Net Type: tangle net ***Net Length:*** 200 m
Mesh Size: 12 inch bar ***Net Depth:*** 3 m

Sampling and Effort

Sampling Regime: opportunistic
Sampling Locations: variable

Sampling-Area Description: bay
Bottom Type: sand, seagrass, live bottom
Water Type: estuarine
Mean Depth (m): 1.9
Depth Range (m): 0.0-16.1
Effort-Data Availability: yes
Years for which CPUE Calculated: 2003, 2004

Method of Calculating CPUE: turtles/km net hr
Species Found: Cm, Cc, Lk

Site Name: **Charlotte Harbor**

Capture Information *Data current through 2006*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	1	5	56.6	n/a	56.6	N
Loggerhead	1	17	82.5	n/a	82.5	A
Kemp's Ridley	4	15	32.7	40.2	37.7	N, S
Hawksbill	0	0	n/a	n/a	n/a	n/a
Leatherback	0	0	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag, PIT tag

Species Exhibiting FP: none

Genetic-Sample Collection: yes
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: no
Tracking Studies Conducted: no
Evidence of Site Fidelity: no

General Findings/ Miscellaneous:

In-water netting and visual surveys began in 2003 to evaluate species composition, developmental migrations, habitat use, and feeding ecology. Loggerheads are typically found near tidal passes, ridleys congregate close to creek or bay mouths, and green turtles are often observed in seagrass pastures in 6-8 feet of water. Annual CPUE rates for visual transect sightings range from 0.011-0.021 turtles/hour. Sighting densities dropped during the winter months.

Another goal of this project is to evaluate posthurricane effects on turtle foraging ecology in Charlotte Harbor. A Kemp's ridley was observed eating horseshoe crabs near the mouth of the Peace River in September 2003. Surveys conducted after Hurricane Charley in 2004 reported hypoxic conditions and a massive horseshoe crab die-off in that same area. Disturbances to seagrass beds and changes in crustacean populations after hurricanes are also being evaluated as having possible effects on sea turtle foraging ecology.

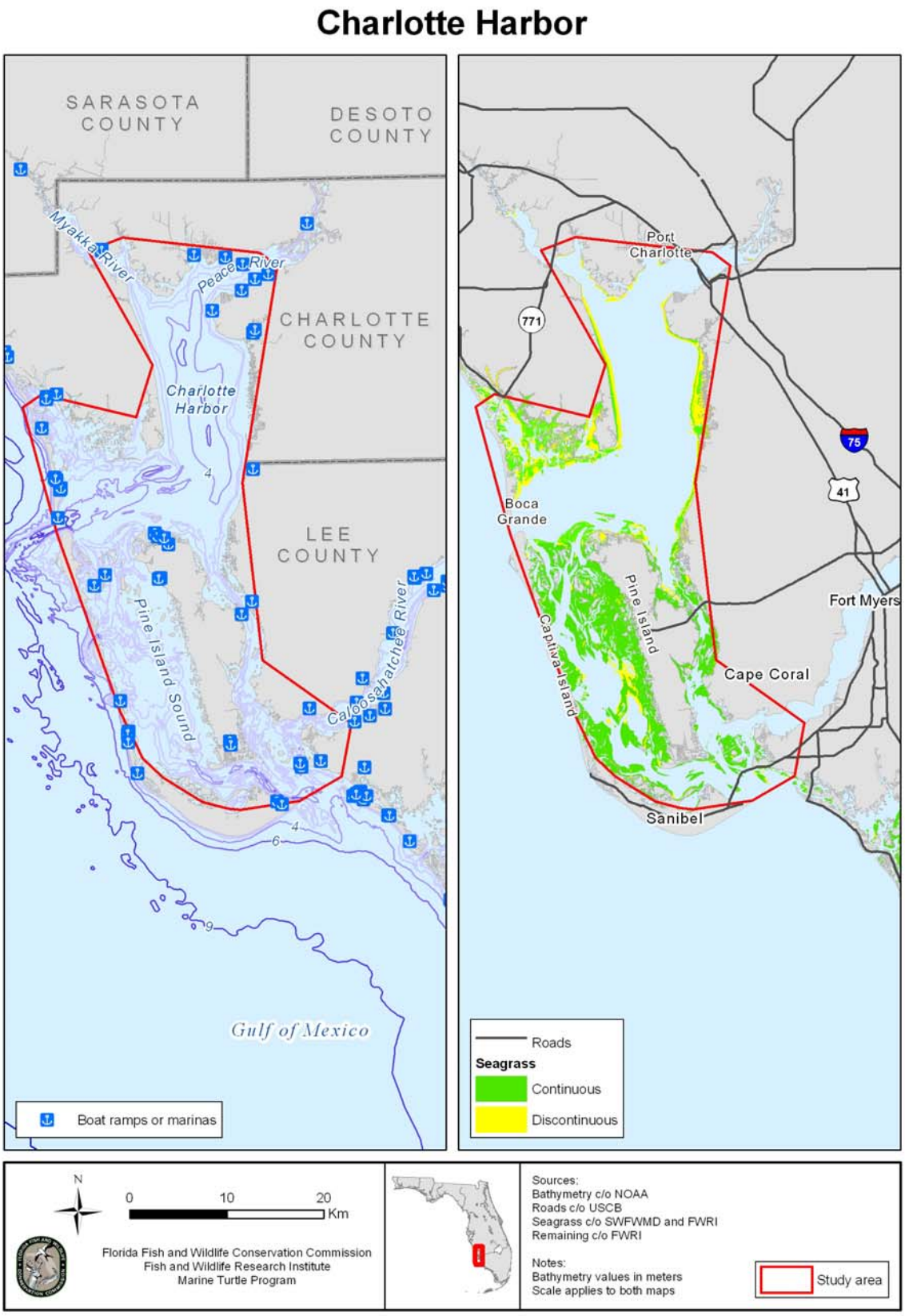

Figure 17 - Charlotte Harbor study area.

Site Name: **Ten Thousand Islands**

General Information

Site Name: Ten Thousand Islands
Site Reference Number: 13
Region: Southwest ***County:*** Collier
Approximate Latitude: 25.87° N ***Approximate Longitude:*** 81.59° W
Principal Investigator (s): Wayne Witzell, Jeffrey Schmid
Contact Address: 75 Virginia Beach Dr., Miami, FL 33149
Contact Email: wayne.witzell@noaa.gov
Organizations Involved: NMFS, Conservancy of Southwest Florida
Organization Type: federal agency, nonprofit
Project Status: inactive
Active Years: 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004

Start Date: June 1997
End Date: August 2004

Equipment and Methods

General Method Used: capture, tracking
Visual-Survey Method: n/a
Capture Method: strike-netting
Net Type: tangle net ***Net Length:*** 200-300 m
Mesh Size: 20.5 cm stretch ***Net Depth:*** 3-4 m

Sampling and Effort

Sampling Regime: opportunistic
Sampling Locations: focus on Gullivan Bay, Cape Romano, Ten Thousand Islands Aquatic Preserve

Sampling-Area Description: bay
Bottom Type: mangrove bays, sand, oyster reefs, mud, seagrass
Water Type: estuarine
Mean Depth (m): 1.5
Depth Range (m): 0.0-4.0
Effort-Data Availability: no
Years for which CPUE Calculated: n/a

Method of Calculating CPUE: n/a
Species Found: Cm, Cc, Lk. Ei

Site Name: **Ten Thousand Islands**

Capture Information *Data current through 2004*

	Number of Captures	***Number of Sightings***	***Size* (cm) Min and Max***		***Mean Size* (cm)***	***Life Stages Captured*****
Green Turtle	13	n/a	n/r	n/r	51.6 SCL_{min}	n/r
Loggerhead	15	n/a	n/r	n/r	65.5 SCL_{min}	n/r
Kemp's Ridley	191	n/a	21.4 SCL_{min}	65.2 SCL_{min}	40.4 SCL_{min}	O, N, S, A
Hawksbill	5	n/a	52.2 SCL_{min}	n/a SCL_{min}	n/a SCL_{min}	N
Leatherback	0	n/a	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag, PIT tag, radio tag, sonic tag

Species Exhibiting FP: Cm, Cc

Genetic-Sample Collection: yes
Laparoscopy Performed: no
Growth-Rate Determination: yes
Sex-Ratio Determination: yes
Tracking Studies Conducted: yes
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

Some Kemp's ridleys set up home ranges in this area for as long as three years. Fewer loggerheads were present in the study area because they may prefer deeper waters. Green turtle numbers were also low, possibly due to sparse seagrass beds in the area. The total number of captures decreased in December through February. Recaptures were documented within and between sampling seasons, indicating foraging-site fidelity. A hawksbill/loggerhead hybrid was captured four times within one year. The study documented habitat-partitioning by different turtle species in Gullivan Bay. Kemp's ridley turtles principally used areas of sand substrate with plumed worm tubes and live-bottom organisms; green turtles were found mainly in the seagrass beds in the northwestern portion of the study area.

Literature/ Reports Produced:

Schmid, J.R. 2004. Determining essential habitat for the Kemp's ridley turtle in the Ten Thousand Islands, Florida. Final report submitted to Marine Turtle Grants Program. 16 pp.

Schmid, J.R. 2005. Essential habitat for Kemp's ridley turtles in the Ten Thousand Islands, Florida. Final report submitted to Florida Fish and Wildlife Commission, Marine Turtle Permit #147, 18 pp.

Witzell, W.N., and J.R. Schmid. 2002. Investigation of immature sea turtles in the coastal waters of southwest Florida. In: Mosier, A., A. Foley, and B. Brost (comps.). Proceedings of the Twentieth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-477, pp. 276-277.

Witzell, W.N., and J.R. Schmid. 2003. Multiple recaptures of a hybrid hawksbill-loggerhead turtle in the Ten Thousand Islands, Southwest Florida. Herpetological Review 34:323-325.

Witzell, W.N., and J.R. Schmid. 2004. Immature sea turtles in Gullivan Bay, Ten Thousand Islands, Southwest Florida. Gulf of Mexico Science 22:54-61.

Witzell, W.N., and J.R. Schmid. 2005. Diet of immature Kemp's ridley turtles (*Lepidochelys kempi*) from Gullivan Bay, Ten Thousand Islands, southwest Florida. Bulletin of Marine Science 77:191-199.

Witzell, W.N., A.A. Geis, J.R. Schmid, and T. Wibbels. 2005. Sex ratio of immature Kemp's ridley turtles (*Lepidochelys kempi*) from Gullivan Bay, Ten Thousand Islands, south-west Florida. Journal of the Marine Biological Association of the United Kingdom 85:205-208.

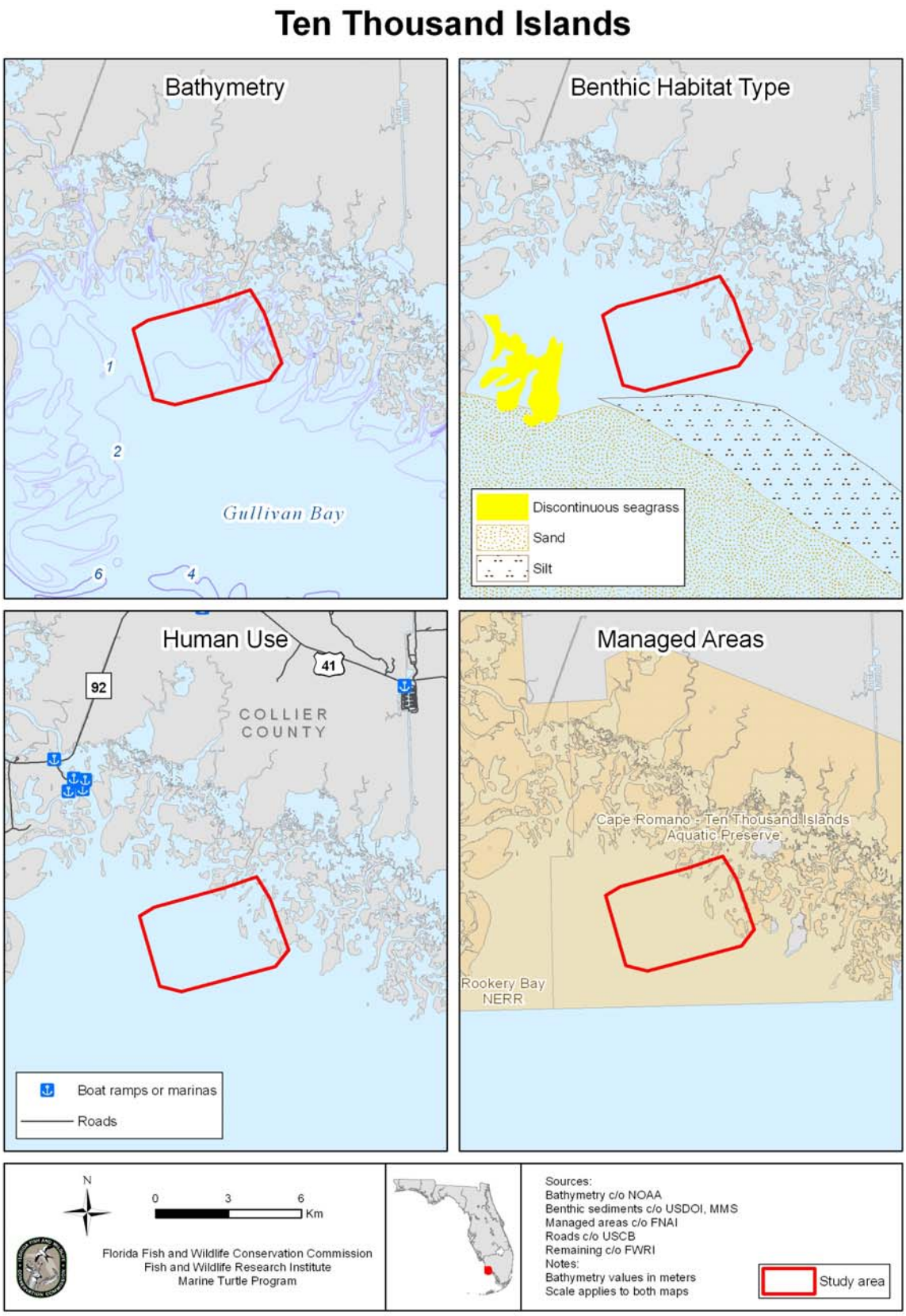

Figure 18 - Ten Thousand Islands study area.

Site Name: **Big Sable Creek Complex**

General Information

Site Name: Big Sable Creek Complex
Site Reference Number: 14
Region: Southwest ***County:*** Monroe
Approximate Latitude: 25.59° N ***Approximate Longitude:*** 81.17° W
Principal Investigator (s): Kristen Hart
Contact Address: 600 4th Street South, St. Petersburg, FL 33701
Contact Email: kristen_hart@usgs.gov
Organizations Involved: USGS, Duke University Marine Laboratory
Organization Type: federal agency, university
Project Status: active
Active Years: 2006

Start Date: November 2006
End Date: n/a

Equipment and Methods

General Method Used: capture, tracking
Visual-Survey Method: n/a
Capture Method: set-netting, strike-netting, pound-netting, dip-netting
Net Type: tangle net, pound net, dip net ***Net Length:*** unknown
Mesh Size: unknown ***Net Depth:*** unknown

Sampling and Effort

Sampling Regime: seasonal
Sampling Locations: variable

Sampling-Area Description: creek complex
Bottom Type: mud, algae mat, mangroves
Water Type: estuarine
Mean Depth (m): 0.9
Depth Range (m): 0.0-3.5
Effort-Data Availability: yes
Years for which CPUE Calculated: 2006

Method of Calculating CPUE: turtles/km net hr (set net); turtles/km (dip-net transects); turtles/hr (pound net)

Species Found: Cm

Site Name: **Big Sable Creek Complex**

Capture Information *Data current through 2006*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	5	n/a	32.8	51.9	40.1	n/r
Loggerhead	0	n/a	n/a	n/a	n/a	n/a
Kemp's Ridley	0	n/a	n/a	n/a	n/a	n/a
Hawksbill	0	n/a	n/a	n/a	n/a	n/a
Leatherback	0	n/a	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag, PIT tag, satellite tag

Species Exhibiting FP: Cm

Genetic-Sample Collection: yes
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: no
Tracking Studies Conducted: yes
Evidence of Site Fidelity: no

General Findings/ Miscellaneous:

Juvenile green turtles had been observed in the creeks around Cape Sable, precipitating this capture-based project. Sampling began in 2006 using pound nets and dip nets. Future sampling will employ tangle nets.

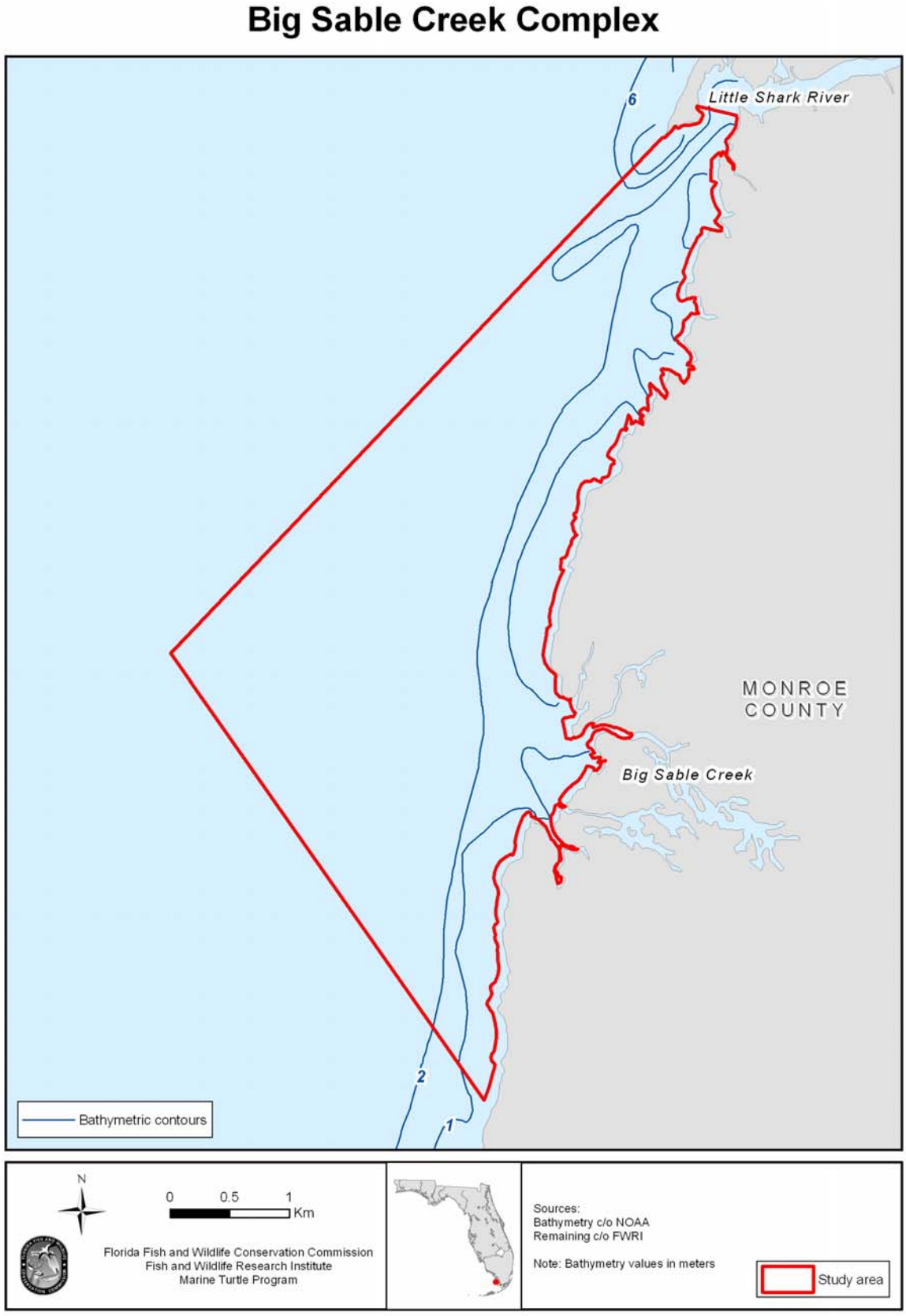

Figure 19 - Big Sable Creek Complex study area.

Southeast

The majority of studies, twenty, have been conducted in the Southeastern region (Keys part of Monroe County through Brevard County) with fourteen still active (Figure 20).

Key West National Wildlife Refuge – Bresette *et al.* (2002-active)
Florida Bay –Schroeder *et al.* (1990-active)
Broward County Reefs – Makowski (2003-active)
Galt Ocean Mile/Lauderdale-by-the-Sea – Wershoven & Wershoven (1986-1991)
The Breakers Central Reef Tract – Salmon & Makowski (2001-2003)
Lake Worth Lagoon – Bresette *et al.* (2005-active)
The Breakers – Wood (2003-active)
Hutchinson Island Hardbottom Surveys – Bresette *et al.* (2004-2005)
St. Lucie Power Plant – Bresette *et al.* (1976-active)
Jenning's Cove – Bresette *et al.* (1998-active)
Indian River County Hardbottom Surveys – Bresette *et al.* (2001-active)
Northern Indian River County Reefs – Ehrhart *et al.* (1988-active)
Central Indian River Lagoon – Ehrhart *et al.* (1982-active)
Central Brevard County Reefs – Holloway-Adkins (2003-active)
Epipelagic Drift Community – Southeast – Witherington (1992-active)
Port Canaveral Ship Channel – Carr *et al*. (1978)
Cape Canaveral – Henwood (1978-1984)
Port Canaveral Ship Channel – Bolten *et al*. (1992-1993)
Cape Canaveral – Standora *et al*. (1993)
Cape Canaveral – Segars *et al.* (2006-active)
Trident Submarine Basin – Ehrhart *et al.* (1993-active)

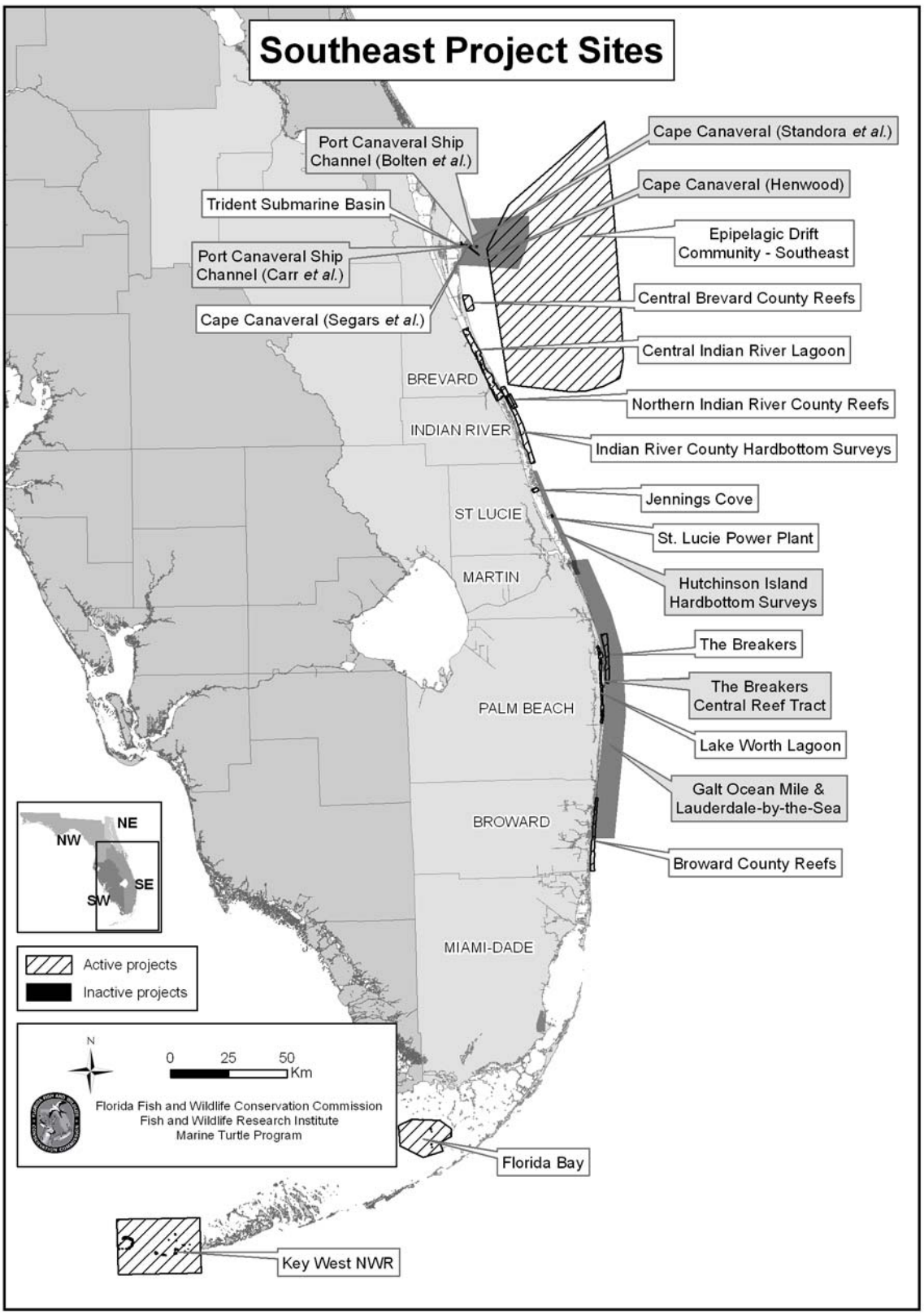

Figure 20 - Southeast Florida in-water projects. Inactive projects described with shaded callout boxes.

Site Name: **Key West National Wildlife Refuge**

General Information

Site Name: Key West National Wildlife Refuge
Site Reference Number: 15
Region: Southeast ***County:*** Monroe
Approximate Latitude: 24.56° N ***Approximate Longitude:*** 82.00° W
Principal Investigator (s): Michael Bresette, Jonathan Gorham, Richard Herren, Blair Witheringon, Dean Bagley
Contact Address: 4160 NE Hyline Dr., Jensen Beach, FL 34957
Contact Email: mbresette@inwater.org
Organizations Involved: Inwater Research Group, Inc.
Organization Type: nonprofit
Project Status: active
Active Years: 2002, 2003, 2004, 2005, 2006

Start Date: May 2002
End Date: n/a

Equipment and Methods

General Method Used: capture, visual surveys
Visual-Survey Method: random sightings from boat, HUNT
Capture Method: hand-capture from boat, set-netting
Net Type: tangle net ***Net Length:*** 150 m
Mesh Size: 40 cm stretch ***Net Depth:*** 4 m

Sampling and Effort

Sampling Regime: seasonally
Sampling Locations: various locations within study area

Sampling-Area Description: archipelago
Bottom Type: seagrass, channels, hardbottom, coral, sand, livebottom
Water Type: marine
Mean Depth (m): 8.1
Depth Range (m): 0.0-40.0
Effort-Data Availability: yes
Years for which CPUE Calculated: 2005, 2006

Method of Calculating CPUE: turtles/km transect; turtles/km net hr (set net)
Species Found: Cm, Cc, Ei

Site Name: **Key West National Wildlife Refuge**

Capture Information *Data current through 2006*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	87	915	27.0	108.5	61.3	N, S, A
Loggerhead	182	472	36.4	98.1	75.5	N, S, A
Kemp's Ridley	0	0	n/a	n/a	n/a	n/a
Hawksbill	19	58	28.2	69.0	46.4	N, S
Leatherback	0	0	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag, PIT tag, paint

Species Exhibiting FP: Cm, Cc

Genetic-Sample Collection: yes
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: no
Tracking Studies Conducted: no
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

In 1986, National Marine Fisheries Service (NMFS), United States Fish and Wildlife Service (USFWS), and University of Central Florida (UCF) personnel surveyed the area near the Marquesas Keys for the possible presence of sea turtles, they determined that this area was potential developmental habitat for marine turtles and warranted further investigation. In 2002, Inwater Research Group (IRG) began systematic surveys in the Key West National Wildlife Refuge and observed many turtles in the vicinity. Soon after capture efforts began, green, loggerhead, and hawksbill turtles were captured. This was the first project in the continental U.S. to sight and capture hawksbill sea turtles on a regular basis. IRG has observed low levels of fibropapillomatosis (FP) in loggerheads and green turtles in the area. GPS-coordinate data are available for turtle-sighting and -capture locations. In 2004, IRG identified an area just west of the Marquesas Keys that appeared to support green turtles of size classes rarely seen in Florida waters: subadults and adults (> 70 cm SCL). This habitat differs from that of other areas worked in the refuge. It contains large *Syringodium* seagrass beds interspersed with stretches of sand and sponge habitat in 4-6 m of water; the rest of the study area consists of shallow (1-3 m) seagrass beds dotted with patchy sponge/hardbottom habitat and deep-water channels. Small green turtles are conspicuously absent from the western area, yet they are found in

significant numbers only 4 km away in the shallow lagoons of the Marquesas. It is possible that smaller green turtles use the 'dead-end' channels found within the Marquesas complex as a refuge from falling water levels and large predators. These small green turtles are also found throughout the rest of the Key West National Wildlife Refuge (KWNWR) in shallow basins and seagrass beds. This study may provide the first evidence of resource-partitioning by green turtles in the refuge.

Literature/ Reports Produced:

Bresette, M., and R. Herren. 2002. Demographic composition of marine turtles in the Key West National Wildlife Refuge, 2002. Annual report submitted to USFWS, Key West NWR, Contract 1448-40181-02-G-044, 31 pp.

Inwater Research Group, Inc. 2003. Demographic composition of marine turtles in the Key West National Wildlife Refuge, 2003. Annual Report submitted to NMFS, 27 pp.

Inwater Research Group, Inc. 2004. Sea turtle sampling in the Key West National Wildlife Refuge, Florida. Interim report submitted to FWC/FMRI, August 2004, 18 pp.

Inwater Research Group, Inc. 2005. Final report on sea turtle sampling in the Key West National Wildlife Refuge, Florida, July 2005. Report submitted to FWC/FWRI, 24 pp.

Schroeder, B.A. 1986. Summary of Marquesas Keys marine turtle field work (12-16 May 1986). Memorandum from files, NOAA, NMFS, Southeast Fisheries Center, 27 May 1986, 5 pp.

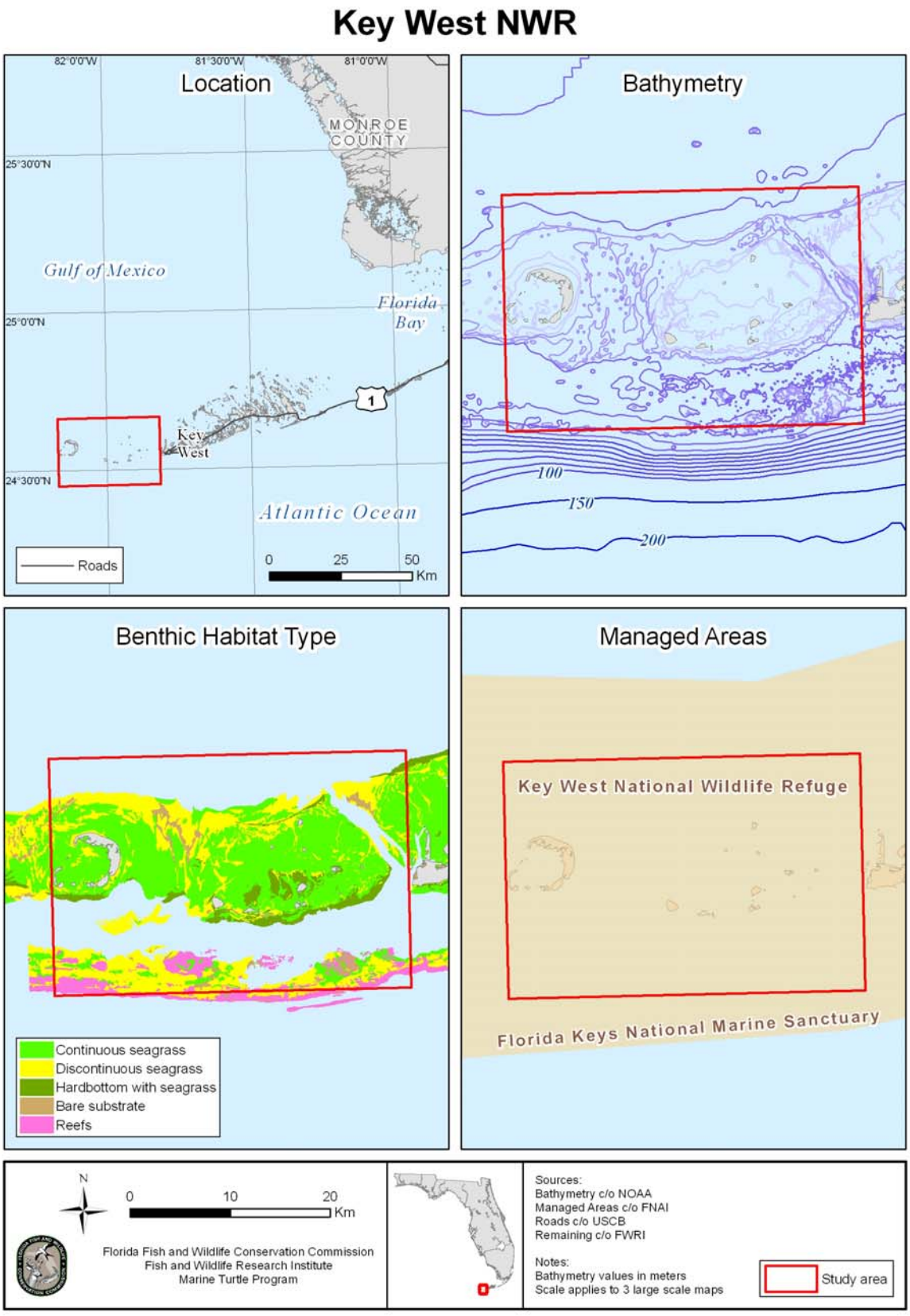

Figure 21 - Key West NWR study area.

Site Name: **Florida Bay**

General Information

Site Name: Florida Bay
Site Reference Number: 16
Region: Southeast ***County:*** Monroe
Approximate Latitude: 24.96° N ***Approximate Longitude:*** 80.86° W
Principal Investigator (s): Barbara Schroeder, Allen Foley, Blair Witherington
Contact Address: NMFS, 1315 East West Highway, Silver Spring, MD 20910
Contact Email: barbara.schroeder@noaa.gov
Organizations Involved: NMFS, FWC/FWRI
Organization Type: federal & state agencies
Project Status: active
Active Years: 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007

Start Date: 1990
End Date: n/a

Equipment and Methods

General Method Used: capture, visual surveys, tracking
Visual-Survey Method: random sightings from boat, HUNT
Capture Method: hand-capture from boat (1991-2007), set-netting (1990-1993)
Net Type: tangle ***Net Length:*** 100 m
Mesh Size: 16 inch stretch ***Net Depth:*** 13.5 ft

Sampling and Effort

Sampling Regime: annually
Sampling Locations: primarily SW area of Florida Bay within Everglades NP

Sampling-Area Description: bay
Bottom Type: seagrass, sand, hardbottom, channels
Water Type: marine
Mean Depth (m): 1.0
Depth Range (m): 0.0-4.0
Effort-Data Availability: yes
Years for which CPUE Calculated: 2000, 2001, 2002, 2004, 2005, 2006, 2007

Method of Calculating CPUE: turtles/km (transect); turtles/km net hr (set net)
Species Found: Cm, Cc, Lk, Ei

Site Name: **Florida Bay**

Capture Information *Data current through 2006*

	Number of Captures	***Number of Sightings***	***Size* (cm) Min and Max***		***Mean Size* (cm)***	***Life Stages Captured*****
Green Turtle	73	n/r	25.5	66.1	45.8	N
Loggerhead	902	n/r	33.0	98.7	77.7	N, S, A
Kemp's Ridley	23	n/r	28.9	64.5	50.7	N, S, A
Hawksbill	3	n/r	38.2	58.1	49.8	N
Leatherback	0	n/a	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag, Rototag, PIT tag, paint, radio tag, sonic tag, satellite tag

Species Exhibiting FP: Cm, Cc

Genetic-Sample Collection: yes
Laparoscopy Performed: yes
Growth-Rate Determination: yes
Sex-Ratio Determination: yes
Tracking Studies Conducted: yes
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

Central and western Florida Bay (primary sampling sites) provide important habitats for immature and adult loggerheads, immature green turtles, and immature (and possibly adult) Kemp's ridleys. Loggerheads and green turtles are the most abundant; Kemp's ridleys are reliably captured in certain areas; immature hawksbills are rarely encountered within the study area. Adult loggerheads of both sexes are found year-round. Multiple recaptures of immature and adult loggerheads over periods of up to ten years indicate some strong site-fidelity within Florida Bay. FP is externally present in green turtles at relatively high rates and is commonly observed in loggerheads, though at a much lower rate. The external expression of the disease is generally less severe in loggerheads. This project produces data on residency, growth, migrations, reproductive status, blood chemistry, sex ratios, genetic composition, tag retention, FP occurrence, and FP progression/regression.

Literature/ Reports Produced:

Foley, A.M. 2006a. Reproductive movements and behavior of male and female loggerheads from a southeast U.S. foraging ground. Final report submitted to the National Fish and Wildlife Foundation, 21 pp.

Foley, A.M. 2006b. Long-term study of sea turtles in Florida Bay. Final report submitted to the National Fish and Wildlife Foundation, 15pp.

Schroeder B.A., and A.M. Foley. 1995. Population studies of marine turtles in Florida Bay. In: Richardson, J.I., and T.H. Richardson (comps.). Proceedings of the Twelfth Annual Workshop on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-361, pp. 117.

Schroeder B.A., A.M. Foley, B.E. Witherington, and A.E. Mosier. 1998. Ecology of marine turtles in Florida Bay: population structure, distribution, and occurrence of fibropapilloma. In: Epperly, S.P., and J. Braun (comps.). Proceedings of the Seventeenth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-415, pp. 281-283.

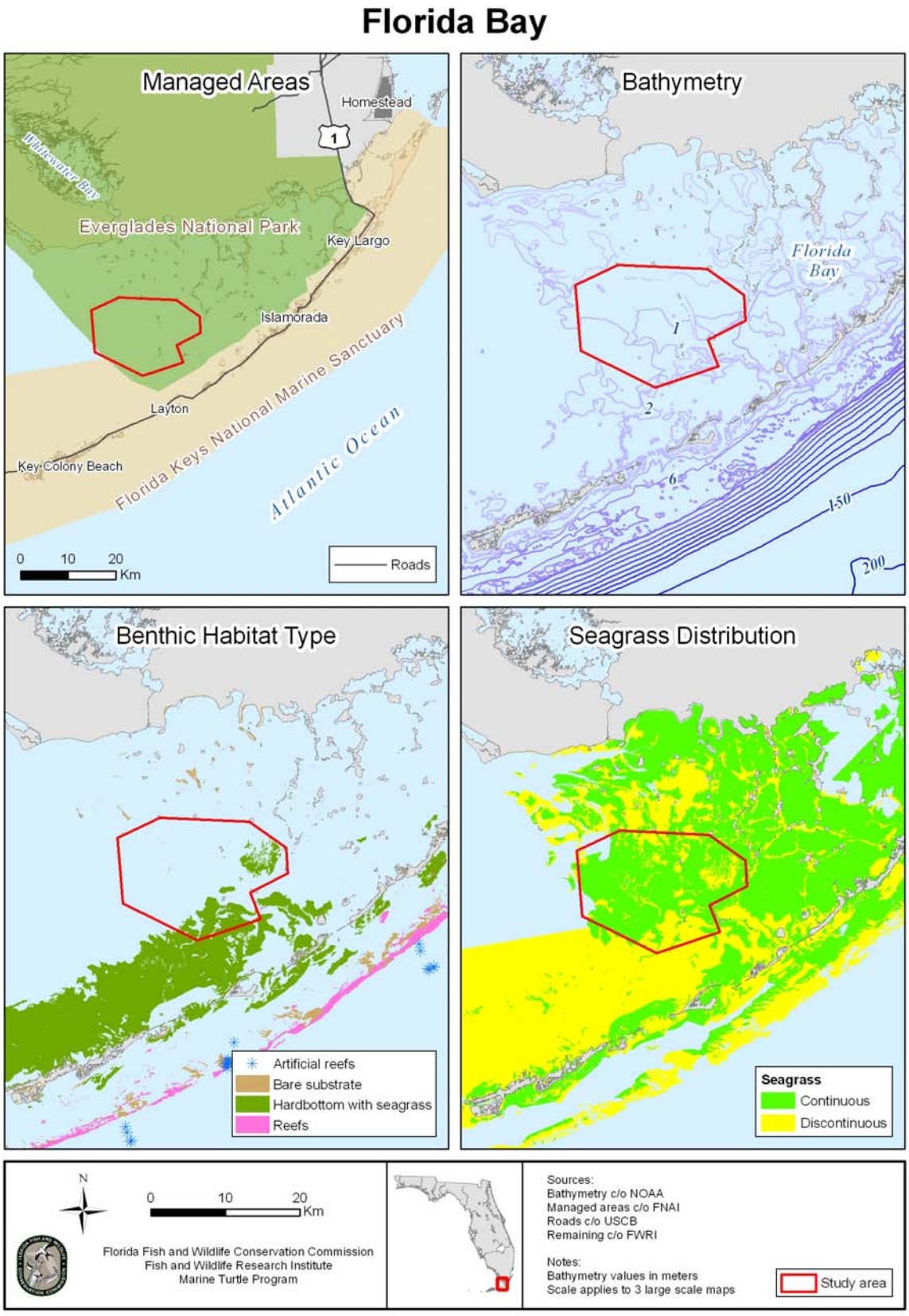

Figure 22 - Florida Bay study area.

Site Name: **Broward County Reefs**

General Information

Site Name: Broward County Reefs
Site Reference Number: 17
Region: Southeast ***County:*** Broward
Approximate Latitude: 26.10° N ***Approximate Longitude:*** 80.10° W
Principal Investigator (s): Chris Makowski
Contact Address: 2481 NW Boca Raton BLVD, Boca Raton, FL 33431
Contact Email: CMakowski@coastalplanning.net
Organizations Involved: Broward County DPEP, Coastal Planning and Engineering
Organization Type: county, consulting firm
Project Status: active
Active Years: 2003, 2004, 2005, 2006

Start Date: May 2003
End Date: n/a

Equipment and Methods

General Method Used: visual surveys
Visual-Survey Method: straight line transects while snorkeling
Capture Method: n/a
Net Type: n/a ***Net Length:*** n/a
Mesh Size: n/a ***Net Depth:*** n/a

Sampling and Effort

Sampling Regime: opportunistic
Sampling Locations: same transects during each sampling session

Sampling-Area Description: nearshore hardbottom/reef
Bottom Type: worm rock reefs, sand
Water Type: marine
Mean Depth (m): 6.3
Depth Range (m): 0.0-16.5
Effort-Data Availability: yes
Years for which CPUE Calculated: n/a

Method of Calculating CPUE: turtles/km transect
Species Found: Cm

Site Name: **Broward County Reefs**

Capture Information *Data current through 2006*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	n/a	370	n/a	n/a	n/a	n/a
Loggerhead	n/a	0	n/a	n/a	n/a	n/a
Kemp's Ridley	n/a	0	n/a	n/a	n/a	n/a
Hawksbill	n/a	0	n/a	n/a	n/a	n/a
Leatherback	n/a	0	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: n/a

Species Exhibiting FP: n/a

Genetic-Sample Collection: no
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: no
Tracking Studies Conducted: no
Evidence of Site Fidelity: no

General Findings/ Miscellaneous:

Beach restoration projects have the potential to compromise nearshore reef habitats and have detrimental effects on the associated ecosystems. Coastal Planning and Engineering and FAU conducted "turtle tows" to monitor green turtle populations along nearshore reef tracts in Broward County. The "turtle tow" method is a variation of the "shark fishing" technique of towing a diver behind a boat so the diver can determine abundance and distribution without disturbing or handling the animals being surveyed. Surveys were performed twice during each sampling session: once north to south and once south to north. A GIS database was also established with the location of each observed turtle. Surveys in 2003 and 2004 have provided two consecutive juvenile green turtle population estimates in this area. Long-term monitoring is planned to assess temporary fluctuations and long-term variation in the population. In 2003, the two directional surveys yielded the same number of green turtles in the area: 48. In 2004, the two directional surveys yielded similar numbers, north to south (35), and south to north (42). Observations of turtle behaviors were also recorded.

Literature/ Reports Produced:

Salmon, M., C. Makowski, C. Christopher, and C. Whalen. 2004. Broward County sea turtle survey: 2004 pre-construction monitoring of green turtle populations on the nearshore reefs of Broward County, Florida. Interim report to Broward County, 8 pp.

Makowski, C., R.P. Slattery, and M. Salmon. 2005. "Shark Fishing": a method for determining the abundance and distribution of sea turtles at reef habitats. Herpetological Review 36:36-38.

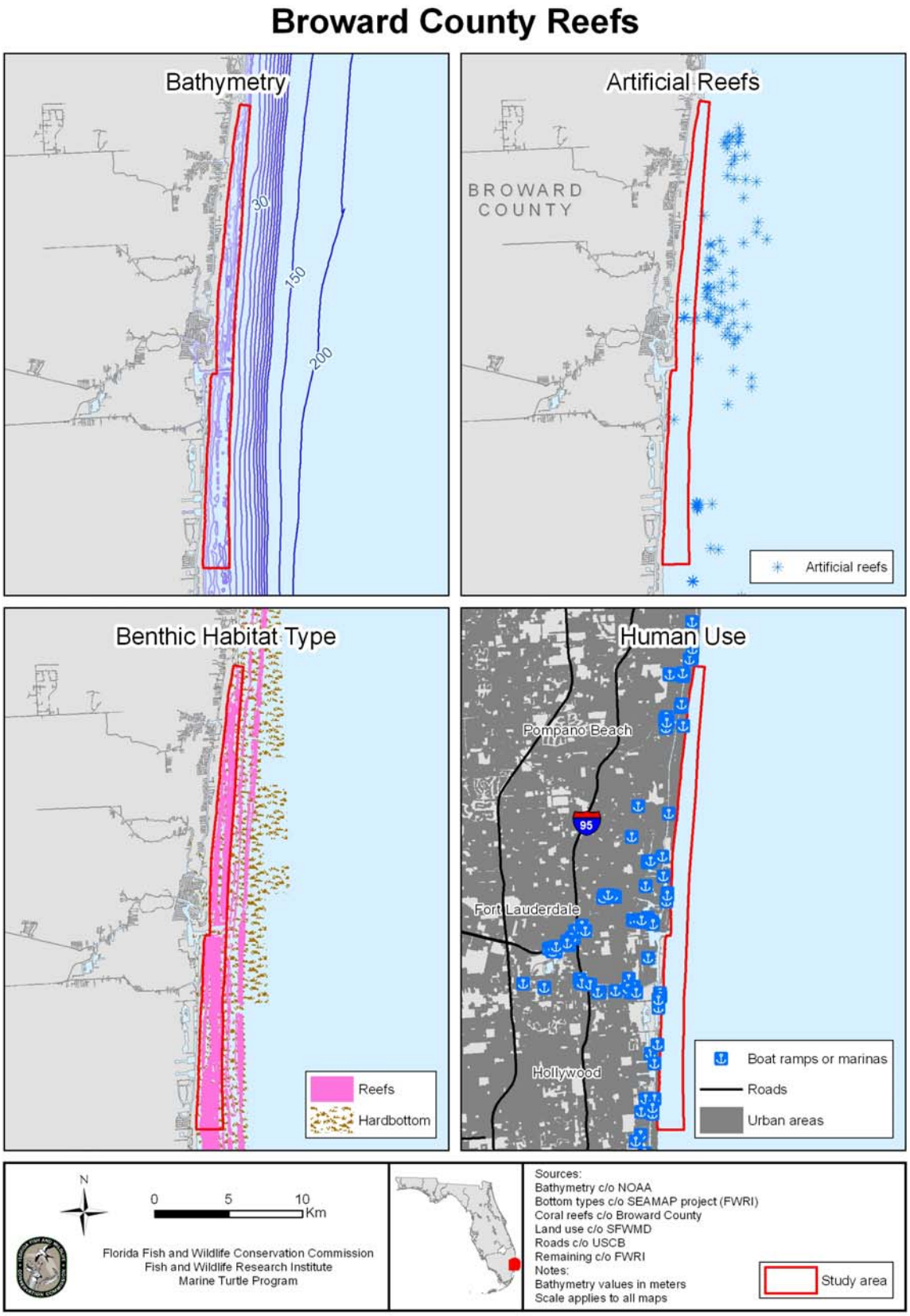

Figure 23 - Broward County Reefs study area.

Site Name: **Galt Ocean Mile and Lauderdale-by-the-Sea**

General Information

Site Name: Galt Ocean Mile and Lauderdale-by-the-Sea
Site Reference Number: 18
Region: Southeast ***County:*** Broward, Palm Beach, Martin
Approximate Latitude: 26.61° N ***Approximate Longitude:*** 80.03° W
Principal Investigator (s): Robert and Jeanne Wershoven
Contact Address: 2962 Waterford Dr. S, Deerfield Beach, FL 33442
Contact Email: ecovista@bellsouth.net
Organizations Involved: Broward County Audubon Society
Organization Type: nonprofit
Project Status: inactive
Active Years: 1986, 1987, 1988, 1989, 1990, 1991

Start Date: March 1986
End Date: March 1991

Equipment and Methods

General Method Used: capture, aerial surveys, strandings
Visual-Survey Method: aerial surveys
Capture Method: SCUBA-diving at night
Net Type: n/a ***Net Length:*** n/a
Mesh Size: n/a ***Net Depth:*** n/a

Sampling and Effort

Sampling Regime: weekly
Sampling Locations: capture site is a 1.5 km stretch of reef in Broward; aerial survey over broader area
Sampling-Area Description: nearshore hardbottom/reef
Bottom Type: reef, limestone ledges
Water Type: marine
Mean Depth (m): 98.2
Depth Range (m): 0.0-242.1
Effort-Data Availability: yes
Years for which CPUE Calculated: n/a

Method of Calculating CPUE: turtles/hr dive time
Species Found: Cm, Ei

Site Name: **Galt Ocean Mile and Lauderdale-by-the-Sea**

Capture Information *Data current through 1991*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	187	19	27.4 CCL	67.0 CCL	43.5 CCL	N
Loggerhead	0	14	n/a	n/a	n/a	n/a
Kemp's Ridley	0	0	n/a	n/a	n/a	n/a
Hawksbill	3	0	34.0 CCL	60.0 CCL	35.0 CCL	N
Leatherback	0	0	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag

Species Exhibiting FP: none

Genetic-Sample Collection: no
Laparoscopy Performed: no
Growth-Rate Determination: yes
Sex-Ratio Determination: no
Tracking Studies Conducted: no
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

This area supports populations of juvenile green turtles and juvenile hawksbills. Turtles were usually found resting on the reef at night. No turtles were observed during daytime surveys of habitat type and food sources; turtles were only observed during night dives. 4.25 man-hours were spent per capture, and the study had an overall capture success rate of 53.95%. Green turtles were captured during all months, with higher numbers captured during June, August, April, and May and lower numbers captured in September and December. The number of turtles captured decreased when colder, fresh water was present on the reef (mainly in July). No adults were captured in the study, and only one adult green turtle was observed. The size distribution of turtles appeared to change with season (larger in fall and winter). Aerial surveys were conducted in March and September of 1987. High concentrations of turtles were observed in March along the first reef area off John U. Lloyd State Recreational Area, Galt Ocean Mile, and Pompano Beach south of the fishing pier. Turtles were not found close to the coast during the September study, but loggerheads were observed offshore in the area between Boca Raton and St. Lucie inlets, with concentrations north of Jupiter Inlet near Hobe Sound NWR. Turtle dispersal during fall and winter may have been the result of a lack of sufficient algae on which to feed in nearshore areas, but further study is needed. Homing

was observed in one green turtle that was sent to a rehabilitation facility for five months, released 10 miles south of the capture site, and recaptured at the original capture site three weeks later.

Juvenile green turtles in Broward County used large expanses of hardbottom reef areas for foraging and resting. Turtles entered this habitat from pelagic zones at 30 cm CCL and departed once they reached 60 cm CCL. Stranding data indicated that recreational activities were a significant source of mortality to the population. Visible propeller injuries were cited in 34 of 56 strandings in Broward County during the study period, and entanglement in fishing lines was observed in seven other strandings.

Literature/ Reports Produced:

Wershoven, R. 1989. Assessment of utilization of sleeping habitat by juvenile turtles off Broward County, Florida. In: Ogren, L., F. Berry, K. Bjorndal, H. Kumpf, R. Mast, G. Medina, H. Reichart, and R. Witham (eds.). Proceedings of the Second Western Atlantic Turtle Symposium. NOAA Technical Memorandum NMFS-SEFC-226, pp. 347-348.

Wershoven, R., and J.L. Wershoven. 1988. A survey of juvenile green turtles and their resting and foraging habitats off Broward County, Florida 3/1/86 - 12/13/87. Report submitted to Florida Department of Natural Resources, Division of Marine Resources, 35 pp.

Wershoven, R., and J.L. Wershoven. 1989. Assessment of juvenile green turtles and their habitat in Broward County, Florida waters. In: Eckert, S.A., K.L. Eckert, and T.H. Richardson (comps.). Proceedings of the Ninth Annual Workshop on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFC-232, pp. 185-187.

Wershoven, R., and J.L. Wershoven. 1992. Juvenile green turtles in their nearshore habitat of Broward County, Florida: A five year review. In: Salmon, M., and J. Wyneken (comps.). Proceedings of the Eleventh Annual Workshop on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-302, pp. 121-123.

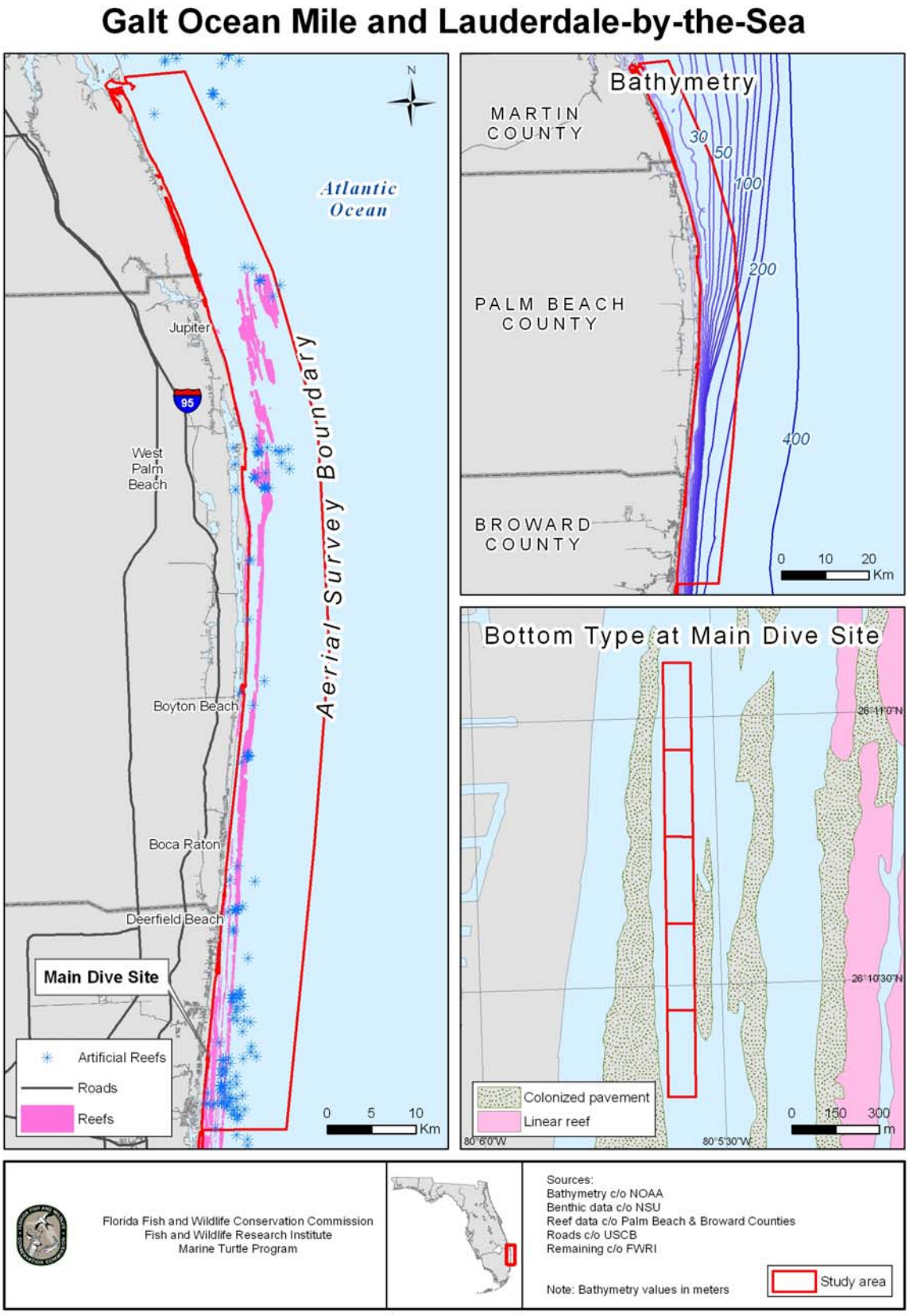

Figure 24 - Galt Ocean Mile/Lauderdale-By-The-Sea study area.

Site Name: **The Breakers Central Reef Tract**

General Information

Site Name: The Breakers Central Reef Tract
Site Reference Number: 19
Region: Southeast ***County:*** Palm Beach
Approximate Latitude: 26.72° N ***Approximate Longitude:*** 80.03° W
Principal Investigator (s): Mike Salmon, Chris Makowski, Jeffrey Seminoff
Contact Address: 777 Glades Rd., Boca Raton FL 33431
Contact Email: salmon@fau.edu
Organizations Involved: Florida Atlantic University
Organization Type: university
Project Status: inactive
Active Years: 2001, 2002, 2003

Start Date: July 2001
End Date: November 2003

Equipment and Methods

General Method Used: capture, visual surveys, tracking
Visual-Survey Method: dive survey
Capture Method: SCUBA-diving
Net Type: n/a ***Net Length:*** n/a
Mesh Size: n/a ***Net Depth:*** n/a

Sampling and Effort

Sampling Regime: opportunistic
Sampling Locations: several consistent capture locations along reef

Sampling-Area Description: nearshore hardbottom/reef
Bottom Type: patchy worm rock reef system, hardbottom
Water Type: marine
Mean Depth (m): 2.8
Depth Range (m): 0.0-6.8
Effort-Data Availability: yes
Years for which CPUE Calculated: n/a

Method of Calculating CPUE: turtles/km transect (visual dive surveys)
Species Found: Cm

Site Name: **The Breakers Central Reef Tract**

Capture Information *Data current through 2003*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	6	141	27.9	48.1	36.7	N
Loggerhead	0	0	n/a	n/a	n/a	n/a
Kemp's Ridley	0	0	n/a	n/a	n/a	n/a
Hawksbill	0	0	n/a	n/a	n/a	n/a
Leatherback	0	0	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag, sonic tag

Species Exhibiting FP: none

Genetic-Sample Collection: no
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: no
Tracking Studies Conducted: yes
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

Six juvenile green turtles were equipped with ultrasonic transmitters and tracked for 55-62 days, with an average of 94 transmissions per turtle. All turtles occupied distinct home ranges and core areas that were largely restricted to the reef and showed considerable overlap with food and shelter sites. At night, each turtle revisited its own exclusive resting site(s) along the nearshore reef tract. Four of the six turtles selected only one resting site. The other two turtles each used two resting sites on opposite ends of their respective home ranges. More than one turtle was never observed at any one resting site. Daytime diving patterns consisted of more frequent, shallower dives than nighttime patterns. Lavage sampling showed all six turtles had a mixed diet of similar macroalgae and sponge fragments.

Literature/ Reports Produced:

Makowski, C. 2004. Home Range and Movements of Juvenile Atlantic Green Turtles (*Chelonia mydas* L.) on Shallow Reef Habitats in Palm Beach, Florida, USA. Master's thesis, Florida Atlantic University, Boca Raton, Florida, 37 pp.

Makowski, C., J.A. Seminoff, and M. Salmon. 2006. Home range and habitat use of juvenile Atlantic green turtles (*Chelonia mydas* L.) on shallow reef habitats in Palm Beach, Florida, USA. Marine Biology 148:1167-1179.

Makowski, C., R.P. Slattery, and M. Salmon. 2005. "Shark Fishing": a method for determining the abundance and distribution of sea turtles at reef habitats. Herpetological Review 36:36-38.

Figure 25 - The Breakers Central Reef Tract study area.

Site Name: **Lake Worth Lagoon**

General Information

Site Name: Lake Worth Lagoon
Site Reference Number: 20
Region: Southeast ***County:*** Palm Beach
Approximate Latitude: 26.70° N ***Approximate Longitude:*** 80.05° W
Principal Investigator (s): Michael Bresette, Jonathan Gorham, Richard Herren, Blair Witherington, Dean Bagley
Contact Address: 4160 NE Hyline Dr., Jensen Beach, FL 34957
Contact Email: mbresette@inwater.org
Organizations Involved: Inwater Research Group, Inc.
Organization Type: nonprofit
Project Status: active
Active Years: 2005, 2006

Start Date: March 2005
End Date: n/a

Equipment and Methods

General Method Used: capture, visual surveys
Visual-Survey Method: HUNT
Capture Method: set-netting
Net Type: tangle net ***Net Length:*** 150 m
Mesh Size: 40 cm stretch ***Net Depth:*** 4 m

Sampling and Effort

Sampling Regime: quarterly
Sampling Locations: focus effort just east of Little Munyon Island

Sampling-Area Description: lagoon
Bottom Type: seagrass, sand
Water Type: estuarine
Mean Depth (m): 0.1
Depth Range (m): 0.0-0.1
Effort-Data Availability: yes
Years for which CPUE Calculated: 2005, 2006

Method of Calculating CPUE: turtles/km net hr (set net); turtles/km (from transects)
Species Found: Cm, Cc

Site Name: **Lake Worth Lagoon**

Capture Information *Data current through 2005 (sightings) & 2006 (captures)*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	30	35	29.8	54.9	43.0	N
Loggerhead	1	1	72.0	n/a	72.0	S
Kemp's Ridley	0	0	n/a	n/a	n/a	n/a
Hawksbill	0	0	n/a	n/a	n/a	n/a
Leatherback	0	0	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag, PIT tag

Species Exhibiting FP: Cm

Genetic-Sample Collection: yes
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: no
Tracking Studies Conducted: no
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

This project was established to assess the extent to which sea turtles use Lake Worth Lagoon. The study was required under a management plan for the lagoon developed by the Palm Beach County Department of Environmental Resources Management in 1998 and seeks to obtain baseline data on species abundance, size distributions, CPUE at different sites, prevalence of FP, and habitat preference within the lagoon.

Initial visual transects in March 2005 began to identify turtle "hotspots" where netting efforts would be most productive. An area around Little Munyon Island just north of Lake Worth Inlet has proven to be important green turtle habitat and is where a majority of netting occurs now. CPUE numbers in this area are comparable to those found in Jenning's Cove. The observations of loggerheads indicate that Lake Worth Lagoon may be developmental habitat for that species.

Approximately two thirds of captured green turtles have exhibited FP, which is a higher rate than that found in other eutrophic, degraded, low-flow environments around the state. Two of the 31 turtles captured so far have been victims of boat strikes, which is a proportion similar to those seen in IRG's other studies (4.4% of captures with boat-related injuries in Jenning's Cove, 8.6% in Key West National Wildlife Refuge).

Literature/ Reports Produced:

Inwater Research Group. 2005. Population assessment of marine turtles in Lake Worth Lagoon, Florida. Report submitted to Palm Beach County Department of Environmental Resources Management, 16 pp.

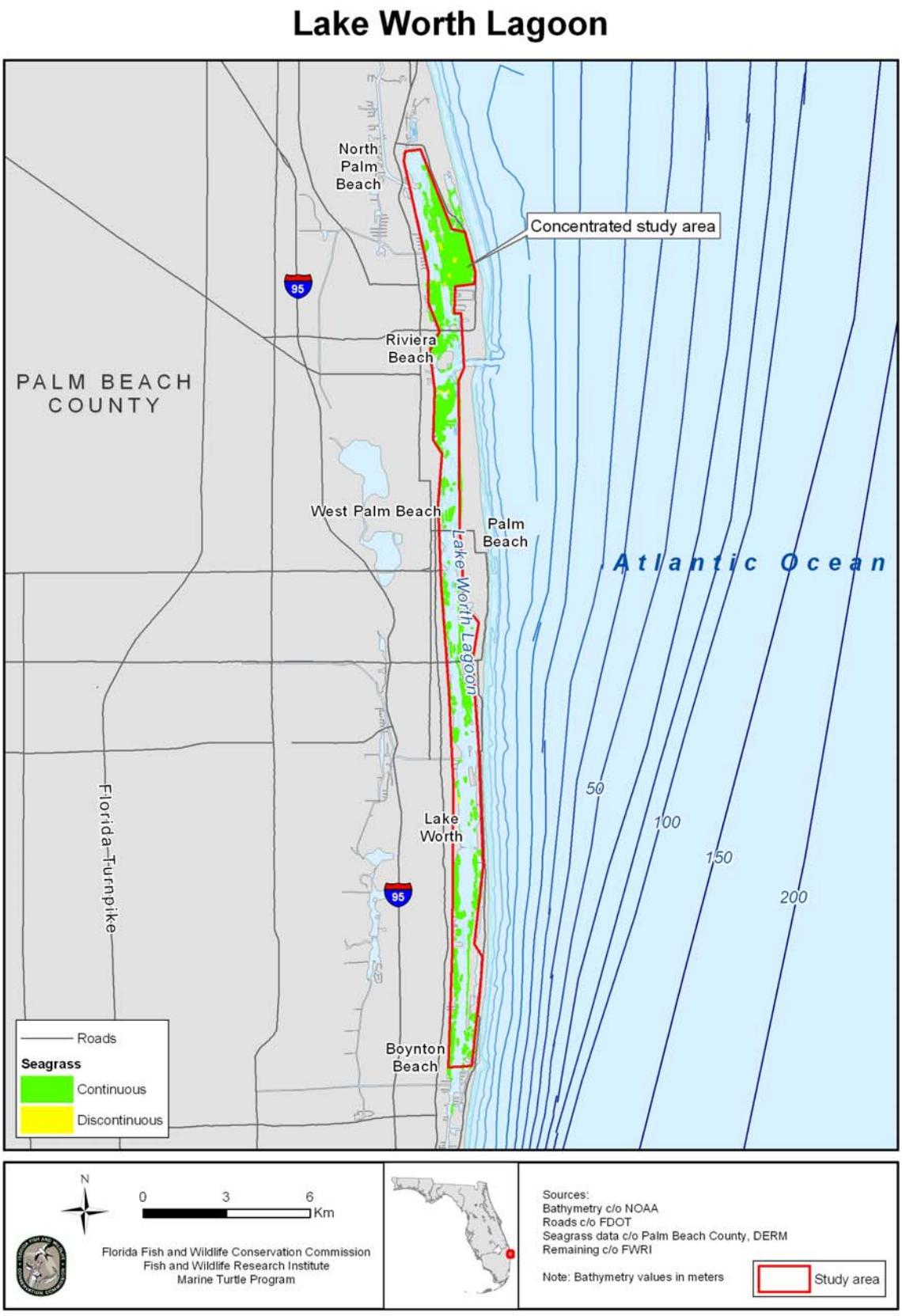

Figure 26 - Lake Worth Lagoon study area.

Site Name: **The Breakers**

General Information

Site Name: The Breakers
Site Reference Number: 21
Region: Southeast ***County:*** Palm Beach
Approximate Latitude: 26.80° N ***Approximate Longitude:*** 80.02° W
Principal Investigator (s): Lawrence Wood
Contact Address: 14200 U.S. Hwy 1, Juno Beach, FL 33408
Contact Email: lwood@marinelife.org
Organizations Involved: Marinelife Center
Organization Type: nonprofit
Project Status: active
Active Years: 2004, 2005, 2006

Start Date: 2004
End Date: n/a

Equipment and Methods

General Method Used: capture
Visual-Survey Method: n/a
Capture Method: SCUBA-diving
Net Type: n/a ***Net Length:*** n/a
Mesh Size: n/a ***Net Depth:*** n/a

Sampling and Effort

Sampling Regime: opportunistic
Sampling Locations: various locations within study area

Sampling-Area Description: nearshore hardbottom/reef
Bottom Type: sand, coral, hardbottom
Water Type: marine
Mean Depth (m): 18.5
Depth Range (m): 6.0-32.2
Effort-Data Availability: yes
Years for which CPUE Calculated: n/a

Method of Calculating CPUE: turtles/hr dive time
Species Found: Ei

Site Name: **The Breakers**

Capture Information *Data current through 2006*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	n/a	n/a	n/a	n/a	n/a	n/a
Loggerhead	n/a	n/a	n/a	n/a	n/a	n/a
Kemp's Ridley	n/a	n/a	n/a	n/a	n/a	n/a
Hawksbill	88	n/a	40.2	82.3	58.2	N, S, A
Leatherback	n/a	n/a	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag, PIT tag

Species Exhibiting FP: none

Genetic-Sample Collection: yes
Laparoscopy Performed: no
Growth-Rate Determination: yes
Sex-Ratio Determination: yes
Tracking Studies Conducted: no
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

Although capture dates above are current through 2006, the findings detailed here are based only on results through October 2005. Fifty-four hawksbills had been caught during a total of 55.7 hours of diving. Resightings had been confirmed for 13 tagged turtles, with a maximum of five sightings of one individual. The maximum time at large for any resighted turtle had been documented at 250 days within close proximity to capture location, suggesting site fidelity. The capture method has proven successful, with only two turtles escaping. Photo ID has been used, relying on barnacle patterns and morphological anomalies. Genetic samples have been collected for all animals.

Literature/ Reports Produced:

Wood, L.D. 2004. A preliminary assessment of hawksbill sea turtles (*Eretmochelys imbricata*) in Palm Beach County waters. Annual report submitted to FWC, FWC permit #077, 2 pp.

Wood, L.D. 2005. A preliminary assessment of hawksbill sea turtles (*Eretmochelys imbricata*) in Palm Beach County waters. Annual report submitted to FWC, FWC permit #077, 4 pp.

Wood, L.D. 2006. A preliminary assessment of hawksbill turtles (*Eretmochelys imbricata*) in Palm Beach county waters. In: Frick, M., A. Panagopoulou, A. Rees, and K. Williams (comps.). Book of abstracts. Twenty-Sixth Annual Symposium on Sea Turtle Biology and Conservation. International Sea Turtle Society, Athens, Greece, pp. 336.

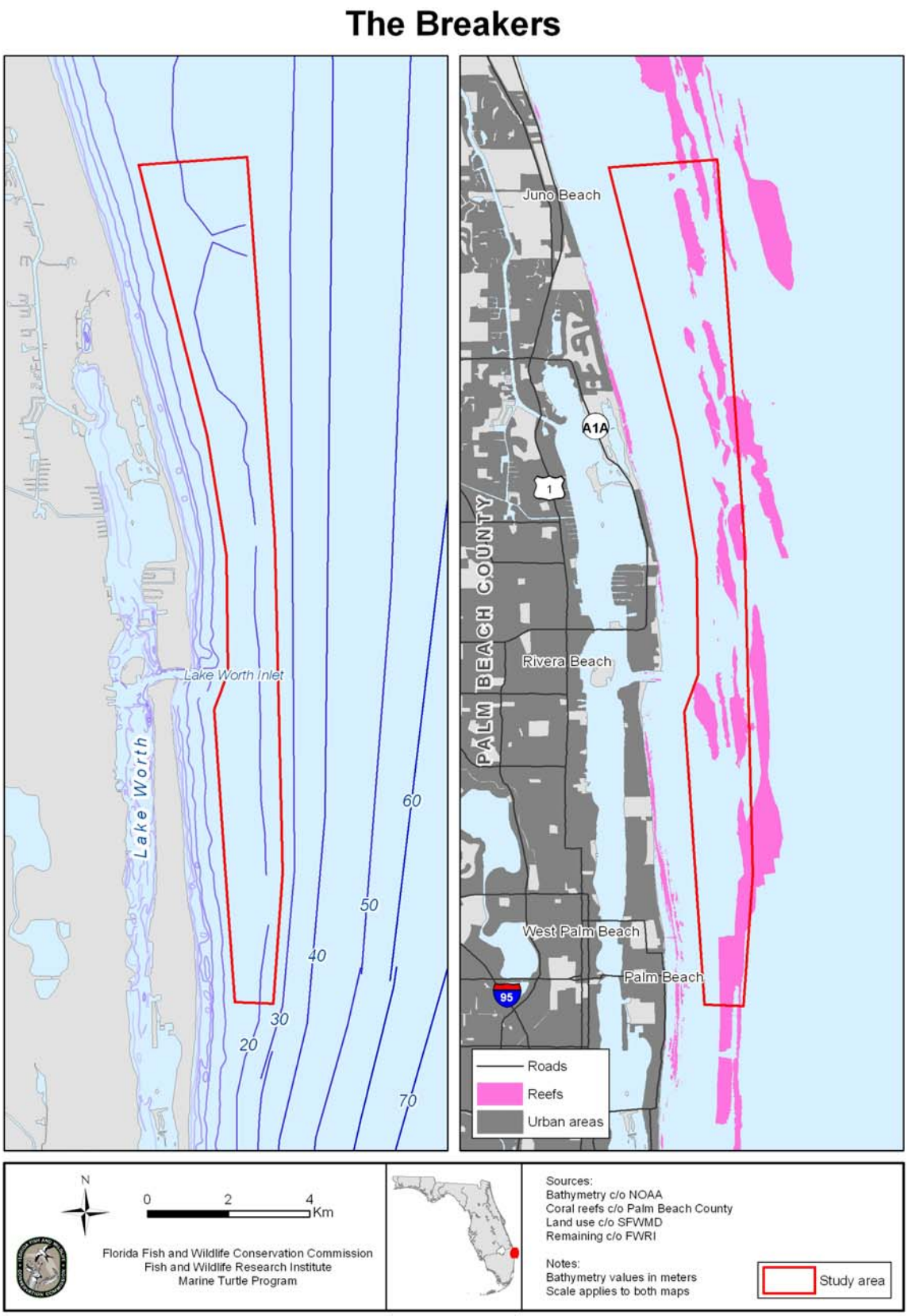

Figure 27 - The Breakers study area.

Site Name: **Hutchinson Island Hardbottom Surveys**

General Information

Site Name: Hutchinson Island Hardbottom Surveys
Site Reference Number: 22
Region: Southeast ***County:*** St. Lucie, Martin
Approximate Latitude: 27.32° N ***Approximate Longitude:*** 80.21° W
Principal Investigator (s): Michael Bresette, Jonathan Gorham, Richard Herren, Blair Witherington, Dean Bagley
Contact Address: 4160 NE Hyline Dr., Jensen Beach, FL 34957
Contact Email: mbresette@inwater.org
Organizations Involved: Inwater Research Group, Inc.
Organization Type: nonprofit
Project Status: inactive
Active Years: 2004, 2005

Start Date: June 2004
End Date: April 2005

Equipment and Methods

General Method Used: visual surveys
Visual-Survey Method: boat-based straight-line transects
Capture Method: n/a
Net Type: n/a ***Net Length:*** n/a
Mesh Size: n/a ***Net Depth:*** n/a

Sampling and Effort

Sampling Regime: monthly
Sampling Locations: same transects during each sampling session

Sampling-Area Description: nearshore hardbottom/reef
Bottom Type: hardbottom, coral, worm-rock reef
Water Type: marine
Mean Depth (m): 8.4
Depth Range (m): 0.0-14.9
Effort-Data Availability: yes
Years for which CPUE Calculated: 2004, 2005

Method of Calculating CPUE: turtles/km transect
Species Found: Cm, Cc

Site Name: **Hutchinson Island Hardbottom Surveys**

Capture Information *Data current through 2005*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	n/a	198	n/a	n/a	n/a	n/a
Loggerhead	n/a	49	n/a	n/a	n/a	n/a
Kemp's Ridley	n/a	0	n/a	n/a	n/a	n/a
Hawksbill	n/a	0	n/a	n/a	n/a	n/a
Leatherback	n/a	0	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: n/a

Species Exhibiting FP: n/a

Genetic-Sample Collection: no
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: no
Tracking Studies Conducted: no
Evidence of Site Fidelity: no

General Findings/ Miscellaneous:

This study investigated the distribution of marine turtles in the nearshore, hardbottom habitat off Hutchinson Island. Eight permanent 3-km visual transects were established parallel to the beach at six locations over and adjacent to the reefs. Turtles were located by observers atop a tower on a slow-moving vessel along these transects.

Many more green turtles were observed than loggerheads in the study area, but their distribution was significantly more variable between transects, indicating that green turtle "hotspots" exist along the reef. Loggerheads were found in nearly equal abundances nearshore (200 m from shore) and offshore (1000 m from shore). Green turtles, however, were significantly more abundant closer to shore. Green turtles were present year-round, but loggerheads were much more common on summer transects than on those in the winter months.

This study method could potentially be used year-round as a noninvasive way to study marine turtle distribution and abundance.

Literature/ Reports Produced:

Inwater Research Group Inc. 2005. Abundance and distribution of marine turtles within nearshore hardbottom and associated habitats. Report submitted to Florida Fish and Wildlife Conservation Commission, 38 pp.

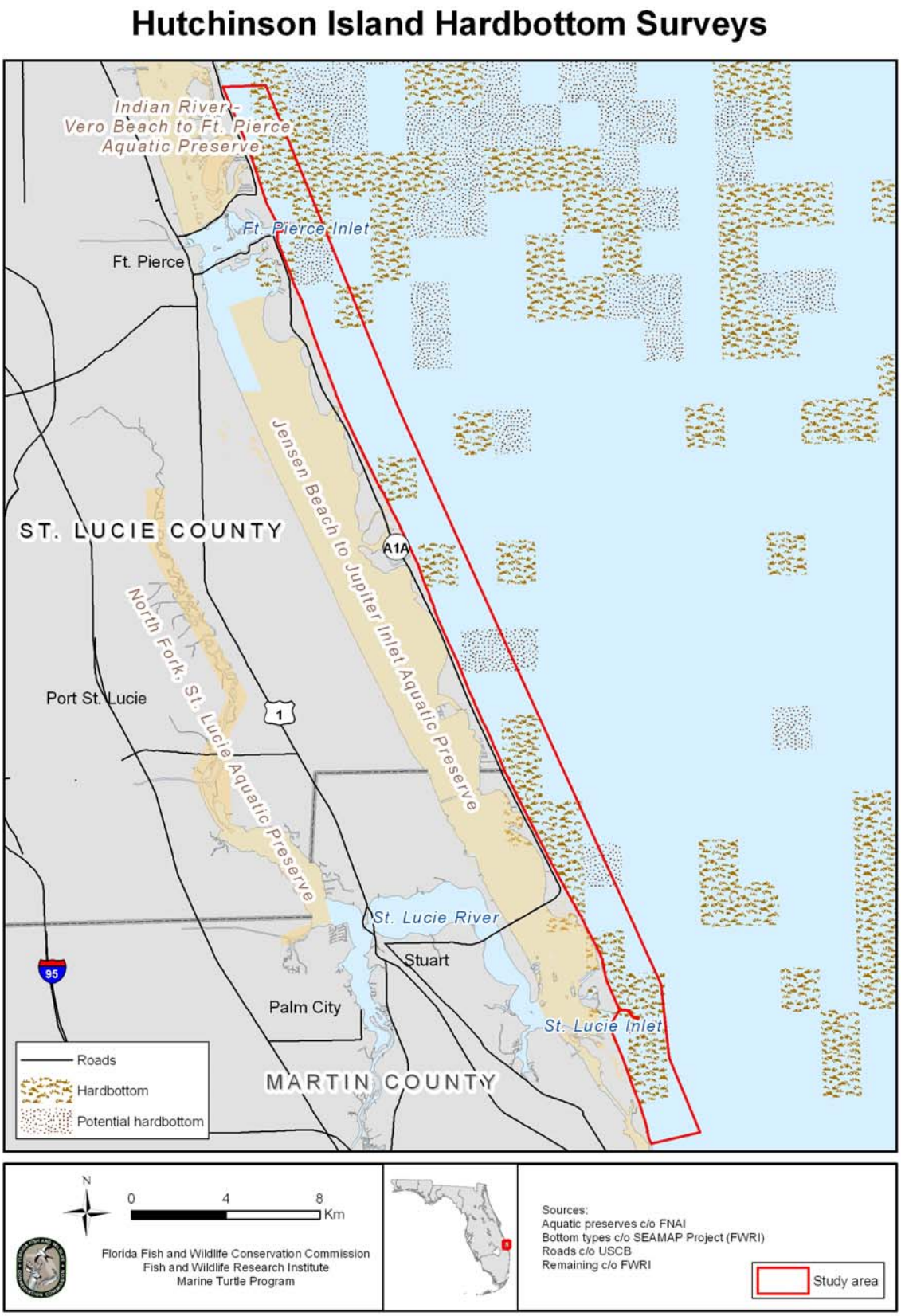

Figure 28 - Hutchinson Island Hardbottom Surveys study area.

Site Name: **St. Lucie Power Plant**

General Information

Site Name: St. Lucie Power Plant
Site Reference Number: 23
Region: Southeast ***County:*** St. Lucie
Approximate Latitude: 27.35° N ***Approximate Longitude:*** 80.23° W
Principal Investigator (s): Michael Bresette
Contact Address: 6451 S. Ocean Dr., Jensen Beach, FL 34957
Contact Email: mbresette@inwater.org
Organizations Involved: Quantum Resources Inc.
Organization Type: consulting firm
Project Status: active
Active Years: 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006

Start Date: 1976
End Date: n/a

Equipment and Methods

General Method Used: capture
Visual-Survey Method: n/a
Capture Method: incidental capture in intake canal
Net Type: tangle net, dip nets ***Net Length:*** 2 @ 35 m each
Mesh Size: 40 cm ***Net Depth:*** 6 m

Sampling and Effort

Sampling Regime: continually
Sampling Locations: consistent

Sampling-Area Description: nearshore sandy bottom
Bottom Type: sand, shell
Water Type: marine
Mean Depth (m): 5.4
Depth Range (m): 0.0-10.2
Effort-Data Availability: yes
Years for which CPUE Calculated: 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005
Method of Calculating CPUE: turtles/year
Species Found: Cm, Cc, Lk, Ei, Dc

Site Name: **St. Lucie Power Plant**

Capture Information *Data current through 2005*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	4260	n/a	18.7	108.3	40.8	O, N, S, A
Loggerhead	5995	n/a	39.7	108.9	70.0	N, S, A
Kemp's Ridley	39	n/a	26.5	66.9	n/r	N, S, A
Hawksbill	41	n/a	35.9	83.8	n/r	N, S, A
Leatherback	30	n/a	110.0	157.0	n/r	I, A

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag, PIT tag

Species Exhibiting FP: Cm, Cc

Genetic-Sample Collection: yes
Laparoscopy Performed: no
Growth-Rate Determination: yes
Sex-Ratio Determination: yes
Tracking Studies Conducted: no
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

Sea turtles become caught in the St. Lucie Power Plant intake pipes and are pulled through to the intake canal where they are retrieved and examined before release. Historically, most captures in the intake canal were loggerhead turtles. From 1976 to 1992, 83% of captures were loggerhead turtles, and only 15% were green turtles. An increase in the green turtle capture rate began in 1992 and they now account for more than 40% of captures. A high level of site fidelity of green turtles to the nearshore worm-rock reefs and areas around the power plant has been documented. Green turtles enter this habitat at 25 to 30 cm SCL and leave as they approach 65 cm SCL. An increase in the green turtle recapture rate from 5% in 1994 to 48.5% in 2003 indicates that the population may be approaching saturation-tagging in this area. Loggerhead captures are predominantly juveniles in the 50-70 cm SCL range. Most adult loggerheads captured are females that may be attempting to nest on nearby beaches.

Witzell *et al*. (2002) used mixed stock analysis with genetic markers found in mtDNA to determine that three different western Atlantic subpopulations contribute to juvenile loggerheads caught in the St. Lucie Power Plant intake canal. Results indicated that 69%

were from south Florida, 20% from Mexico, and 10% from northeastern Florida-North Carolina.

Literature/ Reports Produced:

Bass, A.L., and W.N. Witzell. 2000. Demographic composition of immature green turtles (*Chelonia mydas*) from the east central Florida coast: evidence from mtDNA markers. Herpetologica 56:357-367.

Bresette, M., and J. Gorham. 2001. Growth rates of juvenile green turtles (*Chelonia mydas*) from the Atlantic coastal waters of St. Lucie County, Florida, USA. Marine Turtle Newsletter No. 91, pp. 7-8.

Bresette, M., J. Gorham, and B. Peery. 1998. Site fidelity and size frequencies of juvenile green turtles (*Chelonia mydas*) utilizing near shore reefs in St. Lucie County, Florida. Marine Turtle Newsletter 82, pp. 5-7.

Bresette, M.J., R.M.Herren, and D.A. Singewald. 2004. Comparison of fibropapilloma rates of green turtles (*Chelonia mydas*) from two different sites in St. Lucie County, Florida. In: Coyne, M.S., and M.D. Clark (comps.). Proceedings of the Twenty-First Annual Symposium on Sea Turtle Conservation and Biology. NOAA Technical Memorandum NMFS-SEFSC-528, pp. 125-126.

Bresette, M., D. Singewald, E. De Maye. 2006. Recruitment of post-pelagic green turtles (*Chelonia mydas*) to nearshore reefs on Florida's east coast. In: Frick, M., A. Panagopoulou, A. Rees, and K. Williams (comps.). Book of abstracts. Twenty-Sixth Annual Symposium on Sea Turtle Biology and Conservation. International Sea Turtle Society, Athens, Greece, pp. 288.

Gorham, J.C., and M.J. Bresette. 2000. Bias-free estimates of measurement error in sea turtle morphometric data collection. In: Kalb. H., and T. Wibbels (comps.). Proceedings of the Nineteenth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-443, pp. 178-179.

Gorham, J.C., M.J. Bresette, and B.P. Peery. 1998. Comparative tag retention rates for two styles of flipper tags. In: Epperly, S. P., and J. Braun (comps.). Proceedings of the Seventeenth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-415, pp. 190-193.

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Wibbels, T., D.W. Owens, Y.A. Morris, and M.X. Amoss. 1987. Sexing Techniques and sex ratios for immature loggerhead sea turtles captured along the Atlantic Coast of the United States. In: Witzell, W.N. (ed.). Ecology of East Florida Sea Turtles. Proceedings of the Cape Canaveral, Florida Sea Turtle Workshop. NOAA Technical Report NMFS-53, pp. 65-74.

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Figure 29 - St. Lucie Power Plant study area.

Site Name: **Jenning's Cove**

General Information

Site Name: Jenning's Cove
Site Reference Number: 24
Region: Southeast ***County:*** St. Lucie
Approximate Latitude: 27.45° N ***Approximate Longitude:*** 80.30° W
Principal Investigator (s): Michael Bresette, Jonathan Gorham, Richard Herren, Blair Witherington, Dean Bagley
Contact Address: 4160 NE Hyline Dr., Jensen Beach, FL 34957
Contact Email: mbresette@inwater.org
Organizations Involved: Inwater Research Group, Inc.
Organization Type: nonprofit
Project Status: active
Active Years: 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006

Start Date: September 1998
End Date: n/a

Equipment and Methods

General Method Used: capture
Visual-Survey Method: n/a
Capture Method: set-netting
Net Type: tangle net ***Net Length:*** 150 m
Mesh Size: 40 cm stretch ***Net Depth:*** 4 m

Sampling and Effort

Sampling Regime: monthly
Sampling Locations: focus netting on edge of a 6-7.5 m-deep dredge hole

Sampling-Area Description: lagoon
Bottom Type: seagrass, sand, algae mat
Water Type: estuarine
Mean Depth (m): 1.2
Depth Range (m): 0.2 - 2.2
Effort-Data Availability: yes
Years for which CPUE Calculated: 1998, 1999, 2000, 2001, 2002, 2003, 2004

Method of Calculating CPUE: turtles/km net hr
Species Found: Cm, Cc

Site Name: **Jenning's Cove**

Capture Information *Data current through 2006*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	222	n/a	32.2	74.8	51.6	N, S
Loggerhead	38	n/a	57.1	83.7	n/r	N, S, A
Kemp's Ridley	0	n/a	n/a	n/a	n/a	n/a
Hawksbill	0	n/a	n/a	n/a	n/a	n/a
Leatherback	0	n/a	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag, PIT tag

Species Exhibiting FP: Cm

Genetic-Sample Collection: no
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: no
Tracking Studies Conducted: no
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

This study was designed to address fundamental questions concerning relative abundance, population dynamics, FP rates, and movements of marine turtles in the southern Indian River Lagoon (IRL) system. The southern portion of the IRL supports populations of both loggerhead and green turtles. The mean SCL of green turtles here is more than 10 cm larger than that in the northern IRL system. FP rates are comparable to those to the north but higher than the rates at the nearby St. Lucie Power Plant. The researchers seek to expand sampling to the south of Jenning's Cove in order to obtain a more comprehensive picture of differences in turtle populations in different areas of the Indian River Lagoon.

Literature/ Reports Produced:

Bresette, M., B. Peery, and J. Gorham. 1999. Assessment of marine turtles in an area of the Southern Indian River Lagoon System, Florida: September 1998-June 1999. Annual report submitted to NMFS, NMFS permit number 1144, 22 pp.

Bresette, M., B. Peery, and J. Gorham. 2000. Assessment of marine turtles in an area of the Southern Indian River Lagoon System, Florida: 2000 annual report. Annual report submitted to NMFS, NMFS permit number 1144, 12 pp.

Bresette, M.J., R.N. Herren, and D.A. Singewald. 2001. Comparison of fibropapilloma rates of green turtles (*Chelonia mydas*) from two different sites in St. Lucie County, Florida. In: Coyne, M.S., and M.D. Clark (comps.). Proceedings of the Twenty-First Annual Symposium on Sea Turtle Conservation and Biology. NOAA Technical Memorandum NMFS-SEFSC-528, pp. 125-126.

Bresette, M.J., J.C. Gorham, and B.D. Peery. 2002. Initial assessment of sea turtles in the southern Indian River Lagoon System, Ft. Pierce, Florida. In: Mosier, A., A. Foley, B. Brost (comps.). Proceedings of the Twentieth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-477, pp. 271-273.

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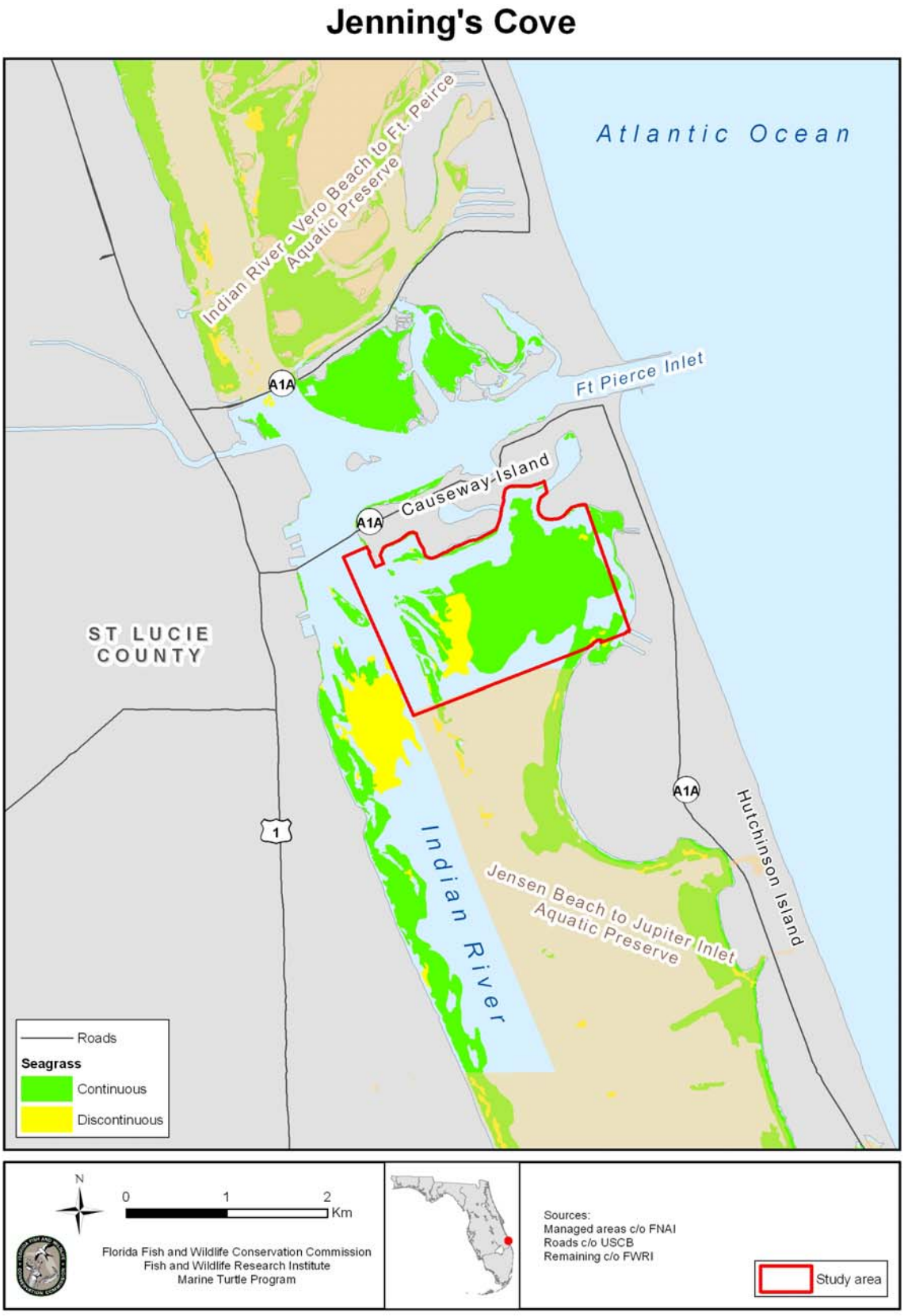

Figure 30 - Jenning's Cove study area.

Site Name: **Indian River County Hardbottom Surveys**

General Information

Site Name: Indian River County Hardbottom Surveys
Site Reference Number: 25
Region: Southeast ***County:*** Indian River
Approximate Latitude: 27.70° N ***Approximate Longitude:*** 80.37° W
Principal Investigator (s): Michael Bresette, Jonathan Gorham, Richard Herren, Blair Witherington, Dean Bagley, Stacy Kubis, Madeline Broadstone
Contact Address: 4160 NE Hyline Dr., Jensen Beach, FL 34957
Contact Email: mbresette@inwater.org
Organizations Involved: Inwater Research Group, Inc.
Organization Type: nonprofit
Project Status: active
Active Years: 2001, 2003, 2004, 2005, 2006

Start Date: June 2001
End Date: n/a

Equipment and Methods

General Method Used: visual surveys
Visual-Survey Method: boat-based, straight-line transects
Capture Method: n/a
Net Type: n/a ***Net Length:*** n/a
Mesh Size: n/a ***Net Depth:*** n/a

Sampling and Effort

Sampling Regime: seasonally
Sampling Locations: same transects during each sampling session

Sampling-Area Description: nearshore hardbottom/reef
Bottom Type: hardbottom, worm rock
Water Type: marine
Mean Depth (m): 7.4
Depth Range (m): 0.0-14.1
Effort-Data Availability: yes
Years for which CPUE Calculated: 2001, 2003, 2004, 2005

Method of Calculating CPUE: turtles/km transect
Species Found: Cm, Cc

Site Name: **Indian River County Hardbottom Surveys**

Capture Information *Data current through 2005*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	n/a	567	n/a	n/a	n/a	n/a
Loggerhead	n/a	113	n/a	n/a	n/a	n/a
Kemp's Ridley	n/a	0	n/a	n/a	n/a	n/a
Hawksbill	n/a	0	n/a	n/a	n/a	n/a
Leatherback	n/a	0	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: n/a

Species Exhibiting FP: n/a

Genetic-Sample Collection: no
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: no
Tracking Studies Conducted: no
Evidence of Site Fidelity: no

General Findings/ Miscellaneous:

This study was initially a four-year effort to determine the effects of a beach-renourishment project on sea turtle abundances in the area and to describe the distribution of turtles in the nearshore reefs off Indian River County. It is now continuing as a population-monitoring project. Three study areas were defined, one of which was affected by the renourishment project. Within each area, three 3-km transects were established parallel to the beach at 300, 600, and 1200 feet offshore. Surfacing turtles were counted by observers on a tower onboard a small boat.

Green turtles made up the majority of overall sightings. Loggerheads were more abundant in the offshore transects than in those close to shore, while green turtles were generally found closer to shore. The vast majority of turtles in each year were sighted in the northern study area of the county, where the renourishment occurred. A comparison of turtle abundance before and after the renourishment project revealed slightly higher numbers in 2005 than before the project.

Literature/ Reports Produced:

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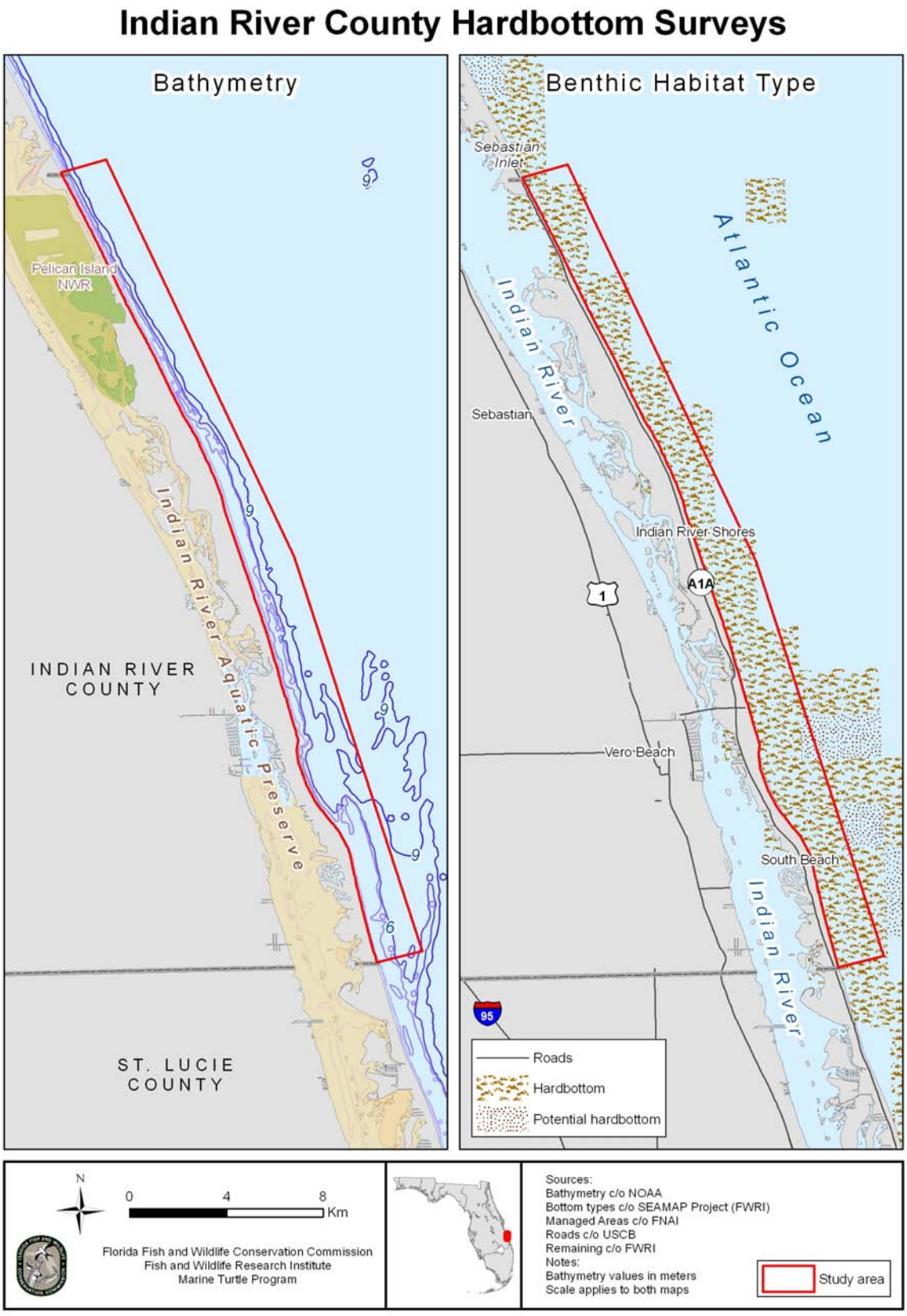

Figure 31 - Indian River County Hardbottom Surveys study area.

Site Name: **Northern Indian River County Reefs**

General Information

Site Name: Northern Indian River County Reefs
Site Reference Number: 26
Region: Southeast ***County:*** Indian River
Approximate Latitude: 27.80° N ***Approximate Longitude:*** 80.40° W
Principal Investigator (s): Llewellyn Ehrhart, William Redfoot, Dean Bagley
Contact Address: Department of Biology, P.O. Box 162368, Orlando FL 32816
Contact Email: lmehrhart@earthlink.com
Organizations Involved: University of Central Florida
Organization Type: university
Project Status: active
Active Years: 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006

Start Date: 1988
End Date: n/a

Equipment and Methods

General Method Used: capture, tracking
Visual-Survey Method: n/a
Capture Method: set-netting
Net Type: tangle net ***Net Length:*** 100-220 m
Mesh Size: 30.5 and 40.0 cm stretch ***Net Depth:*** 3.7 m

Sampling and Effort

Sampling Regime: summer
Sampling Locations: various locations along reef 76-220 m from shore

Sampling-Area Description: nearshore hardbottom/reef
Bottom Type: worm rock reefs
Water Type: marine
Mean Depth (m): 12.6
Depth Range (m): 9.9-14.1
Effort-Data Availability: yes
Years for which CPUE Calculated: 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006

Method of Calculating CPUE: turtles/km net hr
Species Found: Cm, Cc, Ei

Site Name: **Northern Indian River County Reefs**

Capture Information *Data current through 2006*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	1013	n/a	24.7	88.8	42.1	O, N, S, A
Loggerhead	18	n/a	49.7	92.9	65.9	N, S, A
Kemp's Ridley	0	n/a	n/a	n/a	n/a	n/a
Hawksbill	2	n/a	24.8	60.2	42.5	O, N
Leatherback	0	n/a	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag, PIT tag, satellite tag, sonic tag

Species Exhibiting FP: Cm

Genetic-Sample Collection: yes
Laparoscopy Performed: no
Growth-Rate Determination: yes
Sex-Ratio Determination: yes
Tracking Studies Conducted: yes
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

The worm reef on which the study is taking place is nearly continuous along the Atlantic coast of Florida from Biscayne Bay north to Jupiter, then is patchy northward to Cape Canaveral. The reefs are built by aggregations of polychaete worms in the family *Sabellariidae* that cement sand grains and fragments of shells into their tubes. The reefs extend from the intertidal zone to a depth of approximately 10 m in a series of linear structures parallel to the shoreline and they provide a substrate for at least 109 species of marine algae.

This study has captured mainly juvenile and subadult green turtles, as well as some subadult loggerheads, a few adult female loggerheads, and two hawksbills. The small number of loggerhead captures is somewhat odd because divers report sightings of the species over the reefs farther south along Florida's east coast. CPUE for green turtles during summer is higher over the reef than it is in the IRL, suggesting that there is either a greater summer population of green turtles on the reef or that turtles are more concentrated in the sampling area there. A female-biased sex ratio has been documented using Radioimmunoassay (RIA) titrations from green turtles on the reef.

Recapture data suggest that turtles may emigrate to the western Caribbean as they undergo ontogeny. Green turtles from the reef have been captured locally at St. Lucie Power Plant, and turtles tagged by other projects near IRC have been captured on the reef. The turtles consume mostly algae in the Divisions Chlorophyta and Rhodophyta. Green turtles show an 8-32.9% prevalence of FP in this habitat, far lower than that in the nearby IRL. This is possibly due to the "oceanic" nature of the reef system. Haplotype analysis of green turtle mtDNA indicates that turtles in this population originate from Florida, Mexico, Costa Rica, and Aves Island.

Literature/ Reports Produced:

Bagley, D.A., and L.M. Ehrhart. 1999. Characterization of a population of juvenile green turtles from an east central Florida developmental habitat. Florida Scientist 62(1):36.

Bagley, D.A., A.L. Bass, S. Johnson, L.M. Ehrhart, and B.W. Bowen. 1998. Origins of juvenile green turtles from an east central Florida developmental habitat as determined by mtDNA analysis. In: Abreu-Grobois, F.A., R. Briseno Duenas, R. Marquez, and L. Sarti (comps.). Proceedings of the Eighteenth International Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFWC-436, pp. 37.

Ehrhart, L. M. 1984. Structure, status and ecology of loggerhead and green turtle populations in developmental habitats of the Indian River Lagoon System, Florida. In: Bacon, P., F. Berry, K. Bjorndal, H. Hirth, L. Ogren, and M. Weber. 1984. Proceedings of the Western Atlantic Turtle Symposium. Volume 1, pp. 256.

Ehrhart, L. M. 1992. Turtles of the worm rock reefs. The Florida Naturalist 65(2):9-11.

Ehrhart, L.M., and K.G. Holloway-Adkins. 2000. A comparative study of the feeding ecology of *Chelonia mydas*; the incidental ingestion of *Prorocentrum sp.* and related topics. Final Report to the Bernice Barbour Foundation, 11 pp.

Ehrhart, L.M. and L.H. Ogren. 1999. Studies in foraging habitats: capturing and handling turtles. 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. IUCN/SSC Marine Turtle Specialist Group Publication No. 4, pp. 61-64.

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Ehrhart, L. M., W.E. Redfoot, and D.A. Bagley. 1996. A study of the population ecology of in-water marine turtle populations on the east-central Florida coast from 1982-96. Comprehensive final report to NOAA/NMFS, 164 pp.

Ehrhart, L.M., D.A. Bagley, and W.E. Redfoot. 1999. A study of the population ecology of in-water marine turtle populations on the east-central Florida coast, in 1997-98. Final report to NOAA/NMFS, 56 pp.

Ehrhart, L.M., W.E. Redfoot, and D.A. Bagley. 2000. Green turtles in three developmental habitats of the Florida Atlantic coast: population structure, fibropapillomatosis and post-juvenile migratory destinations. In: Abreu-Grobois, F.A., R. Briseno Duenas, R. Marquez, and L. Sarti (comps.). Proceedings of the Eighteenth International Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFWC-436, pp. 32.

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Guseman, J.L., and L.M. Ehrhart. 1990. Preliminary assessment of a marine turtle population inhabiting the Sabellariid reefs off Indian River County, Florida, with comparisons to a nearby lagoon population. Florida Scientist 53(1):23.

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Frutchey, K.P., E.S. Dierenfeld, L.M. Ehrhart, and P.C.H. Pritchard. 2002. Plasma levels of vitamins A and E in three marine turtle species nesting in the Archie Carr National Wildlife Refuge. Florida Scientist 65(Suppl. 1):44.

Hirama, S., and L.M. Ehrhart. 2002. Epizootiology of green turtle fibropapillomatosis on the Florida Atlantic coast. In: Mosier, A., A. Foley, and B. Brost (comps.). Proceedings of the Twentieth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-477, pp. 51.

Hirama, S., and L.M. Ehrhart. 2003. Prevalence of green turtle fibropapillomatosis in three developmental habitats on the east coast of Florida. In: Seminoff, J.A. (comp.). Proceedings of the Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-503, pp. 302.

Holloway-Adkins, K.G., and L.M. Ehrhart. 2000. A comparative study of the feeding ecology of the green turtle (*Chelonia mydas*). Florida Scientist 63(1):44.

Holloway-Adkins, K.G., and L.M. Ehrhart. 2001. A comparison of habitat foraging ecology and the biotoxin okadaic acid in five Florida populations of *Chelonia mydas*. In: Coyne, M.S., and M.D. Clark (comps.). Proceedings of the Twenty-First Annual Symposium on Sea Turtle Conservation and Biology. NOAA Technical Memorandum NMFS-SEFSC-528, pp. 61-63.

Holloway-Adkins, K.G., S.A. Kubis, A.M. Maharaj, and L.M. Ehrhart. 2002. Extraordinary capture rates of juvenile green turtles over a nearshore reef at Sebastian, Florida in the summer of 1999. In: Mosier, A., A. Foley, and B. Brost (comps.). Proceedings of the Twentieth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-477, pp. 265-266.

Holloway-Adkins, K.G., M.J. Bresette, and L.M. Ehrhart. 2003. Juvenile green turtles of the Sabellariid worm reef. In: Pilcher, N.J. (comp.). Proceedings of the Twenty-Third Annual Symposium on Sea Turtle Biology and Conservation. Twenty-Second Symposium Proceedings Addendum. NOAA Technical Memorandum NMFS-SEFSC-536, pp. 259.

Kubis, S.A. 2003. Growth Rates of Juvenile Green Turtles, *Chelonia mydas*, from Three Developmental Habitats Along the East Central Coast of Florida. Master's thesis, University of Central Florida, Orlando, Florida, 60 pp.

Redfoot, W.E., L.M. Ehrhart, and P.W. Raymond. 1985. A juvenile Atlantic hawksbill turtle, *Eretmochelys imbricata*, from Brevard County, Florida. Florida Scientist 48(4):193-196.

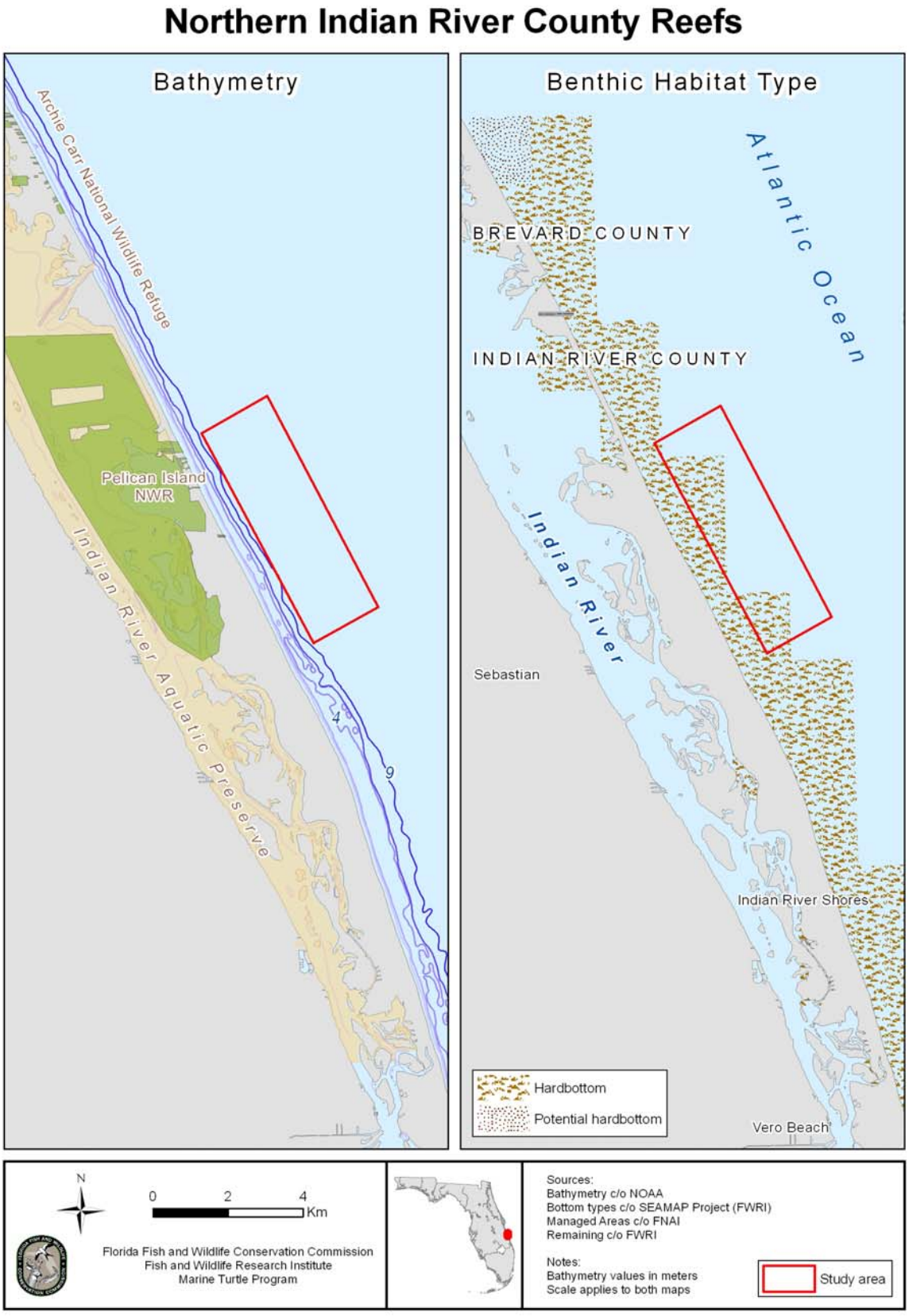

Figure 32 - Northern Indian County Reefs study area.

Site Name: **Central Indian River Lagoon**

General Information

Site Name: Central Indian River Lagoon
Site Reference Number: 27
Region: Southeast ***County:*** Indian River, Brevard
Approximate Latitude: 27.83° N ***Approximate Longitude:*** 80.44° W
Principal Investigator (s): Llewellyn Ehrhart, William Redfoot, Dean Bagley
Contact Address: Department of Biology, P.O. Box 162368, Orlando FL 32816
Contact Email: lmehrhart@earthlink.com
Organizations Involved: University of Central Florida
Organization Type: university
Project Status: active
Active Years: 1982, 1983, 1984, 1985, 1986, 1987, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006

Start Date: May 1982
End Date: n/a

Equipment and Methods

General Method Used: capture, tracking
Visual-Survey Method: n/a
Capture Method: set-netting
Net Type: tangle net ***Net Length:*** 2 nets totaling 450 m
Mesh Size: 10.5 and 40 cm stretch ***Net Depth:*** 3.7 m

Sampling and Effort

Sampling Regime: monthly
Sampling Locations: same netting location each sampling session

Sampling-Area Description: lagoon
Bottom Type: seagrass, drift algae, sand
Water Type: estuarine
Mean Depth (m): 0.1
Depth Range (m): 0.0-0.1
Effort-Data Availability: yes
Years for which CPUE Calculated: 1982, 1983, 1984, 1985, 1986, 1987, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005

Method of Calculating CPUE: turtles/km net hr
Species Found: Cm, Cc, Lk, Ei

Site Name: **Central Indian River Lagoon**

Capture Information *Data current through 2006*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	2685	n/a	24.3	99.5	44.1	O, N, S, A
Loggerhead	988	n/a	41.5	103.0	64.7	N, S, A
Kemp's Ridley	3	n/a	35.1	48.5	40.0	N, S
Hawksbill	1	n/a	67.6	n/a	67.6	S
Leatherback	0	n/a	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag, PIT tag, satellite tag

Species Exhibiting FP: Cm, Cc

Genetic-Sample Collection: yes
Laparoscopy Performed: no
Growth-Rate Determination: yes
Sex-Ratio Determination: yes
Tracking Studies Conducted: yes
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

This study has allowed for the assessment of trends in turtle populations over a long period of time. Since 1982, tangle nets have been deployed at nine locations in the central region of the IRL system between the town of Indialantic, Brevard County, and the town of Wabasso, Indian River County. The majority of netting effort has occurred in a large embayment 3 km south of Sebastian Inlet known locally as South Bay. The undisturbed areas of shoreline are made up of red mangroves; seagrass beds are composed of manatee grass and shoal grass in areas less than one meter deep. *Halophila* is found in deeper waters. Large areas of drift algae cover the lagoon and are found adjacent to the seagrass beds.

Green turtles make up the majority of captures in the lagoon, followed respectively by subadult loggerheads, adult loggerheads (both male and female), and other species including Kemp's ridley and hawksbill turtles. Male loggerheads measuring 63.5 to 72 cm are probably maturing males; those between 74.1 and 80.9 cm are classified as maturing males.

The higher catch of green turtles may be misleading because this may be a result of the netting site and not necessarily representative of the entire lagoon. The netting site is amidst large mats of drift algae, where green turtles may be foraging. Aside from one adult male, all of the green turtles captured have been juveniles. Green turtle captures and CPUE in the lagoon have been increasing over the years. Green turtle relative abundance follows a cyclic pattern throughout the year, with higher abundances during the fall and winter than in the spring and summer. This cycle may be due to seasonal migration and changes in food supply. Green turtles in this area forage principally on drift algae that are more abundant during colder temperatures. The biomass of these algae undergoes a marked decrease during late spring and summer. In addition, this change in seasonal abundance may be due to southern and northern seasonal migrations that occur to areas with appropriate water temperatures along the east coast. A sharp drop in captures of green turtles over 70 cm may signal an ontogenic shift as maturing green turtles leave this area. Genetic samples show that green turtles in the lagoon come from rookeries in Florida, Mexico, Costa Rica, Aves Island, Brazil, Ascension Island, and Guinea Bissau. Genetic samples have also been taken from loggerheads.

RIA techniques show that both greens and loggerheads in this habitat have a sex ratio bias towards females. The severity of green turtle FP varies greatly from individual to individual, as well as temporally. Overall there is 28.3 – 71.6% incidence of the condition.

Literature/ Reports Produced:

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Bagley, D.A., A.L. Bass, S. Johnson, L.M. Ehrhart, and B.W. Bowen. 1998. Origins of juvenile green turtles from an east central Florida developmental habitat as determined by mtDNA analysis. In: Abreu-Grobois, F.A., R. Briseno Duenas, R. Marquez, and L. Sarti (comps.). Proceedings of the Eighteenth International Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFWC-436, pp. 37.

Ehrhart, L.M. 1983. Marine turtles of the Indian River Lagoon System. Florida Scientist 46(3/4):337-346.

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Ehrhart, L. M., W.E. Redfoot, and D.A. Bagley. 1996. A study of the population ecology of in-water marine turtle populations on the east-central Florida coast from 1982-96. Comprehensive final report to NOAA/NMFS, 164 pp.

Ehrhart, L.M., W.E. Redfoot, and D.A. Bagley. 1998. Green turtles in three developmental habitats of the Florida Atlantic coast: population structure, fibropapillomatosis and post-juvenile migratory destinations. In: Abreu-Grobois, F.A., R. Briseno Duenas, R. Marquez, and L. Sarti (comps.). Proceedings of the Eighteenth International Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFWC-436, pp. 32.

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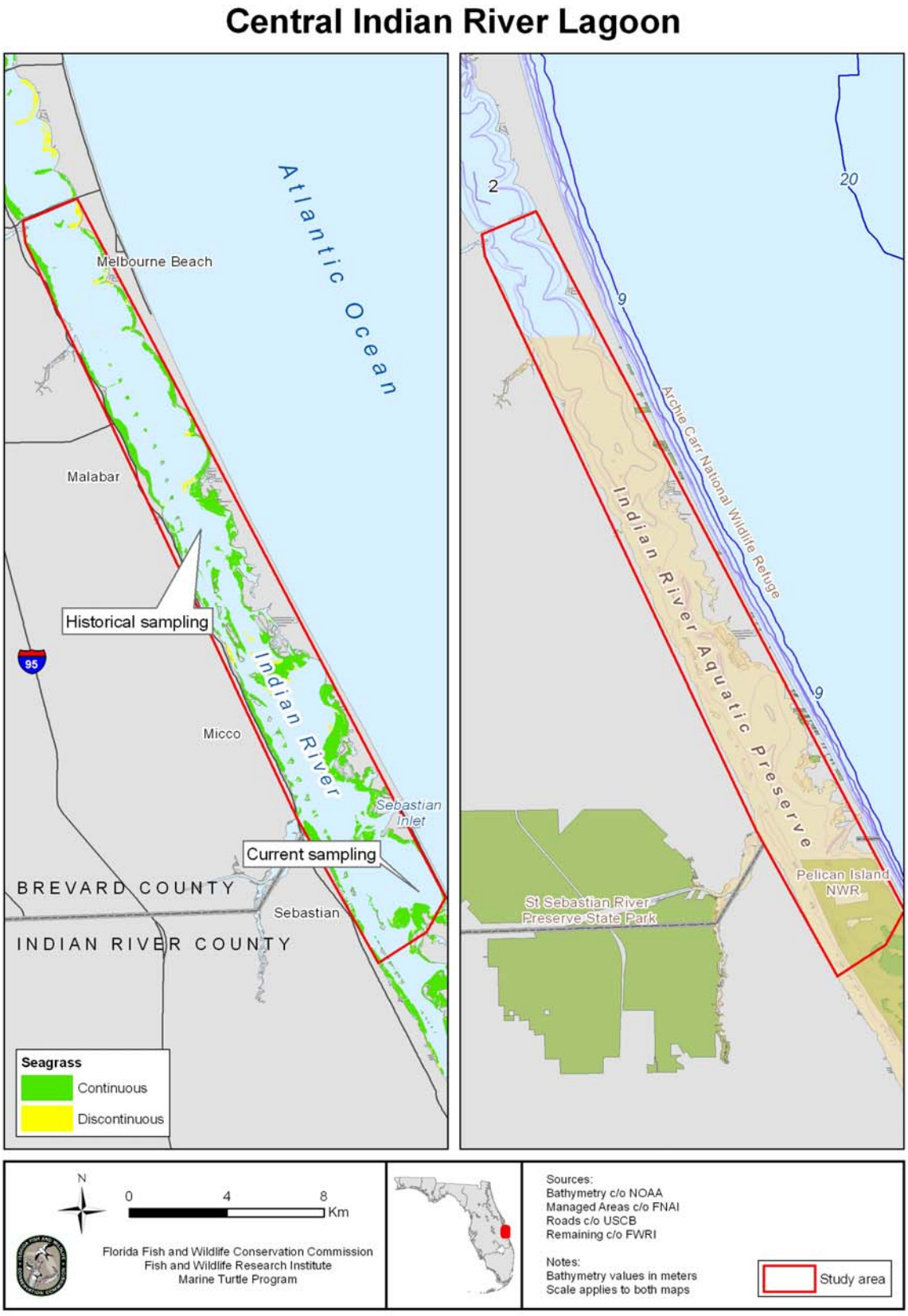

Figure 33 - Central Indian River Lagoon study area.

Site Name: **Central Brevard County Reefs**

General Information

Site Name: Central Brevard County Reefs
Site Reference Number: 28
Region: Southeast ***County:*** Brevard
Approximate Latitude: 28.18° N ***Approximate Longitude:*** 80.57° W
Principal Investigator (s): Karen Holloway-Adkins
Contact Address: P.O. Box 33715, Indialantic, FL 32903
Contact Email: kgha@earthlink.net
Organizations Involved: East Coast Biologists Inc., Florida Atlantic University
Organization Type: nonprofit, university
Project Status: active
Active Years: 2003, 2004, 2005, 2006

Start Date: 2003
End Date: n/a

Equipment and Methods

General Method Used: capture, visual surveys, tracking
Visual-Survey Method: boat-based, straight-line transects
Capture Method: set-netting
Net Type: tangle net ***Net Length:*** 180 m
Mesh Size: 30 cm stretch ***Net Depth:*** 4 m

Sampling and Effort

Sampling Regime: opportunistic
Sampling Locations: netting and transects variable within study area

Sampling-Area Description: nearshore hardbottom/reef
Bottom Type: worm rock reef, hardbottom
Water Type: marine
Mean Depth (m): 12.2
Depth Range (m): 2.4-16.4
Effort-Data Availability: yes (for set-netting only)
Years for which CPUE Calculated: 2003, 2004, 2005, 2006

Method of Calculating CPUE: turtles/km net hr (set net); none for visual surveys
Species Found: Cm, Cc

Site Name: **Central Brevard County Reefs**

Capture Information *Data current through 2006*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	34	172	26.4	64.6	37.0	N
Loggerhead	0	1	n/a	n/a	n/a	n/a
Kemp's Ridley	0	0	n/a	n/a	n/a	n/a
Hawksbill	0	0	n/a	n/a	n/a	n/a
Leatherback	0	0	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag, PIT tag, sonic tag

Species Exhibiting FP: none

Genetic-Sample Collection: no
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: no
Tracking Studies Conducted: yes
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

This study was initiated in 2003 to characterize the marine turtle populations along the reefs off of central Brevard County. It was expanded in 2005 to provide information on marine turtles utilizing the "Mid Reach" as part of a Supplemental Environmental Impact Statement for the Brevard County Shore Protection Study. Both visual transect surveys and tangle netting trips are used to study the turtles in the area. The substrate in the study area consists of hardbottom, worm rocks, coquina, and limestone outcroppings. The water conditions are very dynamic and often turbid due to the close proximity to the intertidal zone. Therefore, tangle nets and dip nets are used east of the reef formation. Juvenile green turtles have made up 99% of visual sightings and all captures. Transects have shown turtles to be fairly evenly distributed across the northern sectors of the study area. Most of the captured green turtles have been in the smaller juvenile size range. Lavage samples are taken to identify the diets of captured turtles and show red algae to make up a major part of green turtle diets. None of the turtles captured have exhibited signs of FP. Turtles are also outfitted with acoustic tracking devices to study their spatial movements.

Literature/ Reports Produced:

East Coast Biologists. 2004. Characterizing the population structure and foraging ecology of marine turtles utilizing nearshore reefs in central Brevard County. Report to Marine Turtle Grants Committee, 12pp.

Holloway-Adkins, K. 2006. Juvenile green turtles (*Chelonia mydas*) foraging on a high-energy, shallow reef on the east coast of Florida, USA. In: Frick, M., A. Panagopoulou, A. Rees, and K. Williams (comps.). Book of abstracts. Twenty-Sixth Annual Symposium on Sea Turtle Biology and Conservation. International Sea Turtle Society, Athens, Greece, pp. 193.

Holloway-Adkins, K. and Provancha, J. 2005. Abundance and foraging activity of marine turtles using nearshore rock resources along the Mid Reach of Brevard County, Florida. Final report to Olsen Associates, Inc. 45 pp.

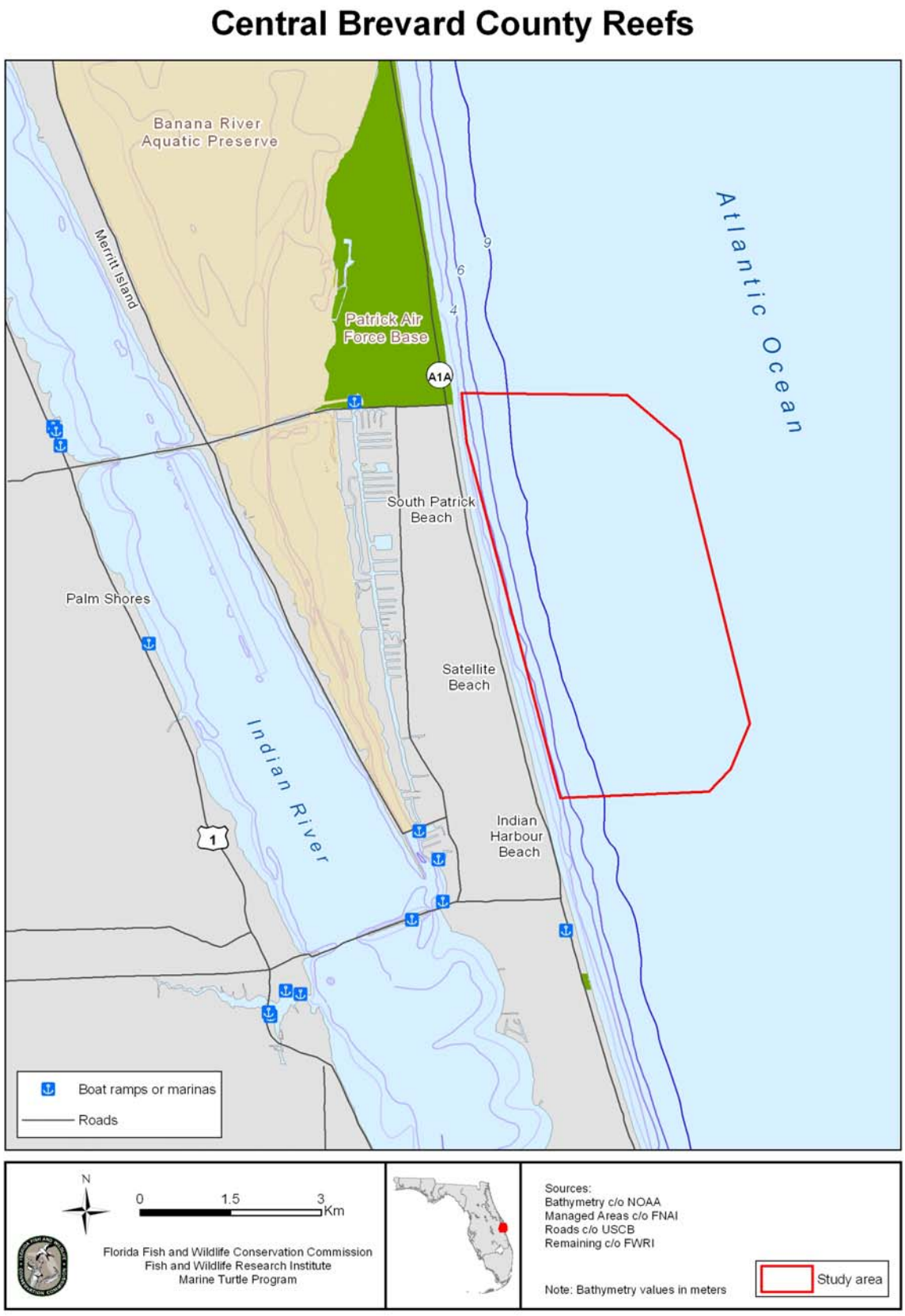

Figure 34 - Central Brevard County Reefs study area.

Site Name: **Epipelagic Drift Community - Southeast**

General Information

Site Name: Epipelagic Drift Community - Southeast
Site Reference Number: 29
Region: Southeast ***County:*** Outside county boundaries
Approximate Latitude: 28.28° N ***Approximate Longitude:*** 80.16° W
Principal Investigator (s): Blair Witherington
Contact Address: 9700 South A1A, Melbourne Beach, FL 32951
Contact Email: witherington@cfl.rr.com
Organizations Involved: FWC/FWRI
Organization Type: state agency
Project Status: active
Active Years: 1992, 1993, 1995, 1997, 1998, 1999, 2000, 2004, 2005, 2006

Start Date: August 1992
End Date: n/a

Equipment and Methods

General Method Used: capture, visual surveys
Visual-Survey Method: boat-based transects through linear drift habitat
Capture Method: dip-netting from surface
Net Type: dip net ***Net Length:*** n/a
Mesh Size: 0.25-1.5 in. ***Net Depth:*** n/a

Sampling and Effort

Sampling Regime: opportunistic
Sampling Locations: various locations within study area

Sampling-Area Description: pelagic downwelling zones, drift lines, *Sargassum* patches
Bottom Type: n/a
Water Type: marine
Mean Depth (m): 60.3
Depth Range (m): 2.4-292.4
Effort-Data Availability: yes
Years for which CPUE Calculated: 1992, 1993, 1995, 1997, 1998, 1999, 2000, 2004, 2005

Method of Calculating CPUE: turtles/km^2 transect
Species Found: Cm, Cc, Ei

Site Name: **Epipelagic Drift Community - Southeast**

Capture Information *Data current through 2006*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	9	3	5.3	26.0 CCL	7.7	O, N
Loggerhead	987	332	3.9	7.8	5.2	O
Kemp's Ridley	0	0	n/a	n/a	n/a	n/a
Hawksbill	1	0	13.4	n/a	13.4	O
Leatherback	0	0	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: n/a

Species Exhibiting FP: none

Genetic-Sample Collection: no
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: no
Tracking Studies Conducted: no
Evidence of Site Fidelity: no

General Findings/ Miscellaneous:

This study area was established earlier than the other three epipelagic drift community sites and focuses on the Florida Current off of Brevard County. Captures are almost exclusively small oceanic-stage loggerheads (young of the year). See the narrative under Epipelagic Drift Community – Northwest for more information and literature produced.

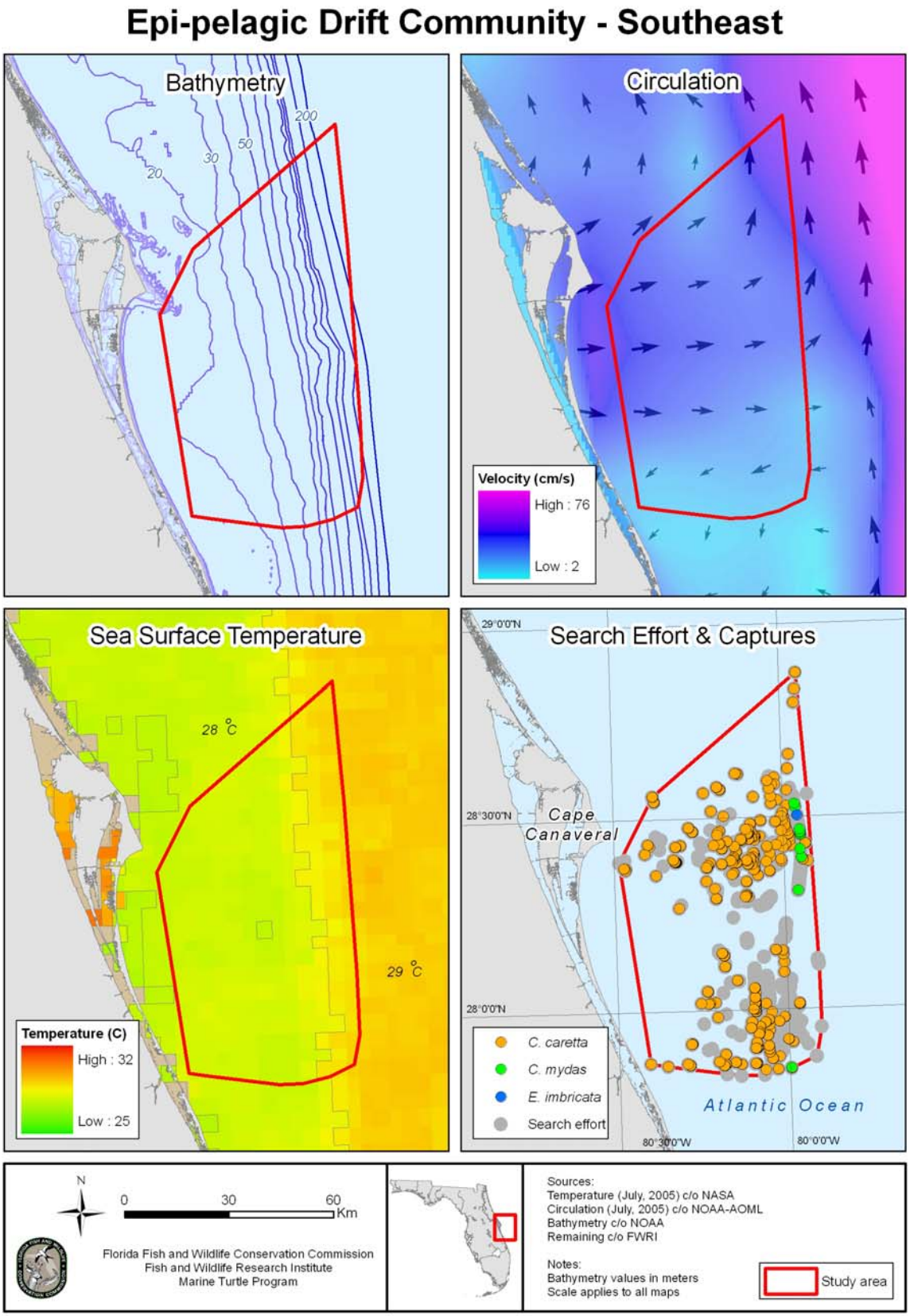

Figure 35 - Epipelagic Drift Community - Southeast study area.

Site Name: **Port Canaveral Ship Channel (Carr *et al.*)**

General Information

Site Name: Port Canaveral Ship Channel (Carr *et al.*)
Site Reference Number: 30
Region: Southeast ***County:*** Brevard
Approximate Latitude: 28.41° N ***Approximate Longitude:*** 80.55° W
Principal Investigator (s): Archie Carr, Larry Ogren, Charles McVea
Contact Address: n/a
Contact Email: lhogren@aol.com
Organizations Involved: University of Florida, NMFS
Organization Type: university, federal agency
Project Status: inactive
Active Years: 1978

Start Date: February 1978
End Date: March 1978

Equipment and Methods

General Method Used: capture
Visual-Survey Method: n/a
Capture Method: trawling
Net Type: trawl net ***Net Length:*** 18 m
Mesh Size: unknown ***Net Depth:*** n/a

Sampling and Effort

Sampling Regime: once in winter
Sampling Locations: various locations within study area

Sampling-Area Description: dredged channel
Bottom Type: channel
Water Type: marine
Mean Depth (m): 9.8
Depth Range (m): 1.4-11.2
Effort-Data Availability: yes
Years for which CPUE Calculated: 1978

Method of Calculating CPUE: turtles/trawl min
Species Found: Cc, Lk

Site Name: **Port Canaveral Ship Channel (Carr *et al.*)**

Capture Information *Data current through 1978*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	0	n/a	n/a	n/a	n/a	n/a
Loggerhead	241	n/a	57.5	98.0	69.1	N, S, A
Kemp's Ridley	3	n/a	n/r	n/r	n/r	n/r
Hawksbill	0	n/a	n/a	n/a	n/a	n/a
Leatherback	0	n/a	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: monel tag

Species Exhibiting FP: none

Genetic-Sample Collection: no
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: no
Tracking Studies Conducted: no
Evidence of Site Fidelity: no

General Findings/ Miscellaneous:

Loggerheads were incidentally captured at high rates in trawlers. Fifty-six loggerheads were caught in a 123-minute trawl, and 100 were caught in a 128-minute trawl. This is the highest concentration ever reported for any species of a sea turtle in a nonbreeding habitat. Eighty-five percent of the captures were subadults. Thermal data suggested that torpid turtles had been dragged out of the bottom and walls of the channel and were likely hibernating. The implication is that loggerheads may sometimes hibernate in temperate sections of their range, just as some freshwater turtles do. Turtles were embedded in mud, which would have been the result of voluntary behavior prior to becoming torpid. Turtle body temperature was documented at 2-3° C higher than the water temperature of 14° C. The temperature 25 cm into the mud bottom was the same as that of the turtles captured. This implies that the turtles would not need to use thermoregulation and could rely on the surrounding mud to maintain a viable temperature.

Literature/ Reports Produced:

Ogren, L., and C. McVea, Jr. 1981. Apparent hibernation by sea turtles in North American waters. In: K. A. Bjorndal (ed.). Biology and conservation of sea turtles. Proceedings of the World Conference on Sea Turtle Conservation. Smithsonian Institute Press, Washington, D.C., pp. 127-132.

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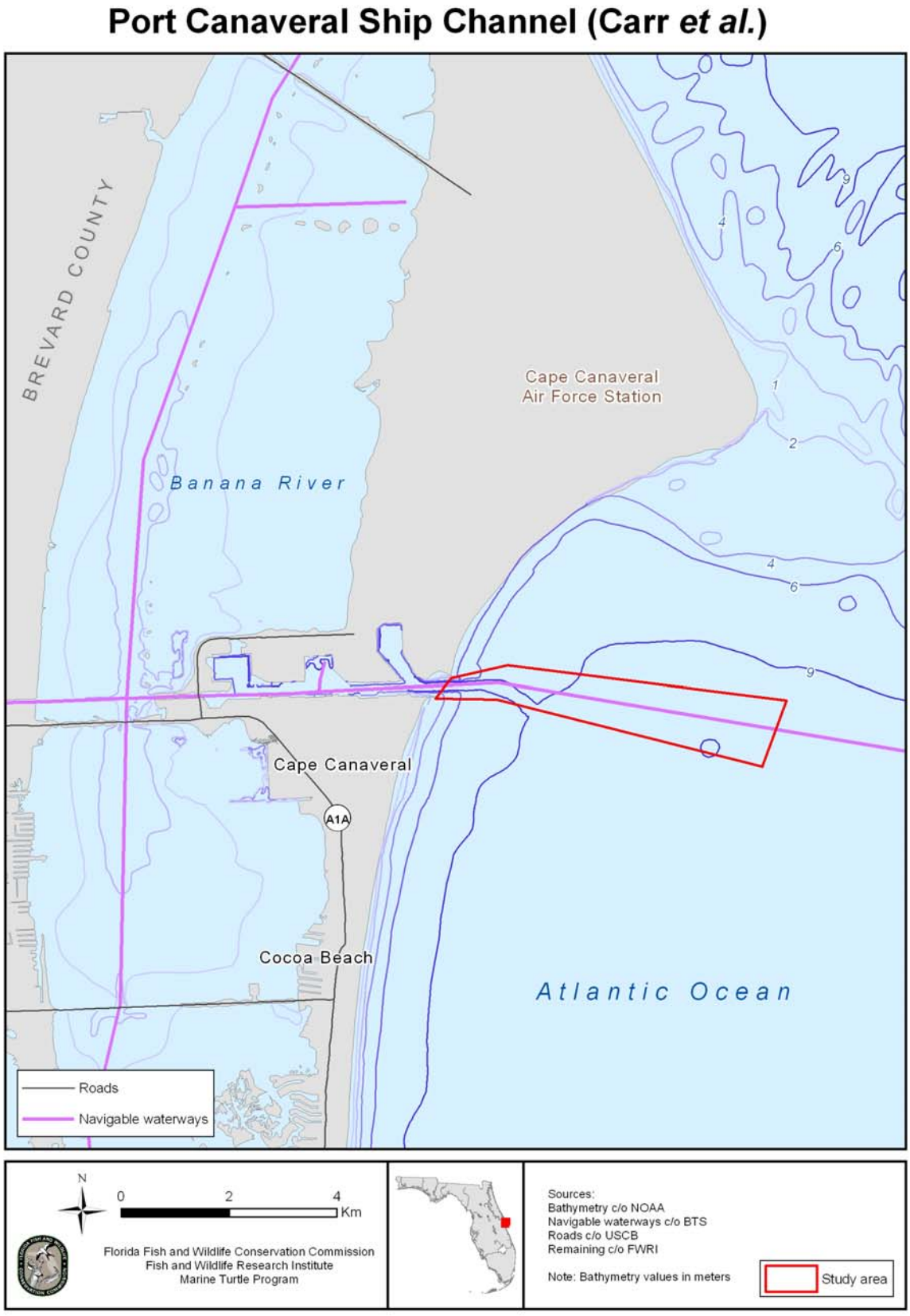

Figure 36 - Carr *et al.* Port Canaveral Ship Channel study area.

Site Name: **Cape Canaveral (Henwood)**

General Information

Site Name: Cape Canaveral (Henwood)
Site Reference Number: 31
Region: Southeast ***County:*** Brevard
Approximate Latitude: 28.41° N ***Approximate Longitude:*** 80.44° W
Principal Investigator (s): Tyrrell Henwood
Contact Address: NMFS, 3209 Frederic Street, Pascagoula, MS 39567
Contact Email: n/a
Organizations Involved: NMFS
Organization Type: federal agency
Project Status: inactive
Active Years: 1978, 1979, 1980, 1981, 1982, 1983, 1984

Start Date: January 1978
End Date: December 1984

Equipment and Methods

General Method Used: capture
Visual-Survey Method: n/a
Capture Method: trawling
Net Type: trawl net ***Net Length:*** 18.5 m
Mesh Size: unknown ***Net Depth:*** n/a

Sampling and Effort

Sampling Regime: opportunistic
Sampling Locations: various locations within channel

Sampling-Area Description: dredged channel
Bottom Type: channel
Water Type: marine
Mean Depth (m): 10.0
Depth Range (m): 0.0-18.9
Effort-Data Availability: yes
Years for which CPUE Calculated: 1978, 1979, 1980, 1981, 1982, 1983, 1984

Method of Calculating CPUE: turtles/trawl hr
Species Found: Cm, Cc, Lk

Site Name: **Cape Canaveral (Henwood)**

Capture Information *Data current through 1984*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	20	n/a	23.6 SCL_{max}	68.1 SCL_{max}	33.8 SCL_{max}	O, N
Loggerhead	3710	n/a	45.0 SCL_{max}	110.0 SCL_{max}	73.2 SCL_{max}	N, S, A
Kemp's Ridley	40	n/a	24.1 SCL_{max}	66.0 SCL_{max}	38.6 SCL_{max}	O, N, S, A
Hawksbill	0	n/a	n/a	n/a	n/a	n/a
Leatherback	0	n/a	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag

Species Exhibiting FP: not reported

Genetic-Sample Collection: no
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: yes
Tracking Studies Conducted: no
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

Loggerheads:

Size and sex composition of turtle aggregations in the Canaveral area changed seasonally. Migrations of breeding turtles occurred during the spring and summer months and were less common throughout the rest of the year, suggesting that adults were not resident in the area. Subadult turtle movements were not dependant on reproductive activities and so their distributions may have reflected changes in environmental conditions and foraging opportunities. CPUE and recapture data indicated that turtle aggregations are dynamic and that turtles move into and out of the area regularly.

Adult males moved into the Canaveral area prior to adult females. Peak densities of males occurred during April and May, with adult males leaving by June. The same males were often present year after year for breeding activities. This suggested that males may breed annually and do not migrate with females. Adult females who nested in the Canaveral area did not overwinter there. Females that were encountered in the winter were either non-breeding or members of other nesting populations. Breeding females

were dominant May to August. These were short-term migrants that emigrated from distant foraging areas.

Subadult turtles were dominant in the ship channel from August to March. Subadults emigrated as far north as Chesapeake Bay in the spring. The majority of the long-distance recoveries of Canaveral turtles occurred north of Cape Canaveral, but these may portray a biased impression of dispersal patterns. Most of the recoveries came from shrimp trawlers. Higher levels of shrimping occur in the north while not much fishing effort takes place to the south. The greatest concentrations of subadults occurred from October to March. Many subadults were present year after year, depending on environmental conditions. This suggested a residential population of subadults which disperse locally during spring and summer and return to the channel each winter.

Green Turtles:

Green turtles were captured during all months except August and November. The infrequent nature of capture and lack of seasonal change in abundance when compared to loggerheads suggested that these animals may represent an itinerant population. No green turtles were ever recaptured. Greens in the Canaveral area may represent early developmental stages that precede the shift to herbivory and subsequent recruitment to feeding pastures since they were smaller than those observed by Ehrhart in Mosquito Lagoon. Offshore captures of green turtles may represent transients that are making their way to coastal developmental habitats where seagrasses are abundant.

Kemp's ridleys:

All but one Kemp's ridley capture were immature. The capture of this one adult-sized Kemp's ridley outside the Gulf of Mexico suggested that mature Kemp's ridleys occasionally forage along the east coast of Florida.

Most Kemp's ridley captures occurred from December through March, suggesting that the species is present primarily during winter months. Recaptures by shrimping vessels off Georgia and South Carolina confirmed that Kemp's ridleys occur in waters north of Canaveral during the summer and fall months, but shrimping effort is biased towards that time of year. There was a southward movement of ridleys during periods of colder water temperatures. Kemp's ridleys overwintered in Cape Canaveral and moved north along the Atlantic coastline with increasing sea temperatures, foraging as far north as Chesapeake Bay. These same turtles moved south when water temperatures began to fall. Seasonal movements up and down the coast may continue until they reach sexual maturity and then return to the Gulf of Mexico to breed.

Literature/ Reports Produced:

Henwood, T.A. 1987. Sea Turtles of the Southeastern United States, with Emphasis on the Life History and Population Dynamics of the Loggerhead Turtles, *Caretta caretta*. Doctoral dissertation, Auburn University, Auburn, AL, 170 pp.

Henwood, T.A. 1987. Movements of loggerhead turtles, *Caretta caretta*, in the vicinity of Cape Canaveral, Florida, as determined by tagging experiments 1978-1984. In: Witzell, W.N. (ed.). Ecology of East Florida Sea Turtles. Proceedings of the Cape Canaveral, Florida Sea Turtle Workshop. NOAA Technical Report NMFS-53, pp. 29.

Henwood, T.A. 1987. Distribution and migrations of immature Kemp's ridley turtles (*Lepidochelys kempi*) and green turtles (*Chelonia mydas*) off Florida, Georgia, and South Carolina. Northeast Gulf Science 9(2):153-159.

Henwood, T.A. 1987. Movements and seasonal changes in loggerhead turtle *Caretta caretta* aggregations in the vicinity of Cape Canaveral, Florida (1978-1984). Biological Conservation 40:191-202.

Wibbels, T., D.W. Owens, and M.S. Amoss. 1987. Seasonal changes in the serum testosterone titers of loggerhead sea turtles captured along the Atlantic Coast of the United States. In: Witzell, W.N. (ed.) Ecology of East Florida Sea Turtles. Proceedings of the Cape Canaveral, Florida Sea Turtle Workshop. NOAA Technical Report NMFS-53, pp. 59-64.

Wibbels, T., D.W. Owens, Y.A. Morris, and M.X. Amoss. 1987. Sexing Techniques and sex ratios for immature loggerhead sea turtles captured along the Atlantic Coast of the United States. In: Witzell, W.N. (ed.). Ecology of East Florida Sea Turtles. Proceedings of the Cape Canaveral, Florida Sea Turtle Workshop. NOAA Technical Report NMFS-53, pp. 65-74.

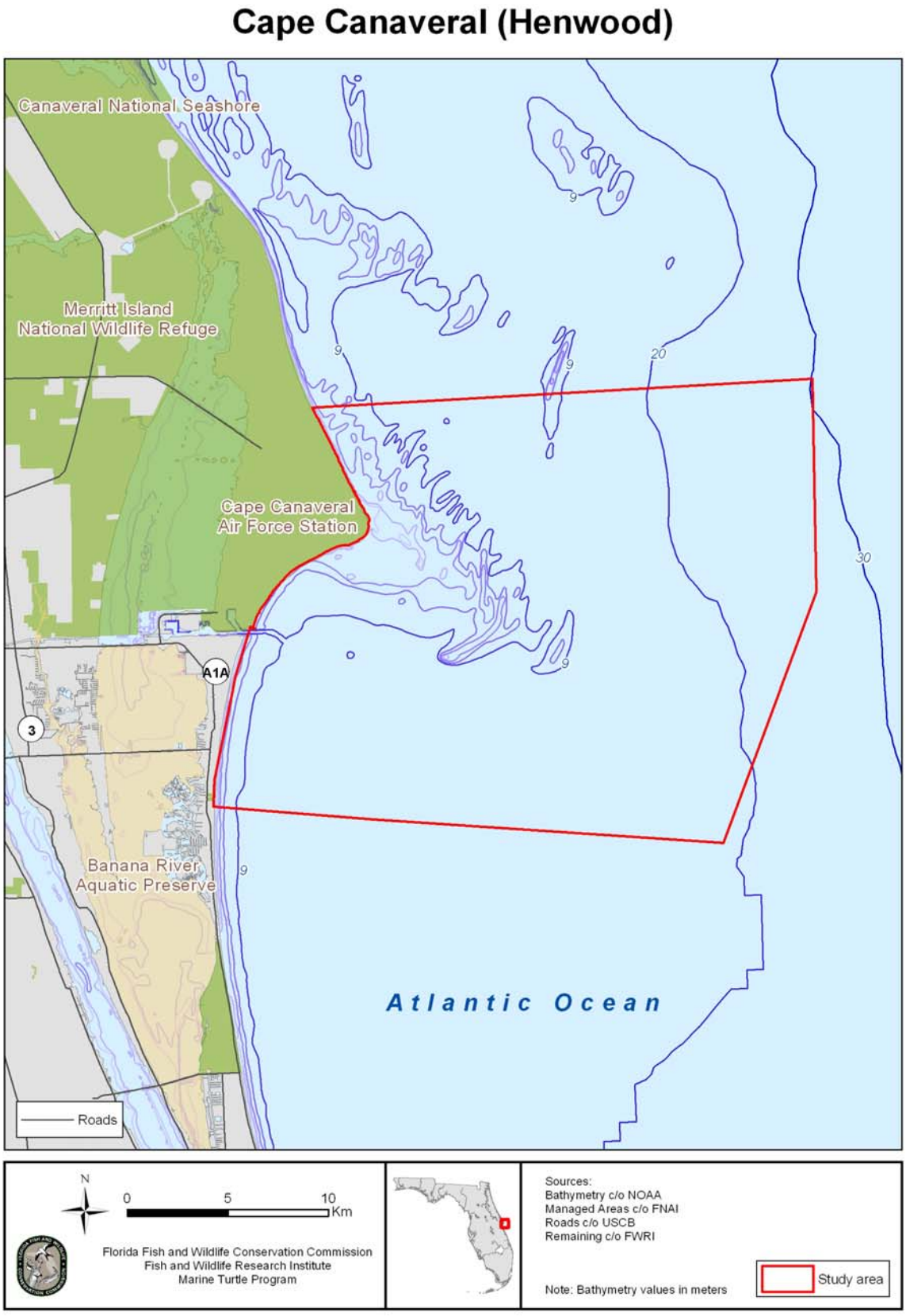

Figure 37 - Henwood Cape Canaveral study area.

Site Name: **Port Canaveral Ship Channel (Bolten *et al.*)**

General Information

Site Name: Port Canaveral Ship Channel (Bolten *et al.*)
Site Reference Number: 32
Region: Southeast ***County:*** Brevard
Approximate Latitude: 28.41° N ***Approximate Longitude:*** 80.55° W
Principal Investigator (s): Alan Bolten, Karen Bjorndal, Dena Dickerson
Contact Address: ACCSTR, Bartram Hall, Gainesville, FL 32611
Contact Email: abb@zoo.ufl.edu
Organizations Involved: University of Florida, USACE
Organization Type: university
Project Status: inactive
Active Years: 1992, 1993

Start Date: March 1992
End Date: February 1993

Equipment and Methods

General Method Used: capture
Visual-Survey Method: n/a
Capture Method: trawling
Net Type: trawl net ***Net Length:*** 20 m
Mesh Size: 8 inch stretch ***Net Depth:*** n/a

Sampling and Effort

Sampling Regime: monthly
Sampling Locations: 4 sampling stations sampled during each session

Sampling-Area Description: dredged channel
Bottom Type: channel
Water Type: marine
Mean Depth (m): 9.8
Depth Range (m): 1.4-11.2
Effort-Data Availability: yes
Years for which CPUE Calculated: 1992, 1993

Method of Calculating CPUE: turtles/trawl hr; turtles/trawl km
Species Found: Cm, Cc, Lk

Site Name: **Port Canaveral Ship Channel (Bolten *et al.*)**

Capture Information *Data current through 1993*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	2	n/a	52.0	98.5	75.3	N, A
Loggerhead	171	n/a	47.0	109.8	n/r	N, S, A
Kemp's Ridley	1	n/a	30.8	n/a	30.8	N
Hawksbill	0	n/a	n/a	n/a	n/a	n/a
Leatherback	0	n/a	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag

Species Exhibiting FP: none

Genetic-Sample Collection: no
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: yes
Tracking Studies Conducted: no
Evidence of Site Fidelity: no

General Findings/ Miscellaneous:

The number of loggerheads captured and the size classes observed varied seasonally. Adults principally used the channel during the spring-summer breeding season; juveniles were present year round. Differences between stations may have been related to differences in bottom type.

A peak in juvenile captures in the winter was believed to represent a group of juvenile loggerheads migrating south away from cooler northern temperatures.

Blood samples were collected from 168 loggerheads, and plasma samples were evaluated for 26 analytes. This was done to establish baseline values for blood chemistries to monitor the long-term physiological status of loggerhead populations.

Literature/ Reports Produced:

Bolten, A.B., K.A. Bjorndal, P.J. Eliazar, and L.F. Gregory. 1993. Assessment of sea turtle relative abundance in Port Canaveral Ship Channel, Florida. Final report submitted to U.S. Army Corps of Engineers, July 1993. Cooperative Agreement DACW17-90-H-0015, 65 pp.

Bolten A.B., K.A. Bjorndal, P.J. Eliazar, and L.F. Gregory. 1994. Seasonal Abundance, Size Distribution, and Blood Chemical Value of Loggerheads (*Caretta caretta*) in Port Canaveral Ship Channel, Florida. NOAA Technical Memorandum NMFS-SEFSC-353, 39 pp.

Dickerson, D.D., K.J. Reine, D.A. Nelson, and C.E. Dickerson, Jr. 1995. Assessment of Sea Turtles Abundance in Six South Atlantic U.S. Channels. U.S. Army Corps of Engineers, Waterways Experiment Station Miscellaneous Paper EL-95-5, 129 pp.

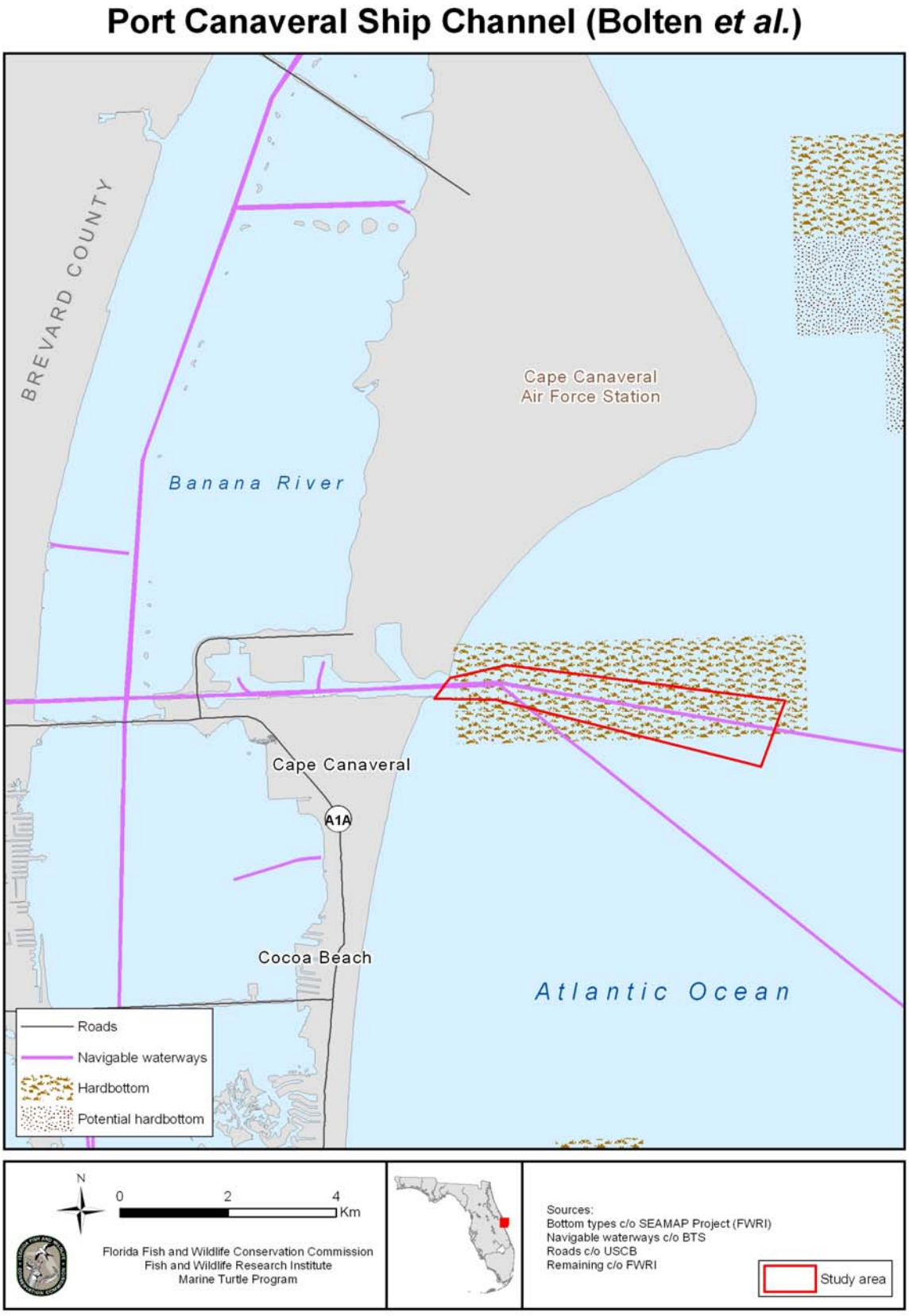

Figure 38 - Bolten *et al.* Port Canaveral Ship Channel study area.

Site Name: **Cape Canaveral (Standora *et al.*)**

General Information

Site Name: Cape Canaveral (Standora *et al.*)
Site Reference Number: 33
Region: Southeast ***County:*** Brevard
Approximate Latitude: 28.41° N ***Approximate Longitude:*** 80.57° W
Principal Investigator (s): Edward Standora, Stephen Morreale, Alan Bolten
Contact Address: 2097 Ferry Rd., Grand Island, NY 14072
Contact Email: standoea@aol.com
Organizations Involved: Buffalo State College, Cornell University, University of Florida
Organization Type: universities
Project Status: inactive
Active Years: 1993

Start Date: March 1993
End Date: April 1993

Equipment and Methods

General Method Used: capture, tracking
Visual-Survey Method: n/a
Capture Method: trawling
Net Type: trawl net ***Net Length:*** 18 m
Mesh Size: unknown ***Net Depth:*** n/a

Sampling and Effort

Sampling Regime: consistently over 2 months
Sampling Locations: various locations within channel

Sampling-Area Description: dredged channel
Bottom Type: channel
Water Type: marine
Mean Depth (m): 11.0 (from nautical charts)
Depth Range (m): 0.0-11.0 (from nautical charts)
Effort-Data Availability: yes
Years for which CPUE Calculated: n/a

Method of Calculating CPUE: n/a
Species Found: Cc

Site Name: **Cape Canaveral (Standora *et al.*)**

Capture Information *Data current through 1993*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	0	n/a	n/a	n/a	n/a	n/a
Loggerhead	81	n/a	45.6	108.7	n/r	N, S, A
Kemp's Ridley	0	n/a	n/a	n/a	n/a	n/a
Hawksbill	0	n/a	n/a	n/a	n/a	n/a
Leatherback	0	n/a	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag, sonic tag, radio tag

Species Exhibiting FP: none

Genetic-Sample Collection: no
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: yes
Tracking Studies Conducted: yes
Evidence of Site Fidelity: no

General Findings/ Miscellaneous:

This study used biotelemetric methods to determine daily patterns of channel usage by turtles and compared them with movements outside the channel. The diurnal diving patterns of turtles were monitored to determine the relative amount of time spent at different depths. The study also documented the amount of time loggerheads spent at the surface in order to assist in calculating correction factors for aerial surveys. The researchers also examined the utility of relocating turtles from the channel as a means of mitigating or minimizing turtle deaths caused by dredging.

Loggerhead sizes ranged from juvenile to adult and included both males and females. Eighty-one turtles were captured, ten of which were adult males that were immediately released from the net. Twenty-two of the captured turtles were tagged and released back into the channel. The remaining 49 turtles were used in the monitoring and relocation studies. A bimodal distribution of size classes indicated that turtles of two distinct size classes used this channel: juvenile and adult. Mainly juveniles were captured in March, and adult males made up the majority of captures in April. A study in the summer of 1992 (Bolten *et al*., 1993), conversely, found females to be dominant.

Turtles spent greater amounts of time in the bottom third of the water column in the spring and considerably less time at the surface than during the 1992 summer study (Bolten *et al*., 1993). There were also differences in behavior between size classes within the spring: mature males were more active at the surface than juveniles and showed a greater tendency toward residency in the channel area. These differences were evident in the direction of movement, net distance moved, and rate of travel for most turtles. The higher levels of adult activity may be due to the start of the mating season for loggerheads in the area. During this period, there was a large influx of adult males and a later one by adult females in the summer. The differences observed both between and within seasons may thus reflect differences between age classes and reproductive condition.

During a relocation experiment to assess management strategies, 34 turtles were released at distances of 10, 40, and 70 km north or south of the channel. Six control turtles were not displaced. Control turtles did not display uniform behavior. The displacement distance was significantly correlated with the time it took for turtles to return to the channel. There was no significant relationship between the direction of displacement and the time required to return or the number of turtles returning. Overall, however, turtles released to the south showed less random movements than those released to the north. The study did not recommend relocation during spring; relocations may, however, different seasonal effects and concomitant changes in turtle behavior and activity.

Literature/ Reports Produced:

Eberle, M.D., E.A. Standora, J.M. Edbauer, T.S. Ryder, K.L. Williams, S.J. Morreale, and A.B. Bolten. 1994. The effect of abiotic factors on the position of loggerhead turtles (*Caretta caretta*) in the water column at Cape Canaveral, Florida. In: Bjorndal, K.A., A.B. Bolten, D.A. Johnson, and P.J. Eliazar (comps.). Proceedings of the Fourteenth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-351, pp. 37.

Ryder, T.S., E.A. Standora, M.D. Eberle, J.M. Edbauer, K.L. Williams, S.J. Morreale, and A.B. Bolten. 1994. Daily movements of adult male and juvenile loggerhead turtles (*Caretta caretta*) at Cape Canaveral, Florida. In: Bjorndal, K.A., A.B. Bolten, D.A. Johnson, and P.J. Eliazar (comps.). Proceedings of the Fourteenth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-351, pp. 131.

Standora, E.A., M.D. Eberle, J.M. Edbauer, T.S. Ryder, K.L. Williams, S.J. Morreale, and A.B. Bolten. 1993. Diving behavior, daily movements, and homing of loggerhead turtles (*Caretta caretta*) at Cape Canaveral, Florida, March and April 1993. Report to the Army Corps of Engineers, 209 pp.

Standora, E.A., T.S. Ryder, M.D. Eberle, J.M. Edbauer, K.L. Williams, S.J. Morreale, and A.B. Bolten. 1994. Homing behavior of loggerhead turtles relocated from dredging areas in Cape Canaveral Channel, Florida. In: Bjorndal, K.A., A.B. Bolten, D.A. Johnson, and J.P. Eliazar (comps.). Proceedings of the Fourteenth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-351, pp. 141-142.

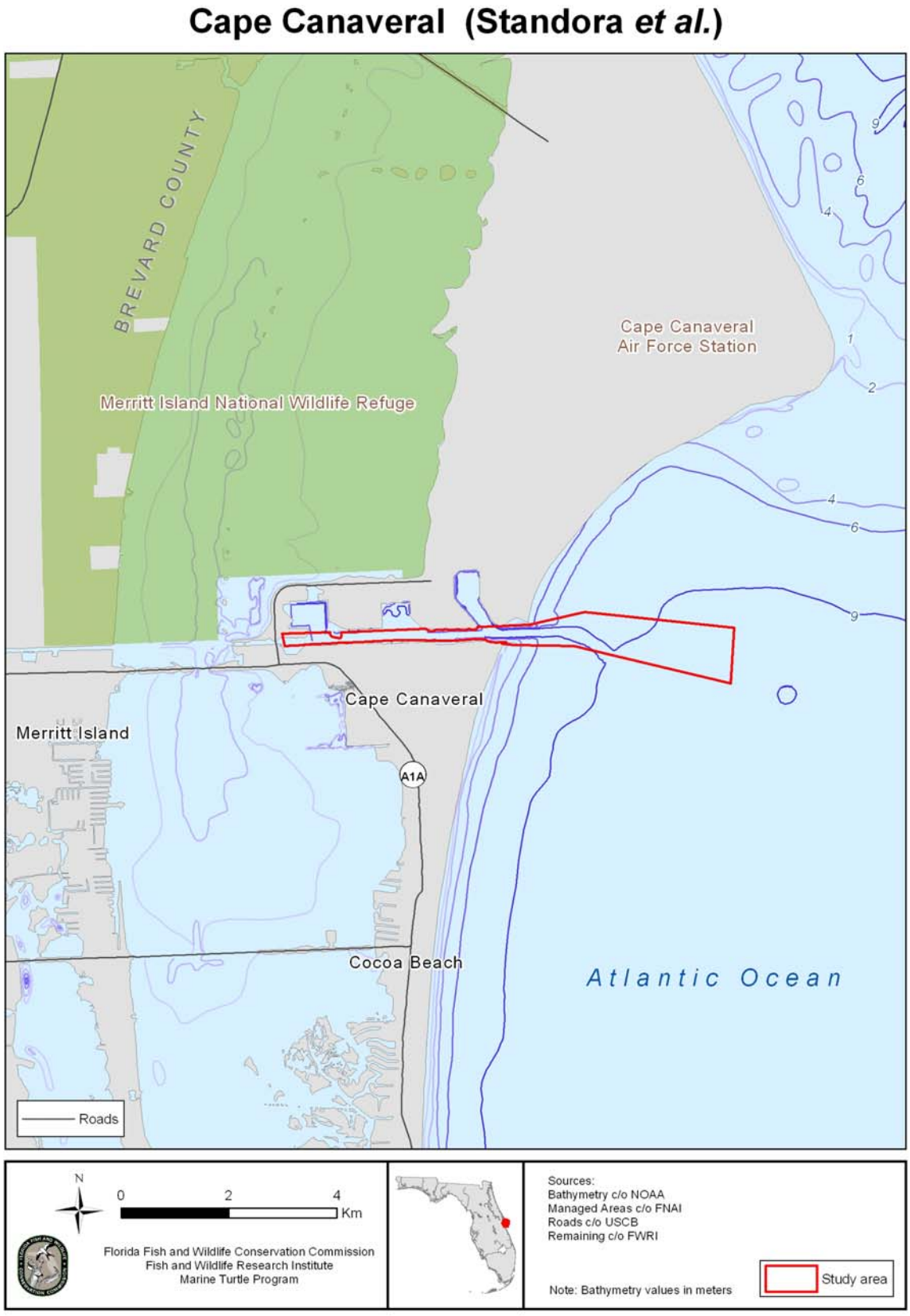

Figure 39 - Standora *et al.* Cape Canaveral study area.

Site Name: **Cape Canaveral (Segars *et al.*)**

General Information

Site Name: Cape Canaveral (Segars *et al.*)
Site Reference Number: 34
Region: Southeast ***County:*** Brevard
Approximate Latitude: 28.39° N ***Approximate Longitude:*** 80.54° W
Principal Investigator (s): Al Segars, Michael Arendt, Julia Byrd, David Whitaker, David Owens, Gaëlle Blanvillain
Contact Address: P.O. Box 12559, Charleston, SC 29422
Contact Email: segarsa@dnr.sc.gov
Organizations Involved: South Carolina DNR, College of Charleston, Georgia Southern University

Organization Type: state agency, universities
Project Status: active
Active Years: 2006

Start Date: April 2006
End Date: n/a

Equipment and Methods

General Method Used: capture, tracking
Visual-Survey Method: n/a
Capture Method: trawling
Net Type: trawl net ***Net Length:*** 60’ head rope
Mesh Size: 8 inch stretch ***Net Depth:*** n/a

Sampling and Effort

Sampling Regime: annually
Sampling Locations: variable within study area

Sampling-Area Description: dredged channel
Bottom Type: channel
Water Type: marine
Mean Depth (m): 10.2
Depth Range (m): 10.2-10.2
Effort-Data Availability: yes
Years for which CPUE Calculated: 2006

Method of Calculating CPUE: turtles/trawl hr
Species Found: Cc

Site Name: **Cape Canaveral (Segars *et al.*)**

Capture Information *Data current through 2006*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	0	n/a	n/a	n/a	n/a	n/a
Loggerhead	23	n/a	59.0	105.0	82.0	N, S, A
Kemp's Ridley	0	n/a	n/a	n/a	n/a	n/a
Hawksbill	0	n/a	n/a	n/a	n/a	n/a
Leatherback	0	n/a	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag, PIT tag, satellite tag

Species Exhibiting FP: none

Genetic-Sample Collection: yes
Laparoscopy Performed: yes
Growth-Rate Determination: no
Sex-Ratio Determination: yes
Tracking Studies Conducted: yes
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

Loggerheads were targeted in the Cape Canaveral Shipping Channel with the primary goal of outfitting the animals with satellite transmitters to monitor their migrations. Nine adult males were tagged in 2006, four of which appeared to remain as residents in the area. Four adult males migrated north to South Carolina, Maryland, and New Jersey and eventually returned southward in September. The ninth transmitter failed after only 10 days.

Laparoscopy and ultrasounds were performed on adult male loggerheads to determine reproductive activity. Researchers compared these methods to hormone sampling and measures of plastron softness as less invasive ways to assess reproductive activity.

Literature/ Reports Produced:

Arendt, M., A. Segars, J. Byrd, J.D. Whitaker, D. Owens, and G. Blanvillain. 2007. Examination of Local Movement and Migratory Behavior of Sea Turtles During Spring and Summer Along the Atlantic Coast Off the Southeastern United States. Annual report to NMFS, 50 pp.

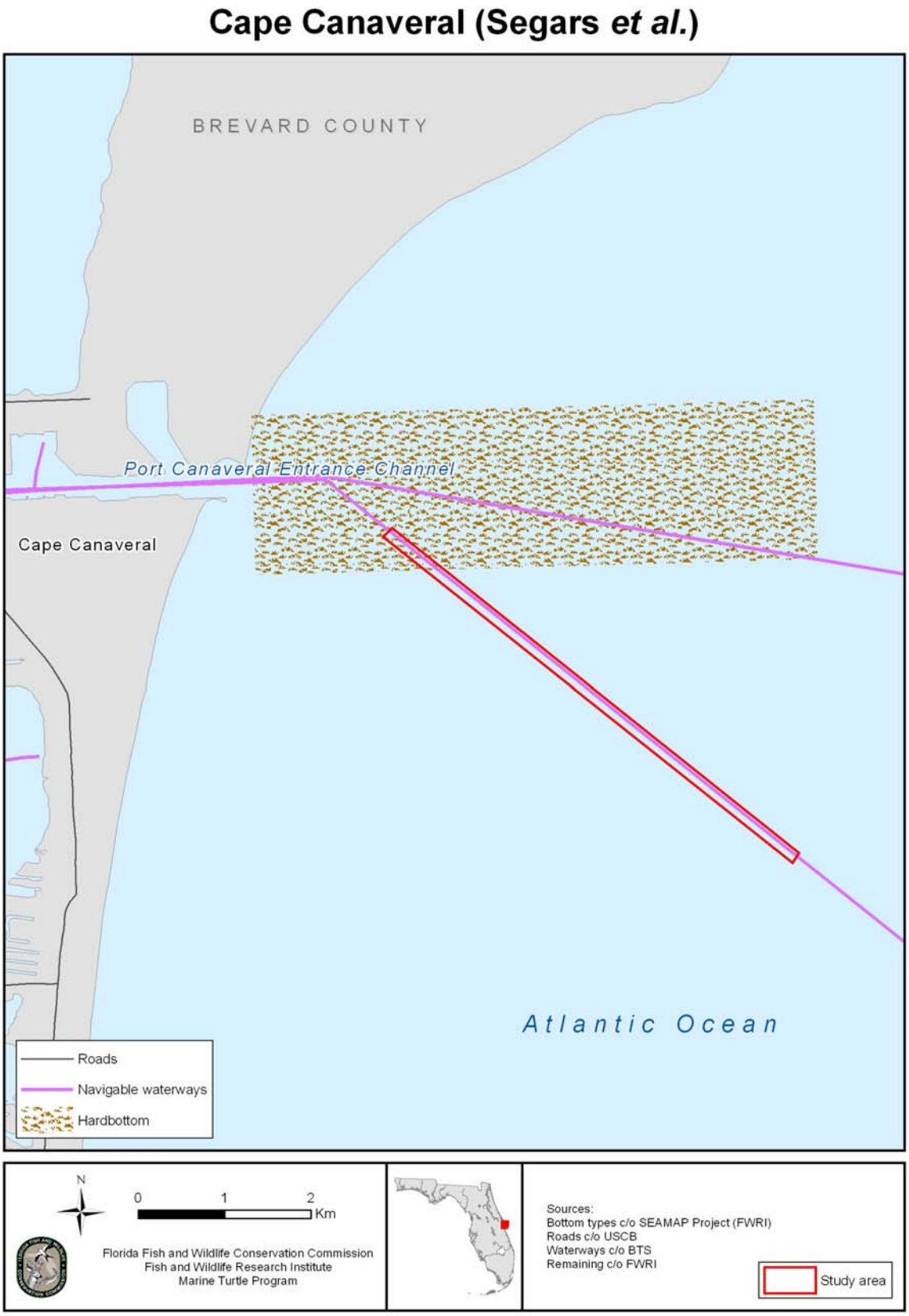

Figure 40 - Segars *et al.* Cape Canaveral study area.

Site Name: **Trident Submarine Basin**

General Information

Site Name: Trident Submarine Basin
Site Reference Number: 35
Region: Southeast ***County:*** Brevard
Approximate Latitude: 28.41° N ***Approximate Longitude:*** 80.60° W
Principal Investigator (s): Llewellyn Ehrhart, William Redfoot, Dean Bagley
Contact Address: Department of Biology, P.O. Box 162368, Orlando FL 32816
Contact Email: lmehrhart@earthlink.com
Organizations Involved: University of Central Florida
Organization Type: university
Project Status: active
Active Years: 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006

Start Date: 1993
End Date: n/a

Equipment and Methods

General Method Used: capture, tracking
Visual-Survey Method: n/a
Capture Method: set-netting, dip-netting
Net Type: tangle net ***Net Length:*** 220-240
Mesh Size: 30.5 and 40.0 cm ***Net Depth:*** 3.7 m

Sampling and Effort

Sampling Regime: seasonally
Sampling Locations: consistent netting locations

Sampling-Area Description: man-made submarine basin
Bottom Type: algae mats, rock walls
Water Type: marine
Mean Depth (m): 12.0 (from nautical charts)
Depth Range (m): 0.0-12.0 (from nautical charts)
Effort-Data Availability: yes
Years for which CPUE Calculated: 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006

Method of Calculating CPUE: turtles/km net hr (set net)
Species Found: Cm, Cc

Site Name: **Trident Submarine Basin**

Capture Information *Data current through 2006*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	1223	n/a	22.8	52.0	32.4	O, N
Loggerhead	8	n/a	36.6	70.8	58.3	N, S
Kemp's Ridley	0	n/a	n/a	n/a	n/a	n/a
Hawksbill	0	n/a	n/a	n/a	n/a	n/a
Leatherback	0	n/a	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag, PIT tag, sonic tag, radio tag

Species Exhibiting FP: none

Genetic-Sample Collection: yes
Laparoscopy Performed: no
Growth-Rate Determination: yes
Sex-Ratio Determination: yes
Tracking Studies Conducted: yes
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

The Trident Basin is a man-made embayment lined with rock rip-rap, which is covered by an algal mat. The site is home to a significant number of juvenile green turtles, which contrasts with the predominance of loggerheads in the adjacent ship channel. Very few loggerheads are ever found in the basin, and most of those are sick and have to be taken to rehabilitation facilities. The small size of green turtles in the basin is remarkable in that none is larger than 50 cm. Most other projects in the state capturing juvenile green turtles find individuals greater than 50 cm. This population structure might be explained by the limited biomass of the algal mat in the basin. Diet analysis shows that the turtles mainly eat the algae that grow on the rip-rap.

David Nelson used radio and sonic telemetry on some of the green turtles captured to determine movements and diving patterns. Turtles spent a majority of time near the rocky shoreline on the western side of the basin, which provides cover and feeding habitat. Some turtles moved out of and then back into the basin during predawn hours. Daytime dives were shorter and more frequent than those at night, suggesting that the turtles feed during the day and rest at night. The sex ratio in this project is strongly biased towards females, and FP has not been found on turtles in the basin.

Literature/ Reports Produced:

Bagley, D.A., A.L. Bass, S. Johnson, L.M. Ehrhart, and B.W. Bowen. 1998. Origins of juvenile green turtles from an east central Florida developmental habitat as determined by mtDNA analysis. In: Abreu-Grobois, F.A., R. Briseno Duenas, R. Marquez, and L. Sarti (comps.). Proceedings of the Eighteenth International Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFWC-436, pp. 37.

Ehrhart, L.M., and K.G. Holloway-Adkins. 2000. A comparative study of the feeding ecology of *Chelonia mydas*; the incidental ingestion of *Prorocentrum sp.* and related topics. Final Report to the Bernice Barbour Foundation, 11 pp.

Ehrhart, L.M., and W.E. Redfoot. 2002. The structure, size and feeding ecology of the unique juvenile green turtle population utilizing the Trident Turning Basin, Cape Canaveral Air Force Station, Florida as developmental habitat. Final report to SpecPro, Inc, 37 pp.

Ehrhart, L.M., W.E. Redfoot, and D.A. Bagley. 1996. A study of the population ecology of in-water marine turtle populations on the east-central Florida coast from 1982-96. Comprehensive final report to NOAA/NMFS, 164 pp.

Ehrhart, L.M., W.E. Redfoot, and D.A. Bagley. 1998. Green turtles in three developmental habitats of the Florida Atlantic coast: population structure, fibropapillomatosis and post-juvenile migratory destinations. In: Abreu-Grobois, F.A., R. Briseno Duenas, R. Marquez, and L. Sarti (comps.). Proceedings of the Eighteenth International Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFWC-436, pp. 32.

Ehrhart, L.M., D.A. Bagley, and W.E. Redfoot. 1999. A study of the population ecology of in-water marine turtle populations on the east-central Florida coast, in 1997-98. Final report to NOAA/NMFS, 56 pp.

Ehrhart, L.M., W.E. Redfoot, and D.A. Bagley. 2000. Green turtles in three developmental habitats of the Florida Atlantic coast: population structure, fibropapillomatosis and post-juvenile migratory destinations. In:Abreu-Grobois, F.A., R. Briseno Duenas, R. Marquez, and L. Sarti (comps.). Proceedings of the Eighteenth International Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFWC-436, pp. 32.

Ehrhart, L.M., D.A. Bagley, W.E. Redfoot, S.A. Kubis, and S. Hirama. 2001. In-water population studies of marine turtles on the east-central Florida coast; September, 1999 through December, 2000. Final report to NOAA/NMFS, 53 pp.

Frutchey, K.P., E.S. Dierenfeld, L.M. Ehrhart, and P.C.H. Pritchard. 2002. Plasma levels of two vitamins (Retinol and Tocopherol) essential for immune system function in juvenile marine turtles from Florida. In: Pilcher, N.J. (comp.). Proceedings of the Twenty-Third Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-536, pp. 252.

Hirama, S., and L.M. Ehrhart. 2002. Epizootiology of green turtle fibropapillomatosis on the Florida Atlantic coast. In: Mosier, A., A. Foley, and B. Brost (comps.). Proceedings of the Twentieth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-477, pp. 51

Hirama, S., and. L.M. Ehrhart. 2003. Prevalence of green turtle fibropapillomatosis in three developmental habitats on the east coast of Florida. In: Seminoff, J.A. (comp.). Proceedings of the Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-5, pp. 302.

Holloway-Adkins, K.G., and L.M. Ehrhart. 2000. A comparative study of the feeding ecology of the green turtle (*Chelonia mydas*). Florida Scientist 63(1):44.

Holloway-Adkins, K.G., and L.M. Ehrhart. 2001. A comparison of habitat foraging ecology and the biotoxin okadaic acid in five Florida populations of *Chelonia mydas*. In: Coyne, M.S., and M.D. Clark (comps.). Proceedings of the Twenty-First Annual Symposium on Sea Turtle Conservation and Biology. NOAA Technical Memorandum NMFS-SEFSC-528, pp. 61-63.

Kubis, S.A. 2003. Growth Rates of Juvenile Green Turtles, *Chelonia mydas*, from Three Developmental Habitats Along the East Central Coast of Florida. Master's thesis, University of Central Florida, Orlando, Florida, 60 pp.

Nelson, D.A. 1997. Summer behavior of juvenile green sea turtles (*Chelonia mydas*) in Cape Canaveral Air Station, Trident Submarine Basin, Florida. Report to Patrick Air Force Base, Cape Canaveral Air Station, 45th Space Wing, 51 pp.

Redfoot, W.E., and L.M. Ehrhart. 1998. The feeding ecology of juvenile green turtles utilizing the Trident Basin, Port Canaveral, Florida as developmental habitat. In: Abreu-Grobois, F.A., R. Briseno Duenas, R. Marquez, and L. Sarti (comps.). Proceedings of the Eighteenth International Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFWC-436, pp. 33.

Redfoot, W.E., L.M. Ehrhart, and D.A. Nelson. 1996. A population of juvenile green turtles utilizing the Trident Submarine Basin, Port Canaveral, Florida. In: Keinath, J.A., D.E. Barnard, J.A. Musick, and B.A. (comps.). Proceedings of the Fifteenth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-387, pp. 258-259.

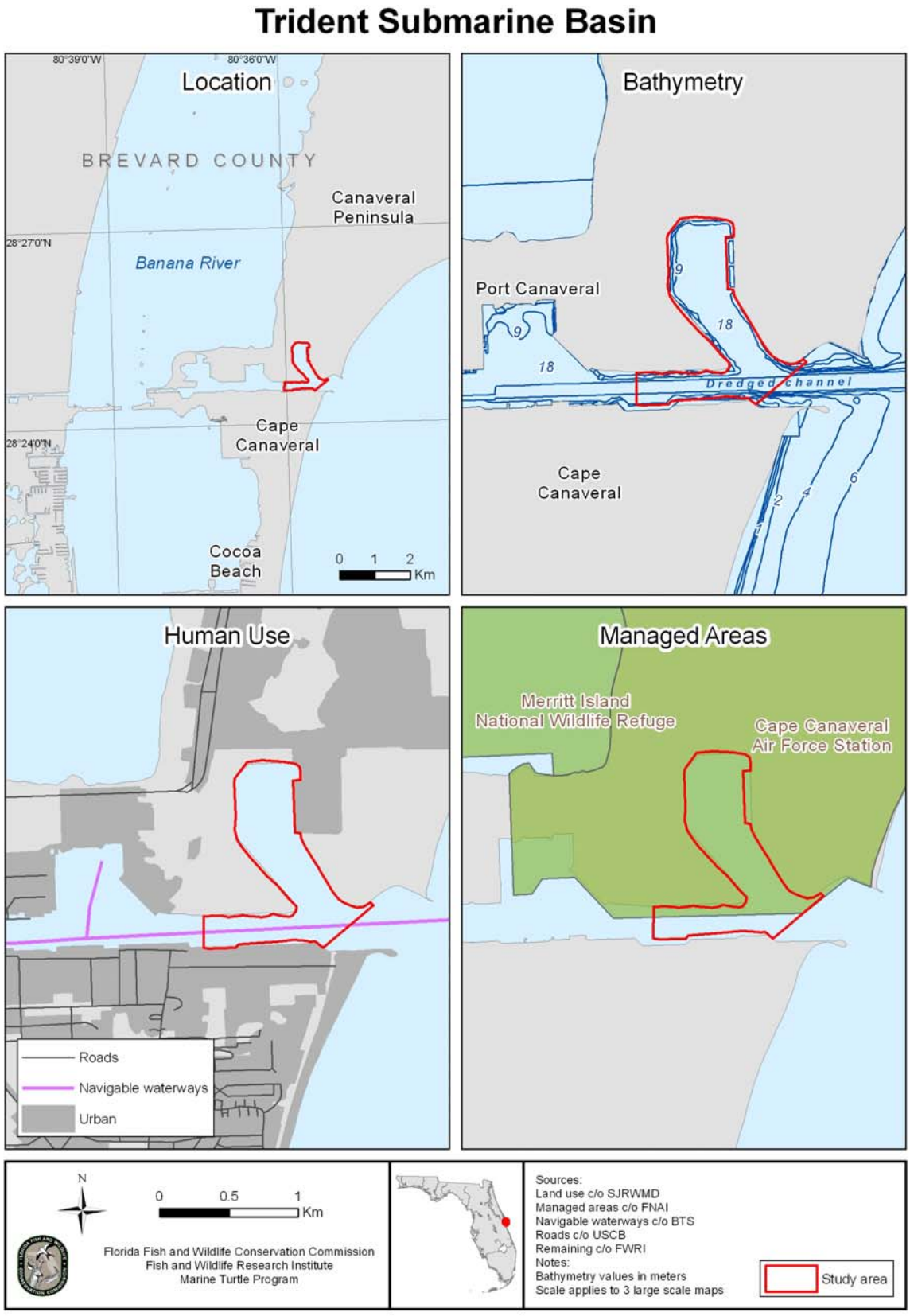

Figure 41 - Trident Submarine Basin study area.

Northeast

The Northeast region (Volusia through Nassau County) has had seven different studies. Four of them are still underway (Figure 42).

Cape Canaveral & Northeast Coast – Schmid (1986-1991)
Mosquito Lagoon – Ehrhart (1976-1979)
Mosquito Lagoon – Provancha (1994-active)
Northeast Coast – Wenner & Webster (1989-active)
Northeast Coast – Segars *et al*. (2000-active)
Epipelagic Drift Community – Northeast – Witherington (2005-active)
Fernandina Harbor – Dickerson *et al.* (1991-1993)

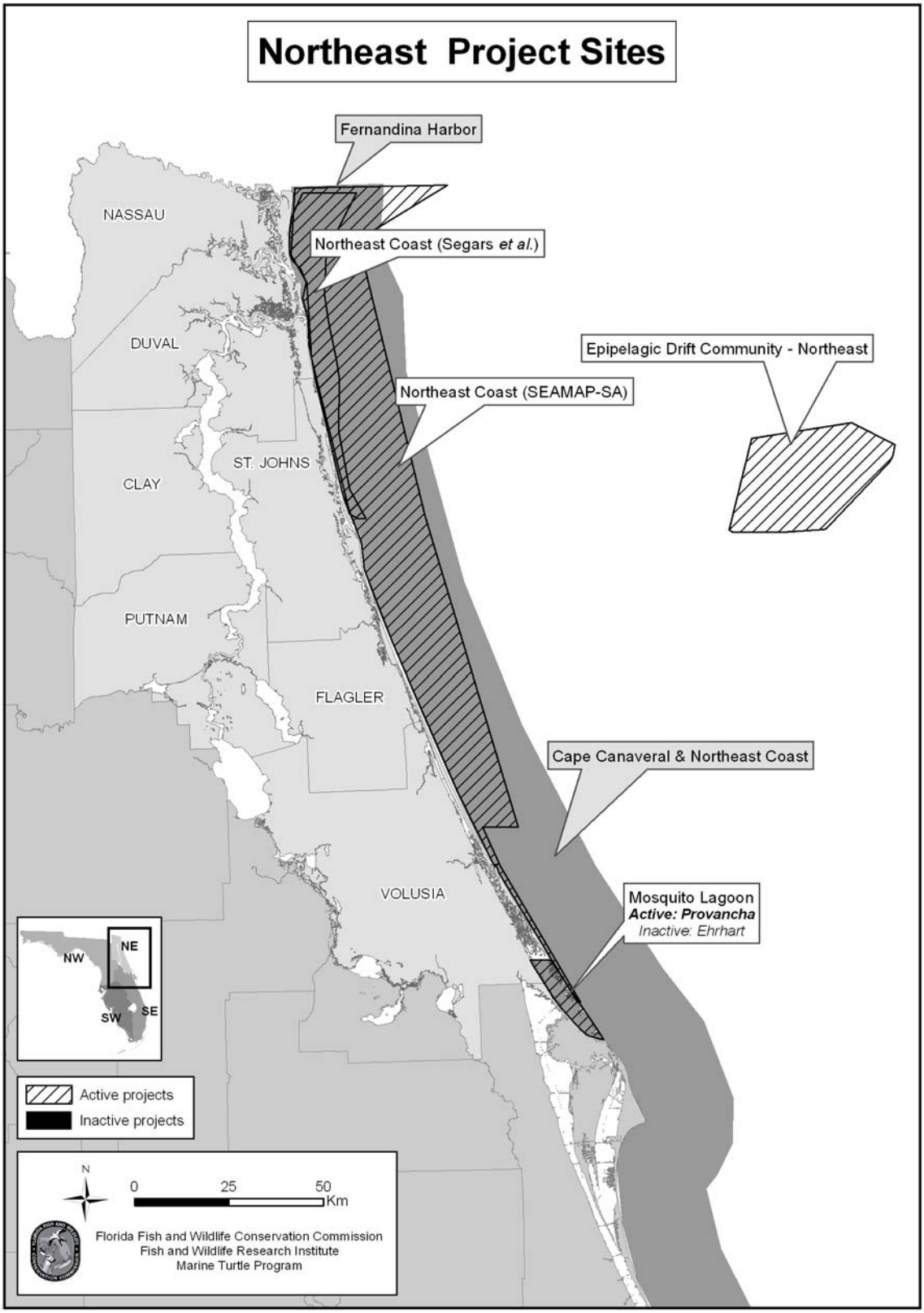

Figure 42 - Northeast Florida in-water projects. Inactive projects described with shaded callout boxes.

Site Name: **Cape Canaveral & Northeast Coast**

General Information

Site Name: Cape Canaveral & Northeast Coast
Site Reference Number: 36
Region: Northeast ***County:*** Brevard, Volusia, Flagler, St. Johns, Duval, Nassau
Approximate Latitude: 29.22° N ***Approximate Longitude:*** 80.82° W
Principal Investigator (s): Jeffrey Schmid
Contact Address: 1450 Merrihue Dr., Naples, FL 34102
Contact Email: jeffs@conservancy.org
Organizations Involved: NMFS
Organization Type: federal agency
Project Status: inactive
Active Years: 1986, 1987, 1988, 1989, 1990, 1991

Start Date: May 1986
End Date: December 1991

Equipment and Methods

General Method Used: capture
Visual-Survey Method: n/a
Capture Method: trawling via contract with shrimpers
Net Type: trawl net ***Net Length:*** 30.5 m
Mesh Size: unknown ***Net Depth:*** n/a

Sampling and Effort

Sampling Regime: monthly
Sampling Locations: various locations within study area

Sampling-Area Description: channel/pelagic
Bottom Type: channel, hardbottom, pelagic
Water Type: marine
Mean Depth (m): 17.8
Depth Range (m): 0.0-26.6
Effort-Data Availability: yes
Years for which CPUE Calculated: 1986, 1987, 1988, 1989, 1990, 1991

Method of Calculating CPUE: turtles/trawl hr
Species Found: Cm, Cc, Lk, Dc

Site Name: **Cape Canaveral & Northeast Coast**

Capture Information *Data current through 1991*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	41	n/a	24.0	55.4	36.0	O, N
Loggerhead	774	n/a	38.2	110.0	67.7	N, S, A
Kemp's Ridley	113	n/a	21.5	60.3	37.0	O, N, S, A
Hawksbill	0	n/a	n/a	n/a	n/a	n/a
Leatherback	1	n/a	n/r	n/a	n/r	n/r

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag

Species Exhibiting FP: none

Genetic-Sample Collection: no
Laparoscopy Performed: no
Growth-Rate Determination: yes
Sex-Ratio Determination: yes
Tracking Studies Conducted: no
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

Size classes of loggerheads present at the study site varied seasonally. Researchers found a decrease in captures of subadults from April to July, whereas adult abundance increased. Loggerheads were present year round, although the total monthly captures were highest during November, December, and January. Eighty percent of total loggerhead captures were subadults; 20% were adults.

More Kemp's ridleys were captured in the winter months and, with one exception, were small to mid-size subadults. Green turtles were captured from November to January, all juveniles (< 40 cm SSCL).

The majority of the study's trawling effort occurred between May and December, which corresponds to the shrimping season. CPUE for loggerheads ranged from 0.02 turtles/net hour to 1.09 turtles/net hour. The maximum CPUEs for Kemp's ridleys and green turtles were 0.25 and 0.05 turtles/net hour, respectively. These values are likely representative of turtles taken during overall commercial fishing efforts off Cape Canaveral.

Short-term growth rates were calculated for some turtles but were based only on recaptures made within less than one year.

Literature/ Reports Produced:

Schmid, J.R. 1995. Marine turtle populations on the east-central coast of Florida: results of tagging studies at Cape Canaveral, FL, 1986-1991. Fishery Bulletin 93:139-151.

Schmid, J.R., and W.N. Witzell. 1997. Age and growth of wild Kemp's ridley turtles (*Lepidochelys kempi*): cumulative results of tagging studies in Florida. Chelonian Conservation and Biology 2(4):532-537.

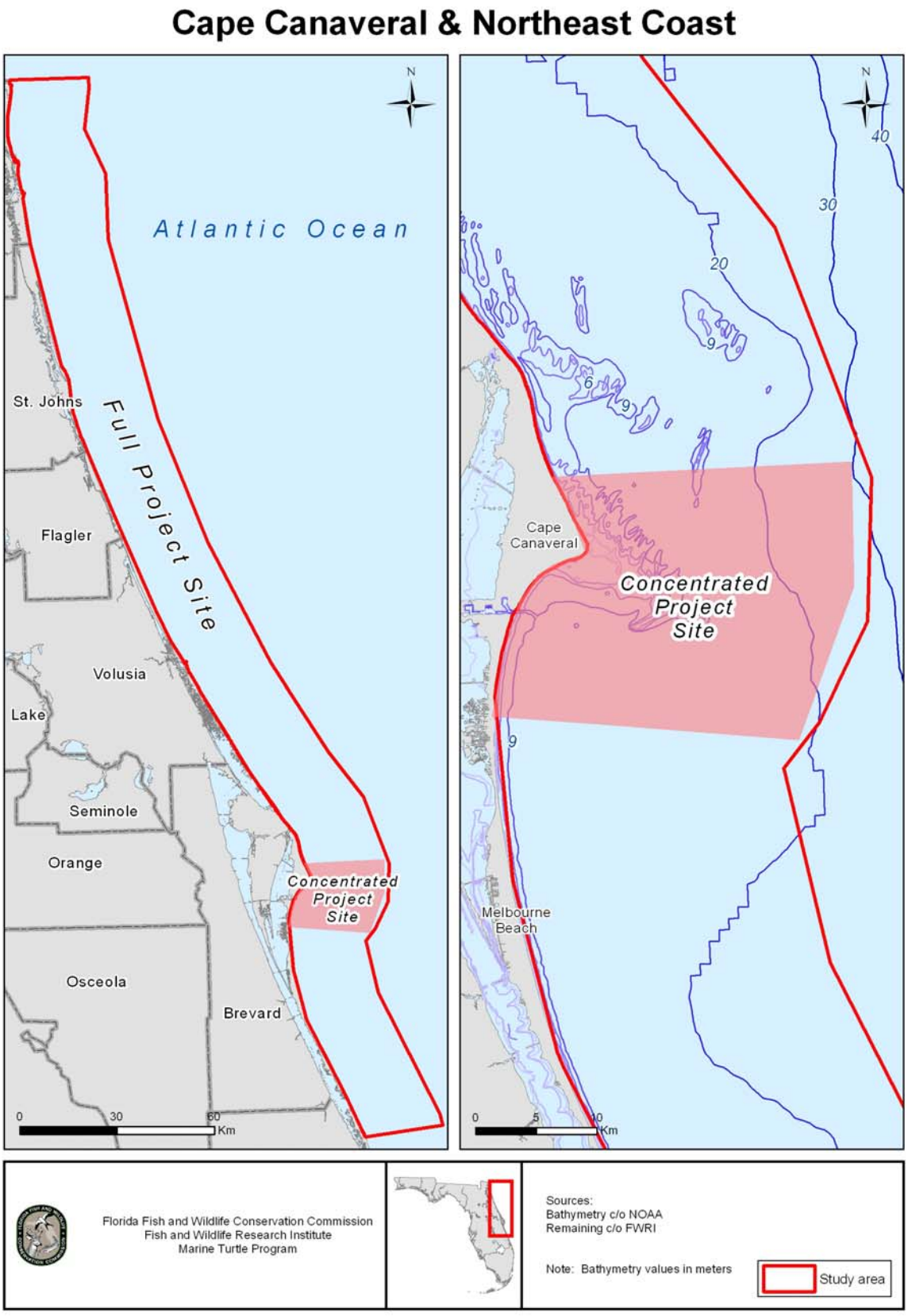

Figure 43 - Cape Canaveral & Northeast Coast study area.

Site Name: **Mosquito Lagoon (Ehrhart)**

General Information

Site Name: Mosquito Lagoon (Ehrhart)
Site Reference Number: 37
Region: Northeast ***County:*** Brevard, Volusia
Approximate Latitude: 28.76° N ***Approximate Longitude:*** 80.74° W
Principal Investigator (s): Llewellyn Ehrhart
Contact Address: Department of Biology, P.O. Box 162368, Orlando FL 32816
Contact Email: lmehrhart@earthlink.com
Organizations Involved: University of Central Florida
Organization Type: university
Project Status: inactive
Active Years: 1976, 1977, 1978, 1979

Start Date: July 1976
End Date: April 1979

Equipment and Methods

General Method Used: capture, tracking
Visual-Survey Method: n/a
Capture Method: set-netting
Net Type: tangle net ***Net Length:*** 150-230 m
Mesh Size: 30.5 - 38.1 cm ***Net Depth:*** 3.7 m

Sampling and Effort

Sampling Regime: monthly
Sampling Locations: netting focused on areas adjacent to extensive seagrass areas

Sampling-Area Description: lagoon
Bottom Type: seagrass, sand
Water Type: estuarine
Mean Depth (m): 0.7
Depth Range (m): 0.0-2.0
Effort-Data Availability: yes
Years for which CPUE Calculated: 1976, 1977, 1978, 1979

Method of Calculating CPUE: turtles/km net hr
Species Found: Cm, Cc

Site Name: **Mosquito Lagoon (Ehrhart)**

Capture Information *Data current through 1979*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	23	n/a	29.5	75.4	n/r	N, S
Loggerhead	82	n/a	44.0	92.5	n/r	N, S, A
Kemp's Ridley	0	n/a	n/a	n/a	n/a	n/a
Hawksbill	0	n/a	n/a	n/a	n/a	n/a
Leatherback	0	n/a	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: monel tag, sonic tag

Species Exhibiting FP: none

Genetic-Sample Collection: no
Laparoscopy Performed: no
Growth-Rate Determination: yes
Sex-Ratio Determination: yes
Tracking Studies Conducted: yes
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

Netting took place at six main sites throughout Mosquito Lagoon between July 1976 and April 1979. The most productive sites for green turtle captures were adjacent to extensive seagrass areas. Loggerheads were captured throughout the year, but the most productive months were from April to October. Low overall catch rates of the species could have been due to a sampling bias towards the warmer months. Green turtles were captured more frequently in warmer months, especially August, than in cooler months.

Green turtles remained in the lagoon for extended periods of time, suggesting residency. The size structures of the loggerhead and green turtle populations were different: all captured green turtles were immature, whereas some captured loggerheads were adults.

Recapture data suggested that there was more immigration of loggerheads than green turtles into the lagoon. In addition, it appeared that the population structure of each species varied in the lagoon, suggesting possible differences in habitat use. Although both species entered the lagoon around the same time, recaptured loggerheads appeared to grow twice as fast as recaptured green turtles and may leave the lagoon earlier than do green turtles. Green turtles and loggerheads may use the lagoon at different life stages, or loggerheads may simply grow faster than green turtles.

Ehrhart and Mendonca found that green turtles adopted home ranges at water temperatures above 25° C and remained active at water temperatures between 18° C and 34° C. Green turtles occupied deeper waters when water temperatures dropped to between 11° C and 18° C and apparently stopped feeding. Diurnal feeding behavior was observed in the telemetered turtles.

Literature/ Reports Produced:

Ehrhart, L.M. 1976. Studies of marine turtles at KSC and an annotated list of amphibians and reptiles of Merritt Island. Office of Graduate Studies and Research, Florida Technological University, Orlando, Florida, 119 pp.

Ehrhart, L.M. 1976. A study of a diverse coastal ecosystem on the Atlantic coast of Florida; studies of marine turtles at KSC and an annotated list of amphibians and reptiles of Merritt Island. Final report grant no. NGR 10-019-004.

Ehrhart, L.M. 1977. Threatened and endangered species of the Kennedy Space Center. In: Vickers, D.H. (ed.). Annual Report: a Continuation of Baseline Studies for Environmentally Monitoring Space Transportations Systems (STS) at John F. Kennedy Space Center. NASA Contract Report NAS10-8986, pp. 587-617.

Ehrhart, L.M. 1980. A continuation of baseline studies for environmentally monitoring space transportation systems (STS) at John F. Kennedy Space Center. Volume 4: Threatened and endangered species of the Kennedy Space Center. Part 1. Marine turtle studies. Final report to the National Aeronautics and Space Administration, NASA Contract Report 163122, 416 pp.

Mendonca, M.T. 1981. Comparative growth rates of wild immature *Chelonia mydas* and *Caretta caretta* in Florida. Journal of Herpetology 15:447-451.

Mendonca, M.T. 1983. Movements and feeding ecology of immature green turtles (*Chelonia mydas*) in a Florida lagoon. Copeia 1983:1013-1023.

Mendonca, M.T., and L.M. Ehrhart. 1982. Activity, population size, and structure of immature *Chelonia mydas* and *Caretta caretta* in Mosquito Lagoon, Florida. Copeia 1982:161-167.

Schroeder, B.A., and D.W. Owens. 1994. Sex ratio of immature green turtles in an east central Florida developmental habitat. In: Schroeder, B.A., and B.E. Witherington (comps.). Proceedings of the Thirteenth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-341, pp. 157-161.

Witherington, B.E., and L.M. Ehrhart. 1989. Hypothermic stunnings and mortality of marine turtles in the Indian River Lagoon System, Florida. Copeia 1989:696-703.

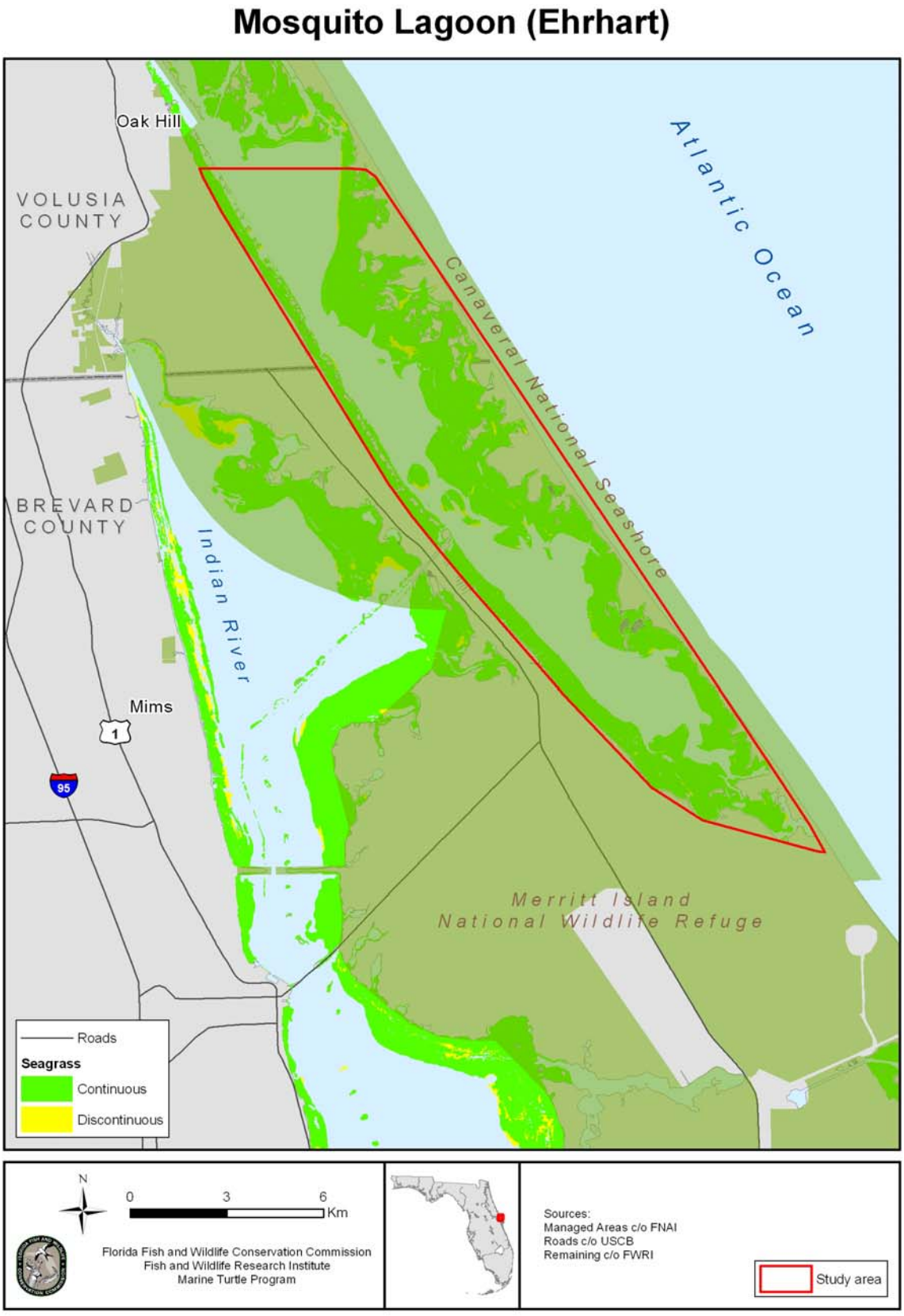

Figure 44 - Ehrhart Mosquito Lagoon study area.

Site Name: **Mosquito Lagoon (Provancha)**

General Information

Site Name: Mosquito Lagoon (Provancha)
Site Reference Number: 38
Region: Northeast ***County:*** Brevard, Volusia
Approximate Latitude: 28.76° N ***Approximate Longitude:*** 80.74° W
Principal Investigator (s): Jane Provancha
Contact Address: 7001 N. Atlantic Ave., Suite 113, Cape Canaveral, FL 32920
Contact Email: jprovancha@dynamac.com
Organizations Involved: NASA/Dynamac Corp.
Organization Type: federal agency, consulting firm
Project Status: active
Active Years: 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006

Start Date: 1994
End Date: n/a

Equipment and Methods

General Method Used: capture, tracking
Visual-Survey Method: n/a
Capture Method: set-netting
Net Type: tangle net ***Net Length:*** 2@240 m
Mesh Size: 9x9 cm ***Net Depth:*** 3.6 m

Sampling and Effort

Sampling Regime: seasonally
Sampling Locations: various locations within study area

Sampling-Area Description: lagoon
Bottom Type: seagrass, sand
Water Type: estuarine
Mean Depth (m): 0.7
Depth Range (m): 0.0-2.0
Effort-Data Availability: yes
Years for which CPUE Calculated: 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006
Method of Calculating CPUE: turtles/km net hr
Species Found: Cm, Cc

Site Name: **Mosquito Lagoon (Provancha)**

Capture Information *Data current through 2006*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	172	n/a	33.2	83.8	50.3	N, S, A
Loggerhead	23	n/a	51.2	97.3	78.6	N, S
Kemp's Ridley	0	n/a	n/a	n/a	n/a	n/a
Hawksbill	0	n/a	n/a	n/a	n/a	n/a
Leatherback	0	n/a	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag, PIT tag, sonic tag

Species Exhibiting FP: Cm

Genetic-Sample Collection: yes
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: yes
Tracking Studies Conducted: yes
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

Mosquito Lagoon continues to provide important developmental habitat for juvenile green and loggerhead turtles. The conditions of the seagrass beds and the water quality are relatively good and are notably protected by the surrounding federal lands. Current threats to turtles in this body of water are related to boating pressure that has increased with the recent surge in local commercial and recreational fishing (trout and redfish). This could result in turtle harassment, boat strikes, and grassbed scarring, among other effects.

This project uses the same study location as Ehrhart used previously, allowing it's data to be compared to his historical data. Green turtles now represent more than 90% of the captures, which differs greatly from the species composition observed by Ehrhart in the 1970s, when 80% of the netting captures were loggerheads. Provancha *et al*. have quantified very low numbers of *Limulus polyphemus* (horseshoe crabs) in the tangle nets as compared to observations from two decades ago, when very large numbers of *Limulus* were incidentally captured in the nets. This finding is of interest because *Limulus* is known to be a common food item for loggerheads.

Recapture rates are relatively low at 10%. The CPUEs are also low in Mosquito Lagoon when compared to other study locations in Florida (overall mean of 0.52 turtles per net kilometer). Winter cold fronts may significantly influence the numbers of turtles in Mosquito Lagoon, but only one moderate cold-stunning event has occurred here since 1989. Some site fidelity has been demonstrated, based on recaptures and acoustic tracking within Mosquito Lagoon. Researchers have also observed connectivity to other sites within the Indian River Lagoon, whereby animals from the other sites are occasionally found in Mosquito Lagoon and vice versa.

FP is externally present in many green turtles, with an average rate of encounter of 50%. No signs of FP have been observed in loggerheads. Four green turtles showed some level of tumor reduction upon recapture, one of which exhibited total regression.

Data collected include passive acoustic tracking of 15 turtles (three from rehabilitation facilities) to yield more detail on travel and use patterns within Mosquito Lagoon and in the northern Indian River Lagoon. Other data include sex ratios and genetic composition.

Literature/ Reports Produced:

Provancha, J. 2006. Annual report for sea turtle netting in Mosquito Lagoon: Reference Florida Permit #114, NMFS Permit #1450. 13 January 2006, 11 pp.

Provancha, J. 1995-2004. Annual reports for sea turtle netting in Mosquito Lagoon: Reference Florida Permit #114, NMFS Permit #942.

Provancha, J., R. Lowers, D. Scheidt, M. Mota, and M. Corsello. 1998. Relative abundance and distribution of marine turtles inhabiting Mosquito Lagoon, Florida, USA. In: Epperly, S.P., and J. Braun (comps.). Proceedings of the Seventeenth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-415, pp. 78-79.

Provancha, J.A., M.J. Mota, K.G. Holloway-Adkins, E.A. Reyier, R.H. Lowers, D.M. Scheidt, and M. Epstein. 2005. Mosquito Lagoon sea turtle cold stun event of January 2003, Kennedy Space Center, Merritt Island National Wildlife Refuge, FL. Florida Scientist 68(2):114-121.

Provancha, J.A., R. Lowers, M. Mota, K. Holloway-Adkins, E. Reyier, and D. Scheidt. 2006. Trials and tribulations of tracking sea turtles in Mosquito Lagoon- trends in abundance and results from the passive acoustic monitoring network. In: Frick, M., A. Panagopoulou, A. Rees, and K. Williams (comps.). Book of abstracts. Twenty-Sixth Annual Symposium on Sea Turtle Biology and Conservation. International Sea Turtle Society, Athens, Greece, pp. 209.

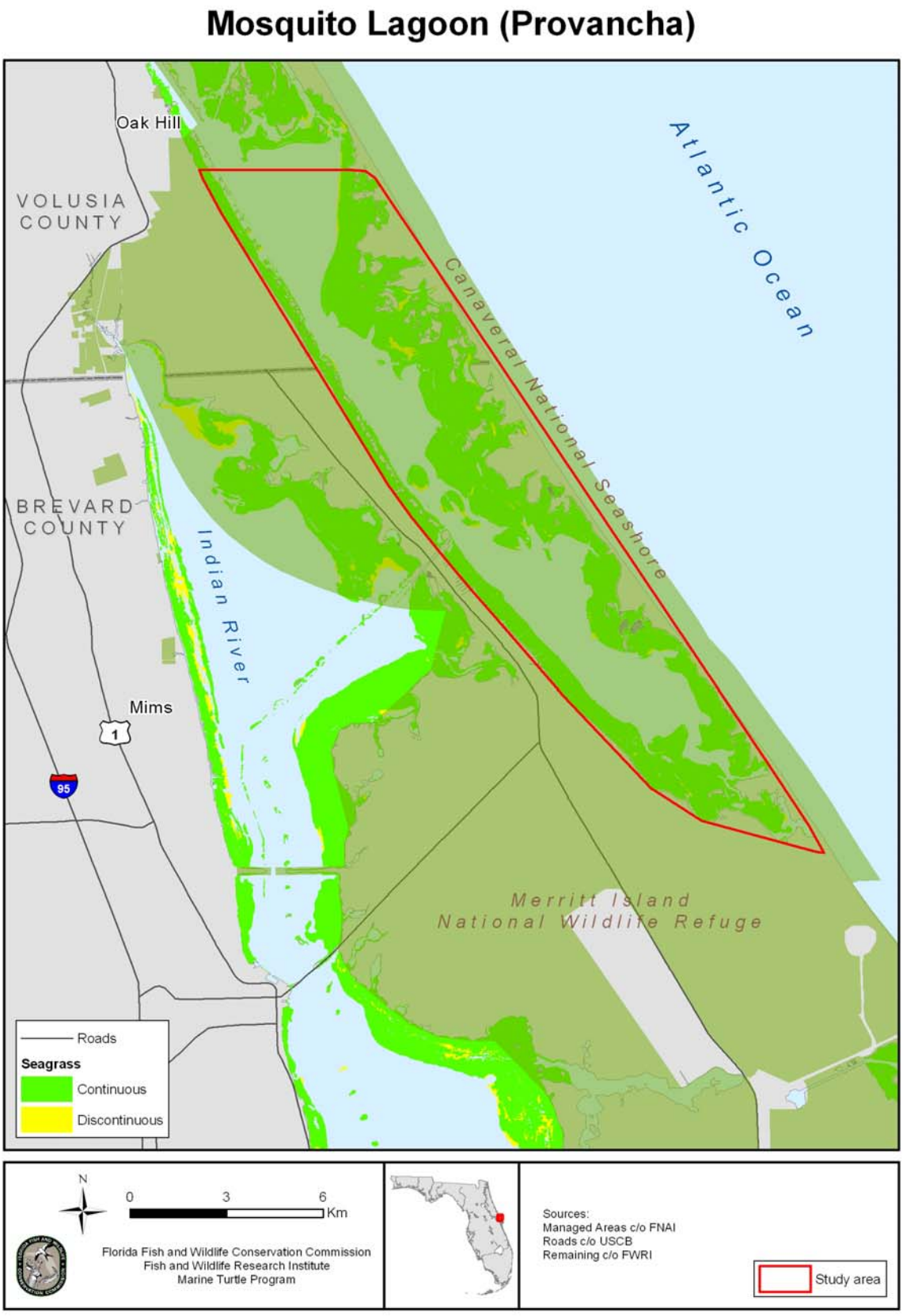

Figure 45 - Provancha Mosquito Lagoon study area.

Site Name: **Northeast Coast (SEAMAP-SA)**

General Information

Site Name: Northeast Coast (SEAMAP-SA)
Site Reference Number: 39
Region: Northeast ***County:*** Volusia, Flagler, St. Johns, Duval, Nassau
Approximate Latitude: 30.42° N ***Approximate Longitude:*** 81.35° W
Principal Investigator (s): Elizabeth Wenner, Pearse Webster
Contact Address: P.O. Box 12559, Charleston, SC 29422
Contact Email: websterp@dnr.sc.gov
Organizations Involved: South Carolina DNR
Organization Type: state agency
Project Status: active
Active Years: 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006

Start Date: April 1989
End Date: n/a

Equipment and Methods

General Method Used: capture
Visual-Survey Method: n/a
Capture Method: trawling
Net Type: trawl net ***Net Length:*** 75' head rope
Mesh Size: 1 7/8" ***Net Depth:*** n/a

Sampling and Effort

Sampling Regime: spring, summer, fall
Sampling Locations: random subsample of set stations

Sampling-Area Description: pelagic
Bottom Type: pelagic
Water Type: marine
Mean Depth (m): 11.7
Depth Range (m): 4.6-19.7 (*4.6-9.1 since 2001)*
Effort-Data Availability: yes
Years for which CPUE Calculated: 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006

Method of Calculating CPUE: turtles/trawl hr
Species Found: Cm, Cc, Lk, Dc

Site Name: **Northeast Coast (SEAMAP-SA)**

Capture Information *Data current through 2006*

	Number of Captures	*Number of Sightings*	*Size*† (cm) Min and Max*		*Mean Size*† (cm)*	*Life Stages Captured***
Green Turtle	5	n/a	31.9 SCL_{min}	65.0 SCL_{min}	48.4 SCL_{min}	N
Loggerhead	127	n/a	52.2 SCL_{min}	84.0 SCL_{min}	64.9 SCL_{min}	N, S, A
Kemp's Ridley	6	n/a	46.0 SCL_{min}	53.8 SCL_{min}	50.5 SCL_{min}	S
Hawksbill	0	n/a	n/a	n/a	n/a	n/a
Leatherback	2	n/a	148.6	149.5	149.1	A

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported
†SCL measurements were not collected prior to 1996

Other Information Collected

Tag Type: Inconel tag, PIT tag

Species Exhibiting FP: none

Genetic-Sample Collection: no
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: no
Tracking Studies Conducted: no
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

This study area is just a portion of the larger study area used in the Southeast Area Monitoring and Assessment Program – South Atlantic Coastal Survey, which extends from Cape Hatteras, NC, to Cape Canaveral, FL. SEAMAP is a fishery-independent trawl survey which does not specifically target any species. Sea turtles are one of several "priority species" from which more detailed data are collected.

Loggerheads were the most prevalent sea turtle species captured. Loggerhead densities were highest off the Florida coast and decreased northward. Seasonal density did not vary.

Literature/ Reports Produced:

SEAMAP-SA Shallow Water Trawl Survey. 2003. Results of Trawling Efforts in the Coastal Habitat of the South Atlantic Bight, 2003. Annual report to NMFS, 97 pp.

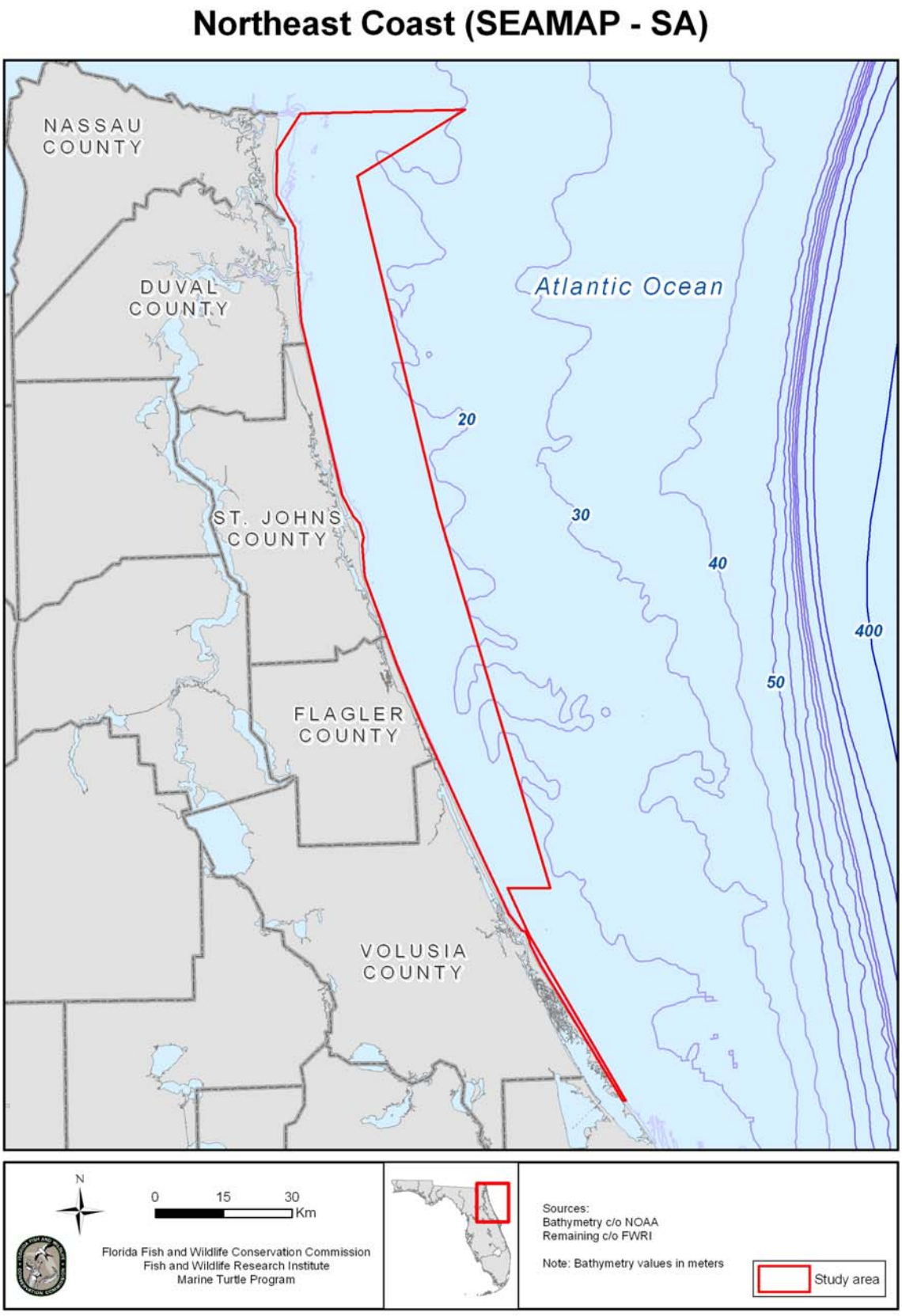

Figure 46 - SEAMAP-SA Northeast Coast study area.

Site Name: **Northeast Coast (Segars *et al.*)**

General Information

Site Name: Northeast Coast (Segars *et al*.)
Site Reference Number: 40
Region: Northeast ***County:*** St. Johns, Duval, Nassau
Approximate Latitude: 29.98° N ***Approximate Longitude:*** 81.17° W
Principal Investigator (s): Al Segars, David Whitaker, Michael Arendt, Phillip Maier
Contact Address: P.O. Box 12559, Charleston, SC 29422
Contact Email: segarsa@dnr.sc.gov
Organizations Involved: South Carolina DNR
Organization Type: state agency
Project Status: active
Active Years: 2000, 2001, 2002, 2003 (***planned to resume by 2008*)

Start Date: July 2000
End Date: n/a

Equipment and Methods

General Method Used: capture
Visual-Survey Method: n/a
Capture Method: trawling
Net Type: trawl net ***Net Length:*** 60’ head rope
Mesh Size: 8 inch stretch ***Net Depth:*** n/a

Sampling and Effort

Sampling Regime: annually
Sampling Locations: subsample of set stations

Sampling-Area Description: pelagic and nearshore
Bottom Type: pelagic, sand
Water Type: marine
Mean Depth (m): 0.9
Depth Range (m): 0.0-6.0
Effort-Data Availability: yes
Years for which CPUE Calculated: 2000, 2001, 2002, 2003
Method of Calculating CPUE: turtles/trawl hr
Species Found: Cm, Cc, Lk

Site Name: **Northeast Coast (Segars *et al.*)**

Capture Information *Data current through 2006*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	7	n/a	27.6	30.6	29.5	N
Loggerhead	827	n/a	44.8	103.5	67.5	N, S, A
Kemp's Ridley	55	n/a	26.7	62.1	45.4	N, S, A
Hawksbill	0	n/a	n/a	n/a	n/a	n/a
Leatherback	0	n/a	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag, PIT tag

Species Exhibiting FP: none

Genetic-Sample Collection: yes
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: yes
Tracking Studies Conducted: no
Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

This project was designed to provide a standardized measure of relative abundance of sea turtles along the southeastern coast of the United States from Winyah Bay, SC, to St. Augustine, FL. Researchers employed fisheries-independent trawl sampling to capture turtles.

Loggerheads were the primary sea turtle species captured. Catch per unit effort of loggerheads was higher in this study than it was in the 1970s and 1980s. Loggerhead catch rates were also significantly higher than those reported by commercial shrimp trawlers in the same area. Catch rates ranged from 0.48 to 0.59 loggerheads per trawl-net-hour. The researchers believe that their higher CPUE values reflect an increase in the juvenile loggerhead population since the 1980s, but they also noted a trend of reduced catch rates of smaller loggerheads over the first four years of the study.

Loggerhead densities increased at lower latitudes. Juvenile loggerheads tended to congregate near inlets, while adults were more evenly distributed. Juveniles also showed stronger site fidelity than adults, as indicated by interannual recaptures.

Literature/ Reports Produced:

Maier, P.P., A.L. Segars, M.D. Arendt, J.D. Whitaker, B.W. Stender, L. Parker, R. Vendetti, D.W. Owens, J. Quattro, and S.R. Murphy. 2004. Development of an Index of Sea Turtle Abundance Based Upon In-water Sampling With Trawl Gear. Final Project Report to NMFS, 92 pp.

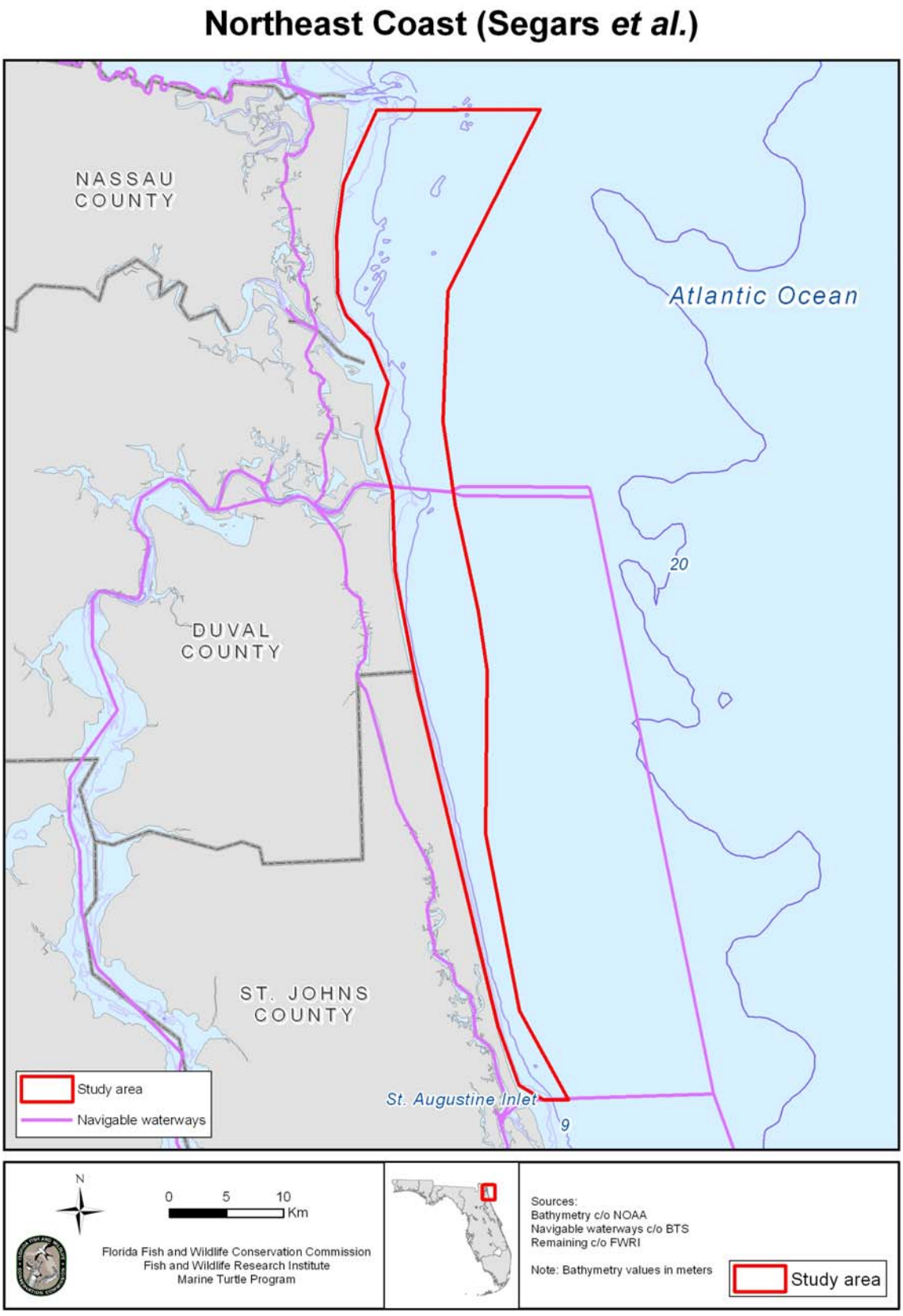

Figure 47 - Segars *et al.* Northeast Coast study area.

Site Name: **Epipelagic Drift Community - Northeast**

General Information

Site Name: Epipelagic Drift Community - Northeast
Site Reference Number: 41
Region: Northeast ***County:*** Outside county boundaries
Approximate Latitude: 29.98° N ***Approximate Longitude:*** 80.03° W
Principal Investigator (s): Blair Witherington
Contact Address: 9700 South A1A, Melbourne Beach, FL 32951
Contact Email: witherington@cfl.rr.com
Organizations Involved: FWC/FWRI
Organization Type: state agency
Project Status: active
Active Years: 2005

Start Date: September 2005
End Date: n/a

Equipment and Methods

General Method Used: capture, visual surveys
Visual-Survey Method: boat-based transects through linear drift habitat
Capture Method: dip-netting from surface
Net Type: dip net ***Net Length:*** n/a
Mesh Size: 0.25-1.5 in. ***Net Depth:*** n/a

Sampling and Effort

Sampling Regime: opportunistic
Sampling Locations: various locations within study area

Sampling-Area Description: pelagic downwelling zones, drift lines, *Sargassum* patches
Bottom Type: pelagic
Water Type: marine
Mean Depth (m): 460.1
Depth Range (m): 108.9-737.3
Effort-Data Availability: yes
Years for which CPUE Calculated: 2005

Method of Calculating CPUE: turtles/km^2 transect
Species Found: Cc

Site Name: **Epipelagic Drift Community - Northeast**

Capture Information *Data current through 2006*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	0	0	n/a	n/a	n/a	n/a
Loggerhead	13	0	4.5	7.2	5.2	O
Kemp's Ridley	0	0	n/a	n/a	n/a	n/a
Hawksbill	0	0	n/a	n/a	n/a	n/a
Leatherback	0	0	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: n/a

Species Exhibiting FP: none

Genetic-Sample Collection: no
Laparoscopy Performed: no
Growth-Rate Determination: no
Sex-Ratio Determination: no
Tracking Studies Conducted: no
Evidence of Site Fidelity: no

General Findings/ Miscellaneous:

The northeast epipelagic drift community study focuses on the Florida Current off St. John's County. All captures thus far have been of small oceanic-stage juvenile loggerheads. See the narrative under Epipelagic Drift Community – Northwest for more information on the broader study and literature produced.

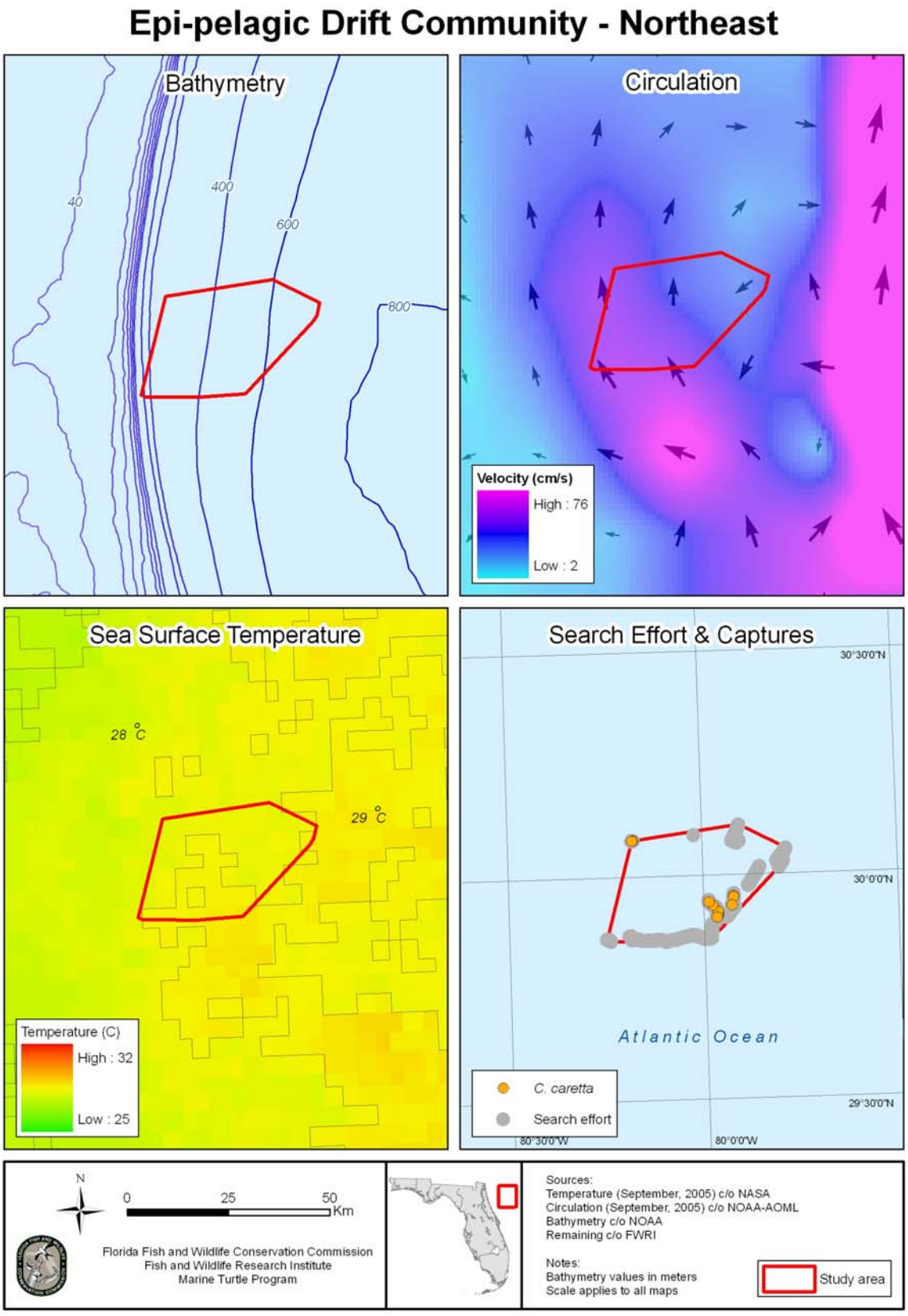

Figure 48 - Epipelagic Drift Community - Northeast study area.

Site Name: **Fernandina Harbor**

General Information

Site Name: Fernandina Harbor
Site Reference Number: 42
Region: Northeast ***County:*** Nassau
Approximate Latitude: 30.71° N ***Approximate Longitude:*** 81.33° W
Principal Investigator (s): Dena Dickerson, Charles Dickerson, Kevin Reine, David Nelson
Contact Address: 3909 Halls Ferry Road, Vicksburg, MS 39180
Contact Email: dena.d.dickerson@erdc.usace.army.mil
Organizations Involved: USACE
Organization Type: federal agency
Project Status: inactive
Active Years: 1991, 1992, 1993

Start Date: October 1991
End Date: March 1993

Equipment and Methods

General Method Used: capture
Visual-Survey Method: n/a
Capture Method: trawling
Net Type: trawl net ***Net Length:*** unknown
Mesh Size: unknown ***Net Depth:*** n/a

Sampling and Effort

Sampling Regime: monthly
Sampling Locations: set stations sampled 6-10 times per month

Sampling-Area Description: dredged channel
Bottom Type: channel
Water Type: marine
Mean Depth (m): 12.9
Depth Range (m): 7.0-16.7
Effort-Data Availability: yes
Years for which CPUE Calculated: 1991, 1992, 1993

Method of Calculating CPUE: turtles/trawl nm; turtles/trawl hr; turtles/trawl tow
Species Found: Cm, Cc, Lk

Site Name: **Fernandina Harbor**

Capture Information *Data current through 1993*

	Number of Captures	*Number of Sightings*	*Size* (cm) Min and Max*		*Mean Size* (cm)*	*Life Stages Captured***
Green Turtle	1	0	30.4	n/a	30.4	N
Loggerhead	125	0	43.4	92.4	63.9	N, S, A
Kemp's Ridley	8	0	31.1	60.7	43.2	N, S, A
Hawksbill	0	0	n/a	n/a	n/a	n/a
Leatherback	0	0	n/a	n/a	n/a	n/a

**** All size measurements are SSCL unless otherwise indicated***
***** For Cm, Cc, Lk, & Ei: O - Oceanic-stage juvenile; N - Neritic-stage juvenile; S - Subadult; A - Adult. For Dc: I - Immature; A - Adult. Based on reported size ranges and life stage sizes in Appendix C***
n/a=not applicable; n/r=not reported

Other Information Collected

Tag Type: Inconel tag, PIT tag

Species Exhibiting FP: none

Genetic-Sample Collection: no

Laparoscopy Performed: no

Growth-Rate Determination: no

Sex-Ratio Determination: no

Tracking Studies Conducted: no

Evidence of Site Fidelity: yes

General Findings/ Miscellaneous:

The Army Corps of Engineers initiated a series of trawl surveys for sea turtles in shipping channels along the southeastern coast of the United States in an effort to determine the seasonality of sea turtle occurrence in the channels. Hopper dredging operations could then be scheduled around sea turtle occurrence in the future.

Sea turtles started returning to the Fernandina Harbor channel in early April and remained in the area until early December. The peak month for captures was October. Juvenile loggerheads made up the majority of turtles captured in the channel. Loggerheads originally captured in Fernandina Harbor were later captured in channel trawl surveys in Brunswick Harbor and Cape Canaveral. Kemp's ridleys were more commonly observed in Fernandina Harbor than in any channel surveyed except Brunswick Harbor.

Literature/ Reports Produced:

Dickerson, D.D., K.J. Reine, D.A. Nelson, and C.E. Dickerson, Jr. 1995. Assessment of Sea Turtles Abundance in Six South Atlantic U.S. Channels. U.S. Army Corps of Engineers, Waterways Experiment Station Miscellaneous Paper EL-95-5, 129 pp.

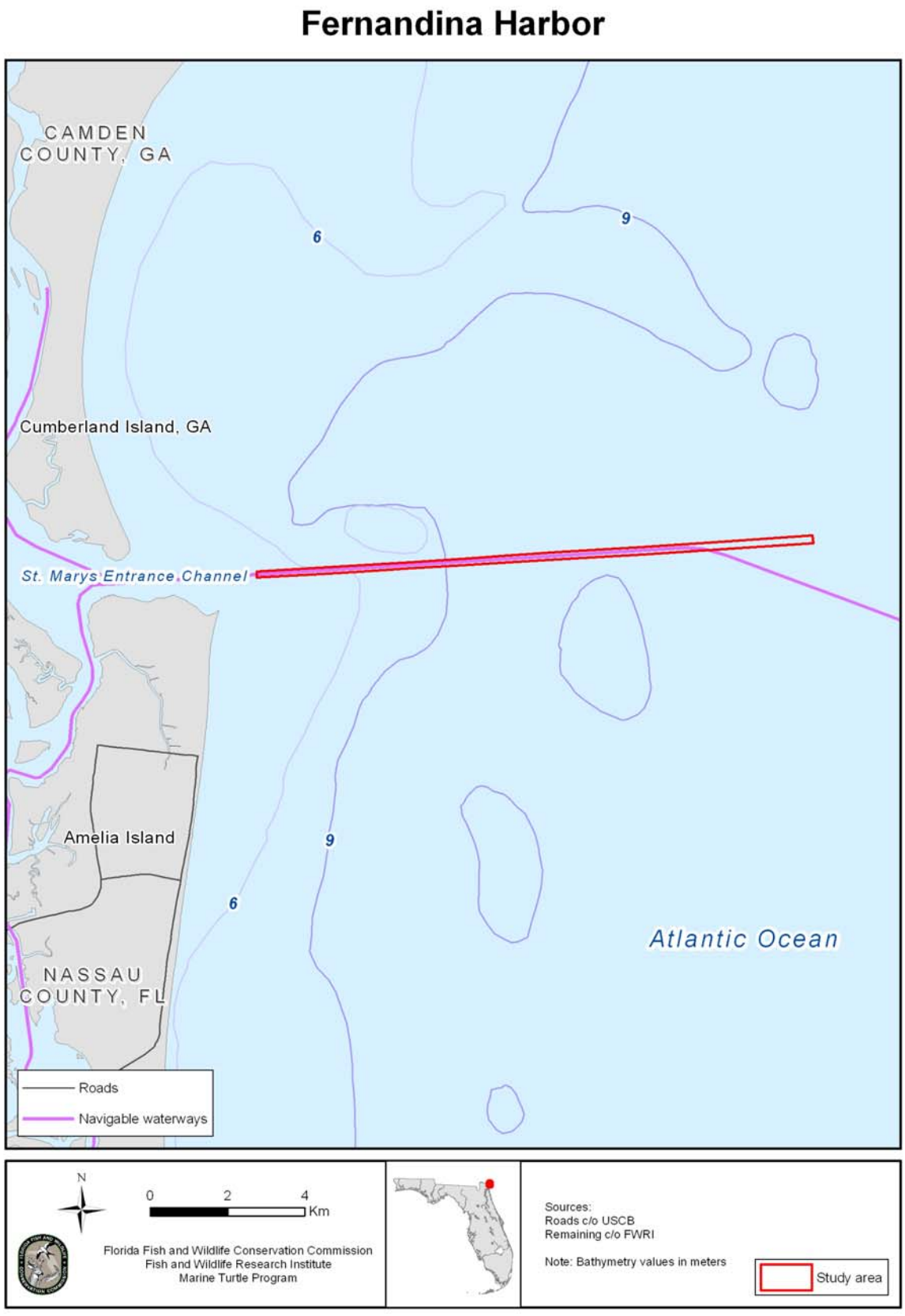

Figure 49 - Fernandina Harbor study area.

Sampling Methods

Sampling regimes varied by project. Most commonly, researchers sampled opportunistically (14 of 42 projects) whenever conditions were favorable. Studies employing only visual surveys involved a more regular sampling schedule, either monthly (one project) or seasonally (usually 3 to 4 trips per year; 2 projects). These regimes allowed sighting rates to be compared from year to year. Many capture projects employed seasonal sampling (10 projects) to examine how sea turtle aggregations change throughout the year. Other sampling regimes of capture-based projects included annual (3 projects), monthly (7 projects), weekly (2 projects), and daily (3 projects).

The methodology for assessing sea turtle aggregations was capture-based in 39 of the in-water projects and sighting-based in three of the in-water projects. Thirteen of the capture-based studies also involved at least some visual surveys. The geographic distribution of these methodologies is shown in Figure 50.

The most commonly used visual method (13 projects) involved boat-based sightings. Sighting data were collected from a vessel by researchers who located sea turtles as they surfaced to breathe or who sighted sea turtles beneath the surface. The species and location were generally noted. Sightings may have been noted opportunistically while the boat was in transit or while researchers were conducting other activities. The preferred boat-based survey method, however, involved conducting standardized transects that used stationed observers. In this method for evaluating relative abundance, two observers were typically stationed atop a viewing platform located a couple of meters above the boat deck, with each observer monitoring a different side of the boat for sea turtles. Another researcher drove the boat in a directed transect that was recorded and used to measure effort. This effort was represented as transect distance or, when an effective perpendicular sighting distance was determined, as transect area (*[effective perpendicular sighting distance]*[transect length]*). The species, exact location, and time of each turtle that surfaced were recorded in order to calculate a catch (or sightings) per unit effort (CPUE; e.g., *turtles/km*).

Methods similar to those used in boat-based transects were employed for both aerial- and dive-transect surveys. In the aerial surveys employed in one of the projects, the observers were stationed inside an airplane rather than on a boat platform. Dive surveys (two projects) involved two divers being towed underwater behind a boat where they noted sightings of sea turtles (Makowski *et al.* 2005). In both of these methods, researchers calculated relative abundance as *turtles/km transect length* or as *turtles/km^2 search area*.

Capture methods varied greatly between projects and were based on the environmental conditions at the study area. We identified eight general techniques used to capture sea turtles, each with a different measure of effort. The specific parameters (e.g., net length, net depth, mesh size) for each of these techniques varied by project. Due to the variations in general capture methods, CPUE units differed between projects. This creates difficulty in analyses using data pooled from all projects.

The method most commonly used to capture sea turtles was set-netting, used in 18 different studies. This technique was used in shallow, turbid waters, where submerged sea turtles were not easily seen, and typically involved a nylon-mesh tangle net up to 500 meters in length that was usually anchored at both ends. The bottom line was weighted so that the net stretched from surface to bottom. Researchers waited for turtles to swim into the net and become entangled, at which time they retrieved them by hand or dip net. CPUE can be measured as *turtles/(length*hours)*, where *length* equals the length of net that is set and *hours* equals the number of hours of soak time for that length of net. Capture location was generally defined as the midpoint of the set net.

Trawling was another common technique used to capture sea turtles and was used in 12 different studies. This was the primary method used to capture sea turtles in deeper waters. One trawl net was typically set from each side of the research vessel. These nets did not have Turtle Excluder Devices (TEDs) installed (by special federal permit) and were generally towed for 15-30 minutes to minimize adverse effects on any sea turtles that were captured. CPUE was measured in several different ways: *turtles/number of tows*, *turtles/tow time*, *turtles/tow area* (*[tow distance]*[combined net width]*), or *turtles/tow volume* (*[tow distance]*[combined area of net mouths]*). Capture location was generally defined as either the geographic or temporal midpoint of the tow.

Strike-netting involved the use of a tangle net similar to that used in set-netting. Employed in six studies, this technique offered a more assertive way of capturing sea turtles in shallow waters, when the animals could only be seen when surfacing. When a sea turtle was spotted, researchers released the net near the turtle and quickly circled the animal while letting out the net. Once the net encircled the turtle, researchers waited until it became entangled in the net and then retrieved the turtle. Effort is typically measured in number of sets, although in some cases, researchers conduct visual transects to spot the sea turtles and base the CPUE on that technique (e.g., *turtles/distance*). Capture location was defined as either the location where the turtle entangled itself in the net or where it was originally spotted.

Dip nets were often used to capture smaller sea turtles, which spend a significant amount of time at the surface. We identified six projects that used this method of capture. The round net at the end of a long handle has a mesh size suited to the size of targeted turtles (e.g., smaller mesh for hatchlings). Dip netting was conducted when turtles were sighted on visual transects or after opportunistic sightings, and the CPUE of the visual method was therefore recorded. Capture location was defined as either the location where the turtle was caught in the dip net or where it was sighted on transect.

The hand-capture from boat method was often used in shallow waters that had good visibility. Researchers in three projects used this technique. This capture method is similar to the turtle-rodeo described by Limpus and Reed (1985) in that turtles were sighted using boat-based surveys; and were then followed until a diver on the boat jumped into the water, captured the animal, and brought it to the surface. Researchers on the boat then brought the animal onboard. As with dip-netting, CPUE was linked to that

of the boat survey. Capture location was typically defined as either the location where the turtle was brought to the surface or where it was originally sighted.

Sea turtles in somewhat deeper waters with good visibility were sometimes captured by SCUBA divers, as was done in three capture-based studies. Upon sighting a turtle, the diver swam toward it and captured it, then swam with the animal slowly to the surface, where researchers brought it onboard a vessel. In one of the three dive-based studies, divers conducted nighttime searches for sea turtles that were resting under rock ledges and captured these turtles before they left their resting place. Researchers recorded CPUE as *turtles/dive time*. Capture locations were generally recorded as the spot at which the diver surfaces with the turtle, which may differ from where the turtle was initially encountered.

Sea turtles became entrapped in the intake canals of two power plants in Florida (Crystal River Energy Complex and St. Lucie Power Plant). They were carried towards the plants by the in-flowing water until reaching nets or bars across the intake canal that blocked further movement. Researchers then pulled the animals out of the canal by hand or with a dip net. Capture rates were calculated as *turtles/year* or *turtles/month*, although the water-intake rate varied throughout the year. The entrance to the intake canal was recorded as the capture location.

Rudloe *et al.* collected data from incidental sea turtle captures by fishermen in the region of Apalachee Bay. The researchers collected measurements from sea turtles that were captured in gill nets, fishing trawls, seine nets, and on rod and reel. CPUE values and specific locations of these captures were not recorded because this information was rarely recorded by the fishermen who participated in this study.

In all in-water sea turtle capture projects, the animals underwent a basic examination after capture. Turtles were measured and examined for basic injuries and health problems. Turtles were also tagged with metal flipper tags and/or a subcutaneous Passive Integrated Transponder (PIT) tag. Some projects also collected other data on the sea turtles through a range of methods: genetic sampling; hormone sampling; tissue/blood sampling for health analysis; diet sampling; and satellite, radio, or sonic tracking.

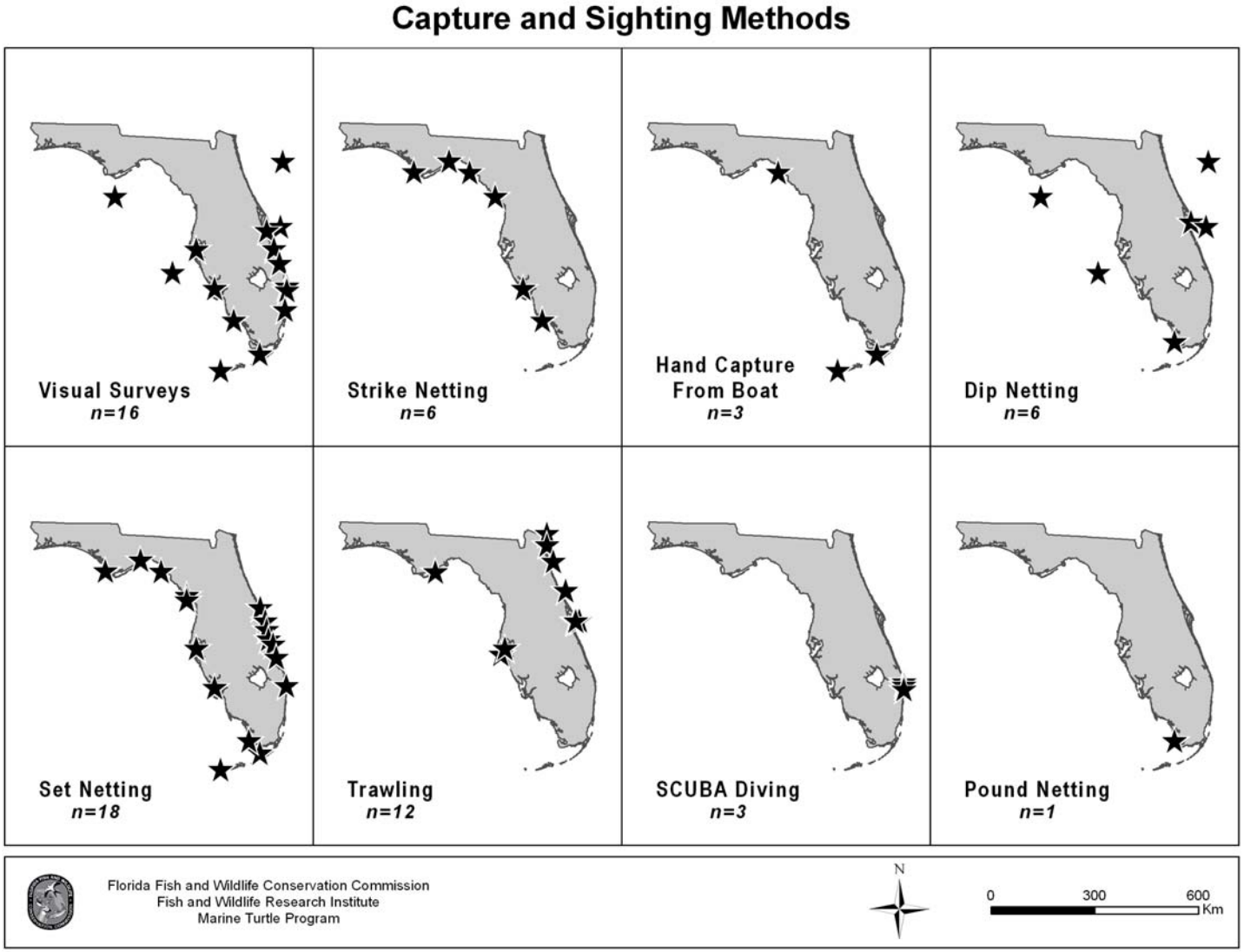

Figure 50 - Capture and sighting methods used by each in-water project.

Species Occurrence

Of the five species of sea turtles regularly occurring in Florida waters, all were captured in at least three of the in-water projects, and all except the leatherback were sighted during visual surveys that targeted sea turtles (Table 2). We combined capture and sighting numbers to evaluate species occurrence and ratios. In total, in-water researchers made 27,474 sea turtle captures and 3517 sightings through the end of 2006, a total of 30,991 observations. Loggerheads (n = 16,306) made up the majority of observations in in-water projects in Florida, followed by observations of green turtles (n = 13,067), Kemp's ridleys (n = 1,359), hawksbills (n = 226), and leatherbacks (n = 33). Marked differences in species ratios existed among the four regions (Figures 53-56). From the data we reviewed, we identified which species and life stages were underrepresented in active projects.

Loggerheads were by far the dominant species in the northeast and, to a lesser extent, in the southeast. The high proportion of loggerheads in the southeast, however, was biased by six in-water studies in the Cape Canaveral shipping channel, where loggerheads were extremely abundant; 98.5% of captures in these projects were loggerheads. When Cape Canaveral data were removed from the analysis, loggerheads made up 44.2% of sea turtle observations in the southeast region; 54.4% were green turtles. All life-history stages of loggerheads have been found in Florida waters, with captured animals ranging from 4 to 110 cm SCL (Table 3).

The green turtle is the second most frequently captured species and is as widely distributed as loggerheads among Florida's in-water projects. Thirty-six projects have documented this species, including in northwest Florida, the west coast, and the east coast (Figures 51-52). Sizes of captured green turtles have ranged from 5 to 109 cm SCL, with the majority of studies capturing turtles in the 30 to 70 cm SCL range (Table 3). Subadult and adult turtles have only been captured occasionally at the St. Lucie Power Plant and, more recently, in relatively high abundance around the Marquesas Keys in the Key West NWR study.

Kemp's ridleys have been captured in in-water projects at relatively high rates all along the west coast of Florida, and they are often the dominant species in study sites along this coast (Figures 53-54). This area may be one of the most important foraging grounds for the species in the Gulf of Mexico. A limited number of Kemp's ridleys have also been captured along Florida's Atlantic coast at Cape Canaveral, several northeast coast studies, St. Lucie Power Plant, and in the Central Indian River Lagoon. Reports of this species in Florida Bay have existed as far back as the 1950s and as recently as January 2005 (Figure 51). The sizes of Kemp's ridleys captured during in-water studies in Florida range from 20 to 67 cm SCL (Table 3).

Hawksbill turtles have been captured in 13 in-water projects, with sizes ranging from 13 to 84 cm SCL (Figures 51-52). Observations of more than five hawksbills over the course of study have only been made in three of these projects (Key West NWR, The Breakers, and the St. Lucie Power Plant); only the former two projects have averaged

more than two hawksbill captures per year. Consequently, little is known regarding the abundance and distribution of the species in other areas. Stranding and other data suggest that hawksbills may be present in small numbers in southwest coastal waters. They are more commonly found on the coral reefs off the Florida Keys, including within the FKNMS and Dry Tortugas National Park and in hard-bottom habitats off Palm Beach and Broward counties (Meylan and Redlow 2006).

Several leatherback turtles have been captured at the St. Lucie Power Plant, and three leatherbacks were captured during two trawling surveys off the northeast coast (Figures 51-52). Other than these few turtles, we rely on aerial surveys, strandings, and incidental capture records for data on leatherback distribution. There are no ongoing studies that target this species in Florida waters, and consequently, relatively little is known about their biology and behavior while in state waters.

Because we did not ask researchers for the number of turtles in each life stage that were captured, we could only evaluate life-stage compositions of the populations of each species based on the number of projects in which each life stage was observed (Table 3). Neritic-stage juveniles were the most common life stage observed in all four hard-shell species. Subadult Kemp's ridleys and loggerheads, as well as adult loggerheads, were also relatively common. Regional differences in life stage compositions of Kemp's ridleys were found, with subadults the prominent life stage in the northeast and southwest regions, and neritic-stage juveniles more common in the northwest. Oceanic-stage juvenile Kemp's ridleys were also observed in half of all studies in the northwest region.

Table 2 - Number of in-water projects in each region (active and inactive) where each marine turtle species has been documented. Value in parentheses next to region heading indicates total number of projects in that region.

Species	Northwest (8)	Southwest (6)	Southeast (21)	Northeast (7)	TOTAL
Green	8	6	17	5	36
Loggerhead	6	5	18	6	36
Kemp's ridley	8	5	6	4	23
Hawksbill	3	2	8	0	13
Leatherback	0	0	2	1	3

Table 3 - Number of in-water projects* (active and inactive) where the various life stages of each species of sea turtle have been captured. Column totals are total number of life stages encountered (not the total number of projects finding those life stages).

Species	Oceanic-Stage Juvenile	Neritic-Stage Juvenile	Subadult	Adult
Green	10	29	12	6
Loggerhead	4	23	23	23
Kemp's ridley	8	18	17	9
Hawksbill	4	7	4	2
Leatherback	----------1[1]----------			2[2]
TOTAL	26	77	56	40

*Does not include visual-survey data.
[1]Total number of immature leatherbacks; not included in column totals.
[2]Total number of adult leatherbacks; not included in column totals.

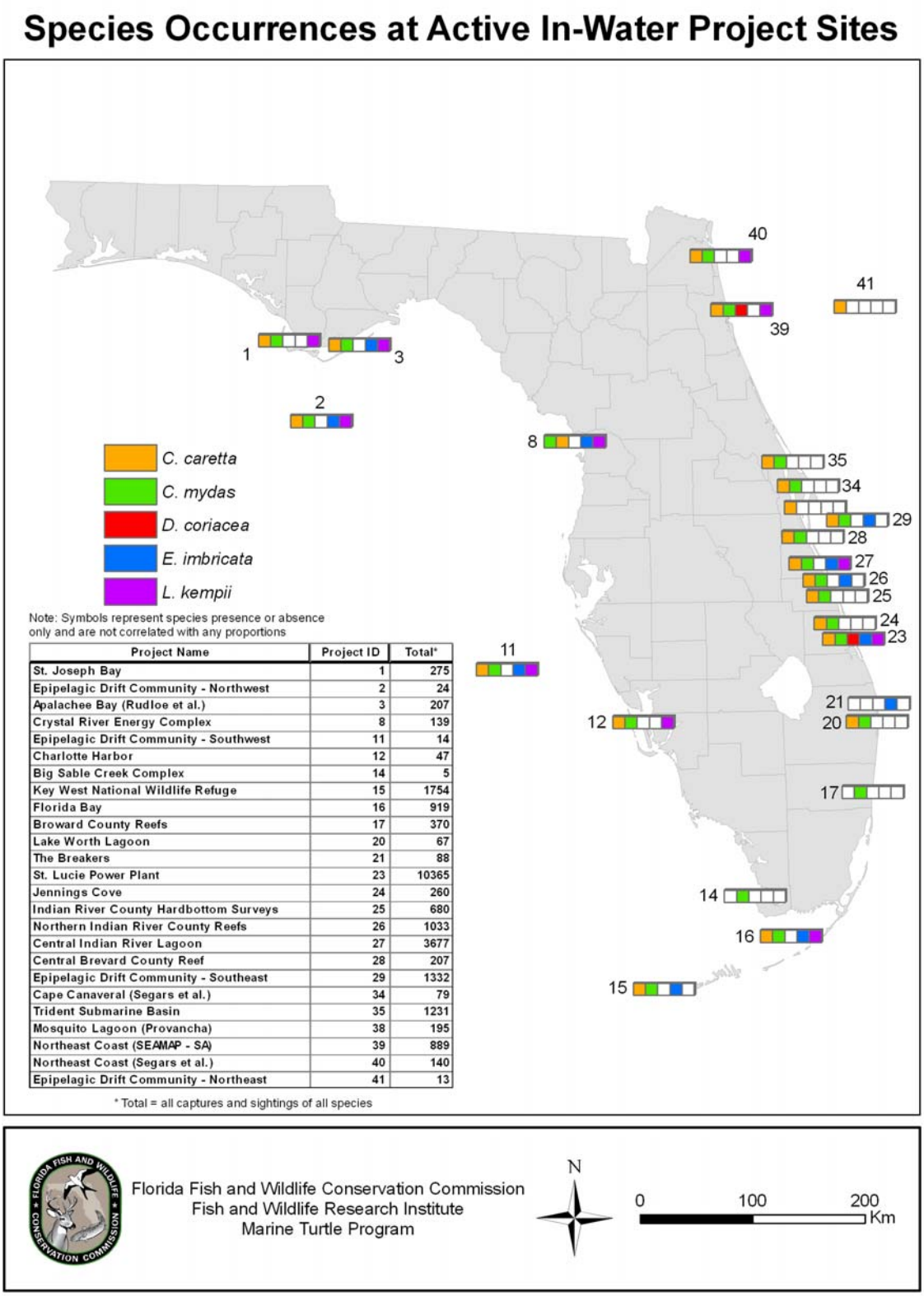

Figure 51 - Species found at each active in-water project site.

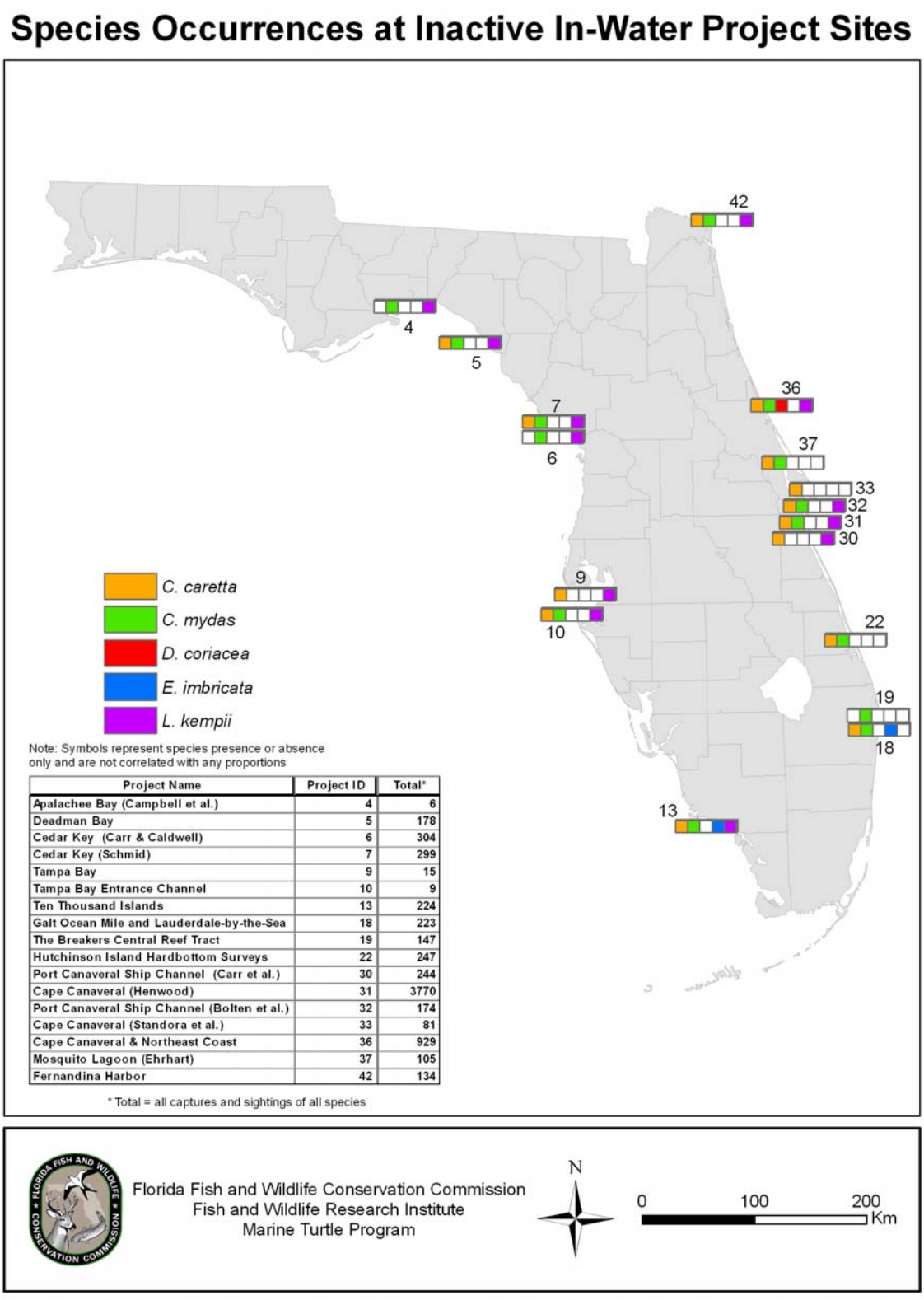

Figure 52 - Species found at each inactive in-water project site.

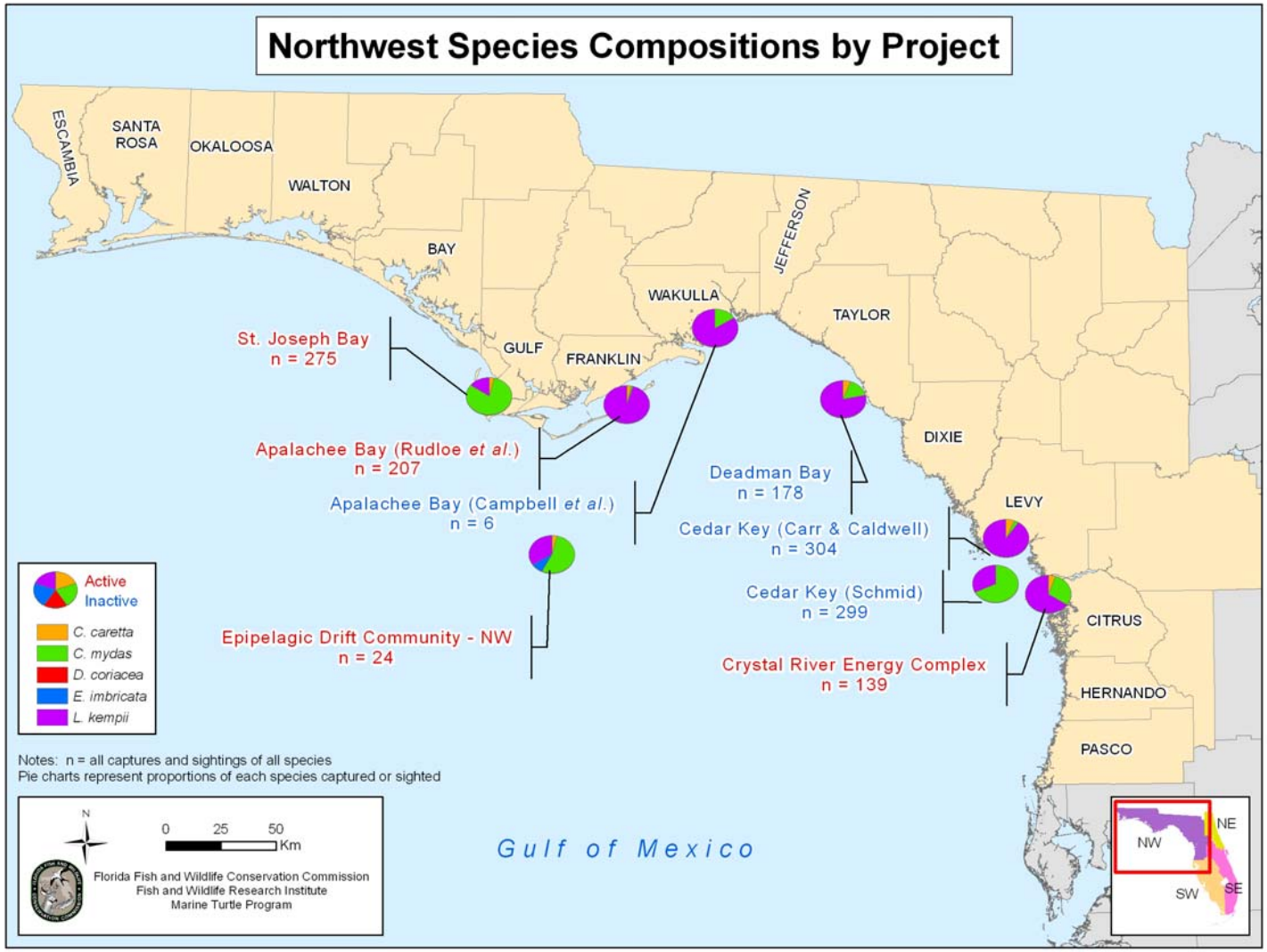

Figure 53 - Species composition in Northwest in-water projects.

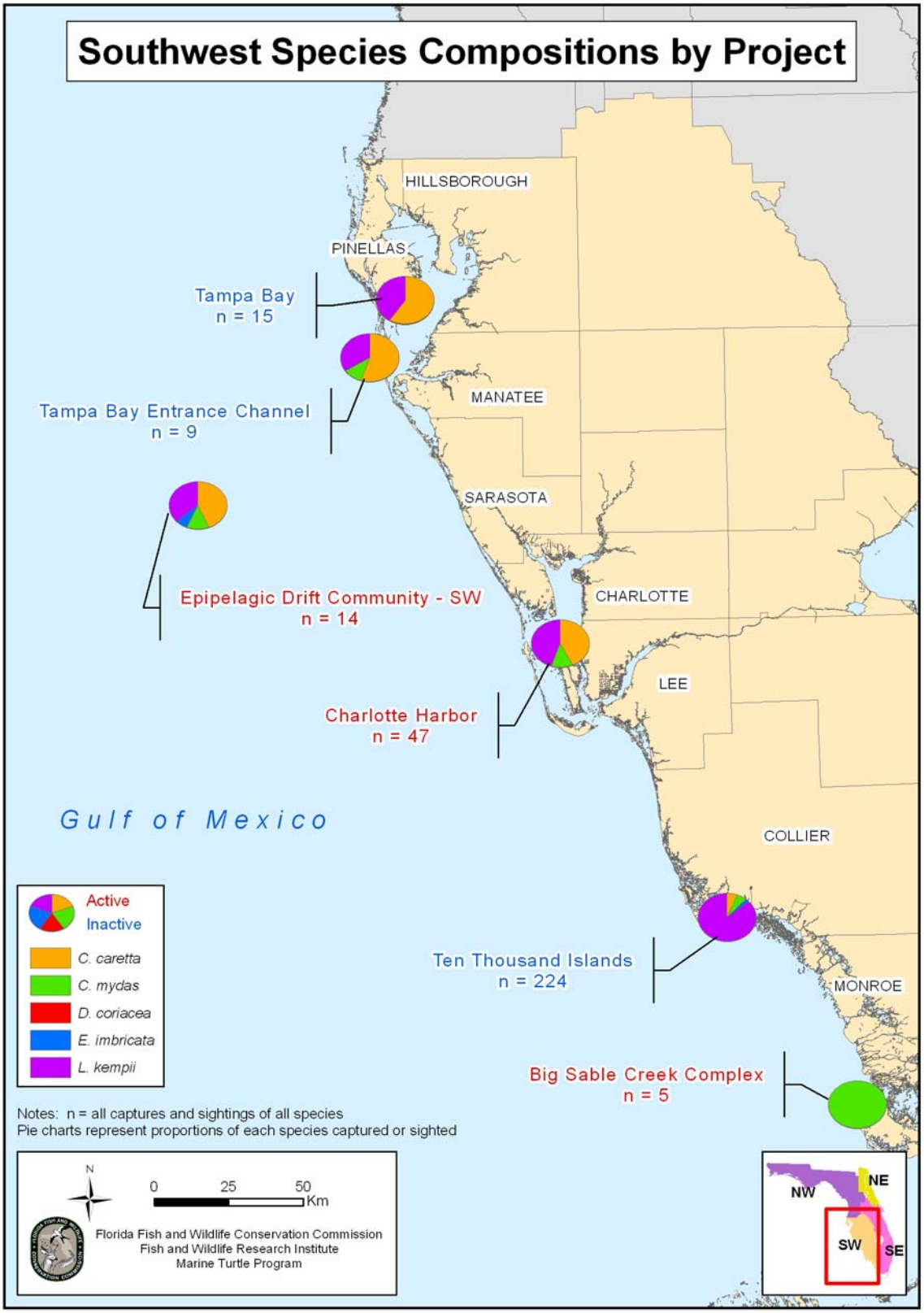

Figure 54 - Species composition in Southwest in-water projects.

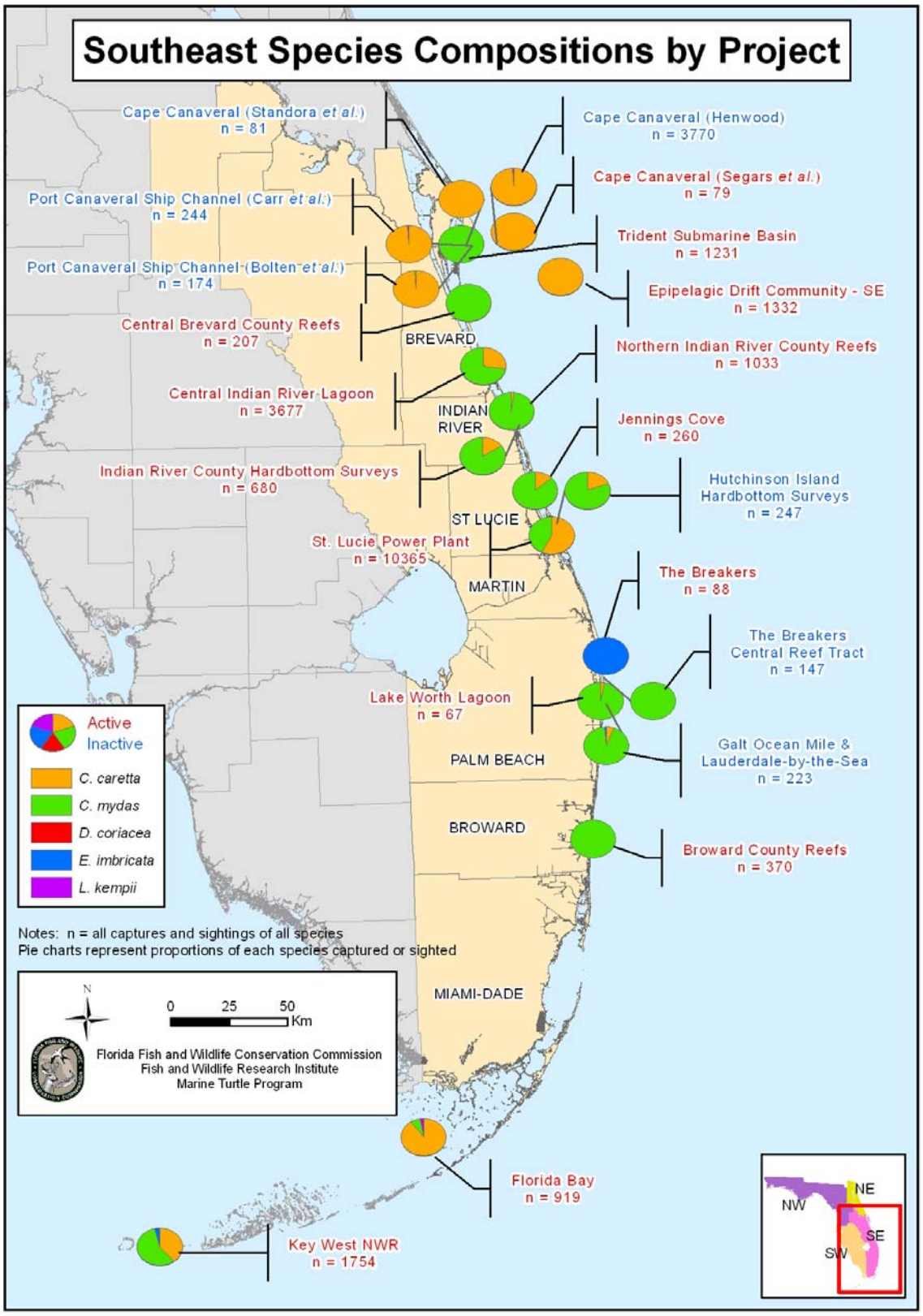

Figure 55 - Species composition in Southeast in-water projects.

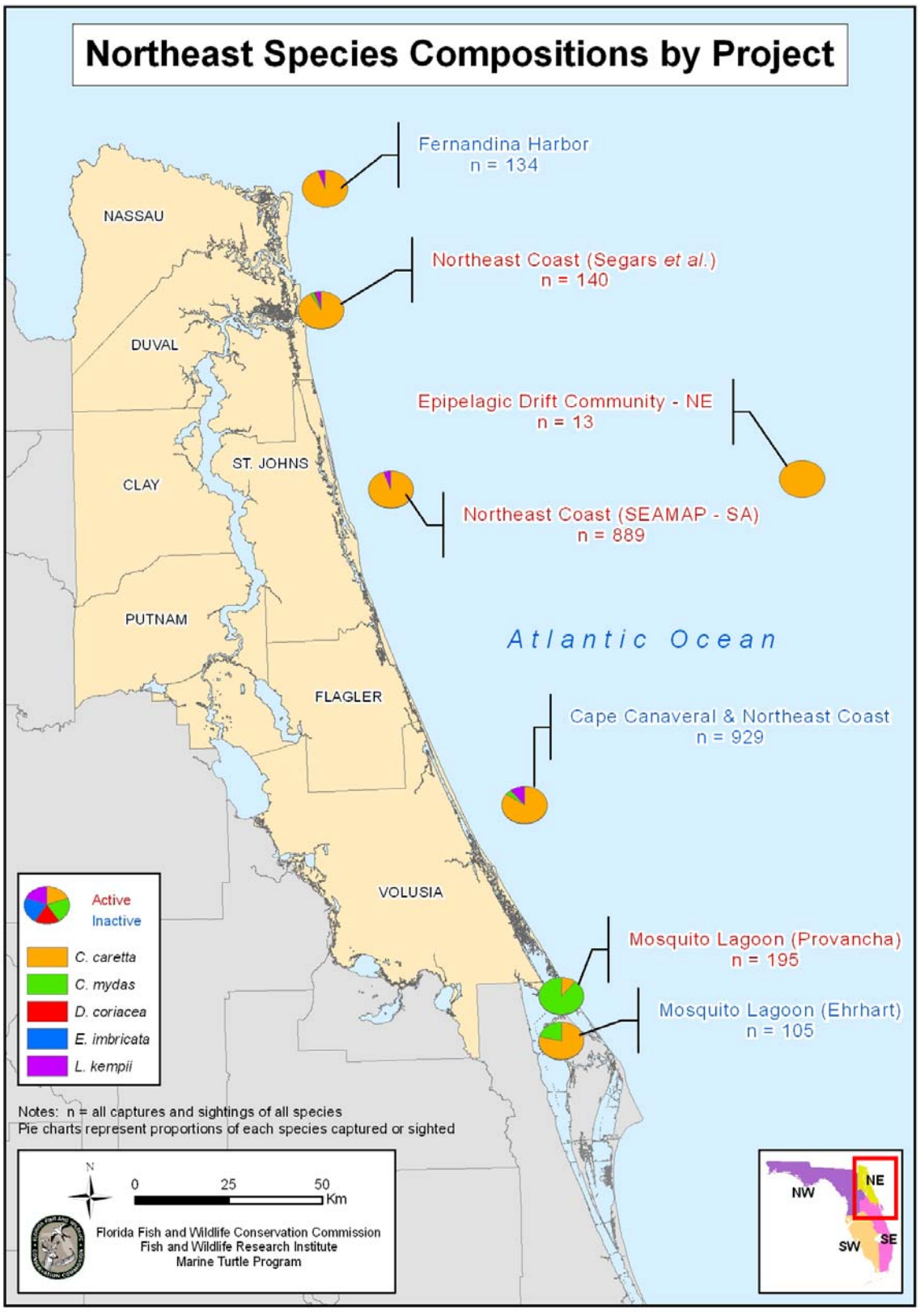

Figure 56 - Species composition in Northeast in-water projects.

Information Gaps

Other than the projects in Florida Bay and the western Florida Keys, current in-water monitoring projects on the east coast extend only from Broward County to Brevard County (Figure 20). Projects north of Mosquito Lagoon occur away from the coast. On the west coast, only seven projects can be considered active at this time, and of these, only the Crystal River Energy Complex, Big Sable Creek Complex, and the two Epipelagic Drift Community studies have regular sampling programs. This leaves many geographic gaps in monitoring and research. Both strandings data (Table 4) and aerial surveys have indicated that sea turtles occur in the waters along the entire coast of Florida. Turtles strand in many counties around the state where no in-water projects are currently underway, including Miami-Dade County, nearshore areas from Volusia County to the Georgia state line, from Collier County to Pasco County, and from Franklin County west to the Alabama state line. Strandings in waters west of Gulf County, for example, are the primary source of Kemp's ridley information for the area. In aerial surveys conducted during the early 1980s, turtles were commonly spotted along the entire east coast of the state, with higher concentrations off Cape Canaveral (see aerial survey section: Schroeder & Thompson 1987). Aerial-survey data from the gulf coast show significantly higher densities of sea turtles from the Keys through the Big Bend region than along the rest of United States gulf coast (see aerial survey section: Thompson 1986, McDaniel 2000).

Additionally, there are areas with significant turtle populations that were once studied but that are no longer being monitored. The reestablishment of monitoring programs at these sites would be beneficial because the projects could use the historical data to help determine long-term trends. Earlier in-water projects in Cedar Key, Deadman Bay, and Tampa Bay found significant numbers of turtles along the west coast. The hardbottom visual surveys off Hutchinson Island and Indian River County found large populations of green turtles and loggerheads but did not collect any physical data on the animals. New studies in these areas that include capture of the turtles would be beneficial to population monitoring.

The seasonal nature of many of the active in-water projects also leaves some gaps in efforts to describe and assess aggregations of sea turtles. Most projects reported being seasonal (or variable, occasional, annual, or opportunistic) and were usually only conducted during the summer months. The paucity of year-round studies could result in a failure to identify overwintering areas, seasonal shifts in foraging areas, and other migratory events.

Table 4 - Strandings of each marine turtle species per kilometer of coastline in the coastal counties of Florida from 1980-2004. Cm – Green turtle; Cc – Loggerhead; Lk – Kemp's ridley; Ei – Hawksbill; Dc – Leatherback. Source: Florida Sea Turtle Stranding and Salvage Network database.

County	Cm/km	Cc/km	Lk/km	Ei/km	Dc/km
Nassau	1.817	30.099	3.591	0.089	1.020
Duval	2.422	30.141	2.561	0.069	1.626
St. Johns	1.854	16.091	1.032	0.105	1.540
Flagler	1.003	10.406	0.622	0.035	1.175
Volusia	2.685	16.120	0.857	0.126	0.832
Brevard	5.360	18.019	0.351	0.105	0.290
Indian River	17.168	9.922	0.139	0.390	0.084
St. Lucie	19.937	17.920	0.173	0.202	0.403
Martin	10.110	14.702	0.144	0.375	0.780
Palm Beach	7.089	7.034	0.109	0.903	0.452
Broward	12.120	6.412	0.052	1.303	0.313
Miami-Dade	2.468	2.417	0.051	0.426	0.051
Monroe	7.411	7.505	0.306	0.867	0.298
Collier	0.349	4.117	0.983	0.044	0.011
Lee	1.424	9.875	2.620	0.136	0.015
Charlotte	0.790	5.038	1.432	0.000	0.099
Sarasota	1.147	8.349	1.845	0.161	0.072
Manatee	2.204	10.076	1.484	0.270	0.045
Hillsborough	0.920	7.260	2.556	0.409	0.000
Pinellas	5.408	7.505	2.979	0.483	0.116
Pasco	1.311	0.320	0.256	0.032	0.064
Hernando	0.275	0.034	0.069	0.000	0.034
Citrus	1.249	0.325	1.174	0.000	0.000
Levy	0.121	0.035	0.104	0.000	0.000
Dixie	0.020	0.000	0.020	0.000	0.020
Taylor	0.000	0.080	0.013	0.000	0.013
Jefferson	0.000	0.000	0.000	0.000	0.000
Wakulla	0.107	0.107	1.555	0.000	0.027
Franklin	0.060	1.271	0.636	0.010	0.010
Gulf	0.660	3.526	1.433	0.023	0.023
Bay	0.315	3.067	1.347	0.014	0.143
Walton	0.050	1.712	0.248	0.000	0.248
Okaloosa	0.129	2.533	0.258	0.000	0.414
Santa Rosa	0.210	2.311	0.840	0.000	0.630
Escambia	0.183	1.844	0.457	0.000	0.290

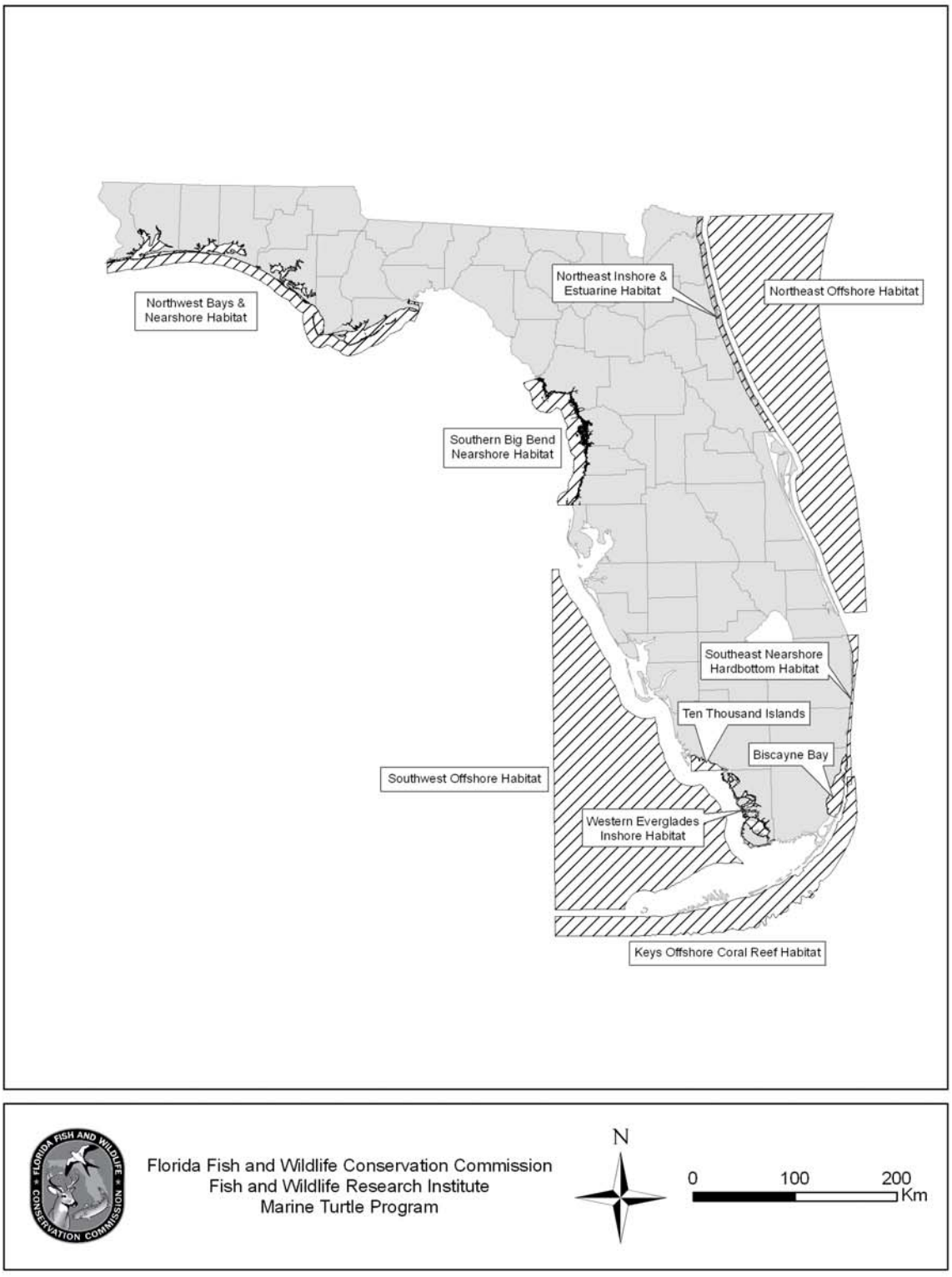

Figure 57 - Locations of geographic gaps in in-water sea turtle research in Florida.

Table 5 - Geographic Gaps in In-Water Sea Turtle Research in Florida.

Gap Area	Comments
Northwest Bays & Nearshore Habitat	Extensive area of unsurveyed, shallow, benthic habitat; Cc and Lk have been frequently observed in the region.
Southern Big Bend Nearshore Habitat	Historically high capture rates of Lk and Cm at Cedar Key; extensive seagrass beds, channels, and shoals.
Ten Thousand Islands	Historically high capture rates of Lk; extensive seagrass beds, channels, and shoals.
Southwest Offshore Habitat	Aerial surveys and strandings indicated a large number of Cc in this region, including adults; hardbottom habitat is conducive to foraging by Cc and Ei; would require innovative, vessel-based sampling methods.
Western Everglades Inshore Habitat	Small Cm have been observed in and around creeks in this area; algae-covered, submerged logs may provide food and cover for marine turtles.
Keys Offshore Coral Reef Habitat	Other than the Key West NWR project, no studies take place on the extensive coral reefs on Atlantic side of Keys; coral reef is the primary habitat of hawksbill turtles and is also used by other marine turtle species.
Biscayne Bay	Contains extensive seagrass beds with areas of mixed seagrass and hardbottom; adjacent to coral reef habitat; could be good developmental habitat for Cm and Ei.
Southeast Nearshore Hardbottom	Several short-term projects have indicated this habitat is important to juvenile Cm and Ei.
Northeast Offshore Habitat	Aerial surveys indicate large numbers of Cc and Dc; Cc may be concentrated in Oculina Bank area and at edge of Gulf Stream.
Northeast Inshore & Estuarine Habitat	Strandings indicate this is important area for Cm, Cc, and Lk (majority of Lk strandings on east coast are north of Volusia County); similar habitat as other east coast inshore areas with large sea turtle aggregations.
Artificial Reefs throughout Florida Waters	Divers often report sea turtles using artificial reefs around the state; these structures have not been studied as sea turtle habitat.

Candidates for a Composite Trend Analysis

We reviewed the information we gathered on all of the active in-water sea turtle research projects in Florida to determine which could contribute to a regional, composite trend-analysis program. Twelve candidate projects were identified: St. Joseph Bay, Charlotte Harbor, Key West NWR, Florida Bay, The Breakers, Jenning's Cove, St. Lucie Power Plant, Northern Indian River County Reefs, Central Indian River Lagoon, Central Brevard County Reefs, Trident Submarine Basin, and Mosquito Lagoon (Provancha) Candidate sites were selected based on their representation of species and life stages (Table 6) and consistency of methodology (Tables 7-9). Also of interest were those projects currently conducting genetic sampling (Table 10) and health assessments (Table 11).

Table 6 - Species and life stages of marine turtles captured/sighted at each candidate index site. Letter denotes life stage captured/sighted during the project. Life stages are based on the size ranges of each species captured that were reported by project principal investigators. Column totals are total number of life stages observed at a site. Life stages included for green turtles, loggerheads, Kemp's ridleys, and hawksbills are as follows: O = oceanic-stage juvenile, N = neritic-stage juvenile, S = subadult, A = adult. Life stages include for leatherbacks are as follows: I = immature, A = adult (see Appendix C).

	St. Joseph Bay	Charlotte Harbor	Key West NWR	Florida Bay	The Breakers	St. Lucie Power Plant	Jenning's Cove	North IRC Reefs	Cen. IRL	Cen. Brevard County Reefs	Trident Sub. Basin	Mosquito Lagoon
Green	N	N	N, S, A	N		O, N, S, A	N, S	O, N, S, A	O, N, S, A	N	O, N	N, S
Loggerhead	N, S, A	A	N, S, A	N, S, A		N, S, A	N, S, A	N, S, A	N, S, A		N, S	N, S, A
Kemp's ridley	N, S	N, S		N, S, A		N, S, A			N, S			
Hawksbill			N, S	N	N, S, A	N, S, A		O, N	S			
Leatherback						I, A						
TOTAL	6	4	8	8	3	15	5	9	10	1	4	5

Table 7 - Description of available trend data for each candidate index site.

	St. Joseph Bay	Charlotte Harbor	Key West NWR	Florida Bay	The Breakers	St. Lucie Power Plant	Jenning's Cove	N. IRC Reefs	Cen. IRL	Cen. Brevard County Reefs	Trident Sub. Basin	Mosquito Lagoon
CPUE Availability	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Method for Calculating CPUE	set net	set net	set net, HUNT*	set net, HUNT*	dive hours	# turtles/ year	set net	set net	set net	set net, transects	set net	set net
Evaluation of CPUE Trends	yes	no	no	no	no	yes	yes	yes	yes	no	yes	yes
Trend Publication	no	no	no	no	no	yes	yes	yes	yes	no	yes	yes
Sampling Technique Changes Over Time	n/a	n/a	formerly set net, now hand-capture from boat	formerly set net, now hand-capture from boat	n/a	intake rate of cooling pipes has varied over time	n/a	sometimes use smaller mesh nets	location changed until current site found	n/a	switched to dip nets and smaller mesh nets to catch smaller turtles	n/a

*HUNT – Haphazard Unmarked Nonlinear Transects (# turtles/km transect)

Table 8 - Morphological data collected from turtle captures at each candidate index site. All size measurements are in cm, and mass measurements are in kg or lb.

	St. Joseph Bay	Charlotte Harbor	Key West NWR	Florida Bay	The Breakers	St. Lucie Power Plant	Jenning's Cove	N. IRC Reefs	Cen. IRL	Cen. Brevard County Reefs	Trident Sub. Basin	Mosquito Lagoon
Standard Straight Carapace Length (notch-tip)	x	x	x	x	x	x	x	x	x	x	x	x
Maximum Straight Carapace Length (tip-tip)				x	x			x	x		x	x
Minimum Straight Carapace Length (notch-notch)		x	x	x	x	x	x			x		x
Standard Curved Carapace Length (notch-tip)	x	x	x	x		x	x	x	x	x	x	x
Maximum Curved Carapace Length (tip-tip)					x							
Minimum Curved Carapace Length (notch-notch)		x			x					x		
Straight Carapace Width	x	x	x	x	x	x	x	x	x	x	x	x
Curved Carapace Width	x	x	x	x	x	x	x	x	x	x	x	x
Straight Plastron Length	x	x	x	x	x	x	x	x	x		x	
Curved Plastron Length					x					x		x
Body Depth	x	x	x		x		x	x	x	x	x	x
Head Width	x	x	x	x	x	x	x	x	x	x	x	x
Plastron to Vent Length			x	x	x			x	x	x	x	x
Pygal to Vent Length	x											
Plastron to Tip of Tail Length		x	x	x	x	x	x	x	x	x	x	x
Vent to Tip of Tail Length	x	x		x				x	x	x	x	x
Interanal Scute Presence Noted	x							x	x		x	
Mass	x	x	x	x		x	x	x	x	x	x	x

Table 9 - Sex-determination methods and growth-rate information available from each candidate index site. All sites predict sex of captures when external characteristics (tail length and SSCL) indicate a mature status of the turtle. No projects have yet to include the regular use of laparoscopy in their determination of maturity and/or sex.

	St. Joseph Bay	**Charlotte Harbor**	**Key West NWR**	**Florida Bay**	**The Breakers**	**St. Lucie Power Plant**	**Jenning's Cove**	**N. IRC Reefs**	**Cen. IRL**	**Cen. Brevard County Reefs**	**Trident Sub. Basin**	**Mosquito Lagoon**
Method of Assigning Sex	tail length, SSCL	tail length, SSCL, hormone assays	tail length, SSCL, hormone assays	tail length, SSCL, hormone assays, laparoscopy, ultrasound	tail length, SSCL, hormone assays	tail length, SSCL	tail length, SSCL	tail length, SSCL, hormone assays	tail length, SSCL, hormone assays	tail length, SSCL	tail length, SSCL, hormone assays	tail length, SSCL, hormone assays
Species From Which Hormone Samples Collected	n/a	Cm, Cc, Lk	Cm, Ei	Cc, Cm, Lk	Ei	n/a	n/a	Cm, Cc	Cm, Cc	n/a	Cm	Cm, Cc
Person Performing Hormone Analysis	n/a	Thane Wibbels	none	Dave Owens	Dave Owens	n/a	n/a	Dave Owens	Dave Owens	n/a	Dave Owens	Dave Owens
Samples Analyzed	n/a	no	no	yes	yes	yes	no	yes	yes	no	yes	yes
Archival of Samples	n/a	yes	yes	yes	yes	no	no	yes	yes	no	yes	yes
Availability of Sex Ratios	yes (necropsies)	no	no	yes	yes	no	no	yes	yes	no	yes	yes
Availability of Annual Growth Rates	Yes, Cm	no	no	Yes, Cc	Yes, Ei	Yes	no	Yes, Cm	Yes, Cm	no	Yes, Cm	no

Table 10 - Description of genetic sampling conducted at each candidate index site.

	St. Joseph Bay	Charlotte Harbor	Key West NWR	Florida Bay	The Breakers	St. Lucie Power Plant	Jenning's Cove	N. IRC Reefs	Cen. IRL	Cen. Brevard County Reefs	Trident Sub. Basin	Mosquito Lagoon
Species From Which Samples Collected	Cm, Cc	Cm, Cc, Lk	Cc, Cm, Ei	Cc, Cm	Ei	Cc, Cm, Ei	none	Cm	Cm, Cc	none	Cm	Cc, Cm
Type of Samples Collected	tissue	tissue	tissue, blood	tissue, blood	tissue	tissue	n/a	tissue, blood	tissue, blood	n/a	tissue, blood	tissue, blood
Timeframe of Sample Collection	2001-2003	2003-2004	2002-present	1990-present	2004-present	1992-1994, 1999	n/a	1995-present	1995-present	n/a	1995-present	1994-present
Archival of Samples	yes	yes	yes	yes	yes	yes	n/a	yes	yes	n/a	yes	yes
Type of Sample Analysis	none	none	mtDNA	mtDNA	mtDNA	mtDNA	n/a	mtDNA	mtDNA	n/a	mtDNA	mtDNA
Person/Organization Performing Analysis	n/a	n/a	UCF	Bowen (early), Dutton (later)	Meylans, Wood	Meylans (Ei), Bass (others)	n/a	Bagley, Bass	Bagley, Bass	n/a	Bagley, Bass	Bass, Bowen, Owens

Table 11 - Health assessment and FP documentation at each candidate index site. Cm = *Chelonia mydas*, Cc = *Caretta caretta*.

	St. Joseph Bay	Charlotte Harbor	Key West NWR	Florida Bay	The Breakers	St. Lucie Power Plant	Jenning's Cove	N. IRC Reefs	Cen. IRL	Cen. Brevard County Reefs	Trident Sub. Basin	Mosquito Lagoon
Type of Health Assessment	visually with general comments	visually with general comments, samples	visually with general comments, samples	visually with general comments, samples	visually with general comments	visually with general comments, samples	visually with general comments	visually with general comments, samples	visually with general comments, samples	visually with general comments	visually with general comments, samples	visually with general comments
Biological Samples Collected (Analysis By)	none	blood (Wibbels)	blood (UF)	blood (Antech Diagnostics)	none	blood (UF)	none	blood (UF/UCF)	blood (UF/UCF)	none	blood (UF/UCF)	none
Condition Index Assigned	none	none	none	none	none	rate as good, fair, poor, dead	rate as good, fair, poor, dead	none	none	none	none	none
Type of FP Assessment	presence/ absence	presence/ absence	pap map	pap map	presence/ absence	pap map	pap map	pap map	pap map	pap map	pap map	pap map
Species In Which FP Is Found	none	none	Cm, Cc	Cm, Cc	none	Cm, Cc	Cm	Cm	Cm, Cc	none	Cm	Cm
Check for Oral Tumors	no	no	yes	yes	no	yes	yes	yes	yes	yes	yes	yes
FP Scoring Sheet Used	none	Balazs*	Balazs*	Balazs*	none	Balazs*	Balazs*	Balazs*	Balazs*	Balazs*	Balazs*	Balazs*
Photography of FP Tumors	none observed	severe cases	always	severe cases	none observed	severe cases	severe cases	severe cases	severe cases	severe cases	severe cases	severe cases

*From: Balazs, G.H. 1991. Current status of fibropapillomatosis in the Hawaiian green turtle, *Chelonia mydas*. In: Balazs, G.H., and S. Pooley (eds.). Research Plan for Marine Turtle Fibropapilloma. NOAA Technical Memorandum NMFS-SWFC-156, pp. 47–57.

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DISCUSSION

In-water sea turtle research in Florida has consisted of many independent projects, each focused on determining characteristics of local sea turtle aggregations. In this report, we have laid the groundwork for a sea turtle in-water project-coordination program. Given appropriate levels of funding, such a program would have the potential to add conservation value to biological information already being collected for sea turtles in Florida waters. We feel that such a program is merited because it would provide a single, comprehensive database of summary information from past and present in-water sea turtle research projects in Florida. A coordinated effort could make it possible to combine the local sea turtle population-trend assessments of the individual projects into statewide sea turtle population-trend assessments. Specifically, we believe this coordination program should 1) compile, report, and maintain summary data from in-water sea turtle research projects in Florida, 2) compile and maintain summary data on sea turtle observations or captures made by projects or activities not targeting sea turtles or not otherwise included as a Florida sea turtle research project, 3) standardize methodologies of data collection for in-water sea turtle research projects in Florida to the extent possible, and 4) use data from an appropriate subset of the in-water sea turtle research projects to provide statistically sound composite, population-trend assessments of in-water populations of the sea turtle species and various life stages of sea turtle species found in Florida.

As part of a project we carried out for NMFS, we have created a database containing summary data from all in-water sea turtle research projects that have been conducted in Florida. Data from other projects or activities that record incidental observations or captures of sea turtles in Florida were also incorporated into the database. This comprehensive database allows the visualization of in-water sea turtle data collected throughout the state. One of the principal users of such information would be natural-resource managers who are working to conserve or recover sea turtle populations. When specific activities that may have an effect on sea turtles in the water are proposed, this summary database could help identify which sea turtle species and life stages of various species occur within the project site. Along with basic distribution data, managers would also be able to see what other sea turtle data have been collected at or near the project site and could contact the appropriate researchers for help in making predictions about the potential effects on sea turtles. Species distributions could be visualized overall or on the life-stage level to help identify sectors of sea turtle populations that could be affected by regional management decisions. Sea turtle researchers themselves can benefit from this database by more easily identifying potential collaborators. Those seeking to examine parameters such as genetics, heavy-metal contamination, or diet on a relatively large geographic scale could locate the in-water sea turtle research projects within an area of interest where pertinent samples are currently being or could be collected. Finally, this database helps FWC assess the extent to which tasks outlined by sea turtle recovery plans have been or are being achieved in Florida. This knowledge may then be used to prioritize areas or topics for future in-water sea turtle research in Florida.

One of the most valuable potential products from an in-water monitoring program would be the ability to provide statewide trend assessments of in-water sea turtle populations in

Florida by combining trend data from individual research projects. However, several obstacles would need to be overcome first. Eleven different measures of effort were used in the projects we reviewed. At best, the number of CPUE unit types among these projects could be reduced to the number of different count methods used, which was eight. It would be impossible to pool all in-water CPUE data into one compatible dataset, but methods could be developed to use the data in a qualitative regional context. A second challenge involves the lack of complete coverage of habitats and the nonrandom distribution of sampling areas. This problem can be addressed by continually assessing information gaps and directing future research towards those needs.

Lastly, the nonrandom distribution of study areas can lead to two significant problems outlined by Dunn *et al.* (2005): (1) regions with the densest concentration of study areas will have the strongest influence on trend analyses, and (2) turtle aggregations in study areas may not be representative of the turtle population in that region. The relative ease of access to sea turtle habitat on the east coast of Florida has precipitated the first issue, as most studies are concentrated in that region. Researchers also tend to seek out the densest sea turtle assemblages for research, disregarding more dispersed aggregations. This dispersed sector of the population may not be as concentrated, but their total number of individuals is likely greater. Any trends in this part of the population may be more indicative of the statewide sea turtle population than trends estimated from clustered aggregations.

For this coordinated in-water program to successfully evaluate trends in the state's sea turtle populations, individual projects must have the power to detect trends themselves. In order to do so, methods within studies must be standardized across years. This ensures that the measure of effort is consistent. There is no way to compare relative abundance between years if set-netting is used one year and strike-netting the next. Variations in effort are also inherently present between studies, although biases can be reduced if project methods have been carefully standardized as part of a broader coordinating effort. Sampling dates could be standardized, but these are usually based on when researchers are available, when sea turtles are most common in the study area, and when sampling conditions are acceptable. Variations in sampling season between projects will, therefore, always exist. Principal investigators can, however, model their CPUE rates with covariates for observer bias, weather, sea state, and other sighting and capture conditions to account for variance from these effects as trends are assessed (Sauer *et al.* 2005).

A coordinated program would promote aspects of projects that make their data powerful in population-trend detection. Gerrodette and Brandon (2000) suggest that the power of a monitoring program to detect a trend depends on four main factors:

1. The duration of the study. Studies spanning a longer period of time tend to provide more data, resulting in more powerful conclusions.
2. The precision of the procedure for assessing or indexing the population. The more precise the estimate, a more likely the trend will be detected. Precision depends on many factors, such as how the population is dispersed, how the

population is assessed (CPUE, mark/recapture, transect), and how much effort is put into each assessment (how many nets set).
3. The rate at which the population is actually changing. It is easier to detect high rates of change than low.
4. The type I error rate (where the null hypothesis is true but is rejected). Computer programs such as TRENDS can conduct power analyses and carry out the linear regressions to assess the population trends (Gerrodette 1993).

We further recommend standardization of key morphometric measurements in order to allow comparisons of size distributions across projects. The measurements that should be standardized include:

- **Carapace length** – measure straight (notch-to-tip & notch-to-notch) and curved (notch-to-tip & notch-to-notch)
- **Plastron length** – measure straight length using calipers to bony edge (ignoring extra scales)
- **Tail length** – measure from bony edge of plastron to tip of extended tail
- **Mass** – weigh to the nearest kilogram.

All projects currently conduct at least a visual assessment of turtle health, but specific methods vary slightly and some are subjective. Adoption of an agreed-upon set of standard definitions would render health assessments more useful. We recommend that the following information be collected for its potential to help evaluate the health of sea turtle populations on both a local and statewide basis:

- **Fibropapillomatosis** – record presence and severity (use pap map and Balazs scoring sheet [see Table 11], take dorsal and ventral photos)
- **Injuries/abnormalities** – use descriptions, drawings, and/or photos (include no-injury findings) to evaluate.

In developing a list of potential participants for a coordinated in-water program, we considered the predicted persistence of the project, the existence of historical population data for that area, geographic representation, species observed, habitat representation, life stages observed, intensity and seasonality of sampling, rates of captures/sightings, and amount of data collected to date for each project. Some projects with low capture rates were also included in order to ensure that all regions and a diverse array of habitats were represented, which could also be important for detecting shifts in sea turtle abundance away from other project locations.

We envision that the projects included in composite sea turtle population-trend assessments would continue to pursue their individual research and monitoring objectives but would voluntarily opt to participate in this collaborative effort to provide a statewide assessment of population trends. Initially, the program would link existing in-water projects that use a variety of capture or sighting methods which have been found to be most appropriate for the conditions at each sampling location. These methods would not

need to be standardized across projects; they would only need to be consistent within each project and have a reliable measure of effort associated with them.
We believe a coordinated in-water monitoring program should have the following features:

1. **Coordinating staff and resources**. A permanent program coordinator is critical to foster and retain participation, reinforce program goals and methods, provide training, and provide ongoing products. GIS staff would provide support to the coordinator and program participants. This service would be an incentive to the in-water participants to remain in the program and would allow them to conduct and publish habitat analyses beneficial to resource managers. Ongoing funding would be necessary for the program to fulfill the goal of assessing temporal trends in sea turtle populations.
2. **Annual, regional workshops**. These meetings would promote standardized program methods, facilitate communication between participating researchers, allow participants to present their individual data, allow the synthesis of data from all participants in workshop proceedings, and focus both enthusiasm and research effort.
3. **Participation from sites/projects representative of Florida**. We list candidate sites/projects that would represent a range of habitats on page 207. These would be index sites/projects whose organizers would agree to standardized data collection and reporting methods.
4. **Continuation of suitable site-specific techniques**. Because many existing projects already use methods that are best suited to their individual location and conditions, these methods should be part of any effort to standardize data collection. Within-site standardization is critical to assessing relative trends.
5. **Standardization of effort and life-history data collection**. Although there may be some variation between sites/projects in capture methods and abundance assessments, all should collect data on effort. These effort data should be directly related to capture or observation success. The collection of additional life history data should also be encouraged. This would include somatic-size data, sex, degree of maturity, diet, behavior, genetic identity, and incidence of disease and injury.
6. **Identification and filling of information gaps**. Geographic, species, and life-history gaps evident in the list of participating sites/projects should be filled when possible. The program coordinator should do this by facilitating funding, recruiting researchers, and communicating research needs to program participants.
7. **Collaboration**. An important function of the program coordinator should be to connect interested researchers who have valuable techniques and expertise with in-water program participants who have access to captured sea turtles. Successful elements of the in-water program should be expanded to states other than Florida so that regional assessments are possible.

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APPENDIX A - *Life Stages*

Determining definitive-size cutoffs for the various life stages is an imperfect exercise for several reasons. Literature often disagrees over the correct size to use. Turtles of a given species mature over a range of sizes, thus resulting in the overlap of life stages at sizes near the cutoff. In addition, it is often difficult to accurately assess maturity and sex in the field. The sizes used below, therefore, are only approximate and should not be considered to be absolute limits.

Green turtle:

Carr (1987) reported pelagic posthatchling green turtles in the Atlantic at < 20 cm SCL. The recruitment of juvenile green turtles to neritic developmental habitats occurs at approximately 30 – 40 cm CCL (Bjorndal and Bolten 1988, Bjorndal and Bolten 1995, Barnard *et al.* 1989). Guseman and Ehrhart (1990) reported the smallest green turtle to appear in demersal habitats off the east coast of Florida at 26.9 cm SCL, and Mendonca and Ehrhart (1982) found juvenile green turtles in east Florida ranging from 30 to 40 cm SCL. Turtles over 70 cm SCL are rarely found in coastal bays along the east coast of Florida (D. Bagley pers. comm.). The smallest green turtle reported to nest at Archie Carr NWR was 83.2 cm SCL (Ehrhart pers. comm.).

This report adheres to the following size ranges for life stage classification for this species:

Oceanic-stage juvenile: < 25 cm SCL
Neritic-stage juvenile: 25-69 cm SCL
Subadult: 70-84 cm SCL
Adult: ≥ 85 cm SCL

Loggerhead:

Loggerhead turtles in the western Atlantic recruit to demersal habitats at 25 to 30 cm CCL, with the average loggerhead in this habitat measuring approximately 50 cm CCL (Lutcavage and Musick 1985). Lutcavage and Musick (1985) reported sizes of stranded turtles in the Chesapeake Bay as small as 25 to 35 cm CCL, whereas loggerhead turtles in the coastal estuaries along the east coast of Florida have been found to range from 50 to 80 cm SCL (Mendonca and Ehrhart 1982, Ehrhart 1983). Bolten (2003) indicated that nesting loggerheads in Florida range from 70 to 109 cm SCL (from CCL measurements in Dodd 1988).

This report adheres to the following size ranges for life stage classification for this species:

Oceanic-stage juvenile: < 30 cm SCL
Neritic-stage juvenile: 30-69 cm SCL
Subadult: 70-79 cm SCL
Adult: ≥ 80 cm SCL

Kemp's ridley:
Ogren (1989) divided life stages of this species into pelagic juvenile (< 20 cm SCL), coastal benthic subadult (20-60 cm SCL), and a coastal benthic adult stage (> 60 cm SCL). Recent studies suggest that gonadal development may begin as early as 40-50 cm SCL (Gregory and Schmid 2001). Coyne and Landry (2000) and Gregory and Schmid (2001) suggest that the coastal benthic subadult stage suggested by Ogren should be divided into a prepubescent juvenile and pubescent subadult stage.

This report adheres to the following size ranges for life stage classification for this species:

Oceanic-stage juvenile: < 25 cm SCL
Neritic-stage juvenile: 25-39 cm SCL
Subadult: 40-59 cm SCL
Adult: ≥ 60 cm SCL

Hawksbill:
Life stages for the hawksbill turtle are as follows: Carr (1987) reported several small (5-21 cm SCL), pelagic hawksbills in association with *Sargassum*. Hawksbills in the Atlantic (U.S. Virgin Islands) typically recruit to neritic developmental habitats at 20 –25 cm SCL (Boulon 1994). Meylan and Redlow (in press) note that the smallest neritic-stage juvenile hawksbill turtles recorded in Florida have measured 22-25 cm SCL. Meylan and Meylan (unpublished) laparoscoped hawksbills of various sizes in Caribbean Panama and found prepubescent animals to be as large as 66.6 cm SCL, while the smallest adult of either sex was 73.2 cm SCL. Their findings suggest that there is a considerable overlap between the various life-stage size distributions. On average, however, hawksbills were found to reach pubescence around 65 cm SCL (Meylan and Meylan unpublished).

This report adheres to the following size ranges for life stage classification for this species:

Oceanic-stage juvenile: < 25 cm SCL
Neritic-stage juvenile: 25-64 cm SCL
Subadult: 65-74 cm SCL
Adult: ≥ 75 cm SCL

Leatherback:
Posthatchling leatherbacks move immediately to the sea and swim actively offshore (Carr and Ogren 1959). Mean hatchling size has been measured at 62.8 mm (Carr and Ogren 1959) and 59.8 mm (Hirth and Ogren 1987). Little is known regarding the oceanic distribution of early developmental stages for leatherback sea turtles, but it is assumed that the juvenile stages occur in the oceanic zone (Eckert 2002, Bolten 2003). At approximately 100 cm Over-the-Curve Carapace Length (OCL), there may be an onset of thermogenerating capacity that is not seen in younger or smaller leatherbacks (Eckert 2002) and may be an indication that once a turtle has reached this size, it is capable of exploiting its full adult geographic range. Hirth and Ogren (1987) measured 76 nesting leatherback turtles and found the mean size to be 152.8 cm OCL (range of 134.6 – 171.5

cm OCL). Boulon (1992) reported the approximate average size of a nesting female as 157 cm OCL, with the smallest size of a nesting female as 137 cm OCL. Nesting leatherbacks along Florida's east coast have been measured as small as 125.0 OCL (Johnson pers. comm.) and 138.9 OCL (Ehrhart unpublished). The mean size of nesting leatherbacks on the east coast has been reported at 151.3 OCL (Johnson pers. comm.).

This report adheres to the following size ranges for life stage classification for this species:

Immature: < 135 cm OCL
Adult: ≥ 135 cm OCL

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APPENDIX B - *In-Depth Questionnaire for PIs of Active Projects*

In-depth Info on Possible Index Sites

Measurements taken

- What morphometric data are collected? Please provide a blank copy of your data collection sheet. Please briefly explain each measurement (point to point, curved or straight, units?)
- What is your primary carapace length measurement?
- Do you weigh turtles? How? Are all turtles weighed, any not weighed?
- Do you have a measure of accuracy/precision for each of these measurements?

Assessing potential for future trend analysis

- Does your current sampling technique allow you to determine abundance and, if so, how is that determination made?
- Have you tested for abundance trends? Published?
- Has your method (formula) for determining abundance changed over time?
- Has your sampling technique that allows for a determination of abundance changed over time and if so, how?

What data are collected other than abundance (CPUE)?

- Do you photograph (digital/film) your animals and what views are used?
- Do you document hybrids? How do you determine hybrid status?
- Are you doing some type of health assessment?
    - How? Are you taking, samples, noting physical attributes, condition index?
    - Do you assess FP? If so, how? Do you use a standardized scoring sheet? If so, could we have a copy? Do you photograph tumors?
    - For what species do you have FP data?
- Do you collect genetic samples?
    - What kind of samples? Nuclear or mtDNA
    - Timeframe of samples and how are they preserved?
    - Hybrid monitoring through genetics?
    - For what species?
- Do you assign sex? If so, how?
    - Hormone assays vs. external characteristics
    - External characteristics cut-offs
    - For what species?
- Are sex ratios available for your site?
    - What type of samples do you collect? Hormone analysis or other? By whom?
    - Are the samples stored or have they been analyzed?
    - For what species?

- Do you determine maturity status? If so, how?
    - Laparoscopy or external characteristics?
    - External characteristics cut-offs
    - For what species?
- Have you determined growth rates?
    - Do you have recaptures >1 year intervals?
    - For what species?

What <u>LIFE STAGES</u> (based on the following guidelines) do you have for each species you encounter?

<u>Kemp's ridley</u>
Hatchling : < 5 cm SCL
Post-hatchling: 5-19 cm SCL
Juvenile: 20-39 cm SCL
Subadult: 40-59 cm SCL
Adult: > 60 cm SCL

<u>Leatherback</u>
Hatchling: unknown
Post-hatchling: unknown
Juvenile: unknown < 100 cm OCL
Subadult: 100 – 135 cm OCL
Adult: >135 cm OCL

<u>Hawksbill</u>
Hatchling: < 5 cm
Post-hatchling: 5 to 21 cm SCL
Juvenile: 22 to 65 cm SCL
Subadult: 65 to 75 cm SCL
Adult: > 75 cm SCL

<u>Loggerhead</u>
Hatchling: < 5 cm SCL
Post-hatchling: 5 > 10 cm SCL
Juvenile: 10 – 70 (50) cm SCL
Subadult: (50) 70 – 85 (70) cm SCL
Adult: > 85 cm SCL (70)

<u>Green</u>
Hatchling: < 5 cm SCL
Post-hatchling: 5 – 22 cm SCL
Juvenile: 22 – 60 cm SCL
Subadult: 60 - 80 cm SCL
Adult: > 80 cm SCL

Presence/Absence (Y/N)

	Hatchling	Post-hatchling	Juvenile	Subadult	Adult
Green					
Loggerhead					
Hawksbill					
Kemp's ridley					
Leatherback					

For each species encountered, what fractions of captures are…

	Hatchling	Post-hatchling	Juvenile	Subadult	Adult
Green					
Loggerhead					
Hawksbill					
Kemp's ridley					

Rank the following <u>LIFE HISTORY CHARACTERISTICS</u> as rare, common, very common, abundant occurrences observed in your study site…Please note species.

Hatchling dispersal:
Post-hatchling development and migration:
Oceanic juvenile development and migration:
Neritic juvenile development and migration:
Neritic sub-adult development and migration:
Oceanic sub-adult development and migration:
Neritic adult foraging and migration:
Oceanic adult foraging and migration:
Male breeding migrations:
Female breeding migrations:
Copulation:
Internesting:
Littoral nest-site selection:

General Questions

- Do you have access to historical abundance information for your site?
    - Are you aware of any uncommon sources for info?
- Are you aware of any GIS databases for your study area or databases that include turtle data from your study?
- How would you like to see in-water research progress in Florida?
- What could the state do that would be most useful for your project?

APPENDIX C - *Additional Information Sources*

In addition to the 42 in-water research projects for which we present detailed descriptions, we gathered data from other projects that reported observations or incidental encounters with sea turtles in Florida waters. Some of these projects specifically targeted sea turtles, including aerial surveys (Table 12), satellite telemetry studies (Tables 16 and 17), trawling projects that captured and relocated sea turtles prior to dredging (Table 14), and stranding data (Table 4). Other projects observed or captured sea turtles in Florida but did so incidental to study of other species or to other activities. These included sightings in aerial surveys that were not targeting sea turtles (Table 15), incidental bycatch in fisheries (Table 13), and incidental take by dredges (Page 231).

Aerial Surveys for Sea Turtles

Table 12 - Aerial-survey projects targeting sea turtles.

Dates	Location	Organization
1963-1969	U.S. Atlantic Coast	NMFS[1]
1982-1984	Cape Hatteras, NC to Key West, FL	NMFS-SEFSC[2]
1985-1986	New Orleans, LA to Key West, FL, & NE Gulf	NMFS-SEFSC[3]
1990-1993	Palm Beach County, FL	Palm Beach DERM[4]
1992-1994	Lafayette, LA to Key West, FL, & NE Gulf	Duke University Marine Laboratory[5]

[1] Deaver, J.W. 1975. Aerial Oceanographic Observations, July 1969-1970, Cape Cod, Massachusetts to Miami, Florida. Oceanographic Report CG373-68, 27 pp.

Witzell, W.N., and T. Azarovitz. 1996. Relative Abundance and Thermal and Geographic Distribution of Sea Turtles Off the U.S. Atlantic Coast Based on Aerial Surveys (1963-1969). NOAA Technical Memorandum NMFS-SEFSC-381, 10 pp.

[2] Schroeder, B.A. 1984. A Review of the Status of the Leatherback Turtles (*Dermochelys coriacea*) in the Western Atlantic. NMFS SAW/84/MMT/19, 8 pp.

Schroeder, B.A., and N.B. Thompson. 1987. Distribution of the loggerhead turtle, *Caretta caretta*, and the leatherback turtle, *Dermochelys coriacea*, in the Cape Canaveral Florida area: Results of aerial surveys. In: Witzell, W.N. (ed.). Ecology of East Florida Sea Turtles, Proceedings of the Cape Canaveral, Florida Sea Turtle Workshop. NOAA Technical Report NMFS-53, pp. 45-53.

Shoop, C.R., and T.J. Thompson. 1983. Southeast turtle survey (SETS). Final report to the National Marine Fisheries Service, contract number NA82-GA-C-00012, 80 pp.

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. NMFS Miami Laboratory, Coastal Resources Division Report, NOAA-NMFS-SAW/84/MMT/7, 64 pp.

Thompson, N.B., and H. Huang. 1993. Leatherback Turtles in Southeast U.S. Waters. NOAA Technical Memorandum NMFS-SEFSC-318, 25 pp.

[3] Thompson, N.B. 1988. The status of loggerhead, *Caretta caretta*; Kemp's ridley, *Lepidochelys kempi*; and green, *Chelonia mydas*, sea turtles in U.S. waters. Marine Fisheries Review 50:16-23.

[4] Carson, D. 2000. Relative abundance and distribution of sea turtles in the marine and estuarine waters of Palm Beach County, Florida, USA, based on aerial surveys, 1990-1993. In: Kalb, H., and T. Wibbels (comps.). Proceedings of the Nineteenth Annual Symposium on Sea Turtle Conservation and Biology. NOAA Technical Memorandum NMFS-SEFSC-443, pp. 148-152.

[5] Blaylock, R.A. 1993. GOMEX92: Survey Data Documentation Report, Gulf of Mexico Regional Aerial Survey, September-October 1992. NOAA/SEFSC Contribution MIA-92/93/24, January 2003.

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 4:15.

Sea Turtle Strandings

Stranding information is available from Atlantic and Gulf Coast Sea Turtle Stranding and Salvage Network reports produced by NMFS[6], and from the Florida Sea Turtle Stranding and Salvage Network database. Reports and publications produced as a result of cold-stunning events in Mosquito Lagoon[7], Indian River Lagoon[8], and St. Joseph Bay also provide stranding data.

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[6] Teas, W.G. 1992. 1990 Annual Report of the Sea Turtle Stranding and Salvage Network: Atlantic and Gulf Coasts of the United States January-December 1990. NMFS, Miami Laboratory Coastal Resources Division Contribution MIA-91/92-60, 52 pp.

Teas, W.G. 1992. 1991 Annual Report of the Sea Turtle Stranding and Salvage Network: Atlantic and Gulf Coasts of the United States January-December 1991. NMFS, Miami Laboratory Coastal Resources Division Contribution MIA-91/92-62, 49 pp.

Teas, W.G. 1993. 1992 Annual Report of the Sea Turtle Stranding and Salvage Network: Atlantic and Gulf Coasts of the United States January-December 1992. NMFS, Miami Laboratory Coastal Resources Division Contribution MIA-92/93-73, 47 pp.

Teas, W.G. 1994. 1993 Annual Report of the Sea Turtle Stranding and Salvage Network: Atlantic and Gulf Coasts of the United States January-December 1993. NMFS, Miami Laboratory Coastal Resources Division Contribution MIA-94/95-12, 47 pp.

Teas, W.G., and A. Martinez. 1989. 1988 Annual Report of the Sea Turtle Stranding and Salvage Network: Atlantic and Gulf Coasts of the United States January-December 1988. NMFS, Miami Laboratory Coastal Resources Division Contribution CRD-88/89-19, 47 pp.

Teas, W.G., and A. Martinez. 1992. 1989 Annual Report of the Sea Turtle Stranding and Salvage Network: Atlantic and Gulf Coasts of the United States January-December 1989. NMFS, Miami Laboratory Coastal Resources Division Contribution MIA-91/92-39, 51 pp.

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Witherington, B.E., and L.M. Ehrhart. 1989. Hypothermic stunning and mortality of marine turtles in the Indian River Lagoon system, Florida. Copeia 1989:696-703.

Fishery Interactions with Sea Turtles

Table 13 – Databases on sea turtle interactions with fisheries. All databases maintained by NMFS.

Dates	Fishery	Location
1950-1976	Exploratory	North Carolina to Texas[9]
1973-1981	Shrimping	North Carolina to Texas[10]
1978-present	Longline	Gulf of Mexico & Atlantic Ocean[11]
1981-1991	Various	Gulf of Mexico & Atlantic Ocean[12]

[9] Bullis, H.R., and S.B. Drummond. Sea turtle captures off the southeastern United States by exploratory fishing vessels 1950-1976. Florida Marine Research Publication No. 33, pp. 45-50.

[10] Henwood, T.A., and W.E. Stuntz. 1987. Analysis of sea turtle captures and mortalities during commercial shrimp trawling. Fishery Bulletin 85:813-817.

[11] Fairfield Walsh, C., 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, 51 pp.

Garrison, L.P. 2003. Estimated Bycatch of Marine Mammals and Turtles in the U.S. Atlantic Pelagic Longline Fleet During 2001-2002. NOAA Technical Memorandum NMFS-SEFSC-515, 52 pp.

Garrison, L.P. 2005. Estimated Bycatch of Marine Mammals and Turtles in the U.S. Atlantic Pelagic Longline Fleet During 2004. NOAA Technical Memorandum NMFS-SEFSC-531, 52 pp.

Garrison, L.P., and P.M. Richards. 2004. Estimated Bycatch of Marine Mammals and Turtles in the U.S. Atlantic Pelagic Longline Fleet During 2003. NOAA Technical Memorandum NMFS-SEFSC-527, 57 pp.

Johnson, D.R., C. Yeung, and C.A. Brown. 1999. Estimates of Marine Mammal and Marine Turtle Bycatch by the U.S. Atlantic Pelagic Longline Fleet in 1992-1997. NOAA Technical Memorandum NMFS-SEFSC-418, 55 pp.

Scott, G.P., and C.A. Brown. 1997. Estimates of Marine Mammal and Marine Turtle Catch by the U.S. Atlantic Pelagic Longline Fleet in 1994-1995. NOAA/SEFSC Contribution MIA-96/97-28, 31 pp.

Witzell, W.N. 1984. The incidental capture of sea turtles in the Atlantic U.S. Fishery Conservation Zone by the Japanese tuna fleet, 1978-81. Marine Fisheries Review 46:56-58.

Witzell, W.N. 1992. The Incidental Capture of Sea Turtles in Commercial Non-Shrimping Fisheries in Southeastern U.S. Waters. NOAA/SEFSC Contribution MIA-91/91-43, 22 pp.

Witzell, W.N. 1999. Distribution and relative abundance of sea turtles caught incidentally by the U.S. pelagic longline fleet in the western North Atlantic Ocean, 1992-1995. Fishery Bulletin 97:200-211.

Witzell, W.N., and J. Cramer. 1995. Estimates of Sea Turtle By-Catch by the U.S. Pelagic Longline Fleet in the Western North Atlantic Ocean. NOAA Technical Memorandum NMFS-SEFSC-359, 14 pp.

Yeung, C. 1999. Estimates of Marine Mammal and Marine Turtle Bycatch by the U.S. Atlantic Pelagic Longline Fleet in 1998. NOAA Technical Memorandum NMFS-SEFSC-430, 26 pp.

Yeung, C. 2001. Estimates of Marine Mammal and Marine Turtle Bycatch by the U.S. Atlantic Pelagic Longline Fleet in 1999-2000. NOAA Technical Memorandum NMFS-SEFSC-467, 42 pp.

[12] Thompson, N.B. 1991. Preliminary Information on Turtle Captures Incidental to Fishing in Southeastern U.S. Waters. NOAA Technical Memorandum MNFS-SEFC-285, 8 pp.

Relocation Trawling Activities Targeting Sea Turtles

Relocation trawling activities are conducted to remove sea turtles from an area where they may interact with ongoing dredging projects. Data are hosted by the U.S. Army Corps of Engineers at http://el.erdc.usace.army.mil/seaturtles/index.cfm.

Table 14 - Trawling activities targeting sea turtles.

Dates	Trawl Type	Location	Organization
1980-1981	Relocation	Canaveral Harbor	NMFS
1999-2004	Relocation	King's Bay Entrance Channel	Coastwise Consulting
2001	Relocation	Palm Beach Harbor	REMSA, Inc.
2002, 2004	Relocation	Canaveral Harbor	REMSA, Inc.
2003	Relocation	Pensacola Harbor	Coastwise Consulting
2005	Relocation	Longboat Key	Coastwise Consulting
2005	Relocation	Brevard County/Patrick AFB	Coastwise Consulting
2005	Relocation	Panama City Beach	East Coast Observers

Incidental Takes Associated with Renourishment and Dredging Projects

Reports of incidental takes during beach-renourishment and channel-dredging projects are administered by the U.S. Army Corps of Engineers and are available at http://el.erdc.usace.army.mil/seaturtles/index.cfm

Locations of projects with documented takes in Florida include:

- Canaveral Harbor/Patrick AFB
- King's Bay Entrance Channel
- Fort Pierce
- Palm Beach Harbor
- Jacksonville Harbor
- Tampa Bay – Egmont Channel
- Charlotte Harbor – Boca Grande Pass
- Mayport Naval Station
- Lake Worth Inlet, Jupiter Inlet
- Venice Beach
- Longboat Key

Incidental Sightings in Aerial Surveys Targeting Other Species

Table 15 - Aerial-survey projects targeting other species that report sea turtles.

Dates	Target Species	Location	Organization
1984-1985	Mullet	Florida Bay	NMFS[13]
1987-1997	Manatees	South FL	Eckerd College[14]
1994	Marine mammals	West coast of FL	NMFS
1995	Red drum	West coast of FL	NMFS
1995-1996	Fisheries	South FL	FMRI Fisheries Dependent Monitoring Group
ongoing	Sharks, manatees, others	Southwest FL	Mote Marine Laboratory
ongoing	Right whales	Northeast FL	FWRI
ongoing	Manatees	South FL	FWRI

[13] McCoy, A.J., and W.N. Witzell. 1995. Incidental aerial sightings of sea turtles in Florida Bay, Florida 1984-1985. NOAA Technical Memorandum NMFS-SEFSC-372, 8 pp.

[14] Reynolds, J.E. III, B.B. Ackerman, I.E. Beeler, B.L. Weigle, and P.F. Houhoulis. 1991. Assessment and management of manatees (*Trichechus mantus*) in Tampa Bay. In: Treat, S.F., and P.A. Clark (eds.). Proceedings of the Second Tampa Bay Area Scientific Information Symposium, pp. 289-306.

Satellite-Telemetry-Tracking of Sea Turtles

Many projects attach satellite transmitters to adult females who come ashore to nest on sandy beaches. Some of the in-water projects presented in this report also outfit captured turtles with transmitters. Many sea turtles are tracked from Florida waters, but there are also numerous turtles that have been tracked into Florida from outside the state. Some of these turtles took up residency in the state, but others continued to other locations. We identified 31 organizations that have tracked sea turtles in Florida waters, 13 of which have released turtles from Florida. A summary of sea turtles tracked into or from Florida is presented in Tables 16 and 17. However, there are likely additional projects that have tracked sea turtles from or into Florida that were not discovered during our literature searches.

Table 16. Sea turtle satellite-telemetry studies involving turtles released from Florida.

Dates	Species	Deployments	Organization	Release Location(s)
2001-2006	juvenile Cm	5	Disney	several Northeast and Northwest locations
1988-1989	adult Cc	1	FWS	Indian River Shores
2005	adult Dc	3	Marinelife Center	Juno Beach
2005-2006	adult Cc, juvenile Cm	14	Mote Marine Lab	Anna Maria Island and Casey Key
2000-2003	adult Cc, adult Cm	7	National Park Service	several Northwest locations
1998-2000	adult Cc	38	NMFS, FWC	Archie Carr NWR, Southwest and Northwest FL
1996-2004	adult Cc	24	NMFS, FWC	Florida Bay
1994-2000	adult Cm	23	NMFS, FWC, UCF	Archie Carr NWR and St. Lucie County
2006	adult Cc	9	South Carolina DNR	Cape Canaveral Area
2001-2006	juvenile and subadult Cm	15	UCF	several East Coast locations
2000	adult Dc	1	UCF, Sea World	Archie Carr NWR
2004	juvenile Cm	7	University of Florida	St. Joseph Bay
1997-1998	juvenile, subadult, and adult Cc	14	USACE	Northeast and Tampa Bay
2000	adult Cc	1	Whalenet	Anna Maria Island

Table 17. Sea turtle satellite-telemetry studies involving turtles tracked into Florida waters from other locations.

Dates	Species	Deployments	Organization	Release Location	Florida location
2005-2006	adult Dc	3	CCC Caribbean Leatherback Tracking Project	Chiriquí Beach, Panama	West Coast
1998-1999	adult Cm	1	Crip, NMFS	Isla Mujeres, Mexico	Western Keys
1999-2003*	Dc	1	Dalhousie University	Nova Scotia, Canada	Northeast Coast
2003	juvenile Cm, subadult Cc and Cm	4	Duke Marine Lab	North Carolina, USA	East Coast
2004-2005	adult Cc	6	Georgia DNR	Georgia, USA	East Coast
1998	juvenile Cc	1	Gray's Reef NMS	Georgia, USA	Northeast Coast
2004-2006	adult Cc	3	Marine Turtle Research Group	North Carolina, USA	East Coast
2005-2006	adult Cm	1	Marine Turtle Research Group	Cayman Islands	Southwest Keys
2005-2006	juvenile Cc	1	National Environmental Research Institute, Denmark	Azores	East Coast
1995	Lk	1	NMFS, TAMUG	Texas, USA	West and East Coasts
2005	juvenile Cc	2	North Carolina Aquariums	North Carolina, USA	Northeast Coast
2001	adult Cc	2	Oceanic Resource Foundation	Lechuguillas, Mexico	West Coast
1998-2006	juvenile and adult Cc	5	South Carolina DNR	South Carolina, USA	East Coast
1999	Dc	1	Universite Louis Pasteur	French Guiana	Northeast Coast
2001	juvenile Cc	1	University of Alabama	Alabama, USA	Northwest Coast
1999	subadult Cc	1	USACE	Georgia, USA	Northeast Coast
2003-2004	juvenile Lk	1	VIMS	Virginia, USA	East Coast

*One of 38 turtles tracked during this time period (James *et al.* 2005)