Section 6 Report Review

Project: Piping Plover and Snowy Plover Winter Habitat Status Survey

Job #: 9.1

Reviewer: Angie Brooks and Karen Meyer Date: December 28, 1994

Reviewer's Station: Corpus Christi Ecological Services Field Office

Lead station was contacted and concurs with the following comments:

_____ Yes _____ No __X__ Not applicable (reviewer is from lead station)

Report: __X__ is acceptable as is

_____ is acceptable as is for an interim report, but the following comments are made for future reference

_____ needs revision (listed below)

Other comments: (Note to commenter: If you make comments directly on a copy of the report, write legibly and dark so comments will reproduce well when photocopied.)

PERFORMANCE REPORT

As Required by

THE ENDANGERED SPECIES ACT, SECTION 6

TEXAS
Grant No: E-1-6

ENDANGERED AND THREATENED SPECIES CONSERVATION

Project No. 9.1

Piping Plover and Snowy Plover Winter Habitat Status Survey

Project Coordinator: Lee F. Elliott

Principal Investigators: Kim Withers
Mark R. Mitchell
Curt Zonick

Larry D. McKinney, Ph.D.
Director
Resource Protection Division

Andrew Sansom
Executive Director
Texas Parks and Wildlife Department

November 30, 1994

ABSTRACT

Three separate research studies address several aspects of the biology of piping and snowy plovers, including their distribution, habitat use, the relationship of bird densities to prey densities, and local movement patterns relative to weather and tidal conditions. An in-depth study of the relationship of macrobenthic prey availability to shorebird use has been completed (Attachment 1). Additional analysis of substrate use, data on peregrine falcon locations, and more specific locality information for piping plovers is provided for the completed coast wide air-boat survey for piping plovers and peregrine falcons (Attachment 2). Analysis continues for a study addressing several aspects of plover biology at sites along the upper, middle, and lower Texas coast (Attachment 3). Field work for all three portions of the project has been completed.

Two study sites, one on Mustang Island and one on Padre Island, were used to examine the relationship of macrobenthic prey availability to shorebird use. Both of the study sites consisted of blue-green algal flats (wind-blown flats of sand or clay substrate covered by a layer predominantly composed of a filamentous blue-green algae, *Lyngbya* sp.). Shorebirds were censused and macrobenthic invertebrates were sampled biweekly from October 1991 to October 1993. Twenty-two species of shorebirds were observed and 50 taxa of macrobenthic invertebrates were identified. Polychaetes, tanaids, and dipteran larvae were most frequently encountered in the macrobenthic samples. Three microhabitat guilds were identified: Open water - tactile-feeding shorebirds; Wet - visual+tactile foragers; and, Damp-Wet - piping, snowy, and semipalmated plovers (visual foragers). Relationships between shorebird density and macroinvertebrate density and/or biomass were determined using linear regression. Overall interpretation of models suggested that shorebird density was determined by sufficient tidal flat area estuary-wide, with enough inundation on particular sites to maintain a well-developed macrobenthic community including both ephemeral, aquatic organisms and persistent, semi-terrestrial organisms. Tidal flats with well-developed macrobenthic communities were likely to be used by shorebirds.

A coastwide air-boat survey of bayside habitats along the Texas coast was completed and additional information addressing locality data (locations of observations of piping plovers and peregrine falcons are provided on USGS 7 1/2" quadrangle maps) as well as data addressing use of various substrates by piping plovers were included. Data provided in this study suggest an association between piping plover use and proximity to bayside passes to inland lakes, bayous, and the gulf.

Field work was completed on the third study of this project and final analysis of data will soon be completed. This study addresses the ecology and conservation of wintering piping plovers and snowy plovers. Three areas were chosen for the present study, the nothern coast (vicinity of Galveston Island), the central coast (vicinity of Mustang Island), and the southern coast (South Bay, South Padre Island, Brazos Island, and Laguna Atascosa National Wildlife Refuge). Data was collected to assess shorebird population size, to determine primary locations of foraging piping and snowy plovers and to evaluate movement patterns using color-marked plovers. Once important foraging areas were located, additional data addressing foraging locomotion, foraging efficiency, and prey population levels were collected. Initial analyses suggest that plovers spend more time in prolonged locomotion in beach habiat than in bayside flats. Foraging efficiency appears to be similar among habitats and data analyzed thus far suggests considerable latitudinal differences among movement patterns. A review of plover population levels and potential impacts to sites is presented.

PERFORMANCE REPORT

STATE:	Texas	**PROJECT NO.:**	E-1-6

PROJECT TITLE: Endangered and Threatened Species Conservation.

PERIOD COVERED: September 1, 1993 to August 31, 1994

JOB NUMBER: 9-1

JOB TITLE: Piping plover (*Charadrius melodus*) and snowy plover (*Charadrius alexandrinus*) winter habitat status survey.

JOB OBJECTIVE: To characterize habitats, examine foraging efficiency, and investigate movement patterns of wintering piping and snowy plovers.

SEGMENT OBJECTIVE:

1. Identify habitat characteristics that are predictive of piping plover and snowy plover site use and density on the Texas coast.

2. Determine foraging efficiency and body condition of piping plovers and snowy plovers as each relates to habitat type, geographic location, and time.

3. Determine piping plover and snowy plover movements within and among wintering sites along the Texas coast.

4. To determine if and when shorebirds are limited by competition for space and/or resources.

5. Determine if shorebird densitites, including piping plovers and snowy plovers, on intertidal sand- and mud- flats are related to prey density and/or availability.

ACCOMPLISHMENTS

Kim Withers of Texas A & M University has recently completed her work addressing objectives 4 and 5. Attach ment 1 provides a complete treatment of the data addressing the relationship between shorebird use and macrobenthic communities.

Additional information from surveys conducted by Mark Mitchell are presented in Attach ment 2. Survey results are provided on USGS 7 1/2" quadrangles,and additional information on peregrine falcon sightings and plover habitat use are also provided.

Field work has recently been completed addressing objectives 1 through 3. This work, accomplished by Curt Zonick of the University of Missouri (Attachment 3) and his

ATTACHMENT 1

Piping Plover and Snowy Plover Winter Habitat Status Survey

ATTACHMENT 2

Piping Plover and Snowy Plover Winter Habitat Status Survey

ABSTRACT

Surveys of Texas' coastal barrier islands were conducted to document the extent of use of the bayside marsh and flats habitats by piping plovers (*Charadrius melodus*) and peregrine falcons (*Falco peregrinus tundrius*). Surveys began in October 1988 and continued through April 1992. An estimated total of 296.75 miles of bayside habitat was surveyed. The survey season began in October and continued through March with 6 surveys planned for each route. Total survey effort is estimated at 2,065 miles traveled through 80 surveys of 12 routes.

Total piping plover observations were 3850. A total of 104 different piping plover use areas were identified. The distribution of use areas on the upper, mid, and lower coast was 17%, 58% and 29% respectively of recorded sites.

Data suggest that bayside habitat influences the winter distribution of piping plovers more than gulf beach habitat. Data also suggest that on the mid and upper coast piping plover distribution is related to bayside passes to inland lakes, bayous, and the gulf.

Peregrine falcons were not observed to be abundant on the bayside marsh and flats habitats, therefore the surveys centered primarily around piping plovers. A total of 26 falcons were observed on all surveys combined.

Piping Plover and Peregrine Falcon Habitat Use

Principal Investigator: Mark Mitchell
Texas Parks and Wildlife Department
Fisheries-and-Wildlife Division

November 1994

I. Objective:

Identify the extent of piping plover and peregrine falcon use of bayside marsh and flats habitat on coastal barrier islands.

II. Background:

The piping plover (*Charadrius melodus*) has received considerable attention after being listed as a threatened species in January 1986 (U.S.F.W.S. 1986). The listing of the species created an explosion of interest in its wintering and nesting habitats. Research in the northern breeding territories has identified problems associated with a reduction in productivity. Vehicular and human traffic on nesting areas and modifications of waterways have created a reduction in beach habitat (Haig 1985).

Wintering habitat along the Gulf of Mexico was a major concern of Texas Parks and Wildlife Department (TPWD) biologists. The Texas Gulf coast has experienced a drastic decline in habitat due to human development and tourism. An increasing human population of coastal habitat will continue this trend. The TPWD biologists determined a need to survey and document the areas of high use by piping plovers along the bayside marsh and flats of the Texas barrier islands. These data would enable biologists to redirect efforts of development toward areas of lesser importance to plovers and other shorebirds. Identification of critical habitat would be of significant importance in cases of industrial accidents.

Peregrine falcons (*Falco peregrinus tundrius*) were surveyed and documented in conjunction with piping plovers. Significant use of the bayside by falcons was not observed, therefore the surveys centered around piping plovers. A total of 26 falcons were identified in the mid and lower coasts. The Padre/Mustang Islands route (route 8) documented the most falcons with 8 being recorded during November 1989 (Table 15).

III. Procedures:

Initially the surveys would span three wintering seasons beginning in October 1988 and finishing in March 1991. In this time frame we could survey from Caney Creek Estates on the northeast end of east Matagorda Bay south to South Bay on the Texas/Mexico border. This being a distance of approximately 252 miles. Areas of large commercial and residential development were excluded from the survey. In 1990 it was decided to extend the survey one year in order to survey Christmas Bay, Galveston Island, and Bolivar Peninsula. The surveys conducted in 1991 and '92 of the upper coasts were extended through April in an attempt to document sites used on spring migration.

The surveys were concluded in April 1992.

A fourteen foot airboat was chosen as transportation for its ability to negotiate shallow inlets and flats and deep water channels. The noise of the airboat was of initial concern but proved not to be a problem in that plover species are relatively tolerant. Sandpiper species seem to exhibit a lesser tolerance of the noise.

Surveys were initially conducted the first four hours of daylight and the last four hours of daylight. After realizing that conducting surveys to identify high use areas was not productive during higher tides, the survey schedule was adjusted to one survey of no specified length of time during the low tide.

Two people were present during each survey to insure complete coverage of the area. The driver of the boat was responsible for navigation and observation. The passenger was responsible for observation and recording of data. Surveys were conducted at lowest possible speed in order to make a thorough search of the habitat. When birds were encountered the boat was stopped for close examination. Counts were made from the boat or from foot when the situation dictated. When birds were found documentation was made of the number of individuals, substrate type, time of day, tidal conditions, and other plover species in the area.

Each survey consisted of one pass along the bayside of the barrier island with the return trip being casual observations. When possible the survey would be a loop with the return trip being a survey of inland saline lakes and marsh.

Each survey route was drawn so that it could be thoroughly examined in a 4 hour period. Starting and ending points were chosen as distinct geographical locations so that routes could be easily mapped. The Texas coast was divided into 12

segments. Beginning in the northeast portion of the Texas: 1) Bolivar Peninsula, 2) Galveston Island, 3) Follet's Island (Christmas Bay), 4) East Matagorda Peninsula, 5) Matagorda Peninsula, 6) Matagorda Island, 7) San Joseph Island, 8) Mustang Island and the north tip of Padre Island, 9) Padre Island to the Land Cut, 10) Padre Island (Land Cut to Green Island, 11) South Padre Island (Port Mansfield to the town of South Padre Island), and 12) South Bay (fig. 1).

Bolivar Peninsula (route 1):

The Bolivar Peninsula surveys began at the Texas Highway Department ferry landing on the southeast tip of the peninsula. The survey route continued northeast along the bayside to Rollover Pass, a distance of approximately 23.25 miles (fig.2). Bolivar Flats was not included in this survey due to its more proximal location as a Gulf side habitat.

Surveys were conducted on Bolivar Peninsula beginning in October 1991 and continued through April 1992. During January the survey was not completed due to mechanical problems with the boat. No survey was conducted during February due to other TPWD obligations.

Galveston Island (route 2):

The Galveston Island surveys began at South Deer Island, approximately 2 miles southwest of the Galveston Island Causeway (IH 45). The survey continued southwest along the bayside of the island for approximately 12.5 miles to the San Louis Pass. The San Louis Pass Causeway was considered the distinction of bayside habitat from gulf beach (fig.3).

Surveys were conducted on Galveston Island beginning in October 1991 and continued through April 1992. During December the survey was not completed due to mechanical boat problems. No survey was conducted during February due to other TPWD obligations.

Follet's Island (route 3):

The Follet's Island surveys began at San Louis Pass and continued southwest along the island side of Christmas Bay to Drum Point, a distance of approximately 9.25 miles. On the return trip the mainland side of the Christmas Bay was surveyed (fig. 3).
Surveys were conducted of Follet's Island beginning in October 1991 and continuing through April 1992. No survey was conducted during February due to other TPWD obligations.

East Matagorda Peninsula (route 4):

Surveys of East Matagorda Peninsula began at the community of Caney Creek Estates and continued Southwest to the town of Matagorda, a distance of approximately 26.5 miles (fig. 4).

Surveys were conducted beginning in October 1990 and continuing through March of 1991. No survey was conducted in February of 1991 due to other TPWD obligations.

Matagorda Peninsula (route 5):

Surveys of Matagorda Peninsula began at the town of Matagorda and continued southwest along the peninsula, across Pass Cavallo, and the northeast tip of Matagorda Island to the TPWD boat dock, a distance of approximately 39 miles (fig.5).

Surveys were conducted beginning in October 1989 and continuing through March 1990. On this survey route personnel would survey to the Matagorda Island Wildlife Area headquarters and remain overnight. On the following day the peninsula would be surveyed back to the starting point at the town of Matagorda. This allowed for two surveys during low tides.

A total of two (2) Peregrine Falcons were observed during the surveys of Matagorda Peninsula. Both birds were observed during the August surveys (table 14).

Matagorda Island (route 5):

The surveys began at the Matagorda Island Wildlife Management Area boat dock and continued south along the outside islands to Panther Point. The return trip surveyed the saline lakes on the inner edges of the outside islands. The total survey distance was approximately 19.5 miles (fig.6).

Surveys were conducted beginning in October 1988 and continuing through March 1989. Surveys of Matagorda Island were conducted during the first 4 hours of daylight and the last 4 hours of daylight during October and November. All subsequent surveys were conducted during low tides. No survey was conducted during February due to other TPWD obligations.

A total of two (2) Peregrine Falcons were observed during the Matagorda Island surveys. One bird was observed during the October survey and one was observed during the March survey (table 14).

St. Joseph Island (route 8):

Surveys of St. Joseph (San Jose) began in October 1990 and continued through March 1991. The surveys began at the Aransas Pass Ship Channel and continued northeast to Cedar Bayou, a distance of approximately 27.75 miles (fig.7). The inland sloughs of the northern portion could only be surveyed during higher tides when the habitat was inundated.

A total of three (3) Peregrine Falcons were observed during the surveys of St. Joseph Island. One falcon was observed during December and two were observed during the January survey.

Mustang/Padre Island (route 9):

Surveys began at the John F. Kennedy causeway and continued southward along Padre Island to South Bird Island. The survey route would return to the causeway and continue northward along Mustang Island to Shamrock Island, a total distance of approximately 24.5 miles (fig. 8).

The Mustang/Padre Island surveys began in October 1989 and continued through March of 1990. No survey was conducted during February due to other TPWD obligations.

A total of seven (7) Peregrine Falcons were observed during the Mustang/Padre Island surveys. al seven sightings occurred during the November survey (table 14).

Upper Padre Island (route 9):

Surveys of the Upper portion of Padre Island began at South Bird Island and continued southward to the Land Cut, a distance of approximately 36.5 miles (fig. 9).

Surveys began in October 1988 and continued through March 1989. Due to this route being surveyed during the first year, a morning and evening survey was conducted on each survey day. This survey format was altered on subsequent routes to surveying during low tides. No survey was conducted during February due to other TPWD obligations.

A total of two (2) Peregrine Falcons were observed during the Upper Padre Island surveys. One falcon was observed during the October survey and one falcon was observed during the December survey (table 14).

Middle Padre Island (route 10):

The Middle Padre Island route began at Green Island and

continued northward to the Land Cut, a distance of approximately 26.5 miles (fig. 10).

Surveys began in October 1990 and continued through March 1991. No survey was conducted during January 1991 due to survey time being allocated to commitments to the National Piping Plover Winter Census. No survey was conducted during March due to high wind conditions and unsafe boating conditions.

A total of three (3) Peregrine Falcons were observed during the Middle Padre Island surveys. One falcon was observed during the November survey and two during the December survey (table 14).

Lower Padre Island (route 11):

Surveys of the lower Padre Island began at the city limits of South Padre Island and continued northward to Green Island, a distance of approximately 40.5 miles (fig. 11).

Surveys began in October 1990 and continued through March 1991. No survey was conducted during January due to survey time being allocated to commitments to the National Piping Plover Winter Census.

A total of six (6) Peregrine Falcons were observed during the Lower Padre Island surveys. One falcon was seen each month during the months of September, October, February, and March. Two falcons were observed during the month of November (table 14).

South Bay (route 12):

Surveys of South Bay began at the Brownsville Ship Channel and continued in a clockwise direction along the edge of the bay until the survey was again at the Brownsville Ship Channel, a distance of approximately 11 miles.

Surveys began in October 1990 and continued through March 1991. No survey was conducted during January due to survey time being allocated to commitments to the National Piping Plover Winter Census. no survey was completed during February due to high winds causing unsafe boating conditions.

A total of one (1) Peregrine Falcon was observed during the surveys of South Bay. This falcon was observed during the March survey (table 14).

IV. & V. Findings and Analysis:

Piping Plover:

The Texas Gulf Coast is large and diverse. The coastline is approximately 367 miles in length with yearly rainfall varying from 53 inches on the Louisiana border to 25 inches on the Mexico border. The inland bays along the upper coast are typically deeper with a more distinct shore or vegetation line. The barrier islands through the mid-coast contain more inland lakes or lagoons. The lower coast is typically shallow with large algal flats.

On the upper Texas Coast (Bolivar Peninsula, Galveston Island, Follet's Island , and East Matagorda Peninsula) 282 plovers were observed on 21 surveys utilizing 17 different sites. Total survey effort for the upper coast was 366.7 miles with a mean plover sighting per mile of 1.3.

Surveys of the mid-coast (Colorado River south to South Bird Island) documented 2,366 plover sightings on 34 surveys utilizing 58 different sites. Total survey effort for the mid-coast was 1,025.5 miles with a mean plover sighting per mile of 2.3.

Through the lower-coast (South Bird Island to Mexico) 1,202 piping plovers were documented on 22 surveys utilizing 29 sites. Total survey effort for the lower-coast was 717.5 miles with a mean plover sighting per mile of 1.7.

Throughout the surveys the higher use areas identified were passes to inland lagoons, bayous, or the Gulf of Mexico. Of the 105 sites identified as plover use areas, 26% (27) were passes. These 27 passes accounted for 40% (1,535 of 3,850) of the plovers identified. The mean number of piping plovers observed at passes was 61.5 as opposed to 30.7 at sites not considered passes.

The piping plover's preference for bayside passes as feeding areas along the mid and upper coasts appeared to be the underlying factor in the distribution of wintering birds. Through the mid and upper coast, the greatest number of birds were found concentrated at passes during low tides. When feeding at bayside sites plovers are gregarious and exhibit little territorality. However, when observed on the beach, they display a high degree of territorality with birds most commonly found alone. These observations suggest an abundance of food at bayside sites and limited food on the gulf side beach.

Concurrent beach/bay surveys support these data. When the surveys were conducted during lower tides, the bayside supported the highest density of birds. During these surveys birds found on the bayside were found in flocks foraging in

the same vicinity. When concurrent surveys were conducted during higher tides the beach supported the higher density but with birds not found in flocks and exhibiting territorality. This suggests that during optimum foraging tides (low tide) that the bayside habitat is more productive (table 14).

The distribution of piping plovers in the mid and upper coast corresponds to the numbers and location of bayside passes to lagoons or the Gulf of Mexico. Surveys (both beach and bay) of areas with few bayside passes showed a low occurrence of plovers.

Through the lower coast (Padre Island) the importance of passes to the overall wintering population is not as evident. Along the lower coast only 20.0% (234 of 1,202) of the plovers observed were found at passes. The passes themselves accounted for 20.6% (6 of 29) of the sites identified through the lower coast. This gives a mean plover per site of 39.0 at passes and 52.3 at sites not identified as passes. Plovers observed utilizing passes did exhibit a more gregarious nature, as typical of the upper portions of the Texas Coast.

In the lower coast the majority (75.8%) of plovers identified were utilizing algal flats. When feeding on algal flats plovers were found in loosely knit flocks foraging over large areas. Territorality was not strongly exhibited, suggesting an abundance of food. Because these algal flats are so extensive, a lack of space does not appear to be a problem on the lower coast.

Substrate type was divided into 7 categories:

1) sand: will not stick to bottom of shoes when wet.
2) sand/silt: will lightly stick to bottom of shoes when wet.
3) sand/shell: majority of material is broken shell fragments.
4) sand/mud: large "globs" or "chunks" stick to bottom of shoes.
5) mud: relatively small percentage of sand.
6) algal mat: a mat of living plant matter covering surface.
7) spoil island: artificial island created from dredge spoil; no specified soil type.

Substrate type preferred (by amount of plover utilization) overall was sand/silt. A majority of plover sightings (64.3%) occurred at sites classified as sand/silt. Algal mat appeared to be the second chosen substrate type accounting for 26.7% of total plover sightings. The remaining 5 substrates accounted

for only 6.9% of plover sightings (table 13).

Preference between sand/silt and algal mat is believed to be more of a preference for geographical location than substrate type due to the high amount of each in its respective areas. The Mustang/Padre Island survey (route 8) was the overlap area of algal mat and sand/silt. On surveys south of route 8 the predominant substrate available is algal mat. On surveys north the predominant substrate is sand/silt. On the route 8 survey itself there is a somewhat even mix of the two types.

Peregrine Falcons:

Peregrine Falcons were not observed consistently during any survey of the bayside of the barrier islands. With a total of only 26 falcons observed during all of the surveys there is evidence that the bayside is not important to foraging falcons (table 15).

It must be pointed out that in the course of surveying both species it is extremely difficult to maintain a watchful eye towards falcons and plovers concurrently. There exist a possibility of low falcon occurrence due to the fact that the survey techniques lend themselves better to plovers than to falcons.

VI. Management Implications:

This study suggest management implication for piping plovers on the Texas Coast. Surveys to census or locate heavy concentrations have historically (with the exception of the 1991 winter census) been concentrated on the gulf beach. Data from these surveys suggest that more accurate census and location data may be obtained from bayside surveys.

Census to estimate numbers of piping plovers should also be concurrent transects of the beach and bay regardless of tidal conditions.

Further studies should be initiated to understand movements of piping plovers and the relationship of movements to food availability. Further studies should investigate site fidelity on winter use areas and key components of high use areas.

LITERATURE CITED

Haig, S. 1985. The Status of the Piping Plover in Canada, a Status Update Prepared for the Committee on the Status of Endangered Wildlife in Canada. National Museum of Canada, Ottawa, Ontario.

U.S.F.W.S. 1988. Great Lakes and Great Plains Piping Plover Plan. U.S. Fish and Wildlife Service, Twin Cities, MN. 160pp.

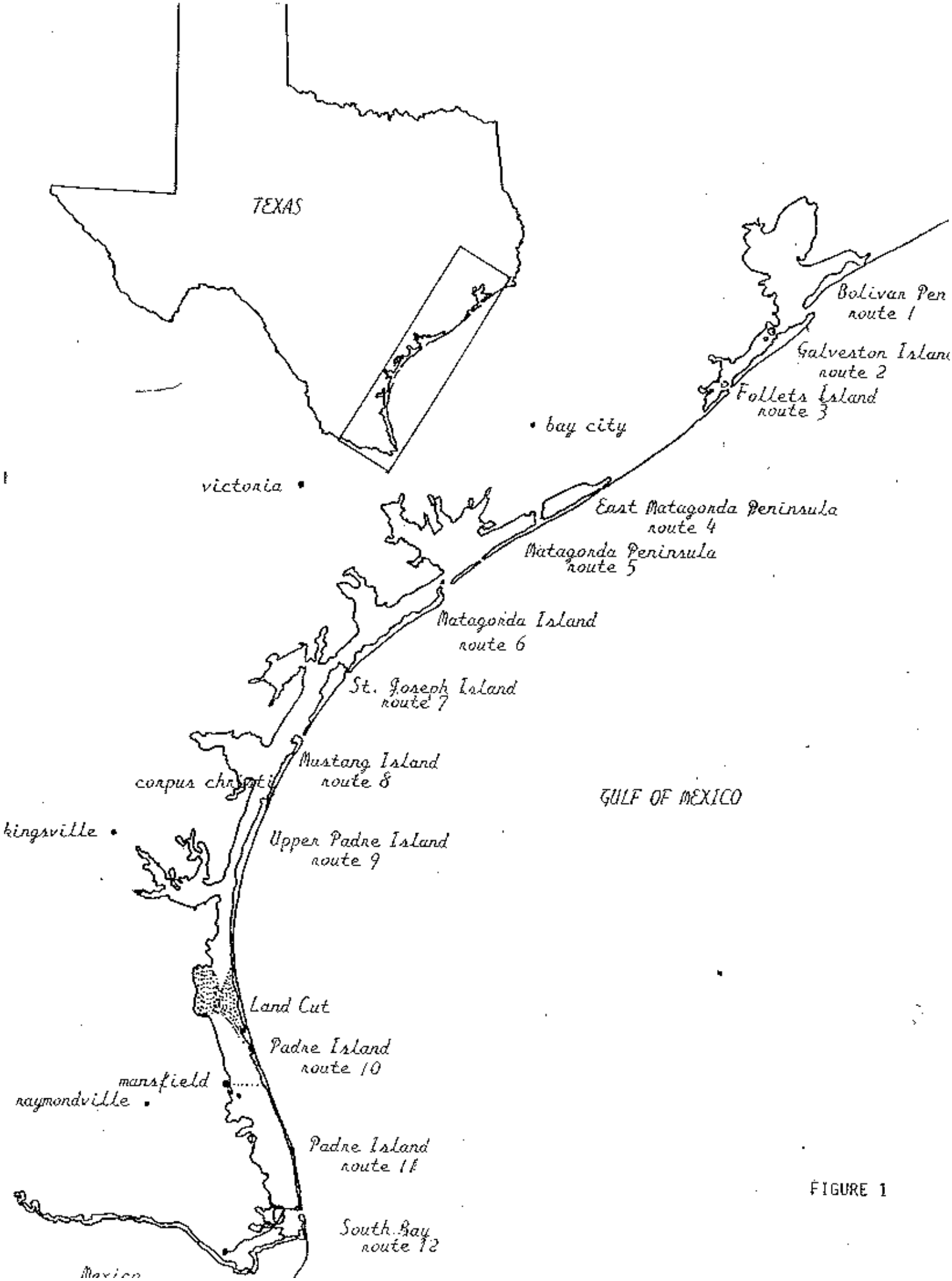

TEXAS
Bolivar Pen
route 1
Galveston Islan
route 2
Follets Island
route 3
bay city
victoria
East Matagorda Peninsula
route 4
Matagorda Peninsula
route 5
Matagorda Island
route 6
St. Joseph Island
route 7
Mustang Island
route 8
corpus christi
GULF OF MEXICO
kingsville
Upper Padre Island
route 9
Land Cut
Padre Island
route 10
mansfield
raymondville
Padre Island
route 11
South Bay
route 12
Mexico

FIGURE 1

FIGURE 2

BOLIVAR PENINSULA (ROUTE 1)

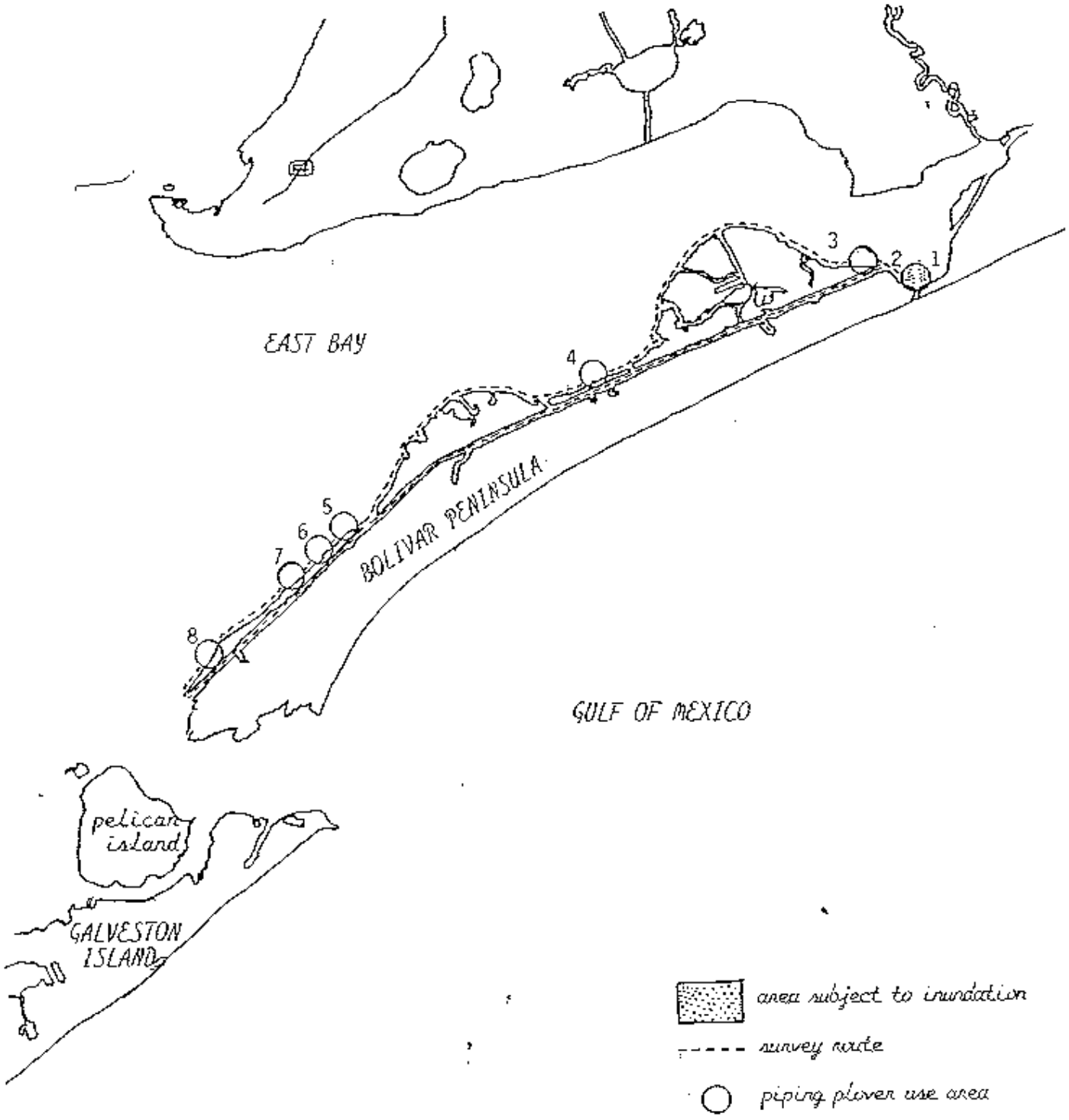


FIGURE 3

GALVESTON ISLAND (ROUTE 2) & FOLLETS' ISLAND (ROUTE 3)

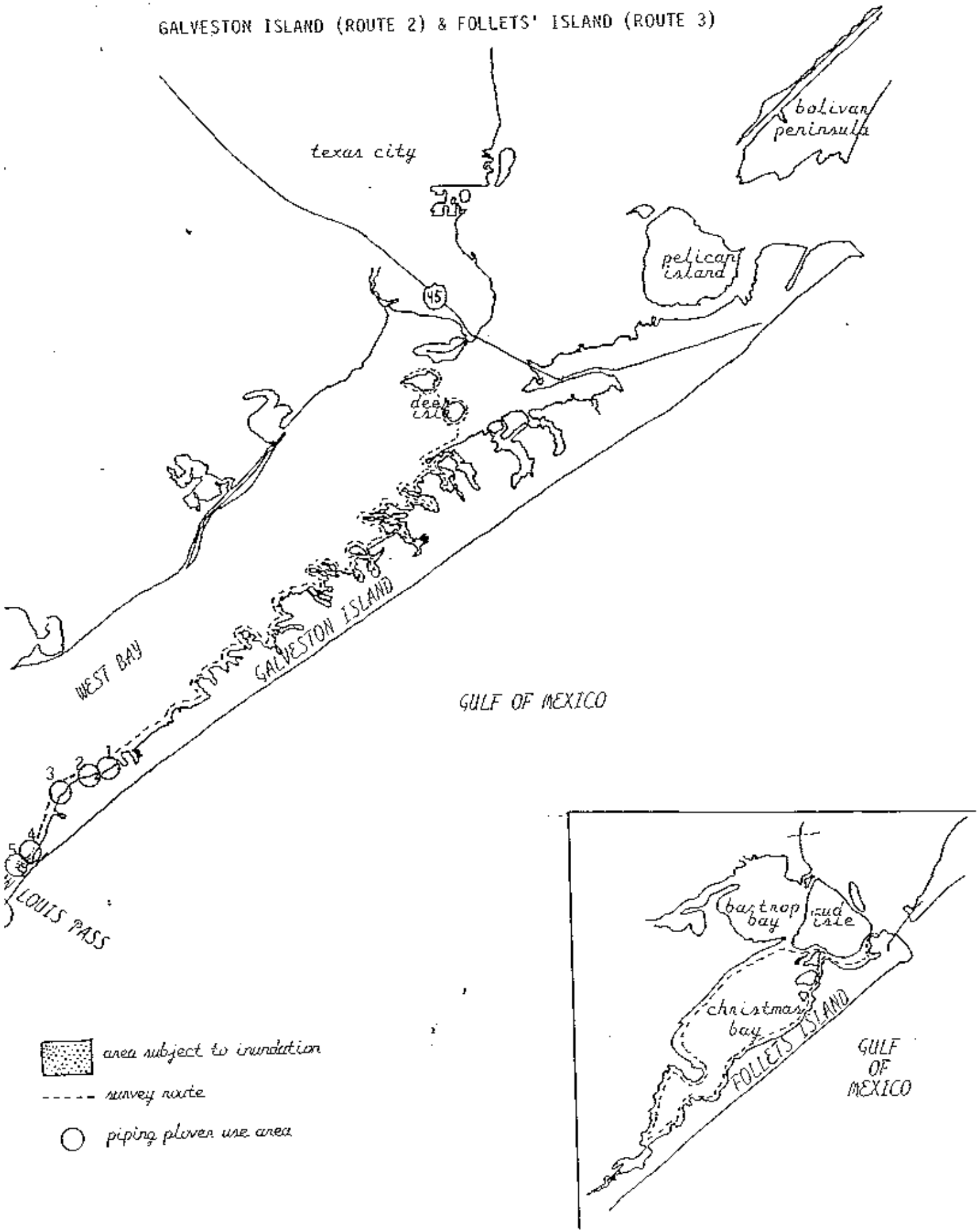
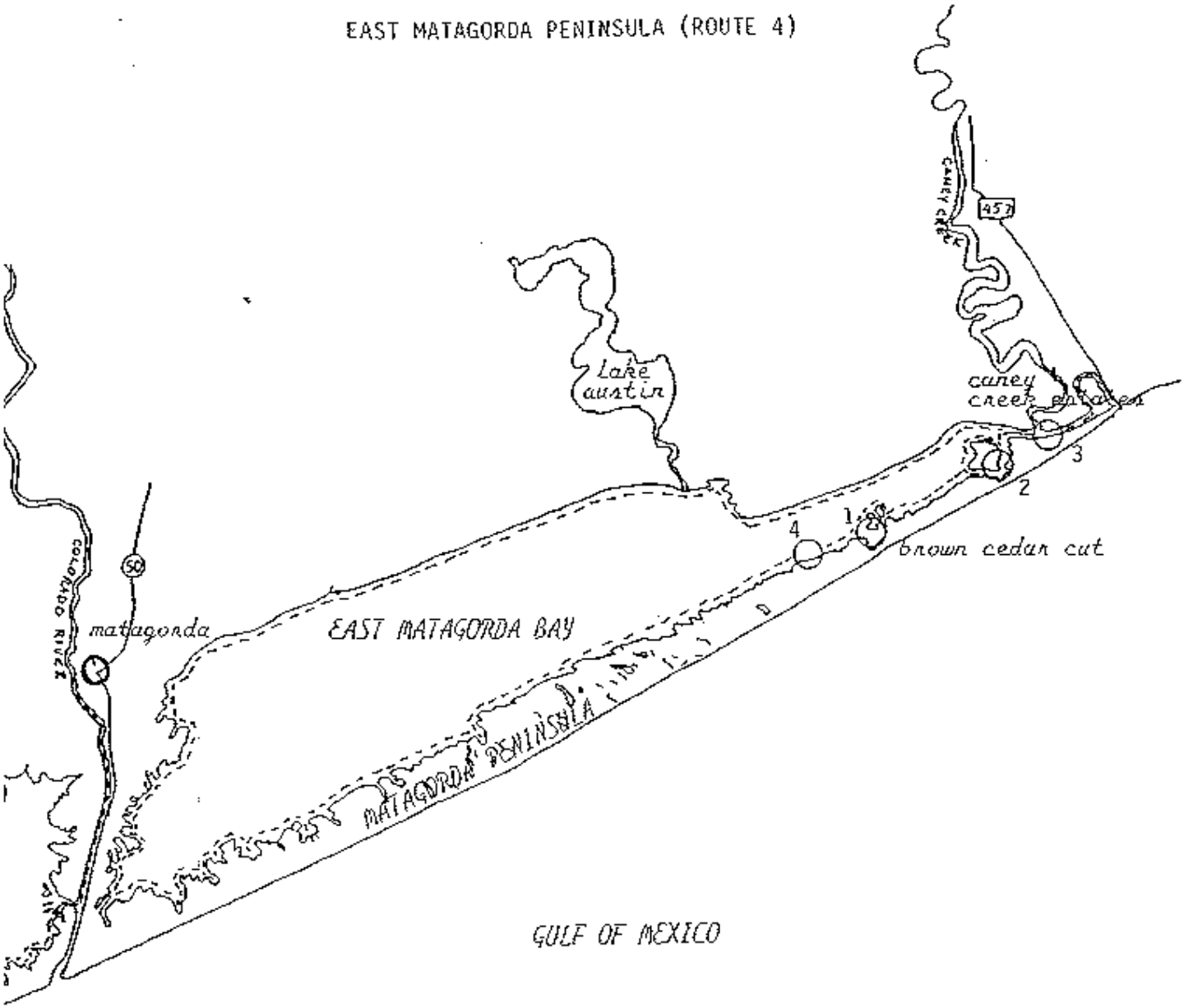


FIGURE 4

EAST MATAGORDA PENINSULA (ROUTE 4)



area subject to inundation

survey route

piping plover use area

FIGURE 5

MATAGORDA PENINSULA (ROUTE 5)

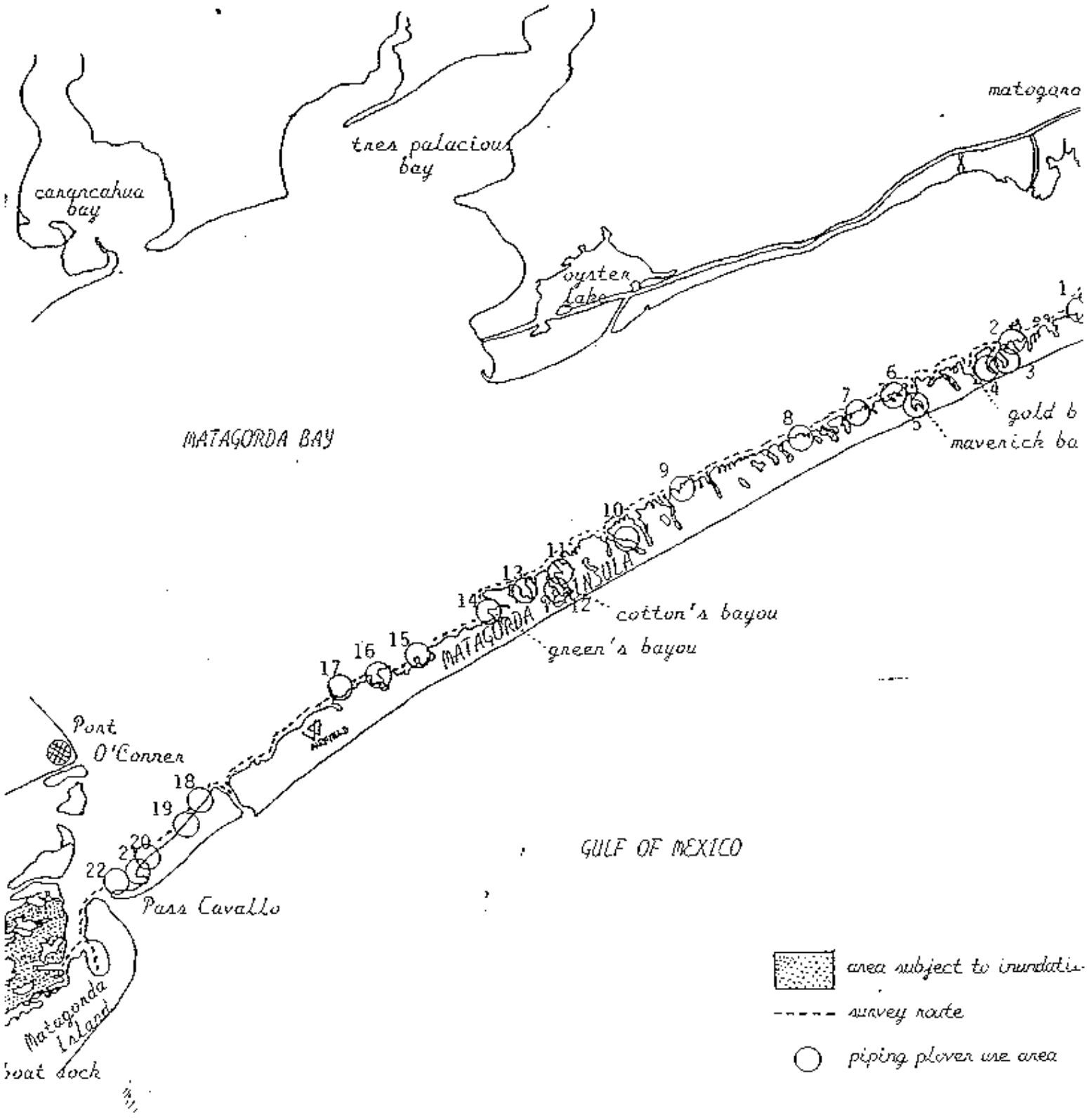


FIGURE 6

MATAGORDA ISLAND (ROUTE 6)

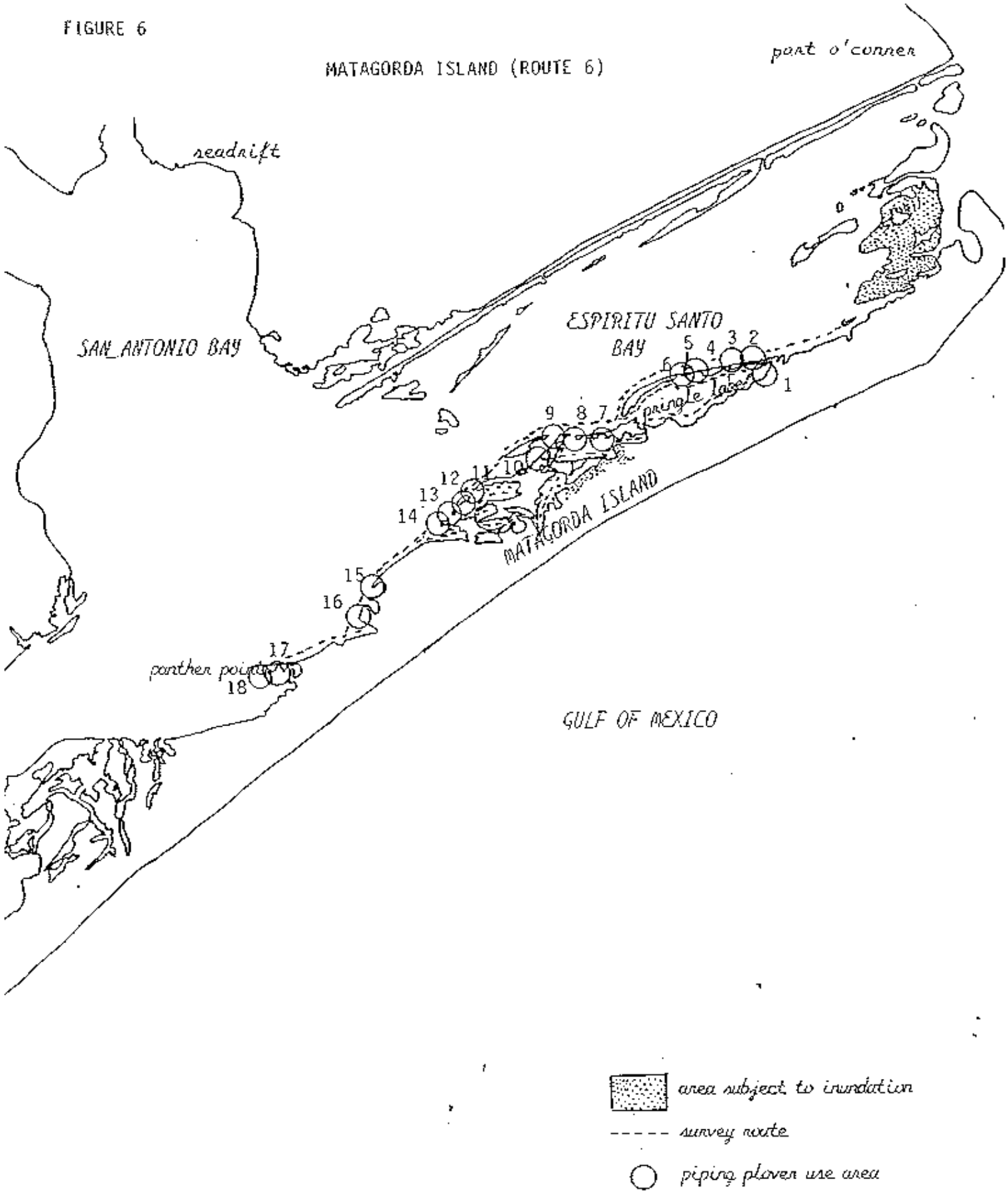


FIGURE 7 ST. JOSEPH ISLAND (ROUTE 7)

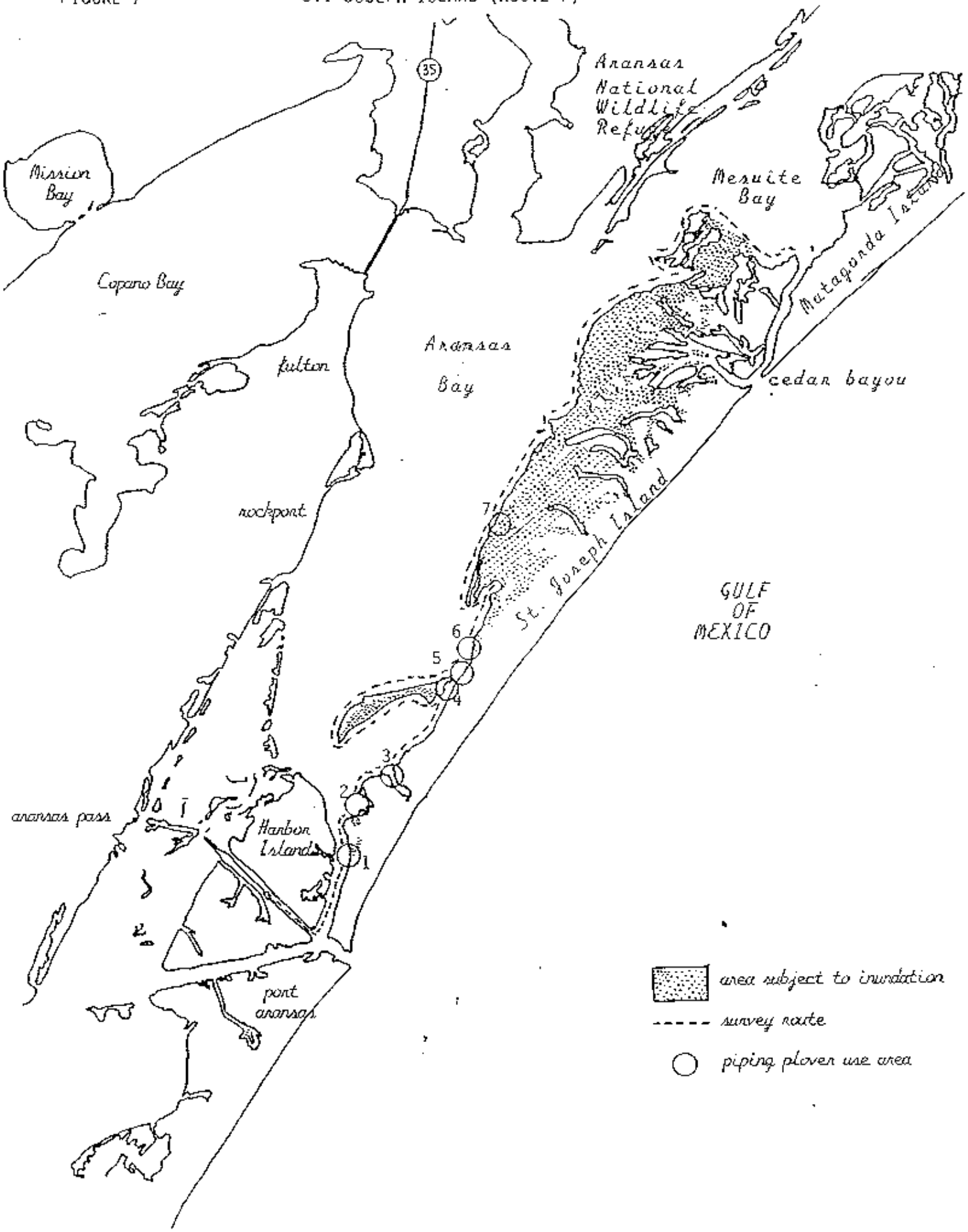


FIGURE 8

MUSTANG/PADRE ISLAND (ROUTE 8)

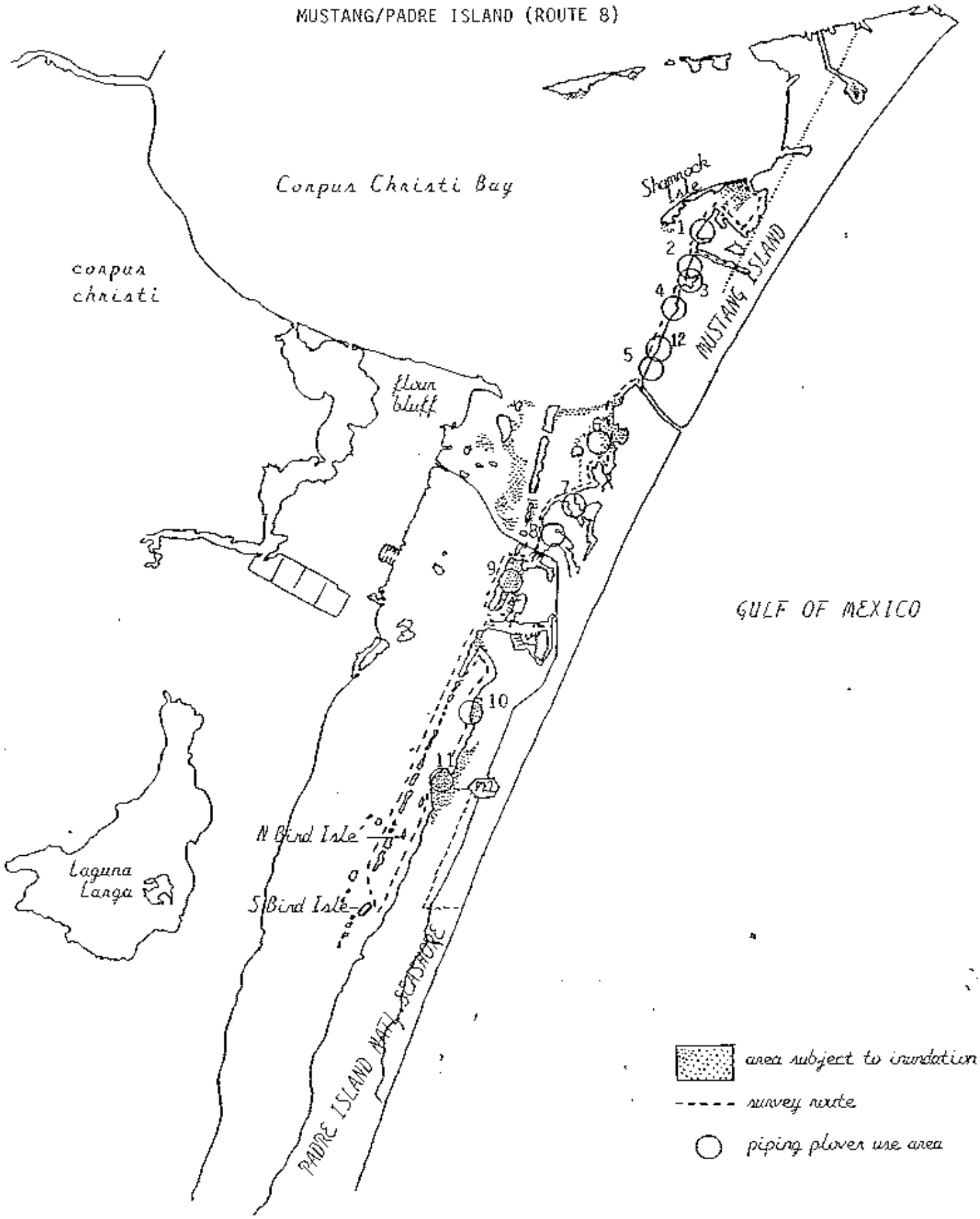


FIGURE 9

UPPER PADRE ISLAND (ROUTE 9)

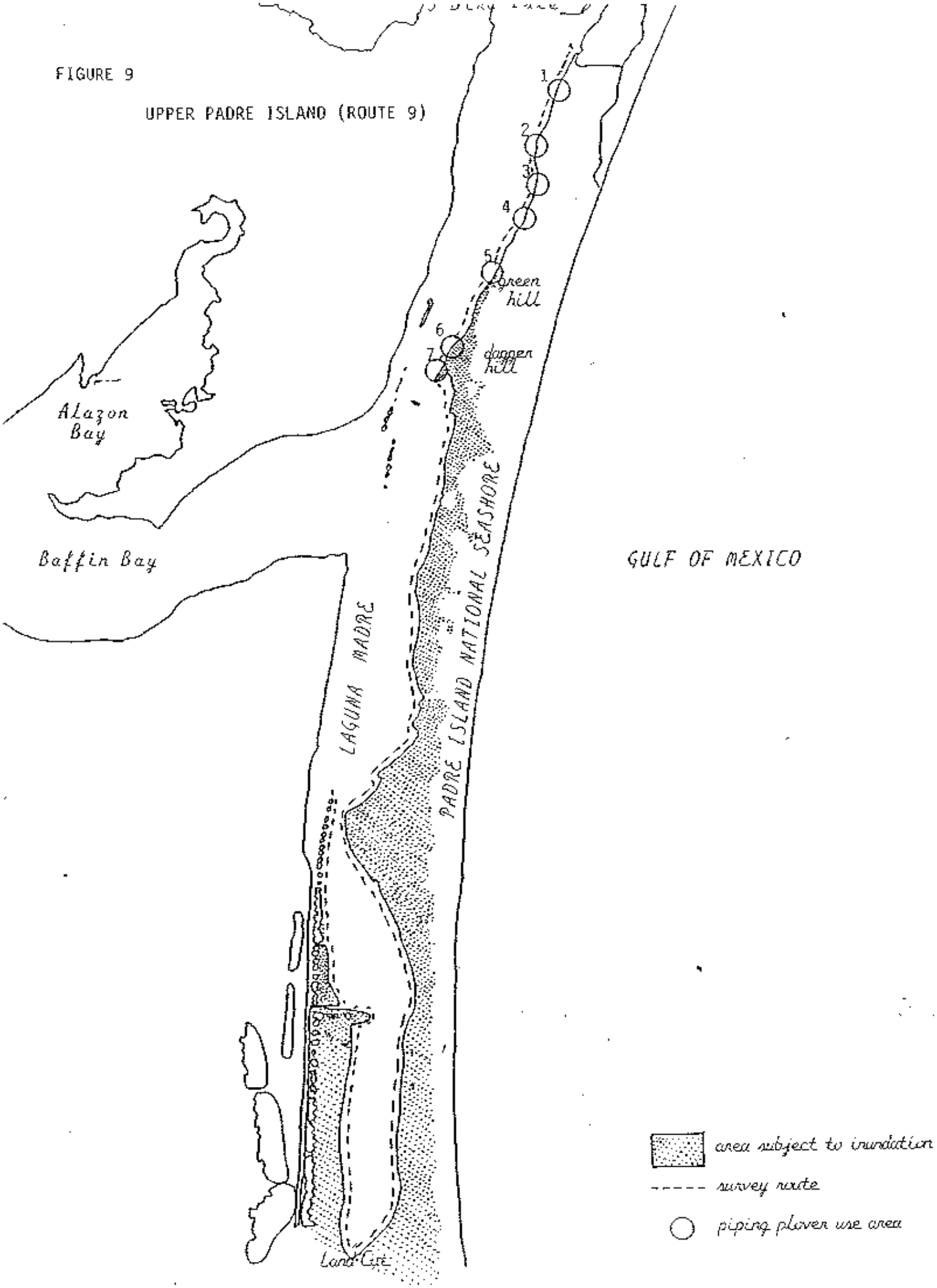


FIGURE 10

UPPER-LOWER PADRE ISLAND (ROUTE 10)

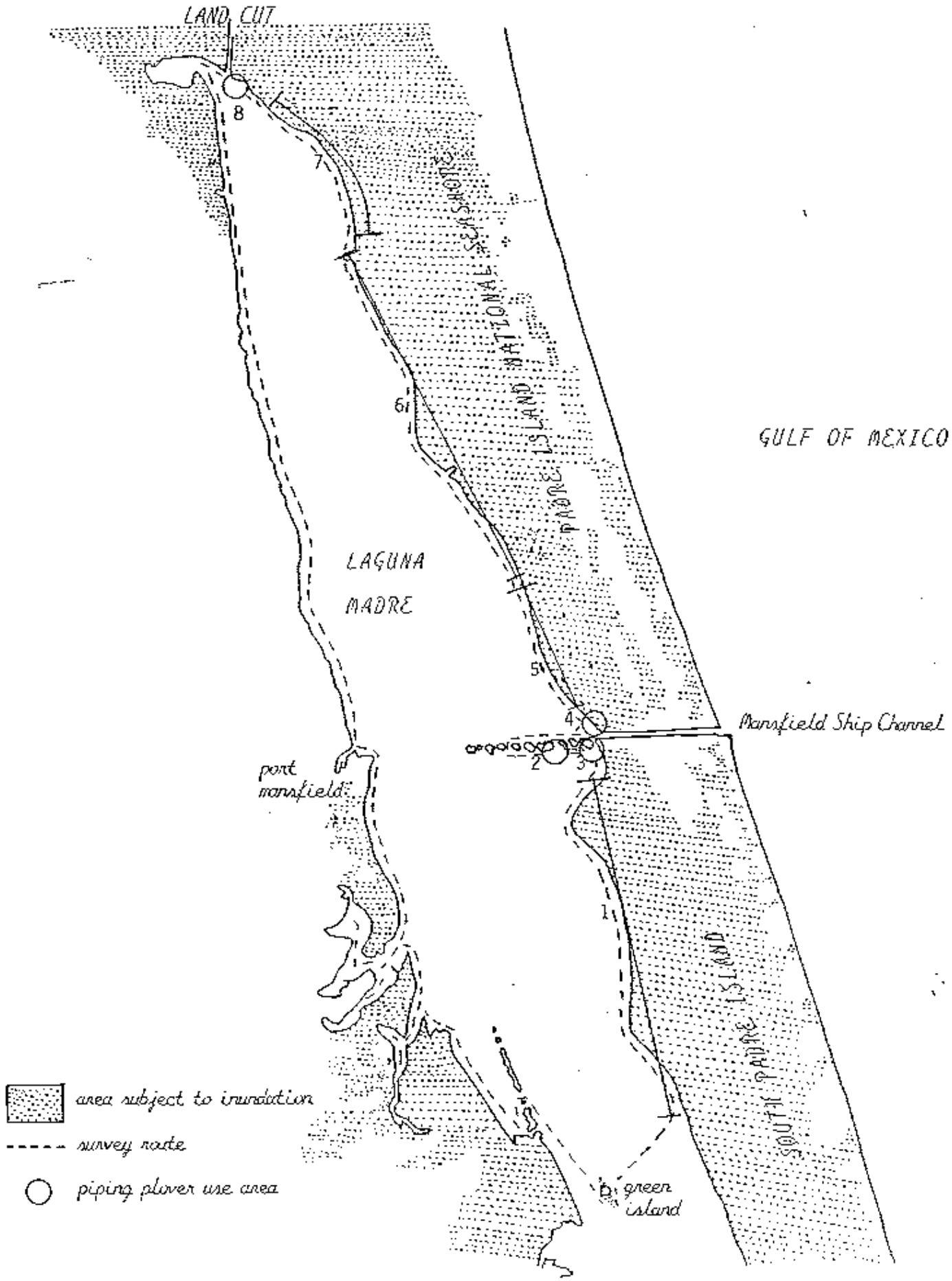


FIGURE 11

LOWER PADRE ISLAND (ROUTE 11)
AND
SOUTH BAY (ROUTE 12)

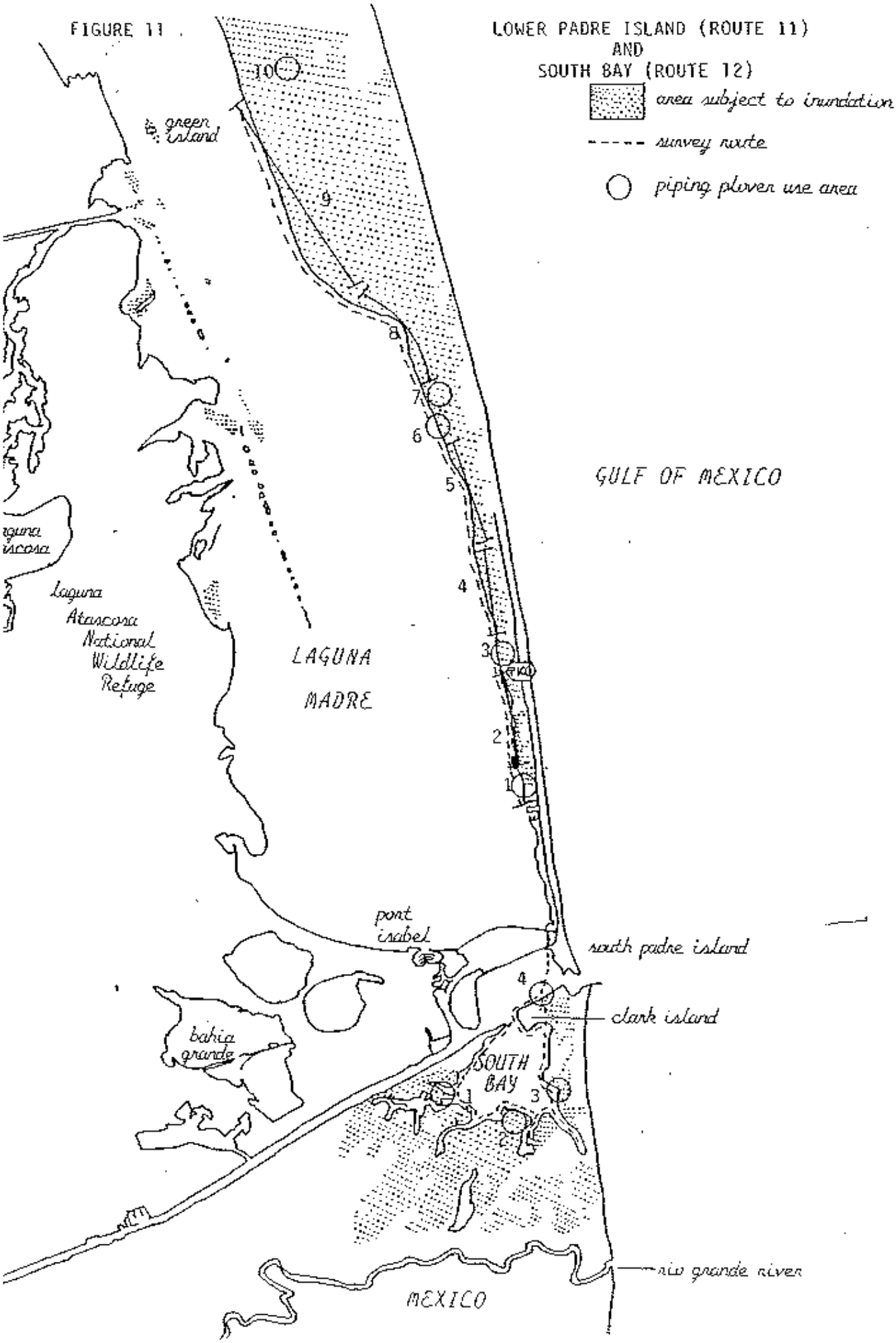


Table 1. Piping plover observations recorded by site for Bolivar Peninsula (Route 1). Survey period from 1991 to 1992 covering an estimated distance of 23.25 miles. (P) identifies site as a pass, X indicates that no survey was conducted for this survey period.

Site No.	Oct 29	Nov 21	Dec 17	Jan	Feb	Mar 25	Apr 15	Total
1 (P)			12	X	X			12
2 (P)		14		X	X			14
3	11			X	X			11
4			3	X	X			3
5	1			X	X			1
6	2			X	X			2
7	2			X	X			2
8				X	X	1		1
Total	16	14	15	X	X	1	0	46

Table 2. Piping plover observations recorded by site for Galveston Island (Route 2). Survey period from 1991 to 1992 covering an estimated distance of 12.5 miles. (P) identifies site as a pass, X indicates that no survey was conducted for this survey period.

Site No.	Oct. 28	Nov. 22	Dec. 16	Jan. 29	Feb.	Mar. 25	Apr. 16	Total
1		1			X			1
2		3			X	2		5
3	4				X		23	27
4 (P)	7	2		21	X	87	3	120
5 (P)	21	21		10	X			52
Total	32	27	0	31	X	89	26	205

Table 3. Piping plover observations recorded by site for Follett's Island (Route 3). Survey period from 1991 to 1992 covering an estimated distance of 9.25 miles. No plovers observed during any survey.

Site No.	Oct. 28	Nov. 20	Dec. 16	Jan. 27	Feb.	Mar. 26	Apr. 16	Total
No plovers observed during any survey								

Table 4. Piping plover observations recorded by site for East Matagorda Bay (Route 4). Survey period from 1990 to 1991 covering an estimated distance of 26.5 miles. (P) identifies site as a pass, X indicates that no survey was conducted on this survey date.

Site No.	Oct. 25	Nov. 19	Dec. 7	Jan. 14	Feb.	Mar. 21	Total
1		1		2	X		3
2 (P)	1	8	8	7	X		24
3	1				X		1
4				3	X		3
Total	2	9	8	12	X	0	31

Table 5. Piping plover observations recorded by site for Matagorda Peninsula (Route 5). Survey period from 1989 to 1990 covering an estimated distance of 39 miles. X indicates that no survey was conducted for this survey period.

Site No.	Oct 10	Oct 11	Nov 7	Nov 8	Dec 5	Dec 6	Jan 2	Jan 3	Feb 5	Feb 6	Mar 20	Mar 21	Total
1										2			2
2			4										4
3			2										2
4			1										1
5	1		2										3
6			5										5
7			14										14
8			1										1
9											1		1
10				9									9
11						1							1
12		18			1					15			34
13					20					45			65
14		35	20	6	24	108				22		53	268
15	1					2							3
16										4			4
17			19	1		3					6		29
18					3					6			9
19										4			4
20			1	18	31	22			13	22		39	146
21			18	1	2								21
22			3										3
Total	2	53	90	35	81	136	0	0	13	120	7	92	629

Table 6. Piping plover observations recorded by site for Matagorda Island (Route 6). Survey period from 1991 to 1992 covering an estimated distance of 19.5 miles. (P) identifies site as a pass, X indicates that no survey was conducted for this survey period.

Site No.	Oct 12	Oct 13	Nov 17	Nov 18	Dec 19	Dec 20	Jan 16	Jan 17	Feb	Feb	Mar 13	Mar 14	Total
1		6							X	X			6
2	1								X	X			1
3	1						1		X	X			2
4 (P)	5	10							X	X			15
5	1								X	X			1
6 (P)	1	1			37	48	2	14	X	X	36	42	181
7 (P)								6	X	X			6
8		2						3	X	X		4	9
9 (P)	2	40			5	38	1	8	X	X	41	62	197
10	3								X	X			3
11 (P)	4				3	2			X	X	1		10
12							1		X	X			1
13					1				X	X			1
14	7	2			1				X	X			10
15 (P)	1	1							X	X			2
16 (P)	6				8				X	X			14
17	1								X	X			1
18		4							X	X			4
Total	33	66	0	0	55	88	5	31	X	X	78	108	464

Table 7. Piping plover observations recorded by site for Saint Joseph (San Jose) Island (Route 7). Survey Period from 1990 to 1991 covering an estimated distance of 27.5 miles. (P) identifies site as a pass.

Site No.	Oct 24	Nov 18	Dec 6	Jan 18	Feb 8	Mar 20	Total
1	9	26					35
2	97	6	34	60	29	22	248
3 (P)	11	108	29	52	41	47	288
4 (P)				9			9
5				2			2
6				33			33
7 (P)				53			53
Total	117	140	63	209	70	69	668

Table 8. Piping plover observations recorded by site for Mustang Island (Route 8). Survey period from 1989 to 1991 covering an estimated distance of 24.5 miles. (P) identifies site as a pass, X indicates that no survey was conducted for this survey period.

Site No.	Oct 12	Nov 9	Nov 10	Dec	Jan 4	Jan 5	Feb	Mar 22	Mar 23	Total
1 (P)		20		X			X			20
2 (P)		27	83	X	16		X	10		136
3			7	X	16		X			23
4 (P)	1	40		X	14		X			55
5 (P)	19			X	2		X	12		33
6 (P)				X			X			0
7 (P)	3			X	14		X	43		60
8				X	25		X	5		30
9	1			X			X			1
10				X			X		13	13
11	4	20		X	60	100	X	28	22	234
Total	28	107	90	X	147	100	X	98	35	605

Table 9. Piping plover observations recorded by site for Upper Padre Island National Seashore (Route 9). Survey period from 1988 to 1989 covering an estimated distance of 36.5 miles. X indicates that no survey was conducted for this survey period.

Site No.	Oct am	11 pm	Nov am	15 pm	Dec am	21 pm	Jan am	18 pm	Feb	Mar am	15 pm	Total
1		1	1						X			2
2				2					X			2
3			2						X			2
4		1							X			1
5		2							X			2
6		1	11						X			12
7			4	3					X			7
Total	0	5	18	5	0	0	0	0	X	0	0	28

Table 10. Piping plover observations recorded by site for Middle Padre Island (Route 10). Survey period from 1990 to 1991 covering an estimated distance of 26.5 miles. (P) identifies site as a pass, X indicates that no survey was conducted for this survey period.

Site No.	Oct 23	Nov 17	Dec 5	Jan	Feb 6	Mar 21	Total
1		73		X			73
2 (P)	67	2	4	X		X	73
3 (P)			80	X		X	80
4 (P)	1	8		X		X	9
5		27	2	X	1	X	30
6		70	22	X	20	X	112
7		26		X	81	X	107
8 (P)				X	2	X	2
Total	68	206	108	X	104	X	486

Table 11. Piping plover observations recorded by site for Lower Padre Island (Route 11). Survey Period from 1990 to 1991 covering an estimated distance of 40.5 miles. X indicates that no survey was conducted for this survey period.

Site No.	Oct 22	Nov 14	Dec 5	Jan	Feb 5	Mar 18	Total
1		8	4	X			12
2	3	8	18	X		3	32
3	3	7	7	X	7	1	25
4	23	37	35	X	1		96
5		11		X			11
6		14	32	X	17	12	75
7		2		X		29	31
8	24	11		X		143	178
9		34	21	X		100	155
10		1					1
Total	53	133	117	X	25	288	616

Table 12. Piping plover observations recorded by site for South Bay (Route 12). Survey period from 1990 to 1991 covering an estimated distance of 11 miles. (P) identifies site as a pass, X indicates that no survey was conducted for this survey period.

Site No.	Oct 23	Nov 17	Dec 4	Jan	Feb	Mar 19	Total
1 (P)		31		X	X		31
2				X	X	1	1
3	1			X	X		1
4 (P)	33	6		X	X		39
Total	34	37	0	X	X	1	72

Table 13. Plover observations identified by substrate present for each route of the survey.

Route	SUBSTRATE							Total
	Sand	Sand/Silt	Sand/Shell	Sand/Mud	Mud	Algal Mat	Spoil Island	Plover Obs.
Bolivar Peninsula		46						46
Galveston Island		205						205
Follet's Island								0
East Matagorda Bay	24	6					1	31
Matagorda Peninsula		619	4	6				629
Matagorda Island	9	430	25					464
St. Joseph Island		567		101				668
Mustang/Padre Island		438	55			112		605
Upper Padre Island		26	1			1		28
Middle Padre Island	1	33				368	84	486
Lower Padre Island		105				511		616
South Bay	40	1				31		72
Total	74	2476	85	107	0	1023	85	3850

Table 14

CONCURRENT BEACH/BAY SURVEYS OF PIPING PLOVERS

DATE	AREA (route #)	TIDE	BEACH #	BAY #
12-19-88	Matagorda Island (6)	med	47	55
12-20-88	Matagorda Island (6)	low	7	88
12-22-88	Padre Island (9)	low	0	0
01-16-89	Matagorda Island (6)	low	0	5
01-17-89	Matagorda Island (6)	low	1	31
03-13-89	Matagorda Island (6)	low	0	77
03-14-89	Matagorda Island (6)	low	0	108
04-24-90	Padre/Mustang Isle (8)	low	1	24
04-27-90	Padre/Mustang Isle (8)	high	28	0

WINTER CENSUS

01-14-91	East Matagorda Bay (4)	med	41	12
01-16-91	Matagorda Peninsula (5)	low	22	132
01-16-91	Matagorda Island (6)	low	12	87
01-17-91	St. Joseph Island (7)	low	1	209
01-19-91	Mustang/Padre Island (8)	high	265	16
01-19-91	Padre Island (9)	high	41	36

Table 15 PEREGRINE FALCON OBSERVATIONS

Route and No.	Oct.	Nov.	Dec.	Jan.	Feb. ,	Mar.	Total
Bolivar Peninsula (1)							0
Galveston Island (2)							0
Follet's Island (3)							0
East Matagorda Bay (4)							0
Matagorda Peninsula (5)		2					2
Matagorda Island (6)		1				1	2
St. Joseph Island (7)			1	2			3
Mustang/Padre Island (8)		8					8
Upper Padre Island (9)	1		1				2
Middle Padre Island (10)		1	2				3
South Padre Island (11)	1	2			1	1	5
South Bay (12)						1	1
Total	2	14	4	2	1	3	26

Table 16

FALCON OBSERVATIONS

	Site #	Obs.	Date	Activity
Matagorda Peninsula (5)	1	1	11-07-89	flying
	2	1	11-08-89	flying
Matagorda Island (6)	1	1	10-12-88	flying
	2	1	03-13-89	flying
St. Joseph Island (7)	1	1	12-06-90	flying
	2	2	01-18-90	flying
Mustang/Padre Island (8)	1	1	11-09-89	flying
	2	1	11-10-89	on causeway
	3	1	11-09-89	on pole
	4	1	11-10-89	on ground
	5	1	11-09-89	hunting
	5	1	11-10-89	flying
	6	1	11-10-89	flying
	7	1	11-09-89	flying
Upper Padre Island (9)	1	1	12-21-88	flying
	2	1	10-11-88	flying
Middle Padre Island (10)	1	1	12-05-90	flying
	2	1	11-16-90	flying
Lower Padre Island (11)	1	1	10-22-90	flying
	1	1	11-14-90	on pole
	2	1	11-14-90	flying
	3	1	02-05-91	flying
	3	1	03-18-91	flying
South Bay (12)	1	1	03-19-91	flying

ADDENDUM I

The piping plover tables (Tables 1 through 12) and the peregrine falcon table (Table 16) are to be used with the set of United States Department of Interior Geological Survey maps that are included as part of this report.

The set of maps cover the areas in which either piping plovers or peregrine falcons were identified. A site was documented if only one (1) plover was identified on at least one (1) survey.

Piping plover locations are identified by a circle with the site number inside. The area of the circle roughly corresponds to the area occupied by the number of plovers indicated for the site.

example:

Peregrine falcon locations are identified by a triangle with the site number adjacent.

example: 1

A site was documented if only one (1) falcon was identified on at least one (1) survey either perched or flying.

Survey routes are shown on the set of small scale maps that are attached to the text of the report. These maps also show accurate but less precise piping plover locations.

ADDENDUM II

Cross-reference identifying routes, plover sites and falcon sites associated with each USGS 7 1/2' quadrangle.

Route	Quad Name	TxNHP Quad #	Falcon Site #	Plover Site #
1	Frozen Point	2909455		1,2,3
	Capleo	2909445		4
	Flake	2909446		5,6,7
	Port Bolivar	2909447		8
2	Sea Isle	2909521		1,2,3
	San Luis Pass	2909511		4,5
4	Brown Cedar Cut	2809566		1,4
	Sargent	2809576		2,3
5	Matagorda SW	2809558		1
	Palacios SE	2809651		2,3,4,5,6,7,8
	Palacios Point	2809652	1	9,10,11,12,13
	South of Palacios Point	2809642		14
	Decros Point	2809643	2	15,16,17,18,19,20,21
	Port O'Conner	2809644		22
6	Pass Cavallo SW	2809634	1	1,2,3
	Long Island	2809635	2	4,5,6,7,8,9,10,11,12
	Mosquito Point	2809636		13,14
	Panther Point	2809626		15,16,17,18
7	Estes	2709781	1	1,2,3
	Allyns Byte	2709688	2	4,5,6
	St. Charles Bay	2809618		7
8	Crane Islands NW	2709762	1,2	1,2,3,4,5,6,7,8,12
	Crane Islands SW	2709752		9
	Pita Island	2709753	3,4,5,6,7	10,11
9	South Bird Island	2709743		1
	South Bird Island SE	2709733	1,2	2,3,4,5,6,7
10	South of Potrero Lopeno SE	2609753	1,2	1,2,3,4,5
	South of Potrero Lopeno NE	2609763		5,6
	South of Potrero Lopeno NW	2609764		6
	Potrero Lopeno SW	2609774		7,8
11	Green Island	2609743	1,2	1,9,10
	Port Isabel NW	2609722		2,3,4,5
	North of Port Isabel SW	2609732	3	5,6,7,8,9
12	Port Isabel	2609712	1	1,2,3,4