Kemp's Ridley, *Lepidochelys kempi*, Sea Turtle Head Start Tag Recoveries: Distribution, Habitat, and Method of Recovery

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Introduction

The Kemp's ridley, *Lepidochelys kempi*, is the most endangered of all sea turtles. The only known primary nesting site for this species is a 20 km (12.4-mile) stretch of beach at Rancho Nuevo, Tamaulipas, Mex., located about 322 km (200 miles) south of Brownsville, Tex. (Hildebrand, 1963). An estimated 40,000 Kemp's ridleys nested near Rancho Nuevo in 1 day in June 1947 (Carr, 1963; Hildebrand, 1963); no more than 600 females nested there during the entire 1987 season[1].

In 1977 the Instituto Nacional de la Pesca (INP) of Mexico, the U.S. Fish and Wildlife Service (FWS), the National Park Service (NPS), the National Marine Fisheries Service (NMFS), and the Texas Parks and Wildlife Department (TPWD) agreed on a conservation program designed to save the Kemp's ridley. The purpose of the program is to increase the wild population of Kemp's ridleys through protection of the nesting beach and an experimental project to establish a second nesting site at Padre Island, near Corpus Christi, Tex., through head starting (Klima and McVey, 1982). The goals of the head start research project are to:

1) Rear Kemp's ridley hatchlings in captivity for about 1 year,
2) Tag and release healthy survivors,
3) Determine distribution and movement of released turtles, and
4) Document nestings of head-started turtles on Padre Island or elsewhere (Fontaine et al., 1985).

To try to create a second nesting site at Padre Island, the hatchlings are "imprinted" (Carr, 1967) to Padre Island sand in hopes they will return there to nest when they reach maturity. Each season INP and FWS transfer about 2,000 eggs from Mexico to the United States for the head start project. The eggs are collected in plastic bags as they are laid, to prevent them from touching the Rancho Nuevo sand, and are placed into polystyrene foam boxes containing sand from Padre Island National Seashore. The boxes of eggs are taken by plane from Mexico to the NPS at the National Seashore, where they are incubated and hatched. The hatchlings are allowed to crawl over the sand and swim briefly in the surf, to complete the "imprinting" process, before being captured and taken to the Sea Turtle Head Start Research Facilities at the NMFS Southeast Fisheries Center's Galveston Laboratory, Galveston, Tex.

This paper summarizes tag recoveries of head started Kemp's ridleys from year classes 1978-86, during the period February 1979 through December 1987, and it represents an update of Fontaine et al (In press b). Tag recoveries are summarized by year class, distribution, method of tag recovery, habitat, turtle status (live or dead), and season. Some interesting multiple tag recoveries are presented, along with a discussion of why Kemp's ridleys, especially juveniles, are commonly found in bays and shallow coastal areas.

[1]Jack Woody, U.S. Fish and Wildlife Service, P.O. Box 1306, Albuquerque, NM 87105. Personal commun., Sept. 1987.

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ABSTRACT—The Kemp's ridley sea turtle, Lepidochelys kempi, *head start research project is an international conservation effort to increase the wild population of Kemp's ridleys and to create a second nesting beach on Padre Island, Tex. Turtles are reared in captivity for about 10 months, tagged, and released at various locations in the Gulf of Mexico, but primarily off Padre Island. Tag recoveries are summarized by distribution, method of recovery, habitat, and season.*

A total of 12,422 turtles from nine year-classes (1978-86) of Kemp's ridleys have been released since the project began in 1978. As of 31 December 1987, 547 (4.4 percent) tag recoveries have been reported. Tag recovery data show turtles were reported from Mexico, all of the Gulf Coast states and most of the states on the U.S. east coast as far north as New York. A few tag recoveries were reported from France and Morocco. Primary recovery locations are Texas (60.9 percent), Louisiana (14.0 percent), and Florida (10.3 percent), and primary tag recovery methods include strandings (34.3 percent) and shrimp trawls (27.6 percent). Tag recovery habitat data show that occurrence in bay waters or ocean waters is about equal with 45.8 and 31.8 percent, respectively. Kemp's ridleys probably move into bays and shallow coastal areas to feed. Seasonally, 52.5 percent of the tag recoveries occur during April, May, and June.

Methods

Headstarting

Fontaine et al. (In press a) described facilities, care, and maintenance of head started turtles and tagging and release procedures. All data in this summary

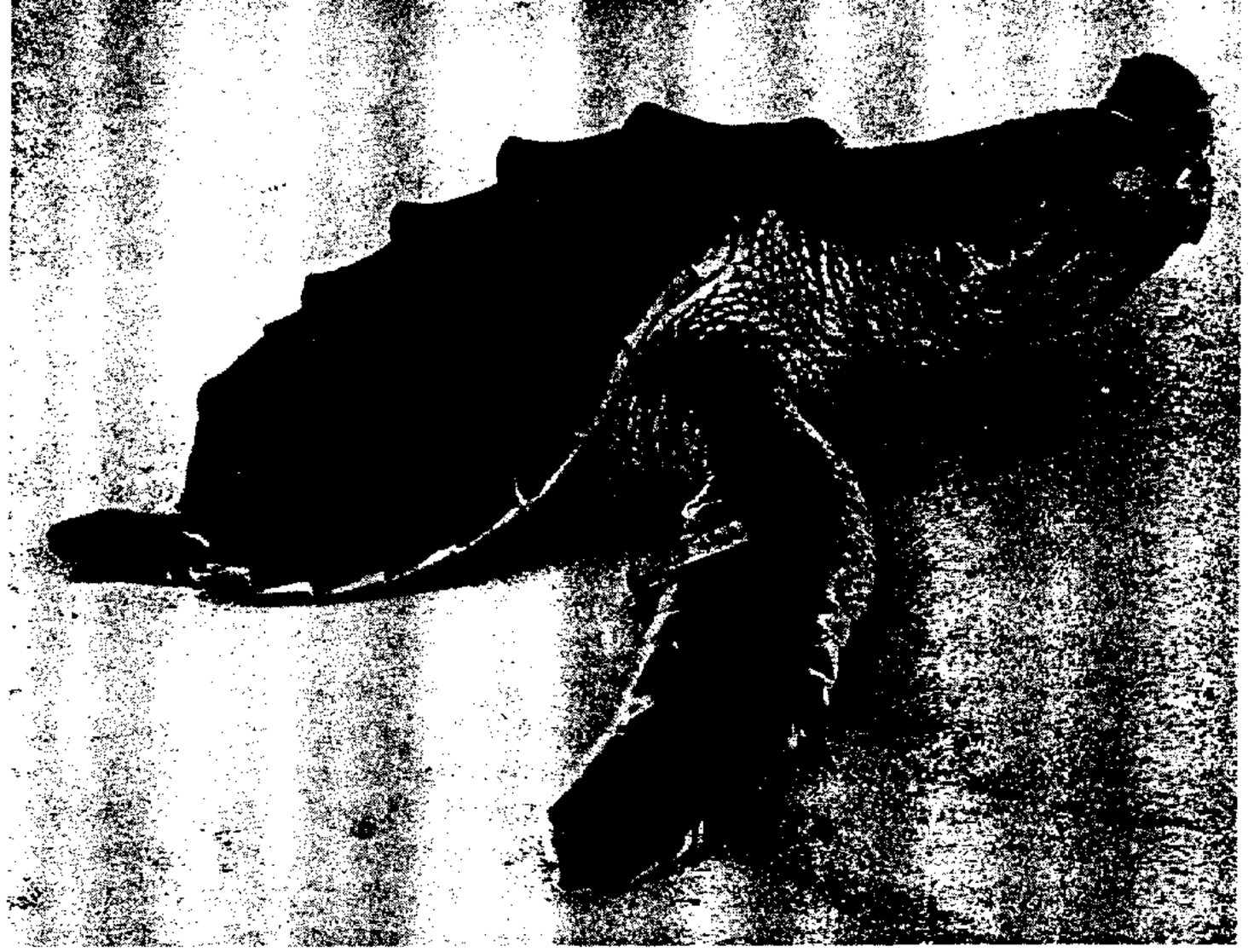


Figure 1a.—Flipper tag attached to the trailing edge of the right front flipper of a head-started Kemp's ridley sea turtle.

represent the recoveries of turtles with flipper tags (Fig. 1a, b). Flipper tag series for each year class are shown in Table 1. The majority of head started turtles were released during the spring in the Gulf of Mexico 19-32 km (12-20 miles) off Padre and Mustang Islands, Tex. (Table 1). There were releases in two Texas bays, Nueces Bay and Copano Bay, and one in Campeche Bay, Mex. Most of the 1978 and 1979 year classes were released 10-19 km (6-12 miles) off Sandy Key, East Cape, and Homosassa, Fla. (Klima and McVey, 1982).

Table 1.—Summary of head-started Kemp's ridley sea turtle release sites, numbers of turtles released, and flipper tag series used for 1978-86 year classes.

Year class	Release site	Release date	No. released	Tag series[1]
1978	Sandy Key, Fla.	22 Feb. 1979	307	G—
	East Cape, Fla.	through	219	F—
	Homosassa, Fla.	7 July 1979	1,380	
	Padre Island, Tex.		113	
1979	Homosassa, Fla.	3-5 June 1980	1,339	NNN—
	Padre Island, Tex.	2 June 1981	5	NNA—
	Galveston, Tex.	28 Sept. 1981	1	K— J0096
1980	Padre Island, Tex.	2 June 1981	1,526	NNB—
	Campeche Bay, Mex.	3 Mar. 1981	197	K— 8001-1800 (inconel)
1981	Padre Island, Tex.	2 June 1982	1,521	NNG—
	Sabine Pass, Tex.	14 July 1982	118	NNH—
1982	Padre Island, Tex.	7 June 1983	1,159	NNL—
	Nueces Bay, Tex.	7 June 1983	96	NNM—
	Sabine Pass, Tex.	15 July 1983	69	
	Mustang Island, Tex.	5 June 1983	1	
1983	Mustang Island, Tex.	5 June 1984	190	NNQ—
1984	Padre Island, Tex.	21 May 1985	1,017	NNT— NNV—
1985	Copano Bay, Tex.	22 Apr. 1986	519	NNX— (inconel)
	Padre Island, Tex.	6 May 1986	961	NNY— (inconel)
	Galveston, Tex.	28 Sept. 1986	54	
1986	Padre Island, Tex.	21 Apr. 1987	1,630	PPK— (inconel) PPL— (inconel)
Total			12,422	

[1]Monel tags, unless noted otherwise. Each dash represents a numerical digit from 0 to 9; actual numerical series can be obtained from the NMFS SEFC Galveston Laboratory, 4700 Avenue U, Galveston, TX 77551.

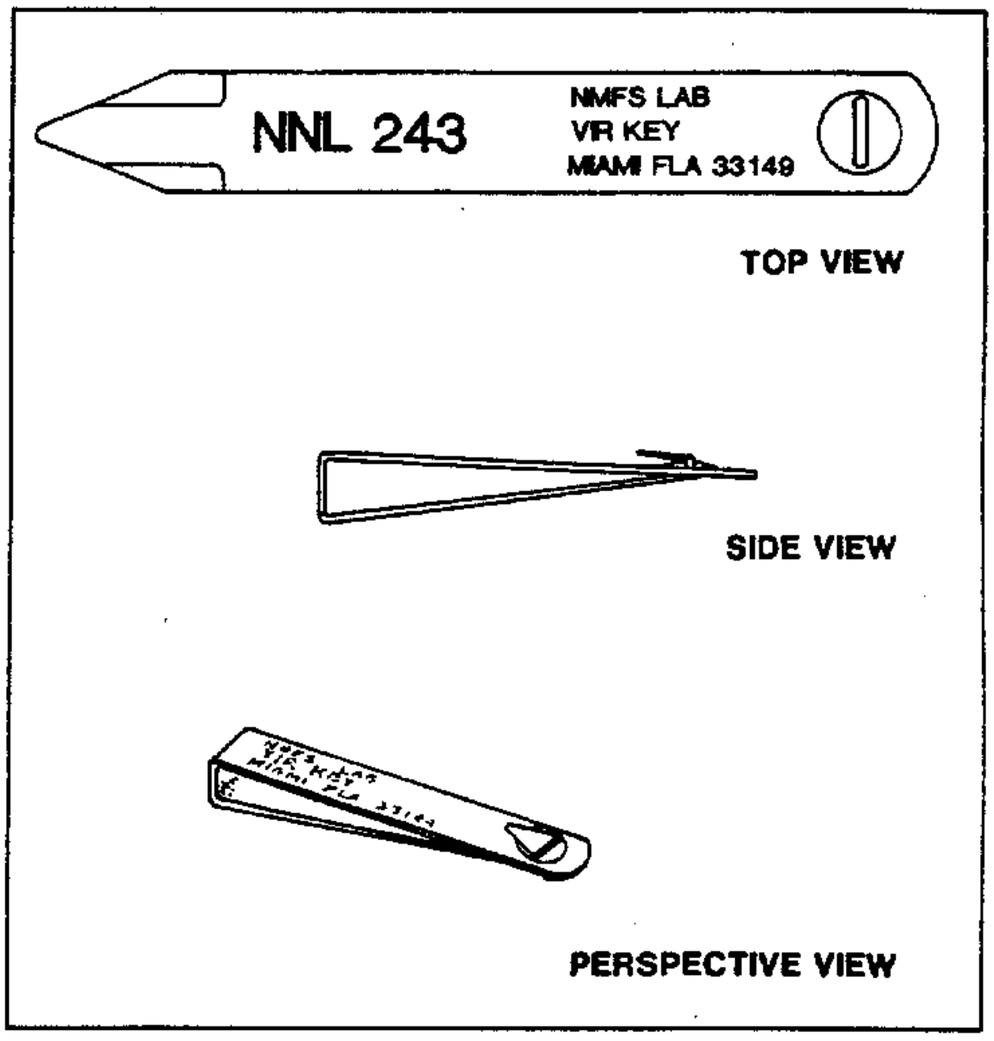


Figure 1b.—Illustration of flipper tag used on head-started Kemp's ridley sea turtles showing letter-number code and address to mail tag recovery information.

Distributional Grouping

To relate distribution of tag recoveries to the release site, the recoveries were categorized into three groups: 1) Florida released turtles, 2) Texas nearshore and offshore released turtles, and 3) Texas bay released turtles. Tag recoveries from the Campeche Bay release were not included in this distributional analysis because of the number (5), but are included in all other analyses in the paper. Within each group, tag recoveries were assigned arbitrary straight line distances, over water, from release site to recovery locations to correlate distance from release site with time at large. The arbitrary distances and number of days in the wild were then assigned ranks and a Spearman Rank Correlation was calculated (Sokal and Rohlf, 1981).

Classification of Tag Recoveries

All tag recoveries were categorized by inshore or offshore habitat, method of recovery, and season. Categories are defined as follows, with coastal waters being divided into two habitats: 1) Bay waters = any body of water recessed from the main coastline or landward of barrier islands, and 2) Gulf/ocean waters = any major body of water bordering the main coastline or seaward beach of a barrier island. Tag recovery methods included: 1) Shrimp trawl = turtles caught and reported by a shrimper, 2) hook and line = turtles caught on a baited hook by recreational fishermen, 3) stranded dead or alive = turtles found washed up on a beach or in the surf zone, 4) swimming = instances where turtles were scooped from the water by hand, and 5) unknown = no method or source of tag recovery reported. Season: 1) Spring = April, May, June; 2) summer = July, August, September; 3) fall = October, November, December; and 4) winter = January, February, and March.

Results

Tag Recoveries by Year Class

Of 12,422 head-started Kemp's ridleys released between 22 February 1979 and 4 April 1987, 547 (4.4 percent) tag recoveries were reported as of 31 December 1987 (Table 2). Recovery numbers ranged from a low of 11 (2.0 percent) for the 1983 year class to a high of 156 (28.5 percent) for the 1982 year class. However, 69 (44.2 percent) of the 1982 year class tag recoveries were reported within the first 14 days after release, an unusually high recovery rate in such a short period of time. This anomalous rate may have been related to two factors: 1) This was the only year class released in nearshore waters, between 6-10 km (4-6 miles) off the beach, and 2) the turtles were released into floating patches of sargassum weed on the expectation that sargassum would provide food and cover. Most of the turtles that washed ashore were coated with oil or had ingested tar balls probably associated with the sargassum. Because of this anomaly, turtles of the 1982 year class found washed ashore during that 14-day period were eliminated to reduce bias. Therefore, the total number of recoveries used in our analyses was 478.

Other unusual events affected the data for the 1983 and 1985 year classes. A poor hatch (12 percent) of the 1983 year class at Padre Island resulted in only 230 hatchlings for head starting. What caused the poor hatch is not fully known. Only 190 turtles of the 1983 year class survived for release. The 1985 year class had an unusual steady stream of tag recoveries within the first 60 days after release. The high recovery rate over this time period is discussed later.

Table 2.—Summary of released head-started Kemp's ridley sea turtles and tag recoveries for 1978-1986 year-classes.

Year class	No. released	No. of tag recoveries	Percent
1978	2,019	75	13.7
1979	1,345	21	3.8
1980	1,723	86	15.7
1981	1,639	51	9.3
1982	1,325	156	28.5
1983	190	11	2.0
1984	1,017	23	4.2
1985	1,534	108	19.7
1986	1,630	16	2.9
Totals	12,422	547	4.4

Table 3.—Summary of tag recoveries by state or nation for head-started Kemp's ridley sea turtles of the 1978-86 year classes.

State/ nation	Recoveries No.	Recoveries %	State/ nation	Recoveries No.	Recoveries %
Texas	291	60.9	France	2	0.4
Louisiana	67	14.0	Maryland	2	0.4
Florida	49	10.3	New Jersey	2	0.4
N. Carolina	19	4.0	New York	2	0.4
S. Carolina	12	2.5	Virginia	2	0.4
Georgia	10	2.1	Morocco	1	0.2
Mexico	7	1.5	Not Reported[1]	2	0.4
Mississippi	6	1.3			
Alabama	4	0.8	Totals	478	100.0

[1]Not enough information collected to determine location.

Distribution

The highest frequency of tag recoveries, 291 (60.9 percent), occurred in Texas (Table 3). Louisiana, Florida, North Carolina, and South Carolina followed with 67 (14.0 percent), 49 (10.3 percent), 19 (4.0 percent), and 12 (2.5 percent), respectively. Of the 478 tag recoveries, 175 (36.6 percent), occurred within 60 days of release (Fig. 2) and were relatively close to the site of release. Tag recoveries that occurred 60 days or longer after release were more widely distributed and similar to the historical distribution and range of wild Kemp's ridleys (Carr, 1952, 1957; Carr and Caldwell, 1958; Pritchard and Marquez, 1973; Hildebrand, 1982; Brongersma, 1972; and Fontaine et al., In press b).

Florida Releases

Turtles released off the west and southwest coasts of Florida accounted for 92 tag recoveries (Fig. 3). Sixty-one (66 percent) were reported from the Atlantic compared with 31 (34 percent) from the Gulf of Mexico. Forty-two (46 percent) tag recoveries were reported from Florida (both Atlantic and Gulf). Days at large for these turtles ranged from 1 to 459, with a mean of 111. Days at large for Florida-released turtles reported from other states was from 15 to 1,563, with a mean of 623. Turtles found shortly after release remained relatively close to the release site while turtles at large for longer periods were further from the site of their release. The positive Spearman Rank correlation coefficient for the relationship between ranks of distances and time at large was $rs = 0.991$ and significant ($P<0.05$), supporting the conclusion that distances from release site increased with time at large,

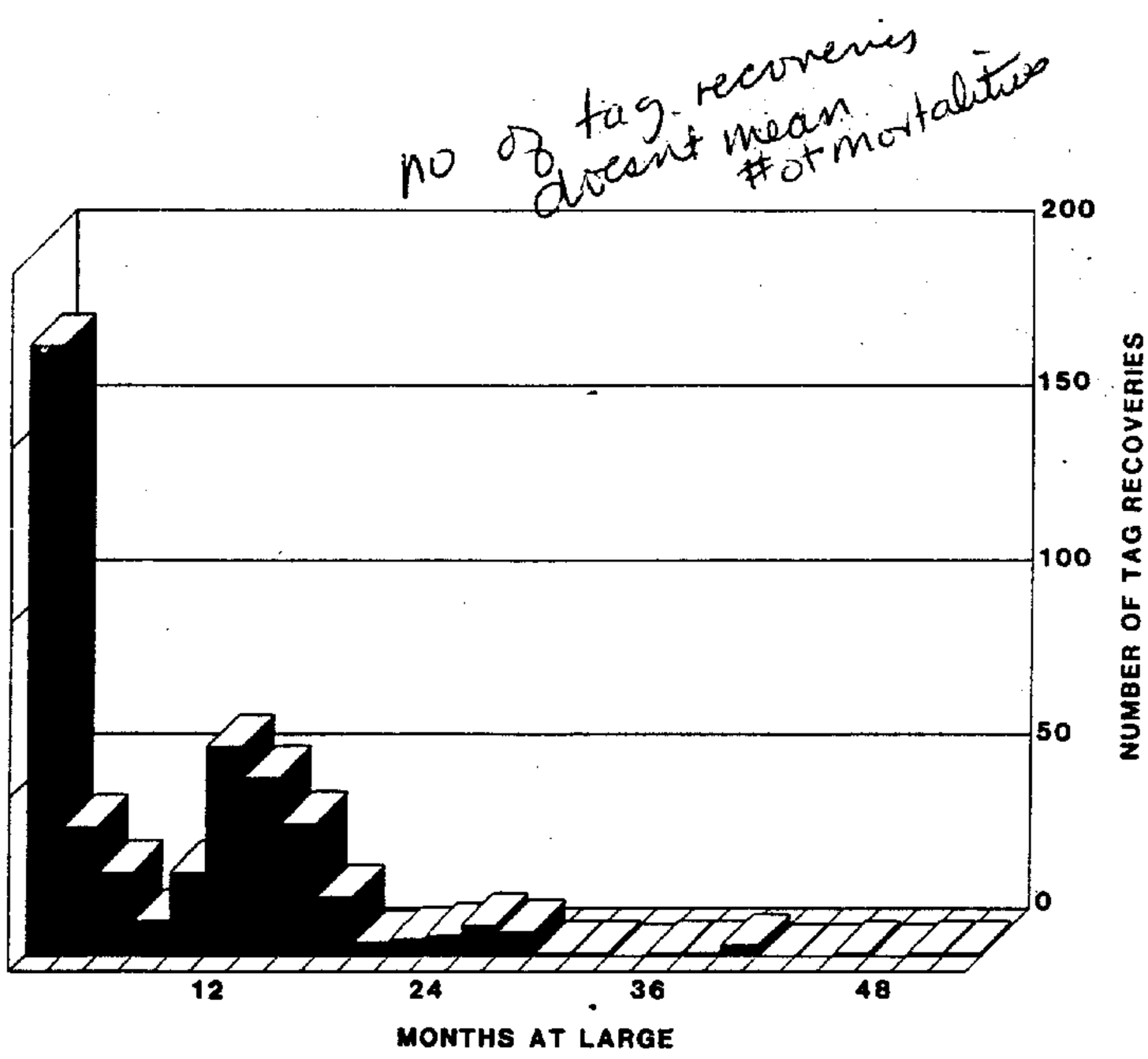


Figure 2.—Frequency distribution of months at large for 478 head-started Kemp's ridley sea turtle tag recoveries of the 1978-86 year classes.

as might be expected.

The percentage of tag recoveries reported outside Florida and in the Atlantic was 45.6 percent. Head-started turtles are no longer released off the Florida coast because it has not been determined whether Kemp's ridleys in the Atlantic return to the breeding population in the Gulf[2].

Texas Releases

Texas nearshore and offshore releases accounted for 295 tag recoveries (Fig. 4). Two hundred eighty-four (96.3 percent) tag recoveries were reported from the Gulf of Mexico and 11 (3.7 percent) from the Atlantic. Of the 295 tag recoveries 202 (68.5 percent) were reported from Texas. Days at large ranged from 1 to 1,210, with a mean of 229. Days at large for the 93 tag recoveries reported from other states ranged from 13 to 1,394, with a mean of 367. In this group of turtles, the relationship between ranks of distance from release site and time at large is supported by a significant positive correlation, $rs = 0.532$ ($P < 0.05$), but less strongly than the Florida group.

For the Texas bay releases, represented by 86 tag recoveries, distribution was very localized with 80 (93.0 percent) reported within the bay system in which the turtles were originally released (Fig. 5). Days at large for tag recoveries representing the Nueces Bay release ranged from 52 to 302 days with a mean of 129, and recoveries from the Copano Bay release ranged from 4 to 526 days with a mean of 105. Only three turtles (3.5 percent) were reported from offshore beaches or waters where days at large for tag recoveries ranged from 36 to 390 days with a mean of 263. Even though the Spearman rank correlation, $rs = 0.986$ ($P<0.05$), was large and significant, the ranks were clustered in only two widely separated groups. This resulted because all turtles found within the bay systems were arbitrarily assigned the same distance rank; thus, these turtles were clustered at the lower end of the scale. The turtles outside the bays were clustered at the other end of the scale of ranks. We feel that turtles released in the bays remained there for long time periods and stayed relatively

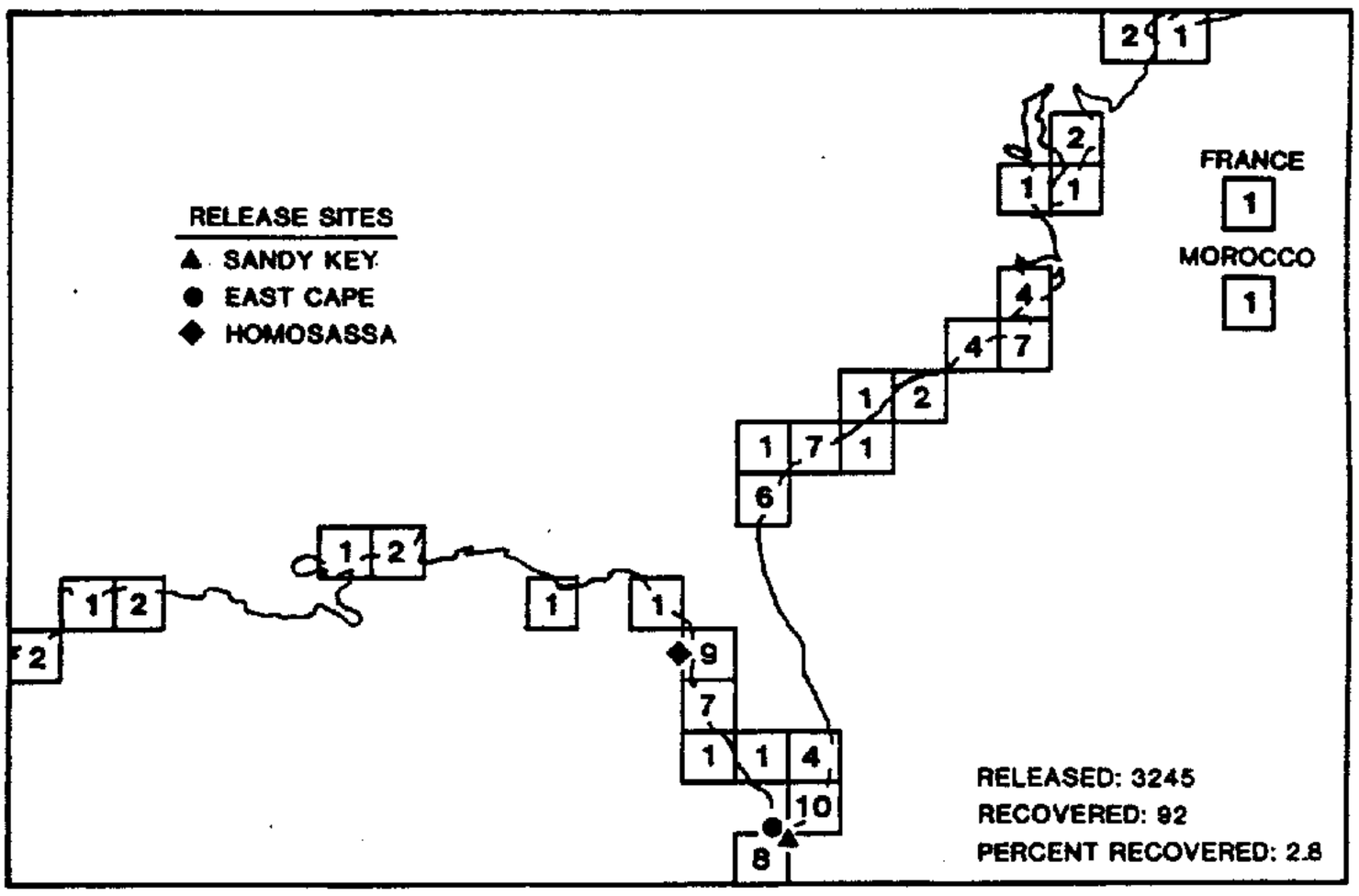


Figure 3.—Distribution of head-started Kemp's ridley sea turtle tag recoveries of the 1978-86 year classes released off Florida. Numbers represent tag recoveries in each one degree block; turtles without latitude and longitude of recovery not included.

[2]Ogren, L. The biology and ecology of juvenile sea turtles: Kemp's ridley (*Lepidochelys kempi*) in the Gulf of Mexico and Western North Atlantic. Unpubl. rep., NMFS Southeast Fisheries Center, Miami, Fla.

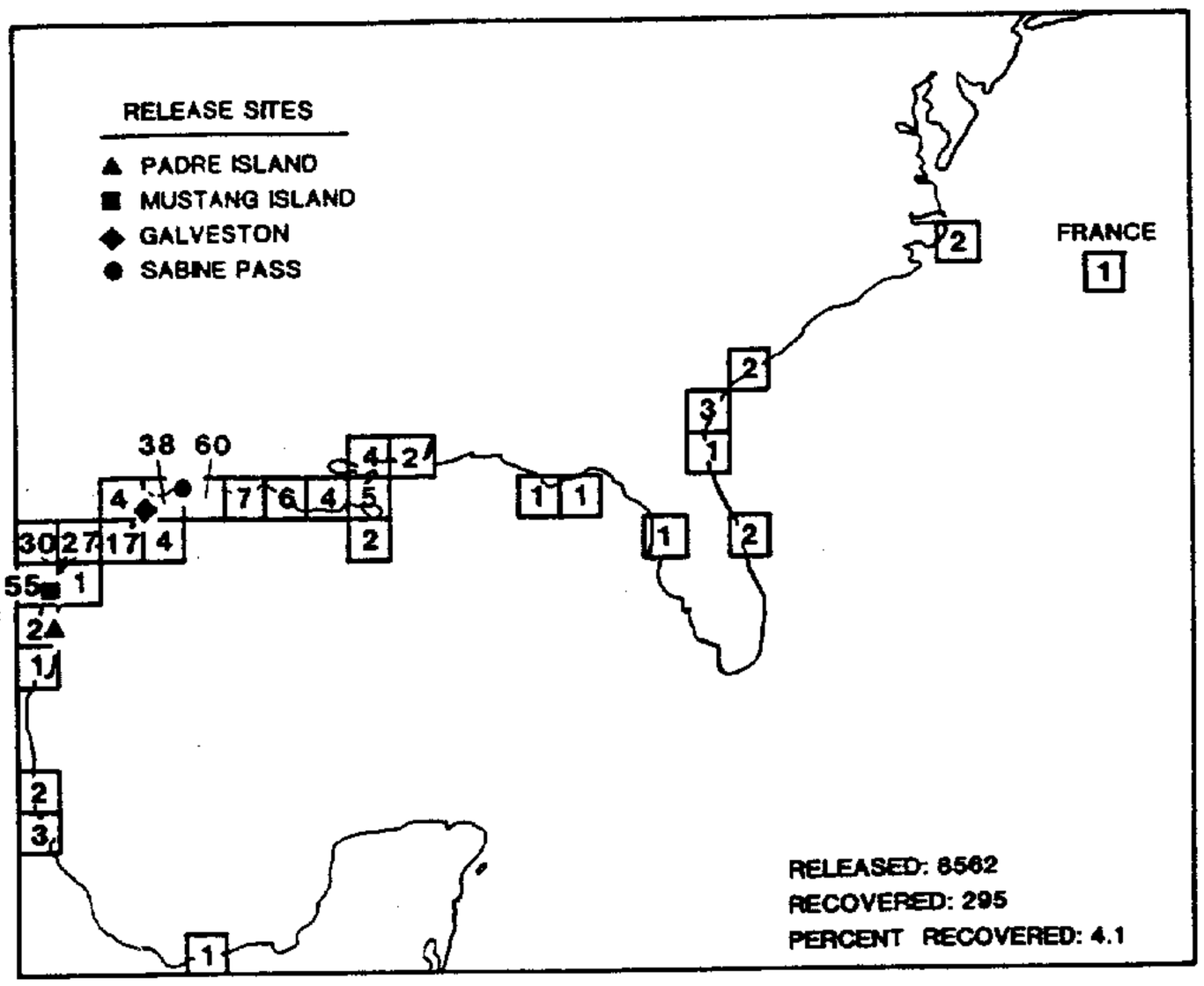


Figure 4.—Distribution of head-started Kemp's ridley sea turtle tag recoveries of the 1978-86 year classes released off Texas. Numbers represent tag recoveries in each one degree block; turtles without latitude and longitude of recovery not included.

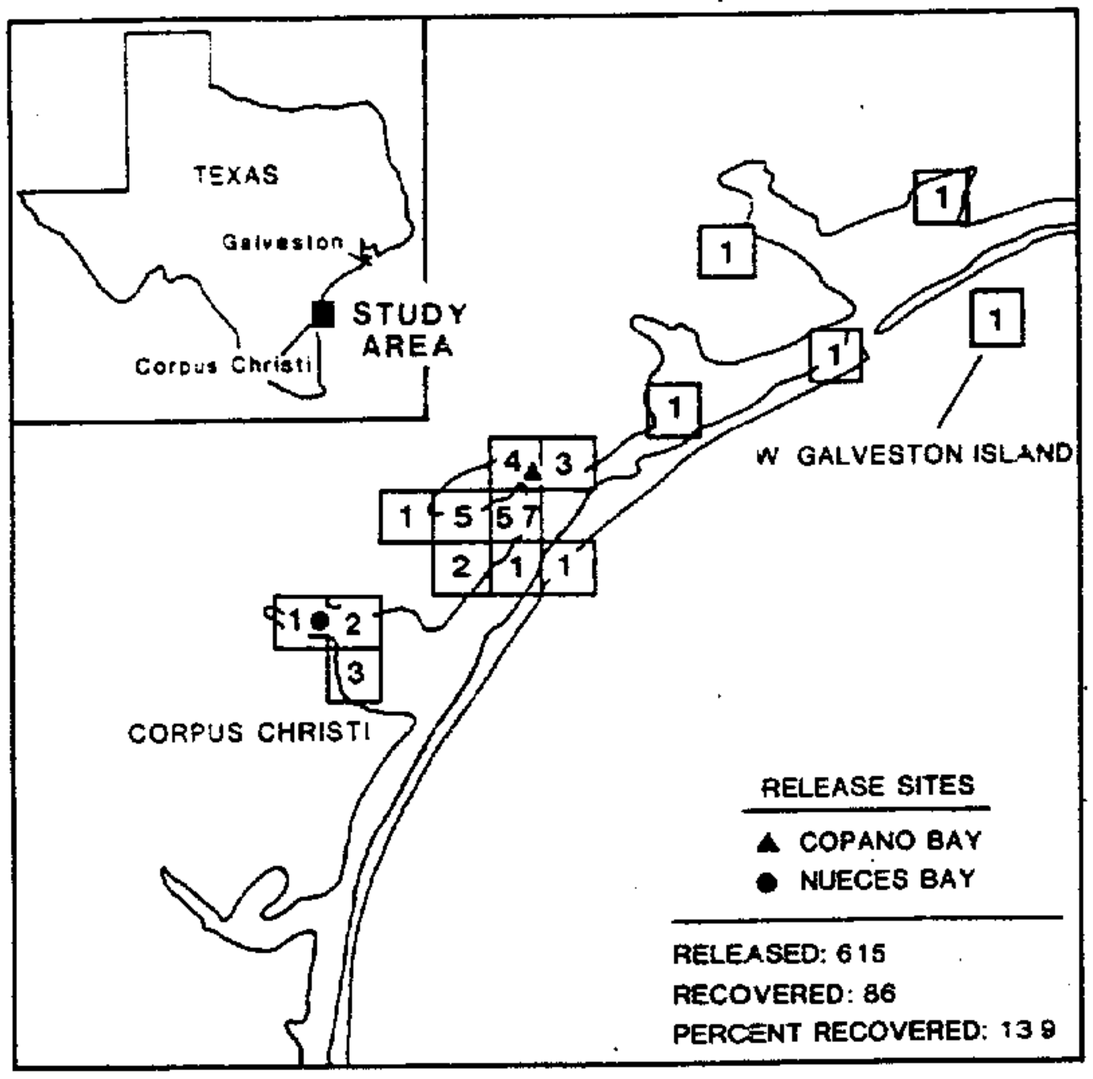


Figure 5.—Distribution of head-started Kemp's ridley sea turtle tag recoveries of the 1982 and 1985 year classes released in Texas Bays. Numbers represent tag recoveries in each six-minute block; turtles without latitude and longitude of recovery not included.

close to the site of their release in contrast to animals released offshore of the Florida and Texas coasts.

Habitat

Head-started Kemp's ridley tag recoveries occurred in bays and Gulf/ocean waters almost equally. Of 478 tag recoveries, 219 (45.8 percent) were reported from bay waters, 152 (31.8 percent) from Gulf/ocean waters, and habitat could not be determined for 107 (22.4 percent) turtles (Fig. 6). Turtles released in nearshore or offshore waters accounted for 140 (35.8 percent) tag recoveries from bay waters.

Table 4.—Summary of tag recovery methods for head-started Kemp's ridley sea turtles of the 1978-86 year classes.

	Recoveries			Recoveries	
Method	No.	%	Method	No.	%
Shrimp trawl	132	27.6	Dip net	5	1.1
			Swimming	4	0.8
Unknown	123	25.7	Cast net	2	0.4
Stranded			Butter-	2	0.4
Dead	116	24.3	fly net		
Alive	48	10.0	Beach seine	1	0.2
Hook and line	27	5.7	Crab pot	1	0.2
Gill net	17	3.6	Totals	478	100.0

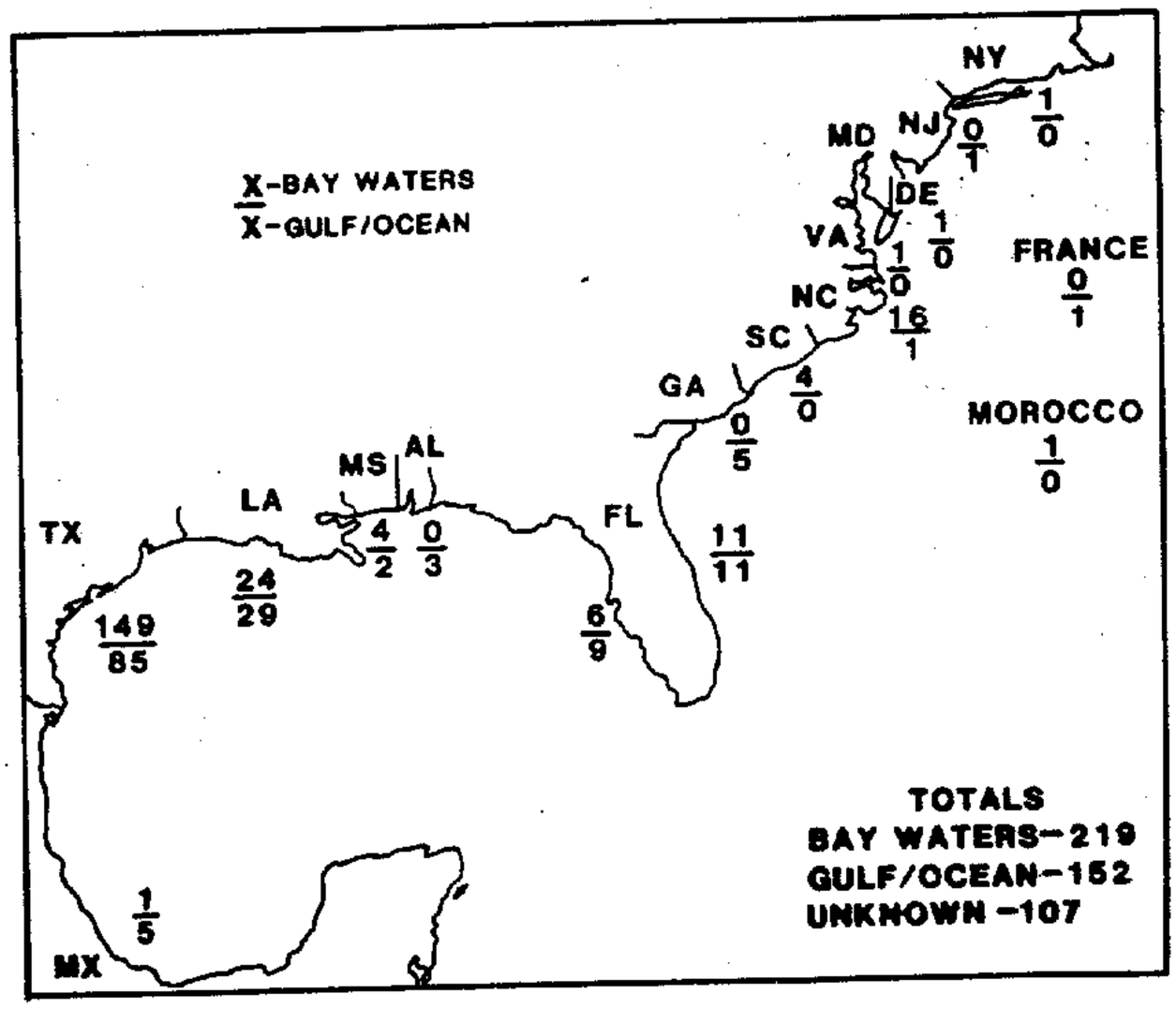
Tag Recovery Methods

Altogether 132 (22.6 percent) head-started turtles were caught in shrimp trawls (Table 4) and 89 (69.5 percent) of these were reported alive and released. One hundred sixteen (24.3 percent) turtles were reported as stranded dead and 48 (10.0 percent) were reported as stranded alive. Recreational fishermen reported 27 (5.7 percent) head-started turtles caught by hook and line, while two (0.4 percent) were taken in cast nets. For 123 (25.7 percent) turtles the method of tag recovery was not reported.

Tag Recoveries by NMFS Statistical Subareas

All tag recoveries were summarized by NMFS shrimp statistical subareas (used to compile shrimp catch and effort statistics). Figure 7 presents the numbers of tag recoveries within each subarea for the Gulf and Atlantic coasts. The largest number, 152 (31.8 percent), were reported from statistical subarea No. 19, encompassing Copano Bay and Nueces Bay release areas. Subarea 20, the Padre Island release area, was second with 65 (13.6 percent) tag recoveries. Two of the more productive statistical subareas for shrimp harvesting, No. 17 near Cameron Parish, Loui-

Figure 6.—Bay tag recoveries vs. Gulf/ocean tag recoveries of head-started Kemp's ridley sea turtles of the 1978-86 year classes. Top number represents turtles from Bay waters. The numbers are located off the state where tag recoveries were reported.



siana and No. 18 near the Galveston/ Sabine pass area, reported 63 (13.2 percent) and 46 (9.6 percent) tag recoveries respectively.

Turtle Status

At the time of tag recovery, 274 (57.3 percent) turtles were reported alive, 166 (34.7 percent) dead, and the status of 38 (7.9 percent) turtles was not reported (Fig. 8). Of the live recoveries, 252 (92 percent) were reported as released and the others held for rehabilitation.

Season

Most of the tag recoveries, 251 (52.5 percent) were reported in spring and 139 (29.1 percent) were reported in summer. The number of tag recoveries decreased during fall and winter (Fig. 8).

Multiple Tag Recoveries

There were 25 turtles captured more than one time. Some of these were worth noting. The 1978 year-class turtle with tag G0045 was captured twice, both times in Core Sound, N.C. This animal was first taken on 25 November 1980, 642 days after release in Sandy Key, Fla., in February 1979 and second, on 21 June 1981, 208 days after the first capture. Another 1978 year-class turtle with tag G0914 was first captured in Beaufort, N.C., on 20 August 1980, 470 days after release in Homosassa, Fla., in May 1979, and for a second time in Hampstead Bay, N.C., on 9 July 1983, 1,053 days (3.5 years) after the first capture. These turtles seem to have stayed in about the same areas and may have overwintered on the North Carolina coast. One other turtle of the 1978 year class, tag G0104, was captured in Miami, Fla., 46 days after release in February 1979 at Sandy Key, Fla. The turtle was captured a second time in Ocean City, Md., 731 days after the first capture. In Bradley Beach, N.J., 56 days after the second capture, the turtle was caught a third time (Fontaine et al., In press b). This turtle seemed to move northward and may have wintered in the Mid-Atlantic region.

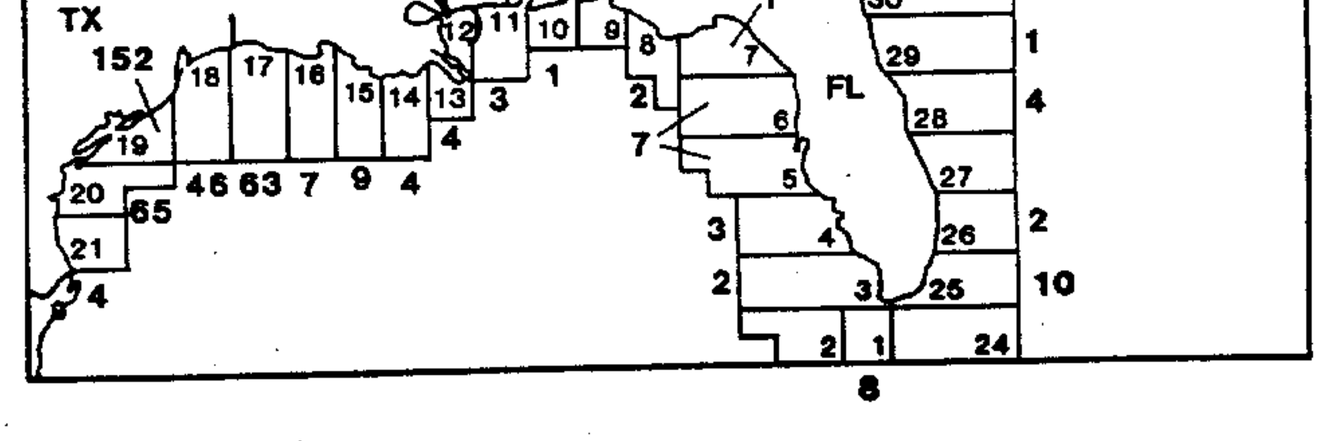


Figure 7.—Tag recoveries of head-started Kemp's ridley sea turtles of the 1978-86 year classes summarized by NMFS shrimp statistical subareas. The numbers on the outside of the subarea boundaries represent the numbers of tag recoveries from that subarea. Turtles without latitude and longitude of recovery not included.

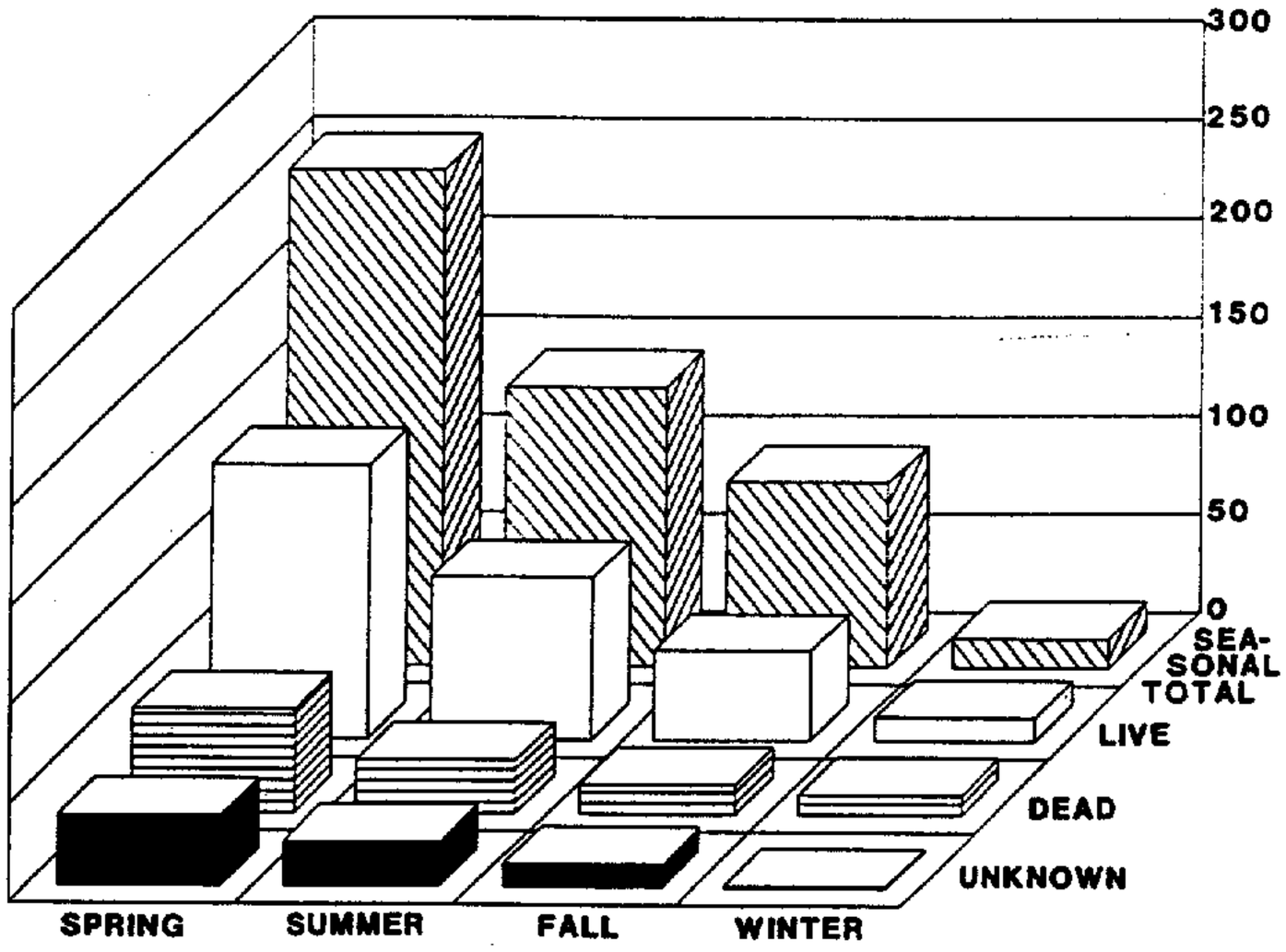


Figure 8.—Turtle status and season of tag recoveries for 478 head-started Kemp's ridley sea turtles of the 1978-86 year classes.

Three other turtles, one from the 1984 year class and two from the 1985 year class also have very interesting tag recovery information (Fig. 9). The 1984 year-class turtle with tag NNT906, released off Padre Island, Tex., on 21 May 1985, was taken in a shrimp trawl in Aransas Pass, Tex., on 6 October 1985, 138 days after release. The turtle was rereleased unharmed. This same turtle was again taken in a shrimp trawl in Matagorda Bay, Tex., on 25 August 1986, 323 days after the first capture. This turtle moved from offshore waters to inshore waters.

The 1985 year-class turtle with tag NNX203 was released in Copano Bay, Tex., on 22 April 1986 (Fig. 9). On 6 May 1986, 14 days later, this turtle was taken in a shrimp trawl in Aransas Bay, Tex., and was rereleased unharmed. On 17 May 1987, 376 days after the first capture, turtle NNX203 was found stranded on West Galveston Island, Tex. The turtle, in very bad condition, was taken to the NMFS Galveston Laboratory for rehabilitation and has since been released. This turtle moved from inshore waters to offshore waters and is one of only three turtles released in a bay and found in Gulf waters.

Another 1985 year-class turtle, tag NNX270, was released in Copano Bay, Tex., and was captured three times (Fig. 9), first, on 22 January 1987 stranded in the mud near Rockport, Tex., 275 days after release. The turtle was badly emaciated, suffering from cold shock and very white in color. The carapace was covered with mud and bits of algae indicating it might have been burrowing on the bottom[3]. The University of Texas Marine Science Institute at Port Aransas rehabilitated this turtle and released it for the second time with the 1986 year class on 21 April 1987 about 19 km (12 miles) off Padre Island, Tex. On 9 May 1987, 18 days after this second release, turtle NNX270 was found basking in 36 inches of water in Matagorda Bay near Palacios, Tex. The turtle was scooped up with a dip net and later rereleased unharmed. On 3 July 1987, 55 days after the second capture, this same turtle was taken in a shrimp trawl in Matagorda Bay, this time near Port Lavaca, Tex. The turtle was reported as alive and very active and was rereleased unharmed. The movement of this turtle is especially interesting. First, it was found near its release location in Copano Bay, possibly attempting to over-winter. After rehabilitation and release offshore, the turtle had returned to the bay system and showed signs of having stayed there for some time.

[3]Pamela Plotkin, University of Texas Marine Science Institute, Port Aransas, TX 78373. Personal commun., Jan. 1987.

Trans-Atlantic Recoveries

Three trans-Atlantic tag recoveries were reported; two from Biarritz, France, and one from El Jadida, Morocco. Of the two turtles reported from France, one, tag NNN893, from the 1979 year class released off Homosassa, Fla., in June 1980, was found in December 1981, 568 days after release. It was alive when found on the beach, apparently suffering cold shock. The second turtle from Biarritz, tag NNG042, was from the 1981 year class released off Padre Island in June 1982. It was found stranded and dead 1,394 days after release. Turtle with tag NNN678, found stranded on a beach in Morocco, was from the 1979 year class released off Homosassa, Fla., in June 1980. The turtle was reported alive 898 days after release. The tag was removed and the turtle rereleased. This may well be the first authenticated report of a Kemp's ridley from the coast of Africa (Fontaine et al., In press b).

Discussion

Tag recoveries of head-started Kemp's ridleys were widely distributed but centered around the Western Gulf of Mexico where most of the turtles were released and close to the area where the second nesting site was proposed. Turtles reported within 60 days after release were usually relatively close to the release site, and turtles at large for over 60 days appeared to be distributed in the same pattern and areas as historical records show for wild Kemp's ridleys. One exception is the tag recovery from Morocco which may represent an extension of the range for the species.

In an earlier study in which a small number of head-started Kemp's ridleys were released with radio tags and tracked for 30 days, the turtles behaved normally (Klima and McVey, 1982; Wibbels, 1984). After remaining in the

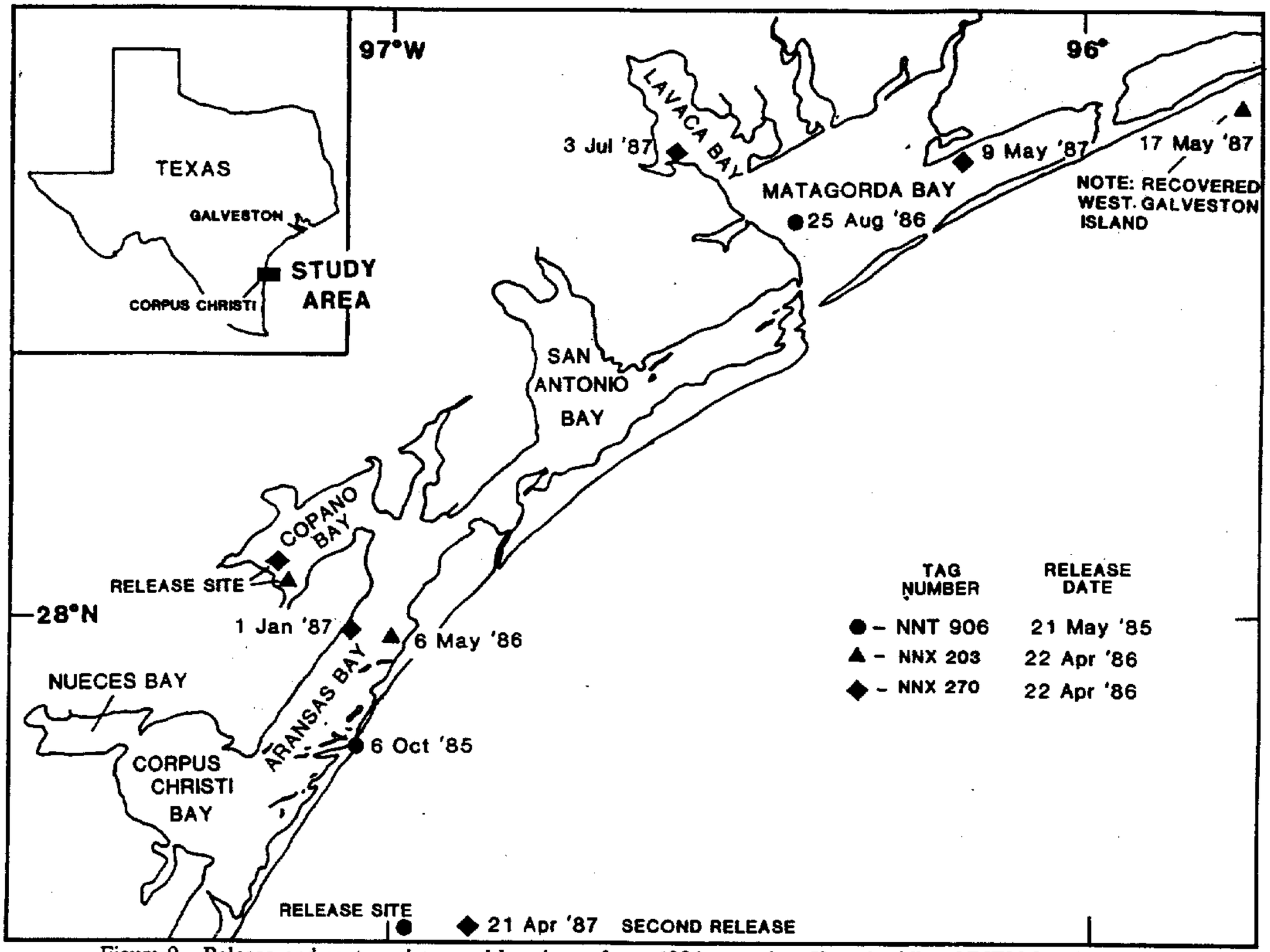


Figure 9.—Release and capture dates and locations of one 1984 year class Kemp's ridley, NNT906 and two 1985 year class Kemp's ridleys, NNX203 and NNX270.

release area a few days, the turtles showed some movement, but generally stayed in the same area throughout the tracking period. Wibbels (1984) concluded that both ocean currents and the turtles' swimming played important roles in the dispersal of the animals.

The head-started turtles have shown movement to and from bay systems. The turtles probably enter the bays and shallow coastal waters in search of the abundant food available there. Carr (1957, 1980), Hildebrand (1982), and Ogren[2] reported that ridleys are commonly found in bays and shallow coastal areas. Lutcavage and Musick (1985) observed that ridleys frequently occurring in the Chesapeake Bay system use that area as a summer feeding ground. Another known U.S. feeding ground is off the coast of Louisiana, from Marsh Island to the Mississippi Delta (Hildebrand, 1982). Shrimp, *Penaeus* sp., and blue crab, *Callinectes sapidus*, a favorite food item of the Kemp's ridley[2], are abundant in those areas. By species, the Kemp's ridley is the second most common sea turtle found stranded in the inshore habitat, with the green sea turtle, *Chelonia mydas*, the most common. Of all wild Kemp's ridley strandings reported to the Sea Turtle Stranding and Salvage Network (STSSN), 22.1 percent are found in the inshore areas[4].

Kemp's ridleys, especially juveniles, inhabit many of the same areas where shrimp and crab occur so it is not unusual that a large number of these turtles are caught in shrimp trawls. Liner (1954) reported eleven Kemp's ridleys caught in shrimp trawls off the Louisiana coast, and Ogren[2] reported that: "Localities where unusual numbers of juvenile ridleys were captured incidental to trawling efforts have been reported since mid 1970's. They are (1) Sabine River offing—Sea Rim State Park, Texas, (2) Terrebonne Parish, Caillou Bay, Louisiana; and (3) Big Gulley, adjacent Mobile Bay offing."

Further, Ogren added that: "These events may have been unusual in that they are thought to be correlated with

[4]Barbara Schroeder, NMFS Miami Laboratory, 75 Virginia Beach Dr., Miami, FL 33149. Personal commun., Sept. 1987.

a high density or abundance of blue crab resulting in a concentration of foraging ridleys."

The 1985 year class, mentioned earlier for the unusual continuous stream of tag recoveries within 60 days after release, had 65 reported within that time period. Fifty-two of these were turtles that stranded in the Copano Bay area and had originally been released into this bay assuming that it would provide a good habitat and that it was closed to shrimping at the time of release. Eight of the tag recoveries were reported as taken by shrimp trawls. David Owens[5] reported to the Kemp's ridley recovery team in 1986 after performing necropsies on 77 Kemp's ridleys that had stranded dead in Texas (47 of them head-started turtles from the Copano Bay release). He concluded that 53 were "possible trawling mortalities." The turtles appeared to have traumatic internal injuries including ruptured hearts.

According to Owens: "The general picture is that the turtles are primarily eating crabs (68%), with many of the head start animals in this group. Unfortunately, two lines of evidence suggest that the turtles are learning to go after discarded trawler by-catch. First, they often have fish in their guts which they could not normally catch.... Second, many that have crabs and fish in the gut also have the small gastropod scavenger *Nassarius*, a strong indication that the food was already dead when it was consumed by the turtle."

Usually, the cause of death of a stranded turtle is not apparent. Even though most head-started turtles caught in trawls were reported to have been released alive, the actual condition of the turtles was not known and some of the stranded animals may have originally been taken by shrimp trawls.

Recreational fishing may also play an important role in the incidental capture of sea turtles. The STSSN reports that of all wild sea turtles that are incidentally taken and reported to the network, 21.7 percent are associated with recreational fishing[4].

The highest number of tag recoveries was reported in the spring. This could be related to several factors: 1) Spring is the usual time for release of head-started turtles; almost 37 percent of the recoveries occur within two months after release (Fig. 2); 2) an increase in recreational activities along the coast increase the chances of a stranded turtle being found along the beaches, and 3) an increase in recreational and commercial fishing occurs.

The head-started Kemp's ridleys seem to adapt well after release into the wild, and the captive-rearing objective of the head start project has been proven successful. When a nesting Kemp's ridley can be identified as a head-started animal, the overall project will be a complete success.

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Literature Cited

Brongersma, L. D. 1972. European Atlantic turtles. Zool. Verhand., Leiden 121:1-318.

Carr, A. F. 1952. Handbook of turtles of the United States, Canada and Baja California. Comstock Publ. Assoc., Cornell Univ. Press, Ithaca, N.Y., 524 p.

_____. 1957. Notes on the zoogeography of the Atlantic sea turtles of the genus *Lepidochelys*. Rev. Biol. Trop. 5(1):45-61.

_____. 1963. Panspecific reproductive convergence in *Lepidochelys kempi*. Ergebn. Biol. 26:298-303.

_____. 1967. So excellent a fishe. A natural history of sea turtles. Am. Mus. Nat. Hist., Nat. Hist. Press, Garden City, N.Y., 280 p.

_____. 1980. Some problems of sea turtle ecology. Am. Zool. 20:489-498.

_____ and D. K. Caldwell. 1958. The problem of the Atlantic ridley turtle (*Lepidochelys kempi*) in 1958. Rev. Biol. Trop. 6(2):245-262.

Fontaine, C. T., K. T. Marvin, T. D. Williams, W. J. Browning, R. M. Harris, K. L. Indelicato, G. A. Shattuck, and R. A. Sadler. 1985. The husbandry of hatchling to yearling Kemp's ridley sea turtles (*Lepidochelys kempi*). U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SEFC-158, 34 p.

_____, T. D. Williams, S. A. Manzella, M. G. Tyree, and C. W. Caillouet, Jr. In press a. Rearing Kemp's ridley sea turtle at the NMFS Galveston Laboratory. *In* C. W. Caillouet, Jr., and Andre M. Landry, Jr. (editors), Proceedings of the First International Symposium on Kemp's Ridley Sea Turtle Biology, Conservation and Management. Tex. A&M Univ., Coll. Sta., Tex.

_____, S. A. Manzella, R. M. Harris, W. J. Browning, and T. D. Williams. In press b. Observations on the growth and distribution of tagged head started Kemp's ridley sea turtles (*Lepidochelys kempi*) from six year-classes, 1978-1983. *In* C. W. Caillouet, Jr., and Andre M. Landry, Jr. (editors), Proceedings of the First International Symposium on Kemp's Ridley Sea Turtle Biology, Conservation and Management. Tex. A&M Univ., Coll. Sta., Tex.

Hildebrand, H. H. 1963. Hallazgo del area anidacion de la tortuga marina "lora", *Lepidochelys kempi* (Garman) en la costa occidental del Golfo de Mexico. Ciencia 22:105-112.

_____. 1982. A historical review of the status of sea turtle population in the western Gulf of Mexico. *In* K. A. Bjorndal (editor), Biology and conservation of sea turtles, Proc. World Conf. Sea Turtle Conserv., p. 447-453. Smithsonian Inst. Press, Wash., D.C.

Klima, E. F., and J. P. McVey. 1982. Headstarting the Kemp's ridley turtle, *Lepidochelys kempi*. *In* K. A. Bjorndal (editor), Biology and conservation of sea turtles, Proc. World Conf. Sea Turtle Conserv., p. 481-485. Smithsonian Inst. Press, Wash., D.C.

Liner, E. A. 1954. The herpetofauna of Lafayette, Terrebone and Vermillion Parishes, Louisiana. Louisiana Acad. Sci. 17:65-85.

Lutcavage, M., and J. A. Musick. 1985. Aspects of the biology of sea turtles in Virginia. Copeia 1985(2):449-456.

Pritchard, P. C. H., and R. Marquez M. 1973. Kemp's ridley turtle or Atlantic ridley *Lepidochelys kempi*. IUCN Monogr. 2: Mar. Turtle Ser., 30 p.

Sokal, R. R., and F. J. Rohlf. 1981. Biometry. W. H. Freeman and Co., N.Y., 607 p.

Wibbels, T. A. 1984. Orientation characteristics of immature Kemp's ridley sea turtles. *Lepidochelys kempi*. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SEFC-131, 67 p.

[5]Owens, David. 1986. Texas A&M University, Dept. of Biology, College Station, TX 77843. Unpubl. rep. to Kemp's ridley recovery team, 4 August 1986.