

NASA Technical Memorandum TM 102783

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# Summary Of 1987 And 1988 Manatee Aerial Surveys At Kennedy Space Center

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February 1989

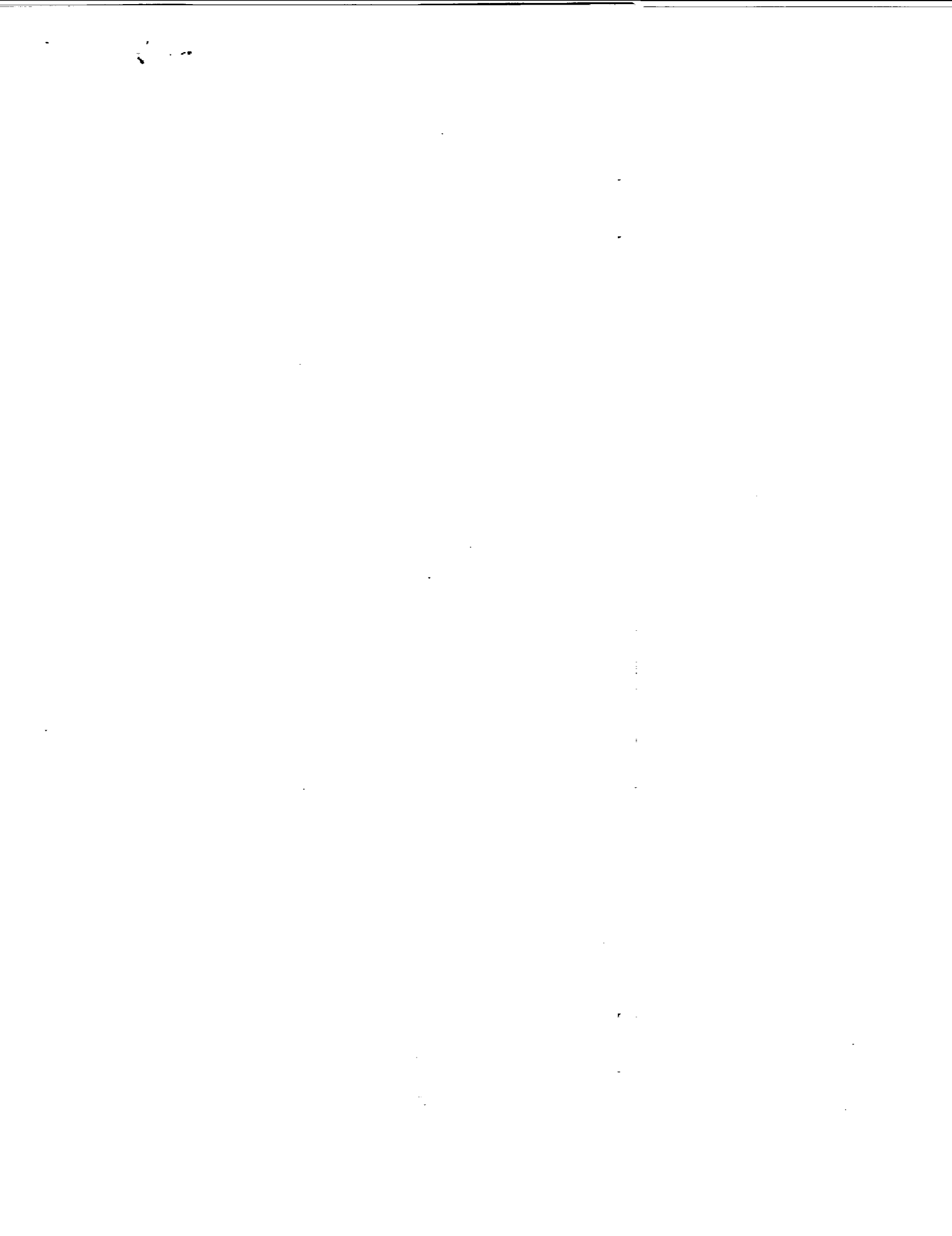
(NASA-TM-102783) SUMMARY OF 1987 AND 1988  
MANATEE AERIAL SURVEYS AT KENNEDY SPACE  
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National Aeronautics and  
Space Administration



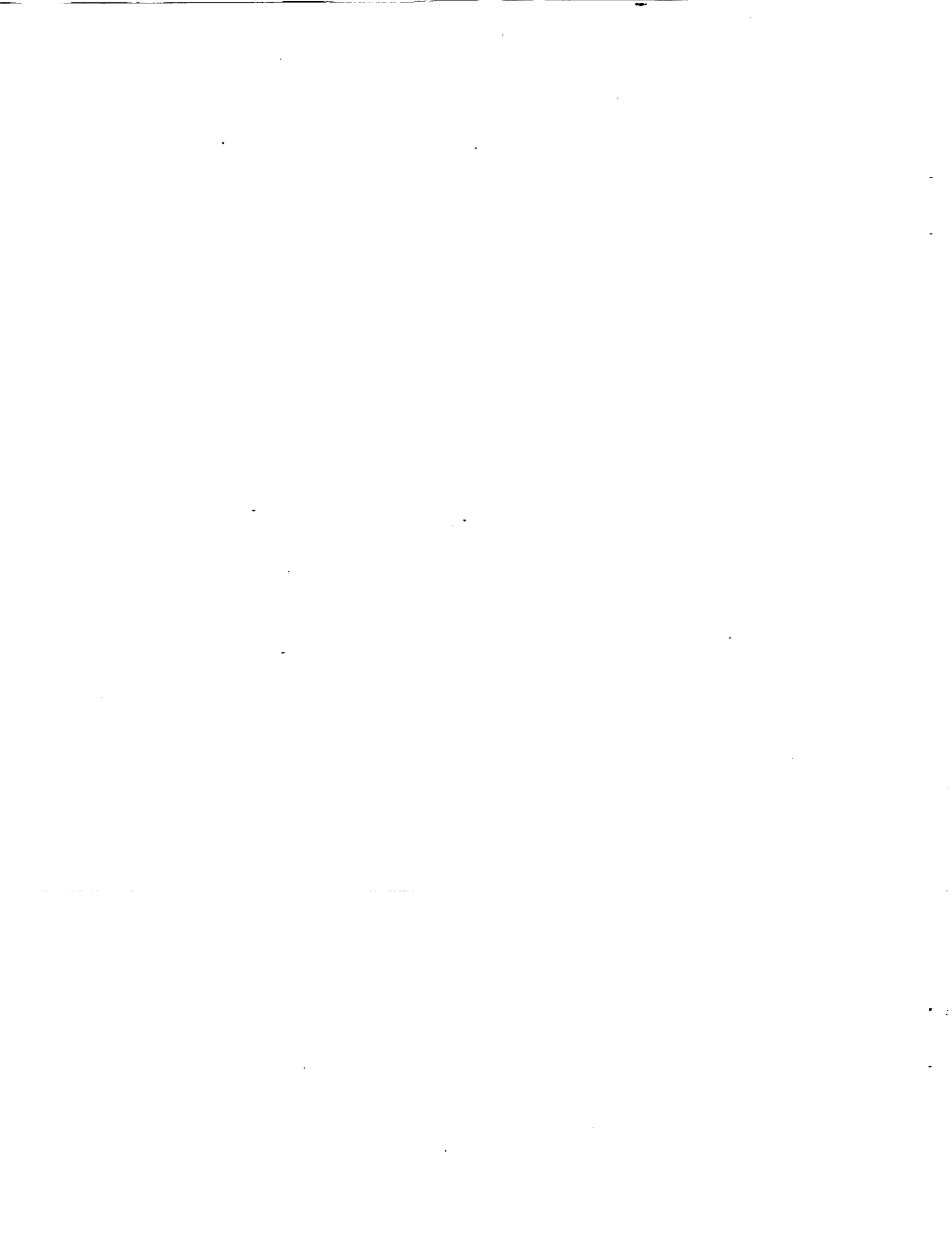
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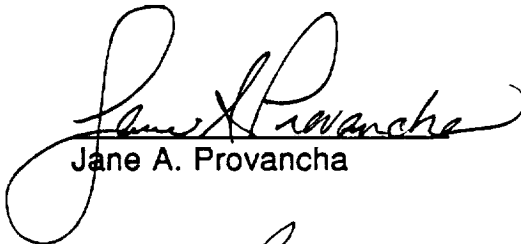
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February 1989



SUMMARY OF 1987 AND 1988 MANATEE AERIAL SURVEYS  
AT KENNEDY SPACE CENTER

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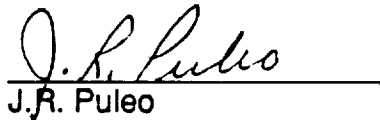
July 30, 1989  
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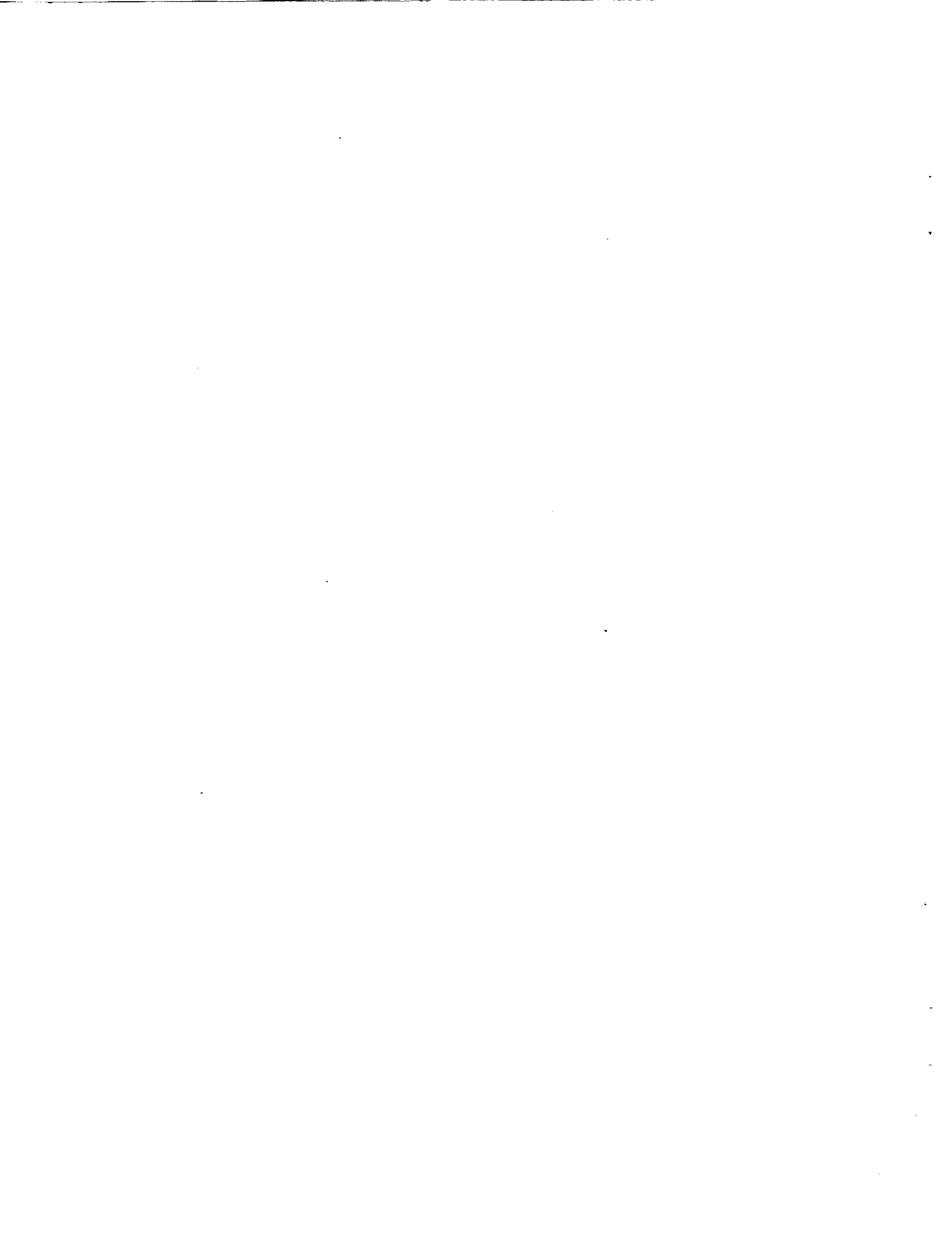
  
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## INTRODUCTION

Aerial surveys of manatees conducted since 1977 at Kennedy Space Center (KSC) have provided a very useful and cost effective monitoring tool in the assessment of abundance and distribution of manatees in the northern Banana River. Data collected in the mid 1980's as part of the KSC Environmental Monitoring Program indicated that the numbers of manatees utilizing the northern Banana River had increased dramatically from earlier years and that the animals appeared to have changed their distribution patterns within the area as well (Provancha and Provancha 1988). United States Fish and Wildlife Service (USFWS) and Florida Department of Natural Resources (FLDNR) conducted bimonthly aerial surveys in 1986 for the entire Florida east coast. Their data clearly show that the Banana River has the highest concentration of manatees during the non-winter months when compared to all other segments of the east coast surveys (B. Wiegler/ FLDNR, unpublished data). They further show that, in the spring, an average of 71% of the manatees in Brevard county were located in the Banana River (Figure 1). During that period 85% of the animals were north of the NASA Causeway (State Road [SR] 402) (Figure 2) in the KSC security zone. These data indicate the importance of the KSC waters to the Florida east coast manatee population. We reinitiated KSC surveys in 1987 to document distributions and numbers of manatees during the spring influx. Aerial censuses were continued throughout the year in 1988 and this report provides a summary of our findings for the two years.

## METHODS

We attempted to perform the surveys three times per month during the spring season in 1987 and 1988 and on a monthly basis for the remainder of the year in 1988. The aerial platform was provided by the NASA/KSC UH-1 Bell Helicopter with the two observers positioned next to the opened doors on either side of the aircraft.

The two observers were the same individuals that have flown the route since 1984 with the exception of the last two surveys in 1988 and one survey in 1987. A back-up observer was trained and acclimated during three flights prior to her assistance in the final surveys of 1988. Surveys were flown at approximately 0900 h, at an elevation of 150 m (500 ft) and at speeds between 65-75 kts. The flight path (Figure 3) covered the northern Banana River starting at the islands just south of Hangar AF and continued northward over water depths of 1 m or greater and then ended in a single flight line that followed the Banana Creek to the Indian River. This is the flight path that has been used since 1984 and closely approximates the routes used by other researchers (Irvine et al. 1979, Shane 1980, and Breen 1981). Additional information on methodologies can be found in Provancha and Provancha (1988). The study area (Figure 2) was arbitrarily divided into seven zones or areas and five subareas where manatees were frequently sighted. The 1987 and 1988 flights were confined to areas 1 through 5, totalling 35.3-km<sup>2</sup>. Density estimates were calculated for each survey by dividing the number of manatees sighted in a given area or subarea by the size (km<sup>2</sup>) of the area. The subareas (A-E) combined total 4.46 km<sup>2</sup>. The data will be presented first to compare the spring of 1987 and 1988 and then the basic trends for the entire year in 1988.

## RESULTS AND DISCUSSION

Results from the individual surveys can be found on Tables 1 and 2. During the 1987 season, eight surveys were conducted between 23 February and 21 May. Total survey time was 7.7 h during which 997 (104) manatees were sighted (numbers in parentheses indicated number of calves in total). This rate of sightings, 2.2 manatees per survey minute, is similar to rates obtained in the spring of 1985, 1986, and 1988. The seven surveys performed in spring 1988, required 5.7 h and yielded 936 (111) manatees. The highest counts for individual surveys were 208 (25) and 224 (18) in



1987 and 1988, respectively. These numbers are very high relative to other parts of the state that are routinely surveyed. The abundance of manatees at KSC in the spring now rivals numbers observed in aggregations at east coast power plants during cold periods. The aggregations that form during winter cold periods have been considered to be the largest. A comparison of highest counts among the survey years at KSC since 1977 is listed in Table 3. The dramatic increase in the numbers of animals in the KSC area after 1984 is quite remarkable. The reasons for this influx are not fully understood, (see Provancha and Provancha 1988 for a review) but the trend is still evident in 1988.

#### Manatee Distributions - Frequency of Occurrence

##### I. Areas

Calculations from the spring flights for both years indicate that manatees continue to be distributed in a non-random fashion with a majority being found in areas 2, 3, and 4; 90% in 1987 and 94% in 1988. Areas 3 and 4 appeared to be equally important to manatees in spring 1988, while their frequency of occurrence in 1987 was greatest in Area 4.

##### II. Subareas

Subarea B, which has been the area of highest manatee density in the recent past, yielded 66.6% of the subarea totals in 1987. Subareas B and C were both of high use in 1988. Forty-nine percent of the manatees sighted in the subareas were found in Subarea B and 39.8% were in Subarea C.

#### Densities

Calculating manatee densities for each area allows for a weighted comparison of areas. Table 4 indicates variations in the densities of manatees in the spring of

1987 and 1988 for each area and subarea. Manatee densities were extremely high in subareas B (37.6/km<sup>2</sup>) and C (31.2/km<sup>2</sup>) in 1988.

### 1988 Trends

A total of 1356 (143) manatees were counted during the 11 h of survey time in 1988 (Table 2). The year long data set for 1988 yielded overall density estimates that are similar but somewhat higher than the 1984-86 surveys as shown in Table 5. The 1988 maximum count (224) was lower than the 1984-86 period (297), but the overall means were higher in 1988. Figure 4 depicts the monthly variations in sightings with the spring data represented as monthly means.

Frequency of occurrence data show that 66.8% of all animals sighted were localized in the five subareas (A-E). These subareas collectively represent only 12.6% of the total study area indicating that these are still high density areas.

Calves were not obviously clumped in any particular region. They occurred at about the same frequency in various areas. Calves represented 10.5% of the animals in 1988 with individual survey percentages ranging from 3.4% to 18.2%. Seasonal variation in calf/adult ratios are difficult to interpret based on our data since the flights only occurred once per month (with the exception of spring). However, higher percentages of calves did occur in spring as expected.

In terms of notable observations during specific flights, we did sight an unusually large percentage of manatees in Area 5 in August and September 1988. This coincided with the hydraulic dredging operations taking place along the Hangar AF channel and basin. These coincidental activities are interesting, as it appeared that manatees were attracted to the dredging activities.

Another distribution observation involved unusually large numbers of manatees (disproportionately large, relative to previous surveys) localized in Area 2 in the Vehicle Assembly Building (VAB) turn basin and Area 1 near the SR 3 culvert on

several flights in 1987 and 1988. These aggregations appeared to coincide with the USFWS-Sirenia Project's use of hoses emitting freshwater into these localities. (The freshwater inputs were used to attract manatees to these areas for capture and tagging operations.)

Included in this report is a copy of the FLDNR summary of manatee deaths by year from 1974-1988 (Table 6). The data show that manatees are under continual pressure from boat/barge activities in Florida which were responsible for 32% of the 133 deaths in 1988. Despite the large numbers of manatees using KSC waters, only two dead manatees were encountered during our studies on KSC since 1984. During that time, 616 manatees were reported dead in Florida. One calf was found in Pepper Flats (Area 2) in 1987 and one large adult in Area 3. Both carcasses were salvaged and relinquished to the USFWS. These two deaths were recorded as natural mortalities.

## ACKNOWLEDGEMENTS

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- Shane, S.H. 1981. Abundance, distribution and use of power plant effluents by manatees (*Trichechus manatus*) in Brevard County, Florida. National Fish and Wildlife Laboratory, Gainesville, Florida. Report prepared for Florida Power and Light Co. Contract No. 61552-86540, NTIS Publication No. PB81-147019. 240 pp.

Figure 1. Preliminary data obtained from B. Wiegler/FLDNR.

# MANATEES IN BREVARD COUNTY 1986 AERIAL SURVEY MONTHLY AVERAGES

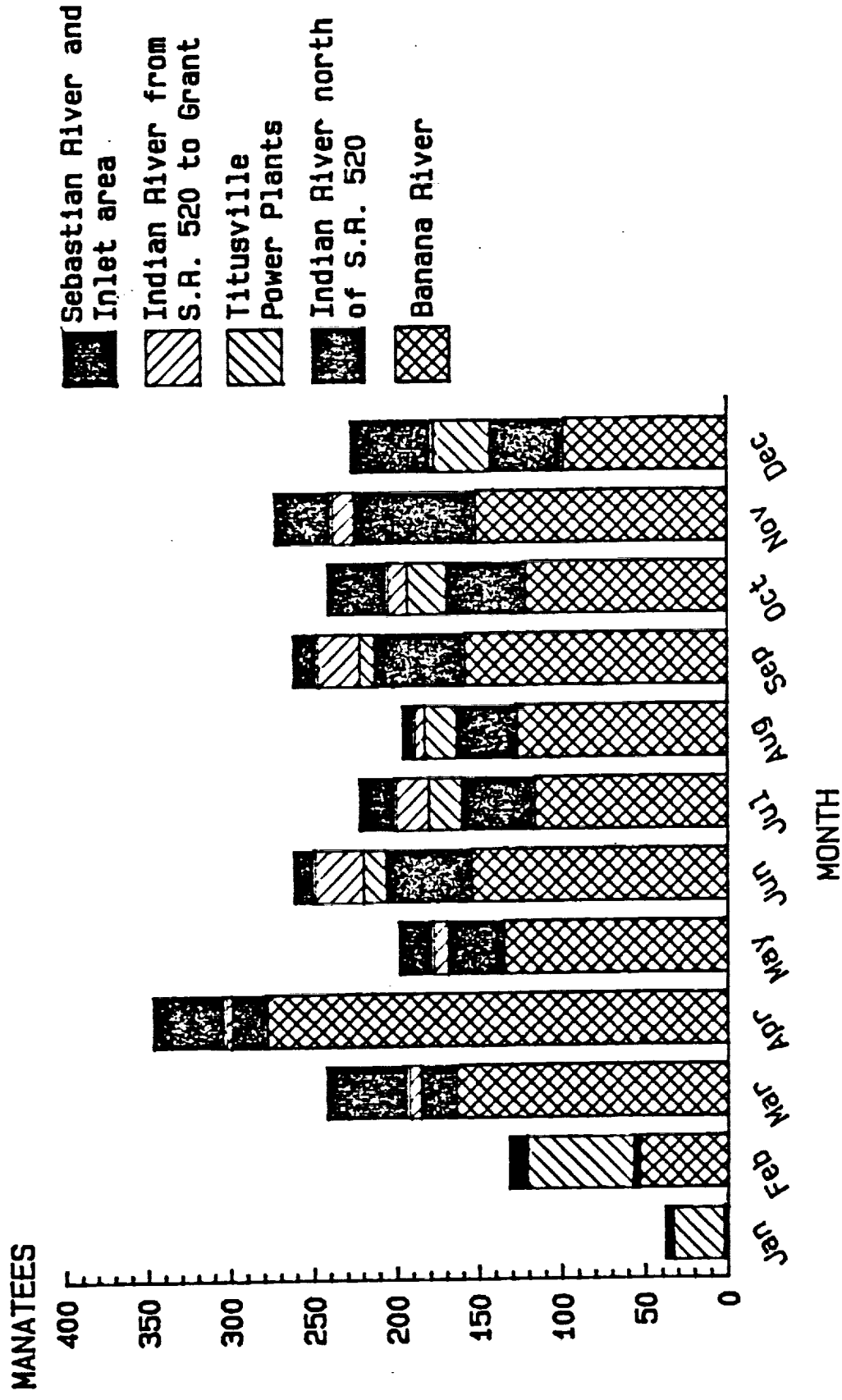


Figure 2. Preliminary data obtained from B. Wiegler/FLDNR.

## MANATEES IN THE BANANA RIVER 1986 AERIAL SURVEY MONTHLY AVERAGES

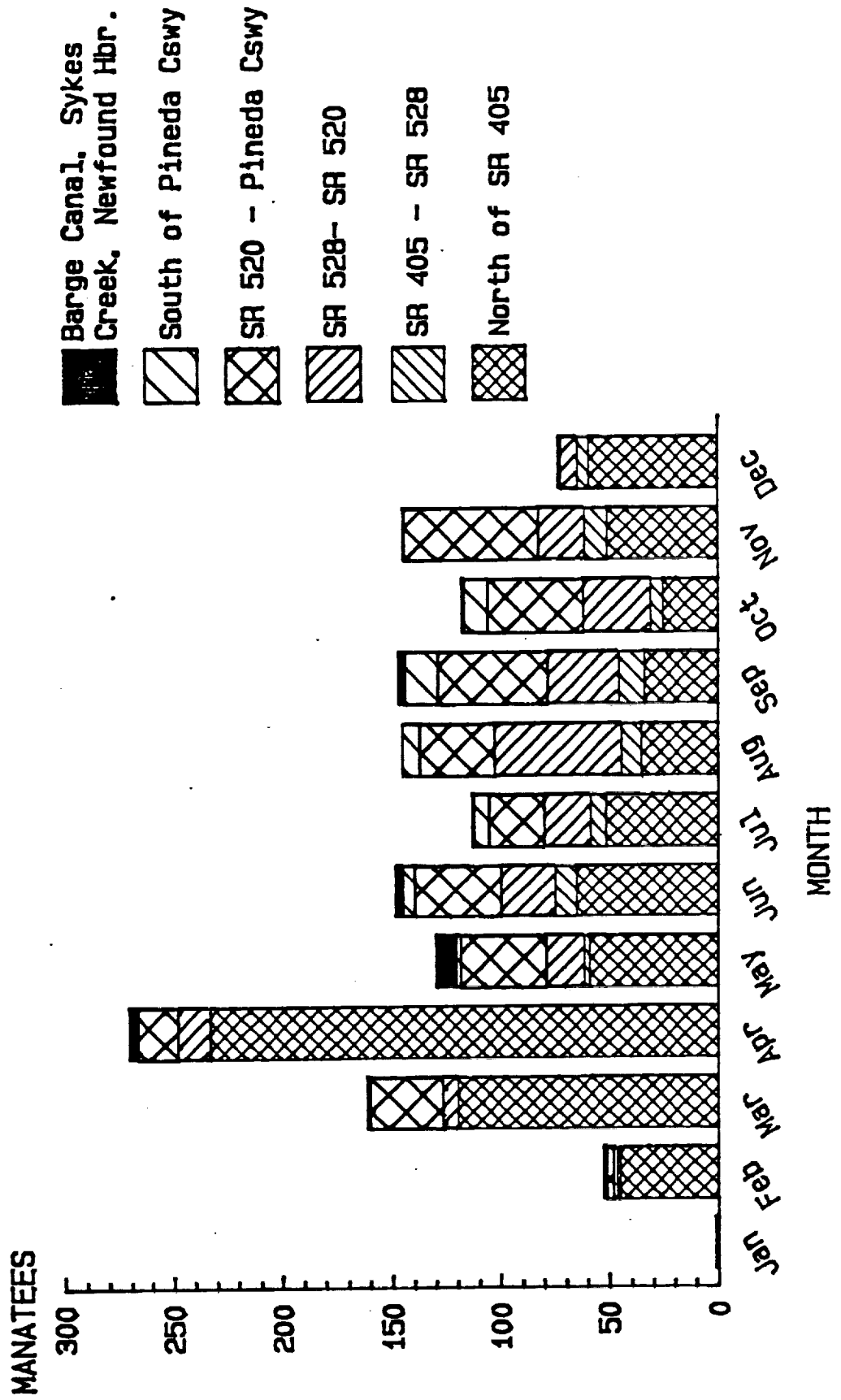
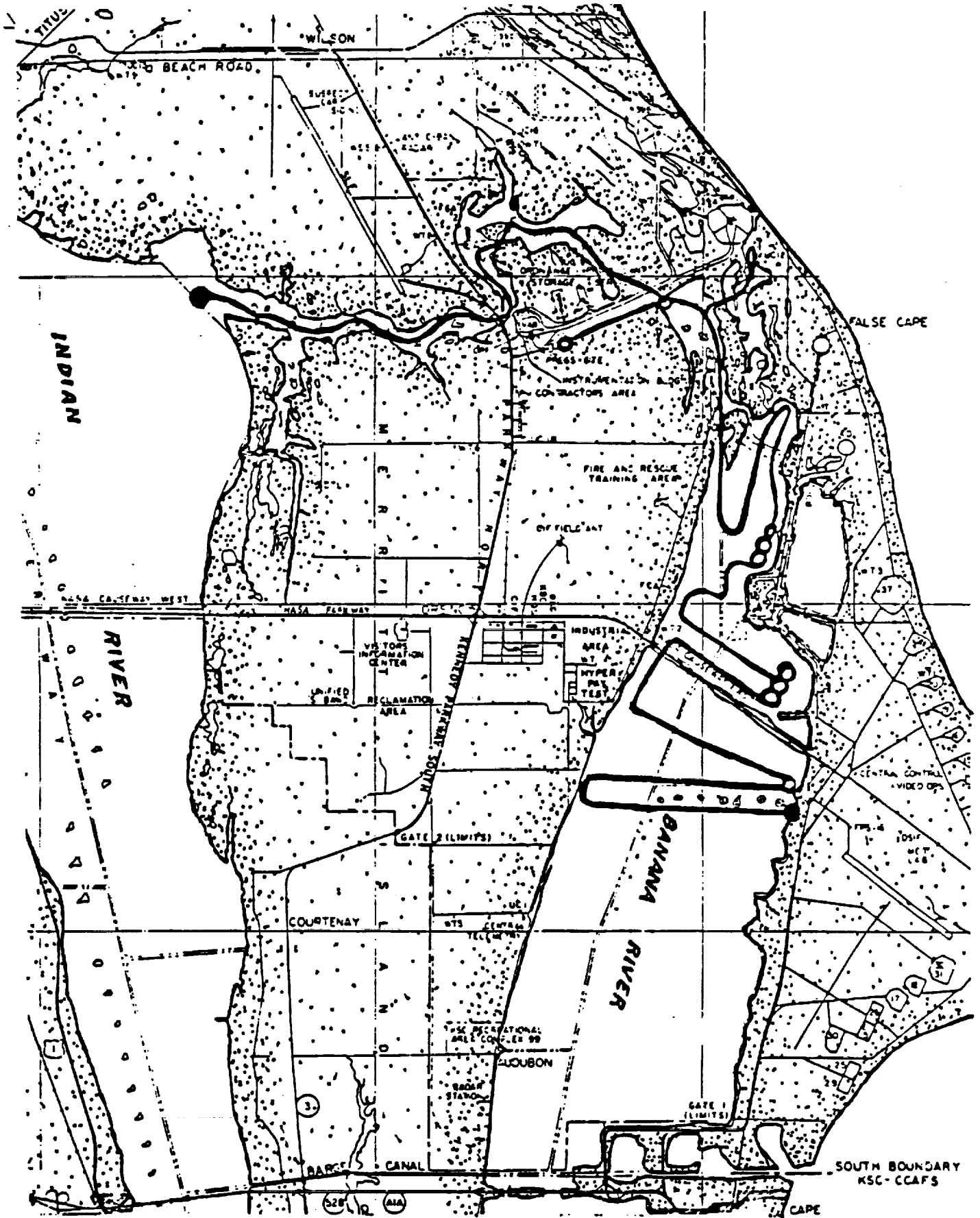


Figure 3. The route followed for manatee aerial surveys at Kennedy Space Center, Florida.





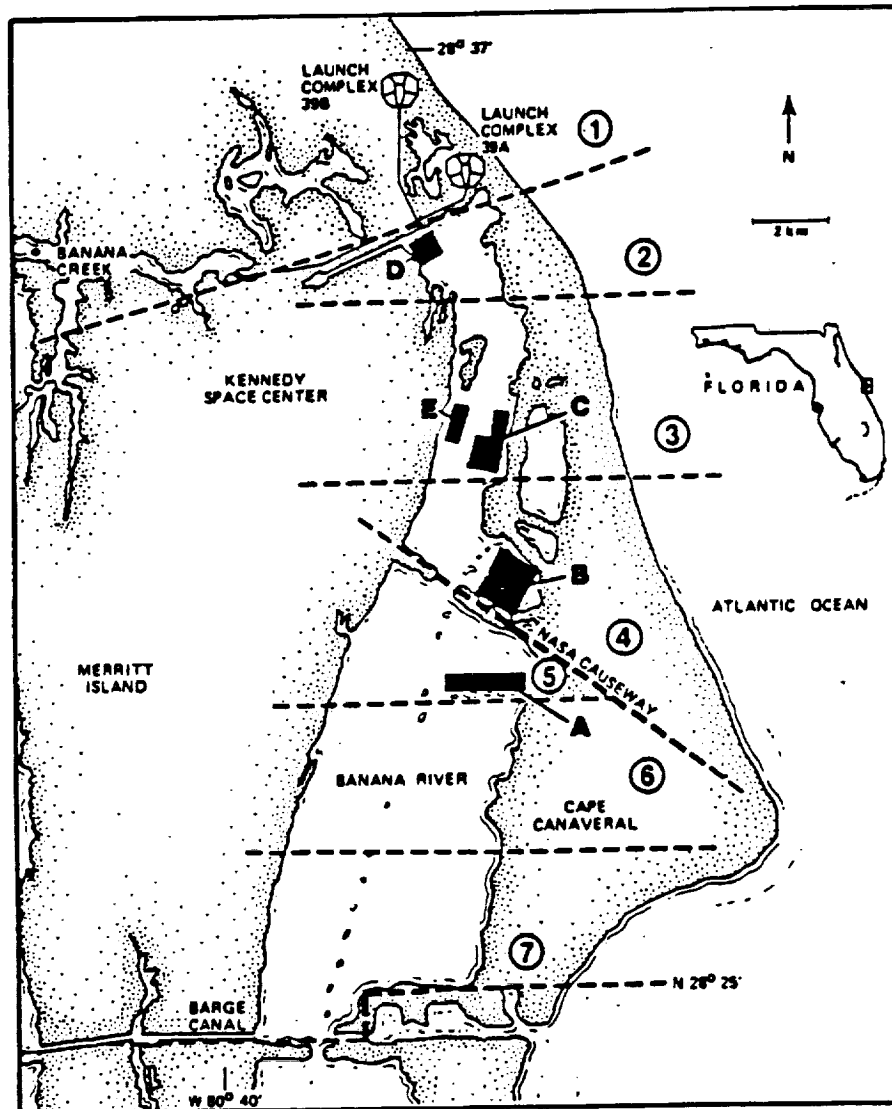


Figure 4 The upper Banana River study zone along the east coast of central Florida, depicting its division into seven areas labeled with circled numbers as well as the five additional subareas (A-E) that were classified as locations of frequent manatee aggregations (see Table 1). The area north of the NASA Causeway is closed to the public.

Table 1. Individual manatee survey tallies for Spring 1987.

DATE Flight	AREA							Flight Totals	HIGH DENSITY SUBAREAS					Subarea Totals
	1	2	3	4	5	A	B		C	D	E			
23 Feb	4	4	22(1)	14(1)	3(1)	47(3)	2(1)	14(1)	0	4	0	20(2)		
13 Mar	0	5	0	31(3)	0	36(3)	0	31(3)	0	0	0	31(3)		
20 Mar	15(3)	62(9)	35(2)	57(4)	5(1)	174(19)	4(1)	55(4)	2	17(3)	0	78(8)		
9 April	0	27	24	36(3)	1	88(3)	0	32(2)	14	1	0	47(2)		
16 April	14(3)	30(4)	27(4)	68(9)	10(1)	149(21)	3	66(8)	16(3)	20(1)	0	105(12)		
24 April	9(1)	23(3)	48(7)	113(12)	4(1)	197(24)	0	103(10)	12(3)	5(1)	0	120(14)		
1 May	6(1)	32(1)	64(10)	98(10)	8(3)	208(25)	8(3)	88(9)	35(4)	8	6(2)	145(98)		
21 May	6	35(1)	38(4)	7	12(1)	98(6)	10(1)	3	10(3)	18	1	42(4)		
TOTAL	54(8)	218(18)	258(28)	424(42)	43(8)	997(104)	27(6)	392(37)	89(3)	73(5)	7(2)	588(63)		
Frequency of occurrence	5.4	21.8	25.8	42.5	4.3		2.7	39.3	8.9	7.3	0.7	58.9		
% Among Subareas							4.5	66.6	15.1	12.4	1.1			

Parentheses ( ) indicate number of calves in the total count.

Table 2. Individual manatee survey tallies for 1988.

DATE Flight	AREA										Flight Totals	High Density Subareas					Subarea Totals
	1	2	3	4	5	6	7	8	9	10		11	12	13	14	15	
29 Feb	0	1	16(3)	6	2(1)	25(4)	2(1)	5	13(3)	0	0	0	20(4)				
11 Mar	0	22(4)	31(5)	19(1)	0	72(10)	0	18(1)	30(5)	0	0	0	48(6)				
22 Mar	5	33(4)	77(9)	80(6)	2(1)	197(20)	0	80(6)	55(5)	12(2)	1	1	147(13)				
29 Mar	1	16(2)	101(6)	103(10)	3	224(18)	1	103(10)	69(5)	4	12	12	189(15)				
13 April	11(2)	53(8)	43(7)	106(12)	0	213(29)	0	103(12)	26(6)	2	0	0	131(18)				
3 May	2	11(2)	61(5)	43(7)	6(1)	123(15)	6(1)	34(6)	52(4)	3	0	0	95(11)				
26 May	0	22(2)	38(7)	0	22(6)	82(15)	22(6)	0	31(4)	10	0	0	63(10)				
16 June	2	19(3)	9	0	8	38(3)	7	0	7	0	0	0	14				
13 July	1	20(1)	3	0	27(2)	51(3)	27(2)	0	3	14(1)	0	0	44(3)				
19 August	1	7(1)	2	2	19(3)	31(4)	16(3)	2	0	0	0	0	18(3)				
20 Sept	6	11(1)	4(1)	3	63(1)	87(3)	16	0	0	0	0	0	16				
19 Oct	7	20(5)	13(1)	26(2)	21(2)	87(10)	20(1)	19(2)	6	5(3)	0	0	50(6)				
10 Nov	9	19(1)	25(2)	10(2)	36(3)	99(8)	32(3)	8(1)	18(2)	7	0	0	65(6)				
15 Dec	1	20(1)	1	4	1	27(1)	1	4	1	1	0	0	7				
<b>TOTAL</b>	<b>46(2)</b>	<b>274(40)</b>	<b>424(46)</b>	<b>402(40)</b>	<b>210(20)</b>	<b>1356(143)</b>	<b>150(17)</b>	<b>376(38)</b>	<b>311(34)</b>	<b>58(6)</b>	<b>13</b>	<b>13</b>	<b>907(95)</b>				
Frequency of Occurrence %	3.3	20.2	31.2	29.6	15.4		11.0	27.7	22.9	4.2	0.9	0.9	66.8				
% Among Subarea							16.5	41.5	34.2	6.3	1.4	1.4					

Parentheses ( ) indicate number of calves in the total count.

**Table 3. Highest counts of manatees at KSC from Hangar AF north in the Banana River and Banana Creek, 1977 - 1988.**

1977	49 (3)	• •
1978	48 (3)	
1979	71 (9)	
1980	34 (3)	•
1981	54 (5)	
1984	103 (14)	• •
1985	202 (20)	
1986	297 (22)	
1987	208 (25)	
1988	224 (18)	

- - This highest count did not occur during spring.
- • - Surveys not conducted in spring, highest count from other period.

Table 4. Average manatee densities (manatees per km<sup>2</sup>) within each area in spring 1987 and 1988.

MANATEES PER KM <sup>2</sup>		
<u>AREA</u>	<u>1987 (N = 8)</u>	<u>1988 (N = 7)</u>
1	0.9	0.3
2	11.4	9.3
3	4.9	8.1
4	7.4	7.1
5	0.5	0.4

MANATEES PER KM <sup>2</sup>		
<u>SUBAREA</u>	<u>1987</u>	<u>1988</u>
A	2.6	3.4
B	37.6	37.6
C	8.8	31.2
D	28.4	13.7
E	2.7	5.6

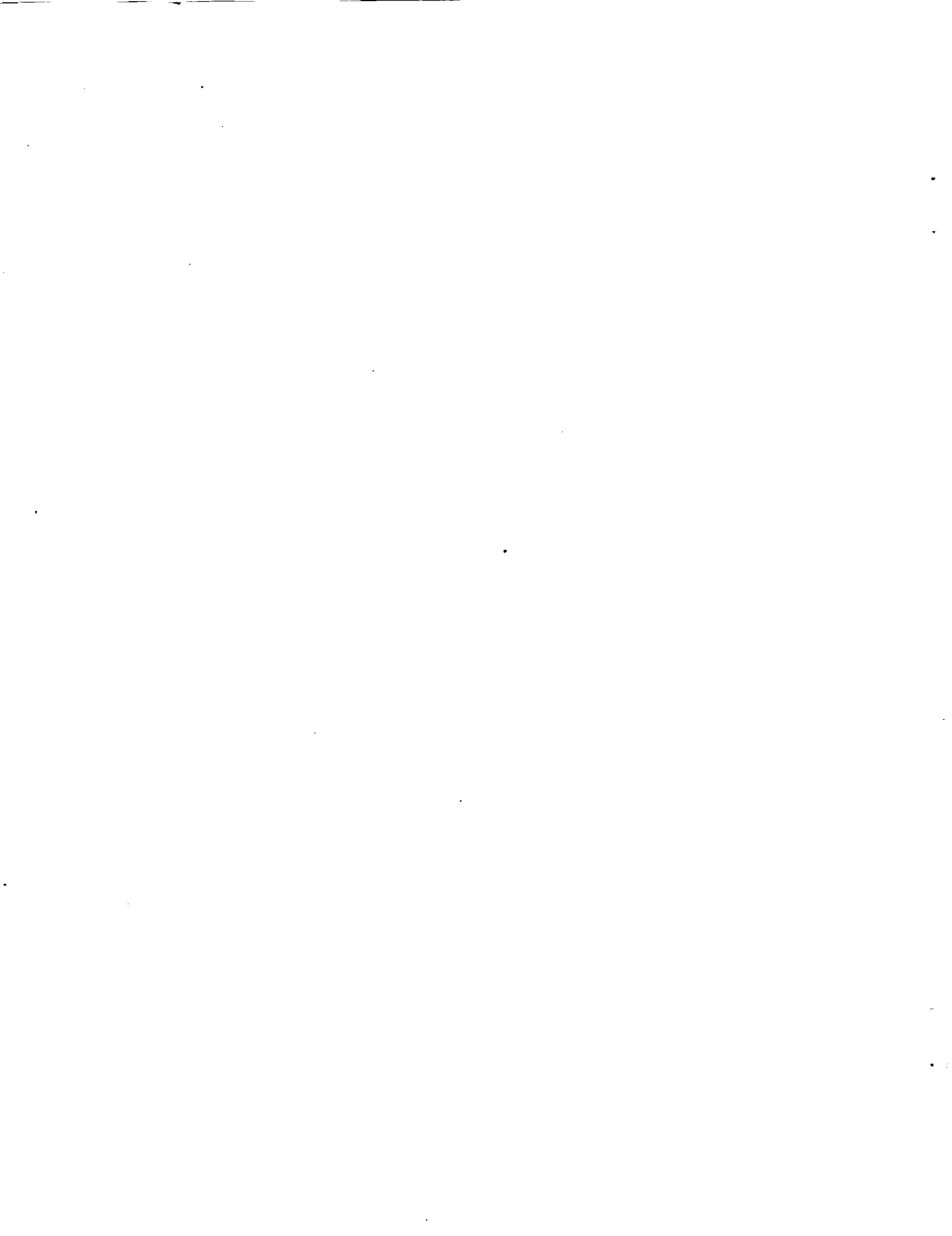
Table 5. Long-term aerial survey counts of *Trichechus manatus* from non-winter flights over the Kennedy Space Center (areas 1 through 5) between 1977 and 1986 with data from 1988 compared. The 1987 data is not included here because the flights occurred only during the spring months.

Year	Total non-winter flights	Total manatees	Range in total manatees per flight	Mean manatees per flight	Mean density (km <sup>2</sup> ) per flight	Mean calves per flight	Percent calves
1977 - 78	19	354	2 - 56	18.6 ± 15.6	0.52	1.7 ± 1.4	9.3
1979 - 80	17	599	11 - 71	35.2 ± 16.9	0.99	4.2 ± 2.6	12.1
1980 - 81	10	215	11 - 54	21.5 ± 13.1	0.61	1.7 ± 1.5	7.9
1984 - 86	21	2,028	42 - 297	96.5 ± 63.0	2.73	9.4 ± 5.4	9.7
1988	12	1,205	3 - 224	108.6 ± 67.1	3.07	11.5 ± 7.8	11.4

Table 6. Manatee deaths by year, 1974 - 1988 based on year reported - Does not include Puerto Rico

FLORIDA DEPARTMENT OF NATURAL RESOURCES

YEAR	STATE	TOTAL	BARGE/ BOAT	GATE/ DAM	OTHER HUMAN	DEP. CALF	OTHER NATURAL	VERIFIED - NOT REC.	UNDETER- MINED
1974	FL	7	3	-	2	-	-	-	2
	Other	1	-	-	-	-	-	1	-
1975	FL	29	6	1	1	7	1	3	10
1976	FL	62	10	4	-	14	2	9	23
1977	FL	114	13	6	5	9	1	16	64
	Other	1	-	-	1	-	-	-	-
1978	FL	86	21	9	1	10	3	8	34
1979	FL	77	24	8	9	9	4	5	18
	Other	1	-	-	-	-	-	-	1
1980	FL	63	16	8	2	13	5	4	15
	Other	2	-	-	-	-	2	-	-
1981	FL	116	24	2	4	13	9	2	62
	Other	1	-	-	-	-	-	1	-
1982	FL	114	20	3	1	14	41	6	29
	Other	3	-	-	1	-	-	-	2
1983	FL	81	15	7	5	18	6	2	28
1984	FL	128	34	3	1	25	24	1	40
	Other	2	-	-	-	1	1	-	-
1985	FL	119	33	3	3	23	19	6	32
	Other	4	2	-	-	-	1	-	1
1986	FL	122	33	3	1	27	13	6	39
	Other	3	-	-	-	-	-	-	3
1987	FL	114	39	5	2	30	16	-	22
	Other	3	-	-	2	-	-	-	1
1988	FL	133	43	7	4	30	24	2	23
	Other	1	-	-	-	-	-	-	1
<b>TOTAL</b>		<b>1387</b>	<b>336</b>	<b>69</b>	<b>45</b>	<b>243</b>	<b>172</b>	<b>72</b>	<b>450</b>







# Report Documentation Page

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15. Supplementary Notes					
16. Abstract <p>This report is a brief summary of the results from aerial surveys conducted in 1987 and 1988 to assess the abundance and distribution of manatees at the Kennedy Space Center, Florida. Surveys performed in the spring yielded 997 manatees in 1987 and 936 in 1988. The highest counts for individual surveys were 208 and 224 in 1987 and 1988, respectively.</p>					
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