ADAK BALD EAGLE STUDY

1983 PROGRESS REPORT

By Natasha Kline

Key Words: Bald Eagle, Adak Island, Breeding Biology, Banding, Electrocution, Measurements

U.S. FISH & WILDLIFE SERVICE
ALEUTIAN ISLANDS UNIT
ALASKA MARITIME NATIONAL WILDLIFE REFUGE
BOX 5251 NAVSTA ADAK
FPO SEATTLE, WA. 98791
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OBJECTIVE To monitor the bald eagle population, age composition and movements on the Naval Station on Adak Island; to obtain production data; and to determine measurement criterion for accurately sexing eagles in the field.

METHOD OF STUDY Population composition and movements were monitored through routine vehicle, boat and dump surveys and by eagle banding operations in the winter and summer. Nest surveys in a sample area throughout the breeding season provided egg and production data nestling counts. Eagle carcasses (usually from birds electrocuted on Naval Station power lines) provide measurement data which can be correlated to sex through necropsy.

MAIN FINDINGS Eagle visitation to Naval Station appears to correspond to seasonal phenomenon, peaking in winter and summer, and decreasing in the fall and spring. Production figures from the sample area are 2.07 eggs per active nest, and 0.813 nestlings per active nest, indicating a stable eagle population. Insufficient data precluded the determination of new measurement criterion, but the tarsal width and mandible length criterion established last year still appear to be valid indications of sex.

CONCLUSIONS A more efficient means of capturing eagles for banding and subsequently sighting them would be useful. Production figures from the sample area indicate a stable eagle population. More data must be collected before any new measurements yield correlative figures.

MANAGEMENT IMPLICATIONS Continuation of all phases of eagle study on Adak Island will eventually lead to a large and valuable data base of many aspects of bald eagle natural history. Production and movement data are important in determining the population structure of eagles in the Aleutians. Measurement data should reveal a reliable method of sexing eagles in the field.

ADDITIONAL REMARKS

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Natasha Kline wrote the study report with assistance from Leslie Slater. The report was edited by Fred Deines. Study design was based on previous Adak eagle work (Reiswig 1981, and Kline and Deines 1982) with modifications as determined by Natasha Kline and Fred Deines.

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INTRODUCTION

This report is an update, incorporating data collected in 1983, of the ongoing study of the bald eagle (Haliaeetus leucocephalus) on Adak Island, Alaska. As this is a progress report, it is helpful to read it in conjunction with previous Adak Bald Eagle Study reports. For background and further coverage of procedures please refer to the 1981 and 1982 Adak Bald Eagle study reports (Reiswig 1981, Kline and Deines 1982).

The study has three major components: (1) Banding eagles with records of subsequent sightings of these banded eagles, provides qualitative information on individual movements and age, as well as measurement figures. (2) Nest surveys in the summer and spring give production data, population estimates, and provide opportunity for banding known aged birds. (3) Year-round vehicle and boat surveys conducted in the vicinity of the naval station furnish trend data on movements and age composition of the local eagle population. Carcasses of eagle (mostly victims of electrocution on naval station power lines) provide the opportunity to correlate external anatomical measurements with sex and will hopefully reveal one or more measurements enabling accurate sex determination of live eagles. Production and measurement data are the only figures that lend themselves to quantitative analyses, other information is useful for trend or baseline data for more in depth studies that may be conducted in the future.

STUDY AREA

The island of Adak is located approximately half way along the Aleutian chain at about 51'50'N, 174'40'W (Figure 1). The island is volcanic in origin and most of its 290 sq km is extremely rugged terrain. It is Adak's irregular coastline, characterized by many bays and inlets and surrounded by offshore reefs, rocks and islets, that receives the most eagle use.

Mean average annual temperature is 5 C and total annual precipitation averages 167 cm. 1983 was an unusual drought year, with a very snowy winter and a mild summer. A weather summary for the 1982/1983 season can be seen in Table 1.

The naval station on Adak is located on the northeast portion of the island (Figure 2). Human habitation, some 5000 year-round residents, is virtually confined to this area. The naval station provides a unique opportunity for bald eagle study. The local garbage dump is a reliable food source for the opportunistic eagles and attracts them to the naval station area. The population of bald eagles wintering on the naval station is an estimated 150-250 birds (Reiswig 1981). This year all eagle work was limited to this area because of limited personnel and time.

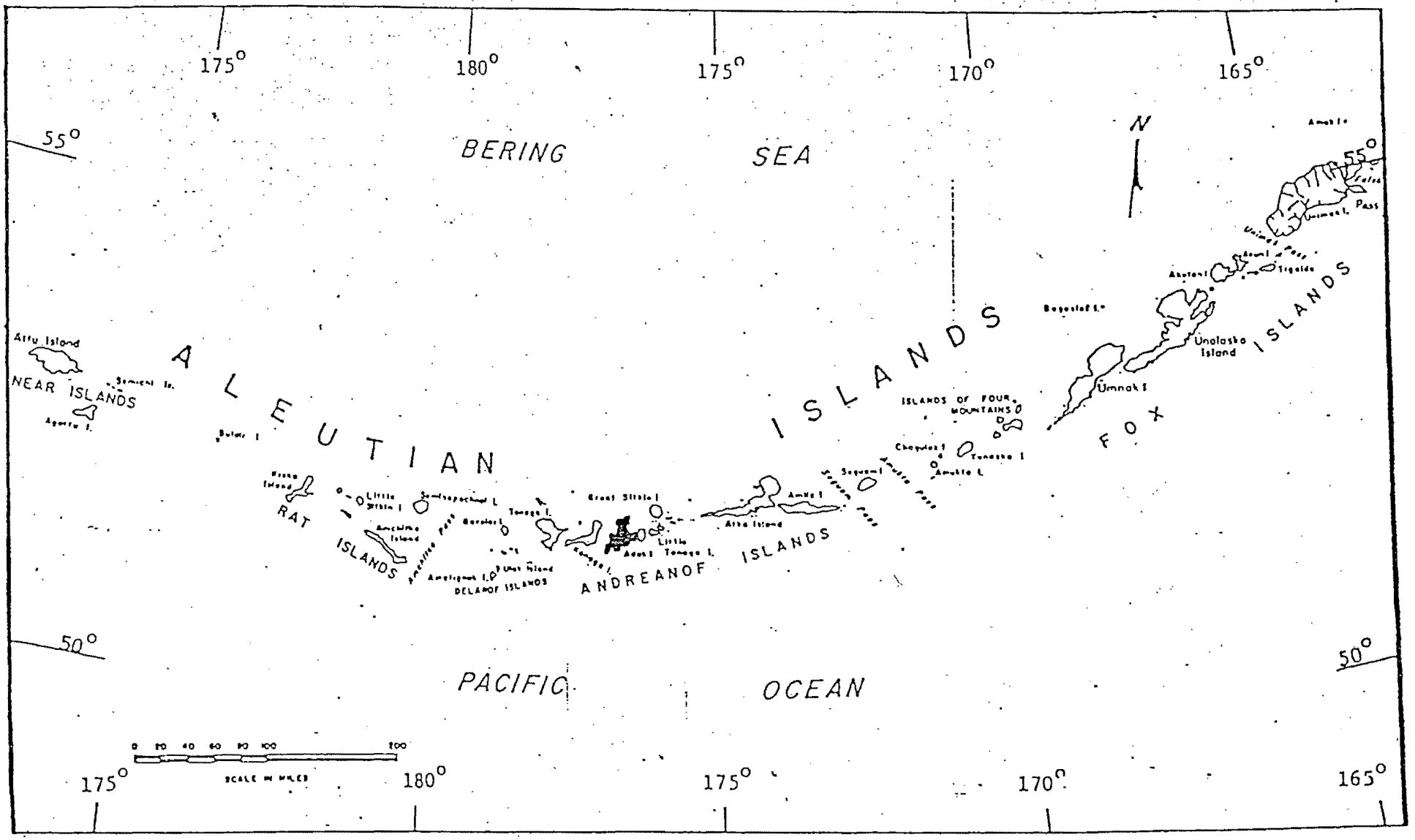


Fig. 1 Map of the Aleutian Island chain.

TABLE 1. 1983 ADAK, ALASKA, WEATHER SUMMARY (WITH COMPARISONS TO NORMAL** DATA).

	1983 Pcpt* (")	NORM Pcpt* (")	1983 SNOW (")	NORM SNOW (")	1983 Days Meas. Pcpt*	1983 Max. F	1983 Min. F	1983 Ave. F	NORM Ave. F
JAN	3.83	6.43	36.6	17.0	26	46	8	29.6	34.0
FEB	4.88	4.77	42.3	19.3	24	47	15	32.2	33.0
MAR	3.18	5.97	22.0	20.2	2	42	13	33.7	34.2
APR	3.47	4.58	7.8	10.1	28	52	26	37.4	37.2
MAY	1.47	4.30	0.3	2.1	23	50	33	40.7	40.6
JUN	1.95	3.17	0	T	19	56	35	45.2	44.6
JUL	2.28	5.07	0	0	18	61	41	48.6	51.0
AUG	3.56	4.18	0	0	22	71	43	53.4	51.0
SEP	4.52	4.74	0	.01	15	61	32	48.1	48.2
OCT	8.09	5.85	1.0	2.0	28	55	31	44.2	45.1
NOV	8.60	8.07	15.3	11.7	27	46	22	36.5	37.0
DEC	6.62	7.25	8.6	22.1	25	46	21	36.4	34.0
Totals:						Extr:		Ave:	
	52.72	64.38	78.7	104.5	283	71	8	41.5	40.8

*Includes rain and melted snow.
**Average of most recent past ten years data.

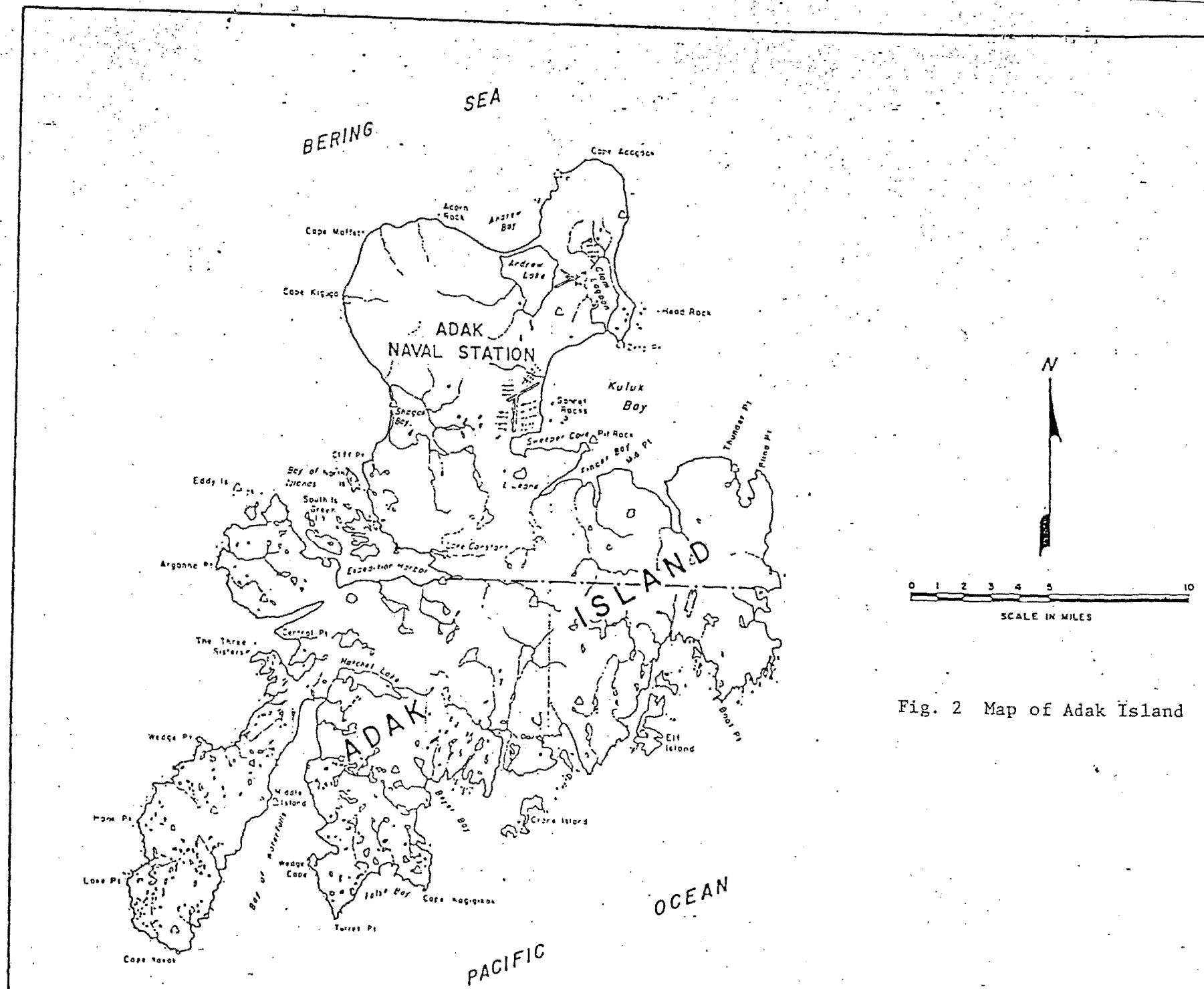


Fig. 2 Map of Adak Island

MATERIALS AND METHODS

A. Winter Capture, Banding and Marking

1. Methods: The winter banding effort was minimal this year owing both to a change in navy policy regarding the storage of munitions and to the detrimental side effects of baiting eagles into the banding site. Previous banding efforts (1981, 1982) determined that rocket nets were by far the most efficient means of capturing eagles for banding. Unfortunately, because the Navy's regulations on black powder storage could not be met, this method was not used in 1983. This year's banding effort was limited to leg hold traps laid out behind the Refuge headquarters.

2. Materials:
   - 7 padded leg hold traps (#3 or 4)
   - 5 lb weight attached to each trap
   - 1 hand net
   - 1 wool blanket
   - 1 pr leather gloves
   - 2 buckets
   - 1 bottle mild dishwashing detergent
   - 1 pr surgical or rubber gloves
   - picric acid
   - methanol
   - meat scraps (from Commissary)
   - velcro raptor leg restraints
   - velcro raptor restraint jacket
   - cloth raptor hoods
   - riveting gun
   - rivets
   - riveting FWS leg bands
   - colored, numbered leg bands
   - 5 kg+ spring scale
   - calipers
   - pencil
   - data recording sheet

3. Procedure: The jaws of seven number three leg hold traps were padded with electrician's tape to prevent injury to the bird's legs. These traps were concealed in the snow and baited with meat scraps from the local Commissary butcher shop. Eagles are abundant about the naval station at this time of year searching for food scraps in the dumpsters and are easily attracted to the trap site behind the Refuge headquarters.

Baiting and trapping were initiated twice this year. Bait alone was set out on the first day of each effort to begin attracting eagles to the site. The trap site was an open field on the west side of the Refuge headquarters building where the traps could be easily monitored from inside the building. Seven traps were set out on 18 Feb, daily from 20 Feb to 24 Feb, and again daily from

6 Mar to 8 Mar.

Captured eagles were hand netted, restrained with the velcro raptor restraint jackets and leg ties, then weighed, measured and banded. To allow for comparison to previous years data, measurements recorded were the same as those taken last year. Wing, tarsus, head and bill measurements were taken as described by Baldwin et al (1931), and the age class of the eagle was determined by plumage characteristics, eye and bill color (Sherrod 1976).

Eagles were banded both with riveting aluminum Fish and Wildlife Service bands and red annodized aluminum bands with yellow numerals. Using certain measurement criterion as suggested by Kline and Deines (1982) a sex estimate was made on each eagle and it was banded accordingly (colored bands on the left leg of females, right leg of males).

A saturated solution of picric acid and methanol was used to dye the retrices of adult birds in individual color codes. First, the tail was washed with a mild detergent and dried, then select remices were dyed according to the color scheme assigned the bird. Once the dye dried, the eagle was released.

B. Nest Survey/Egg Count

1. Methods: It was determined last year that there was insufficient time and manpower to conduct thorough island wide eagle nesting surveys on Adak (Kline and Deines 1982). Therefore, the coastline on the northeastern portion of Adak from Zeto Point to Blind Cove was designated as a sample area to gather productivity data in 1983.

2. Materials:
13 ft Zodiac raft (equipped with standard safety and repair kit)
15 hp outboard motor
gas tank(s) with sufficient gas
1 survival suit /person
1 "Mustang" suit /person
1 pr hipboots or waders /person
1 pr 10x 40 Leitz binoculars
1 4 ft+ wooden pole /person
1 hard hat /person
1 compass /person
1 map Adak (1:50,000 scale)
1 write-in-the-rain pad
1 pencil
1 35mm camera
color film

3. Procedures: Most active nests were determined by

circumnavigation of the sample area from 20 April to 12 May concentrating on areas known to be breeding pair territories from previous years. One inland nest was discovered by unfortunate passerbys who strolled too near the nest which was located near a residential area. Active nests were identified by the presence of an incubating adult whose white head was usually conspicuous. Nests were approached either using a 13 ft inflatable Zodiac powered by a 15 hp motor, or by foot. Nest contents were observed from a nearby vantage point or the nest was actually visited, depending on the location. Incubating adults were often reluctant to leave the nest and sometimes had to be enthusiastically encouraged to fly.

Adult eagles can be rather aggressive at this particular time, and the plastic hard hats and wooden poles were necessary accoutrements for protection against their often persistant attacks.

The following data was recorded from each nest: date observed, location, substrate, nest number, number of eggs, and any other pertinant notes (See Appendix A).

The locations of active nests were marked on a 1:50,000 scale map for records and to facilitate relocating the aeries later in the year for nestling counts and banding. Photos were taken of most aeries to illustrate their location and easiest access routes (see Adak Bald Eagle Aerie Histories, AIUAMNWR files).

C. Nestling Banding

1. Methods: From 8 July through 15 July, known active nests in the sample area were revisited for eaglet censusing, measuring and banding.

2. Materials: All of equipment from Part B, and:
   1 hand net /person
   1 pr leather gloves
   2+ velcro raptor leg ties
   2+ velcro raptor restraint jackets
   2+ drawstring hoods
   #9 riveting USFWS bands
   red plastic coded leg bands
   2 pr riveters
   rivets
   2 pr calipers
   2 5 kg+ spring scales
   2 pencils
   Data recording sheet/Rite-in-the-Rain Pad
   1 daypack /person
   35mm camera
   color film

3. Procedures: Accessible aeries were visited. While still at the lip of the nest, surveyors restrained eaglets with hand nets. This ensured the eaglets wouldn't be frightened out of the nest when it was entered. (Generally only older eaglets close to fledging threatened to fly, younger eaglets merely gaped and hissed at the intruding biologists). Nestlings were extricated from the nets, hooded, and placed in raptor restraint jackets and leg ties. Then, according to the eagle banding data sheet, eagles were measured, weighed and banded both with Fish and Wildlife Service bands and red plastic coded bands (Instructions for making these bands are in Appendix B).

Processing of eaglets was done as gently and quickly as possible to minimize stress. Nestlings were as apt to attempt to flee the nest after this ordeal as before, so a technique was developed to allow biologists to depart the nest while keeping the eaglets in. Nestlings were positioned so they faced away from the exiting biologists, who maintained a grip on the eaglets tarsus until the eaglet was quiet and the biologist was out of sight (below the lip of the aerie). When possible the nest was rechecked from a vantage point to confirm all eaglets remained in the aerie.

D. Year-round Surveys and Data Collection

1. Methods: Biweekly vehicle and boat surveys on the naval base and vicinity are scheduled throughout the year to monitor local wildlife population trends. Unfortunately, due to both severe weather which kept roads closed and water iced over, and an emphasis on off-island refuge activities this year, the routine surveys were severely cut back.

2. Materials:
Appropriate Data Recording Sheet
Pen/pencil
Field guides
1 pr 10x 40 binoculars
Land vehicle (preferably 4 WD)
Spotting scope with window mount, and 25x, 40x lenses
21 ft Boston Whaler with 2 90 hp outboard motors (equipped with appropriate safety and repair kits)
1 survival suit /person
1 "Mustang" suit /person

3. Procedures:. Vehicle surveys (normally biweekly) follow a prescribed route and include salt, brackish and freshwater habitats as well as inland areas. Locations and numbers of all avian and mammalian sightings are recorded on vehicle survey forms. In the case of eagles, the rough age class (adult or immature) is also recorded.

Surveys of the Naval base garbage dump and adjacent Mitt Lake allow for more detailed eagle observations. Eagles in these areas are counted, specific age classes determined according to Sherrod (1976), and band numbers and color marked eagles are noted. All information is recorded on dump survey and banded eagle observation forms.

Boat surveys in Kuluk and adjacent bays, and Kagalaskan straits provide the same type of data as vehicle surveys.

Carcasses of eagles (usually electrocuted on Naval Station power lines) are collected, weighed, measured, and necropsied for sex determination; any other pertinent information is also recorded. Carcasses in good condition are saved for live mounting or museum specimens. Those in poor condition are salvaged for remiges and retrices which are sent to the Anchorage law enforcement office of the USF&WS. The remainder of the carcasses are deposited at sea.

Through these procedures, data were gathered on total eagle numbers, age class ratios, measurements, and eagle movements on Adak Island.

RESULTS AND DISCUSSION

A. Winter Capture and Marking

No eagles were captured in leg hold traps during the first trapping effort. Bait set out the first day enticed some 21 eagles to refuge headquarters on 17 February and for the next five trapping days eagles were perched all around the trap site. However, no eagles were observed feeding on scraps or were caught in the leg hold traps.

Glaucous-winged gulls (Larus glaucescens) and common ravens (Corvus corax) were also attracted to the trap site; seven gulls were inadvertantly caught and banded.

The second trapping effort captured two eagles, one immature and one adult. A comparison of 1982 and 1983 trapping results and 1983 data recorded can be seen in Tables 2 and 3 respectively.

It is unknown why this years trapping effort was so unsuccessful. Perhaps the traps and bait were laid out too near the refuge headquarters building. The eagles were certainly lured to the area, and though they would even swoop down to take bait tossed farther away, very few ventured into the main bait area.

TABLE 2. Comparison of 1982 and 1983 Leg-hold Trapping Results.

Year	Trap Days	Eagles Captured Imm	Ad	Total	# Captured Per Day
1982	90	13	7	20	0.222
1983	63	1	1	2	0.032

An unfortunate side effect or risk of baiting eagles onto the Naval Station is the possibility of their electrocution on the power poles they roost on. Although this was not a problem in previous years of Refuge baiting, this year three eagles were electrocuted on power poles near the refuge headquarters. (Ironically these poles even had perches installed on them to prevent such occurances.) Trapping was therefore ceased. Severe weather which closed roads, precluded baiting in more remote areas without power lines.

Measurements taken from the two captured eagles and an additional eagle* obtained later were incorporated into data compiled and analyzed last year. A summary of bald eagle measurements can be found in Table 4 (See Appendix C for calculations). Adult and immature eagle-- measurements were combined as no significant difference was found between the means of their measurements (Kline and Deines 1982).

Leg hold traps are an undesirable means of capturing eagles. Not only are they inefficient, but the probability of their injuring their victims is great. Foraging eagles are as apt to be caught by their toes, wings, even their heads, as they are by their legs. They are also prone to injury while they flounder about after being caught. Furthermore, the effect of the jaws of these indiscriminate traps, although padded, on smaller birds legs can be disastrous (at least one gull lost a leg to a trap), not to mention the profound negative effect a screaming captured gull or raven had on eagles contemplating a visit to the trapping site.

*On 17 March a "brown head" eagle was rescued from a log under a pier. The eagle had clambered onto the log from the water and sat there the entire day without drying off. Once captured via Zodiac raft it was taken to refuge headquarters, blown dry with a hair dryer, measured, banded, and released.

TABLE 3. Summary of Data from 1983 Winter Bald Eagle Trapping

Date	Wght (kg)	Age Class	Bill Hght	Wid of Base	Bill Gape	Mndbl Ovrlp	Mndbl Lngth	Wing Chord	Tarsus Diag	Tarsus Total	Tarsus Wid	Bands FWS	Bands Color	Tail Mark
3/7	--	Ad	3.76	2.86	5.40	1.62	7.59	--	10.30	10.88	1.47	*	158	YWW
3/7	4.8	BH	3.69	2.71	5.51	1.38	7.14	63.4	10.64	11.39	1.45	**	159	--

* 629 11962
** 629 11968

For descriptions and instructions on how to take measurements, refer to the Electrocuted Raptor Measurement Handbook

TABLE 4. Summary of Bald Eagle Measurements (1981, 1982, 1983)

Measurement Statistic	Wing Chord	Diag Tarsus	Total Tarsus	Tarsus Width	Hght of Bill	Wid of Bill Base	Wid of Bill Gape	Mandbl Ovrlap	Man Length
n	168	168	168	169	155	154	151	151	154
x	64.98	10.06	11.26	1.50	3.86	3.54	5.95	1.48	7.49
s	4.60	0.814	0.663	0.153	0.275	0.616	0.322	0.153	0.480
Range	51.8-90.17	7.42-11.90	8.23-14.6	0.98-1.95	3.05-4.89	2.11-4.69	5.07-6.80	1.11-1.89	6.36-9.84

Hopefully next year a more efficient and safer method of capturing eagles can be employed. Rocket nets are desirable, but it is unlikely the Navy's blackpowder storage regulation will be met. The eagles habit of frequenting the base area in the winter and foraging in and around the dumpsters might predispose them to capture in some type of baited enclosure. Designs for traps of this type will be studied and perhaps implemented in the winter of 1983.

B. Nest Survey and Egg Count

Seventeen active nests were identified in the sample area. Twelve of these nests were either known from last year or replaced known nests,and an additional five were discovered. Only one nest site, #6, known from last year was not in use or replaced this year. The pair was present and even mildly territorial but never showed any signs of actually nesting.

Data on nest histories and substrates are summarized in Table 5. It appears that eagle pairs fairly routinely change nest sites. One possible cause for this phenomenon is the infestation of aeries by lice. In the future, by noting which aeries have lice perhaps a correlation may be drawn.

TABLE 5. Summary of 1983 Bald Eagle Nest Histories/Substrates in Sample Area.

		History		Substrate			
	Nests	New	Reused	SS	CSS	H	R
#	17	11	6	5	4	6	2
%	100	65	35	29	24	35	12

The pairs often rebuild on the same type of substrate. This could either be due to a preferance on the eagles part or an artifact of available substrates on a particular territory. An effort to follow the histories of each nest site will be attempted in the "Bald Eagle Nest Sites on Adak" file. Perhaps this will reveal more information on eagle territories, nest site selections, etc.

It is not known if the six nests previously unknown are actually new nests or if they were active but unsuccessful last year and never discovered due to the late 1982 nest survey. If these are new nest sites several questions are raised. Did the entire island see an increase in breeding bald eagles? If so why? Or was this just a local phenomena, and how did it affect existing eagle pairs territories and nesting success?

Fourteen of the 17 active nests were accessible by climbing, one nest, #9, on a sea stack could be observed from the mainland, and two nests, 1A and 1B, were inaccessible and their contents could not be determined. The locations of these aeries are shown in Figure 3.

Results of the egg count are shown in Table 6. Of the 15 viewable nests, two had one egg, four had two eggs, and three had three eggs. Thus there was an average of 2.07 eggs per active nest. Based on an estimated breeding pair population of about 50 (Reiswig 1981), these figures can be extrapolated to give an estimate of 1983 bald eagle production on Adak to be about 103.5 eggs.

TABLE 6. Summary of 1983 Bald Eagle Egg Production in Sample Area.

	Number of Eggs			
	U	1	2	3
#	2	2	10	3
%	12	12	58	18

The 1981 estimate of 50 breeding bald eagle pairs may not be accurate for 1983 but it is probably close enough to provide a meaningful figure. Only 34 active nests were discovered in 1982 but due to the method employed and the timing of the 1982 nest survey, many nests, especially those that failed early on, would have been overlooked. However, if production data is going to continue to be gathered from a sample area (especially from an area which could give such biased data as the Kuluk Bay area), it would be desirable to conduct an island wide nest count at least once every three years. In the sample area alone a significant difference of five active aeries was noted between 1982 and 1983.

Timing of active nest surveys is extremely important and it is probably necessary to conduct at least two to obtain accurate results. On Adak, bald eagles appear to lay their eggs from March to May, peaking in mid April (Reiswig 1981, Kline and

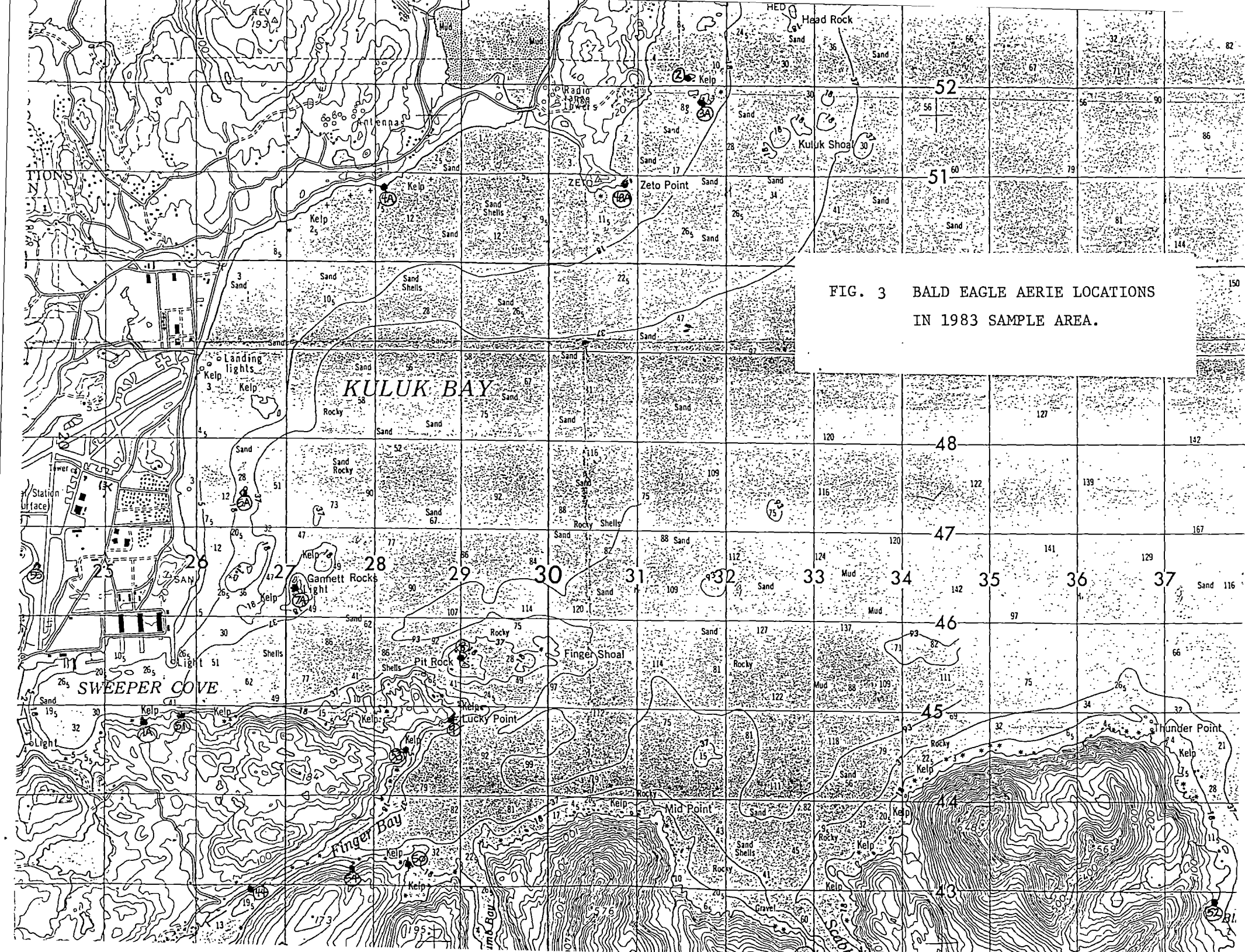


FIG. 3 BALD EAGLE AERIE LOCATIONS IN 1983 SAMPLE AREA.

Deines 1982). Therefore, an early count may not include "late breeders", and a late count may miss aeries that were begun but failed early.

Based on data collected this year, timing of egg laying does not appear to be correlated to area, but rather a characteristic of individual pairs. The initial egg count in the 1983 sample area on 20 April found many nests with incubating adults. Later checks in these same areas around mid-May revealed active nests with incubating adults on nest sites which did not even have a pair in attendance on the first count.

It appeared that the peak of initiation of incubation in the 1983 sample area was around mid April. Egg counts were begun when several incubating adult eagles were sighted during boat surveys. The schedule recommended by Kline and Deines (1982) was accurate and should be applicable for future eagle work. This schedule, with a few additions, is shown in Table 7 (optimum banding dates and the recommendation of more than one date for the initiation of egg counts were added). Variation in timing between eagle pairs must be taken into consideration, and more than one trip to some nests may be necessary to complete all work at the appropriate times. Estimation of the ages of nestlings banded would be helpful in predicting their fledgling dates and for future scheduling.

It should be noted that the one adult eagle banded and color marked this winter (presumed to be a female according to its measurements) was seen at nest #9. This bird, YWW, was the more aggressive defender of the nest, perhaps this is another characteristic of the female.

C. Summer Nestling Banding

It was hoped that an island wide nestling count and banding effort could be made, but lack of time and personnel due to other refuge activities precluded that. Nestling data were obtained from 16 of the 17 known active nests in the sample area - all of the nests observed in the egg count and from inaccessible nest #1A. Of these 17 nests, nine successfully reared nestlings. Four of these successful nests raised two nestlings each, and five produced one nestling each. Nestling production is therefore 0.813 nestlings per active nest, and 1.44 nestlings per nest with nestlings. This number can be extrapolated to determine an estimate for bald eagle nesting production on Adak in 1983. Again, assuming about 50 breeding pair, some 41 nestlings would be produced.

Production of 0.813 nestlings per active nest compares well to the 0.86 young per nest attempt Sherrod et at (1976) found as a reproductive rate for bald eagles on Amchitka. Sprunt (1971) cites 0.7 young per active nest as the stability point for maintaining bald eagle populations. Therefore, it appears the

Adak bald eagle population is probably stable.

TABLE 7. Recommended Schedule for Bald Eagle Production Surveys

Stage of Production	Begins	Lasts	Ends	Peaks	Study Activity	Beg. Activity
Eggs Layed	Mar		May	m-Apr	Egg Count	1 m-Apr
Incubation	Mar	34-45 days	Jun			2 m-May
Hatching	May		Jun	m-May		
Nestlings					Band/ Measure	
Downy	m-May	5-6 wks	m-Jun			m-Jun
Juvenile	m-Jun	5-6 wks	m-Jul			
Fledging	Jul			m-Jul	Fledg. Count	Jul

TABLE 8. Nest Numbers of Banded Nestlings from 1983 Sample Area.

Band No. F&WS	Band No. Colored	Nest Number
629-11976	A1	48
77	A3	3A
78	A5	3A
79	A6	53
80	A7	53
81	A8	7A
82	A9	8
83	A0	1A
84	B1	52
85	B2	52
87	B3	4A

Nine nestlings and two fledglings were banded from eight nests (See Table 8). The two fledglings were birds that apparently left the nest prematurely as they were both found near their respective nests, unable to fly. These birds were banded and left where they were found. In both cases the parent birds were still protective of them and appeared to be feeding and caring for them. Our presence caused one other eaglet to jump from its aerie onto an adjoining sea stack; we were unable to band that bird. The data collected from these young birds can be found in Appendix D., the 1983 eaglet banding data sheet.

Unfortunately, personnel were not available in late July to perform a fledgling count. The only data available on fledgling success were sightings of this years birds. At this time (October 1983) seven of the eleven eaglets banded have been sighted around the naval base. One of these "brown heads" was accidently hit by a dump truck and killed after it had gorged itself on salmon (the 700 g of salmon in its crop may have had something to do with its being hit by the truck).

D. Year-round Surveys

Survey data from 1983 is incomplete for the following reasons. Unusual weather patterns caused a very heavy snowfall during the winter months and early spring. Access to many places on the vehicle survey route was made impossible by snow drifts. Boat surveys were precluded during much of this time because the boat basin was frozen over. During the summer months most of refuge time and personnel were obligated to preparation for and actual work off island. It is especially regrettable that surveys were not completed this year because of the opportunity for monitoring changes in population trends in an unusual weather year. Furthermore, in the early spring both vehicle and boat surveys were revised and the routes slightly altered, thus adding to the difficulty in summarizing surveys.

Although incomplete, data from the various surveys (see Appendix E) are illustrated. Figure 4 is a line graph representing the monthly fluctuation of eagles at the dump based on dump surveys. Because the number of surveys done each month varied, each months surveys were averaged to give a weighted final figure. Figure 5 breaks this information down further and shows annual trends for each age class in 1983.

A bar graph of the monthly flucuations of adult and immature eagles frequenting the entire Naval Base area is shown in Figure 6. This graph was constructed from data from vehicle, boat and dump surveys. The line graph over the bar graph illustrates the monthly trend of total eagle numbers. Each month is not represented by the same number or combination of vehicle, boat and/or dump surveys. The type of survey(s) that provided data for each month is indicated in Appendix E.

FIGURE 4. Line Graph Showing Monthly Fluctuations of Eagles at the Dump in 1983 (Based on "Dump Surveys").

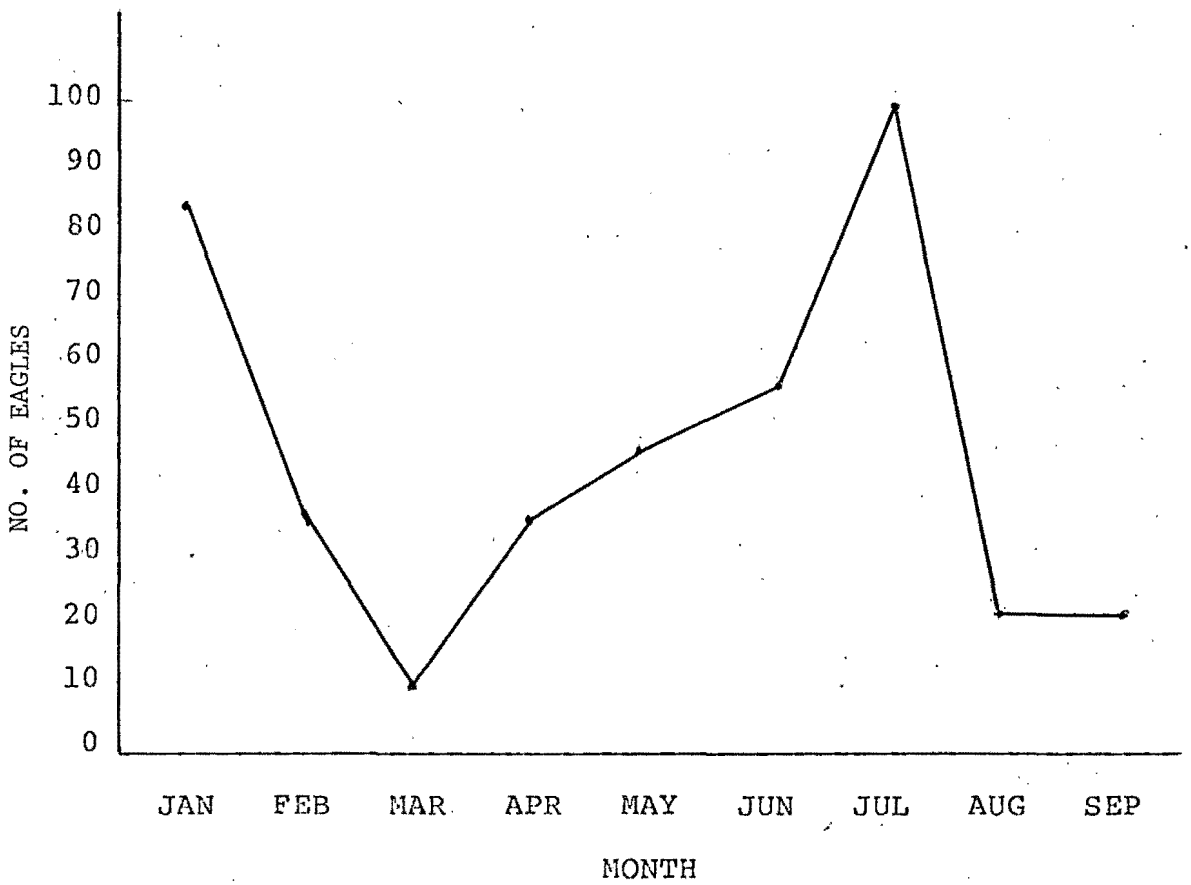


Figure 5. Annual Trend in Dump Use For Each Bald Eagle Age Class (1983)

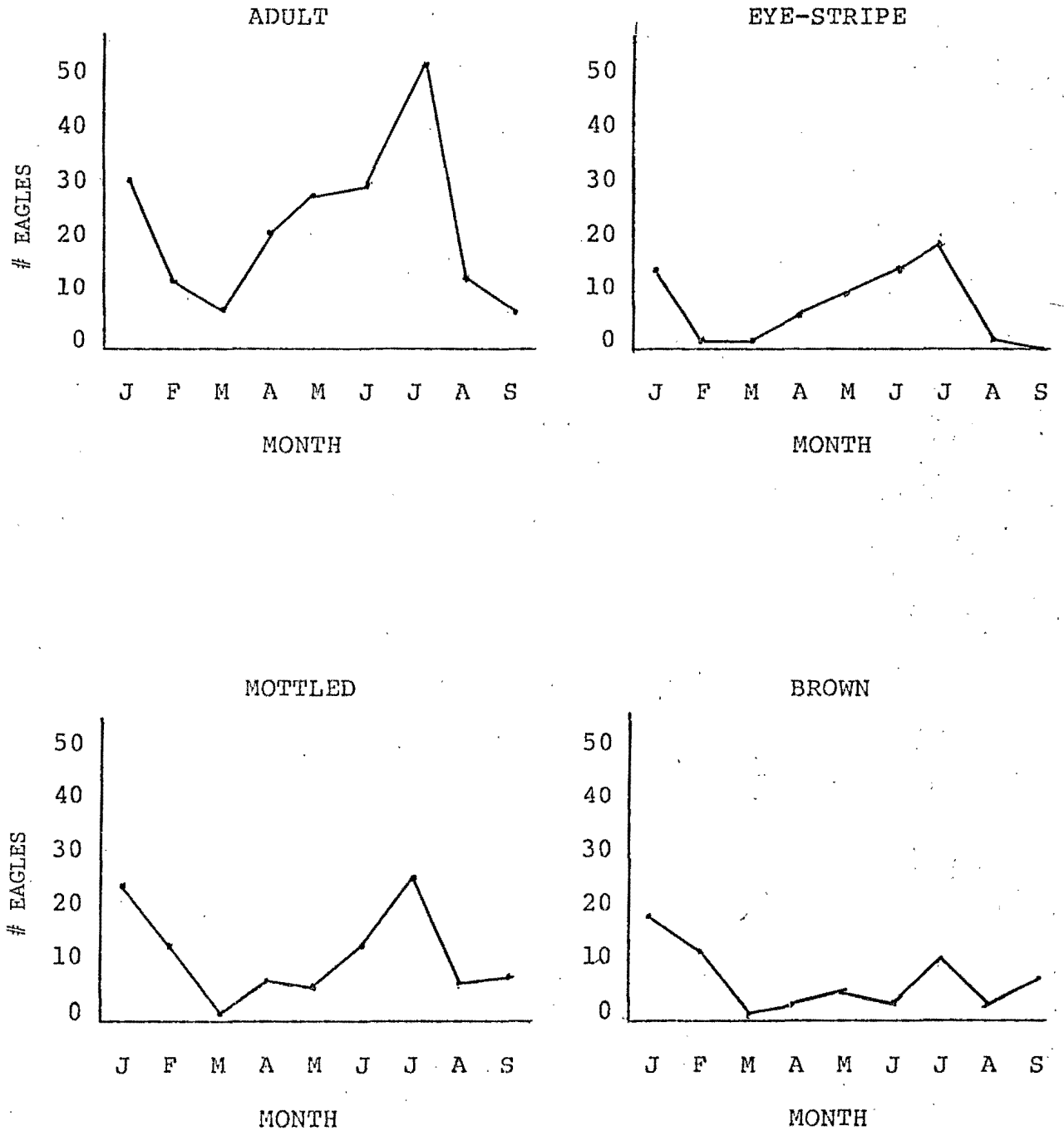
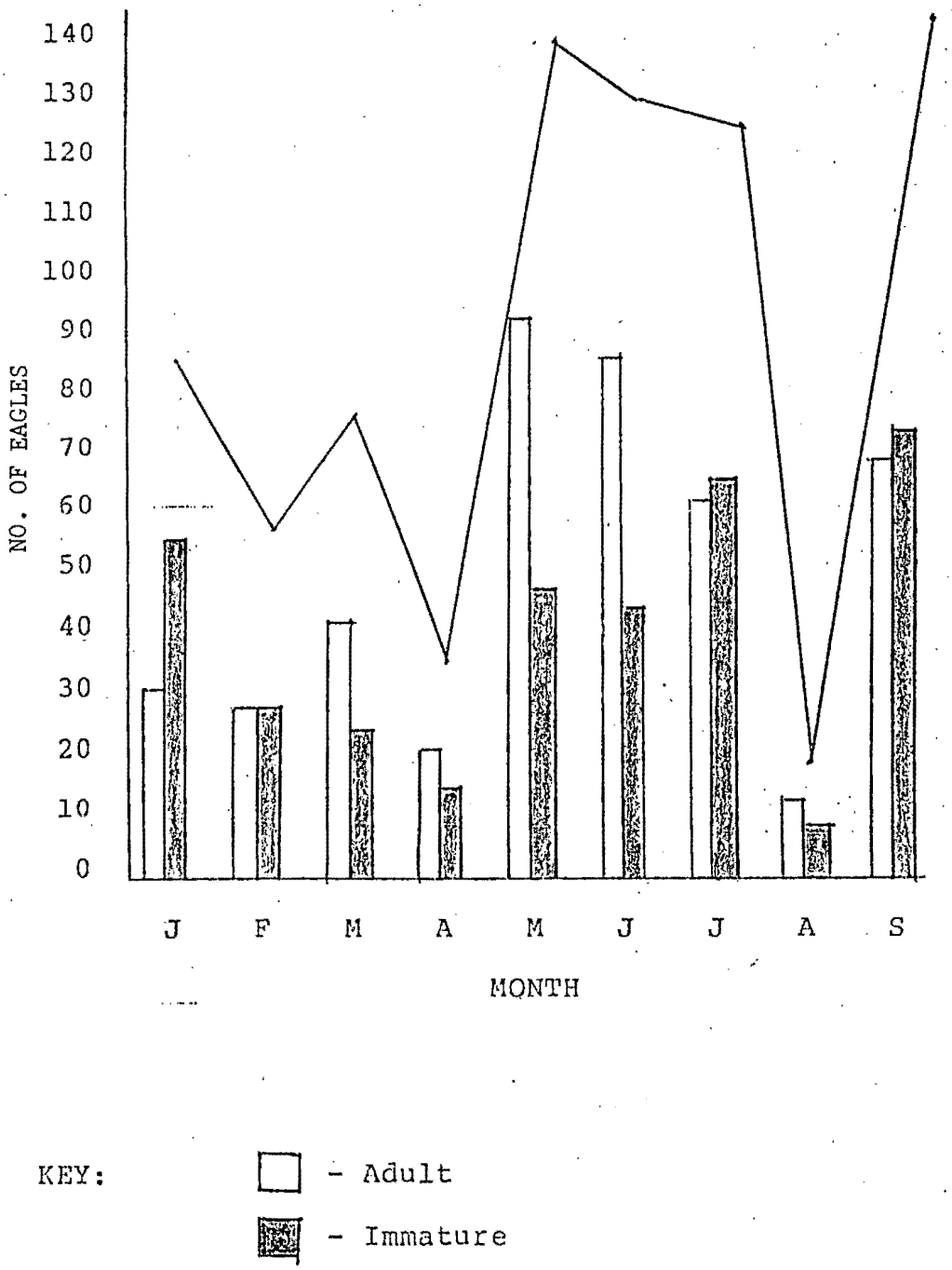


FIGURE 6. Bar Graph Showing Trends of Adult and Immature Bald Eagles in the Vicinity of the Naval Station, Combined with Line Graph Showing Monthly Fluctuations of Total Bald Eagle Numbers in this Area (1983)



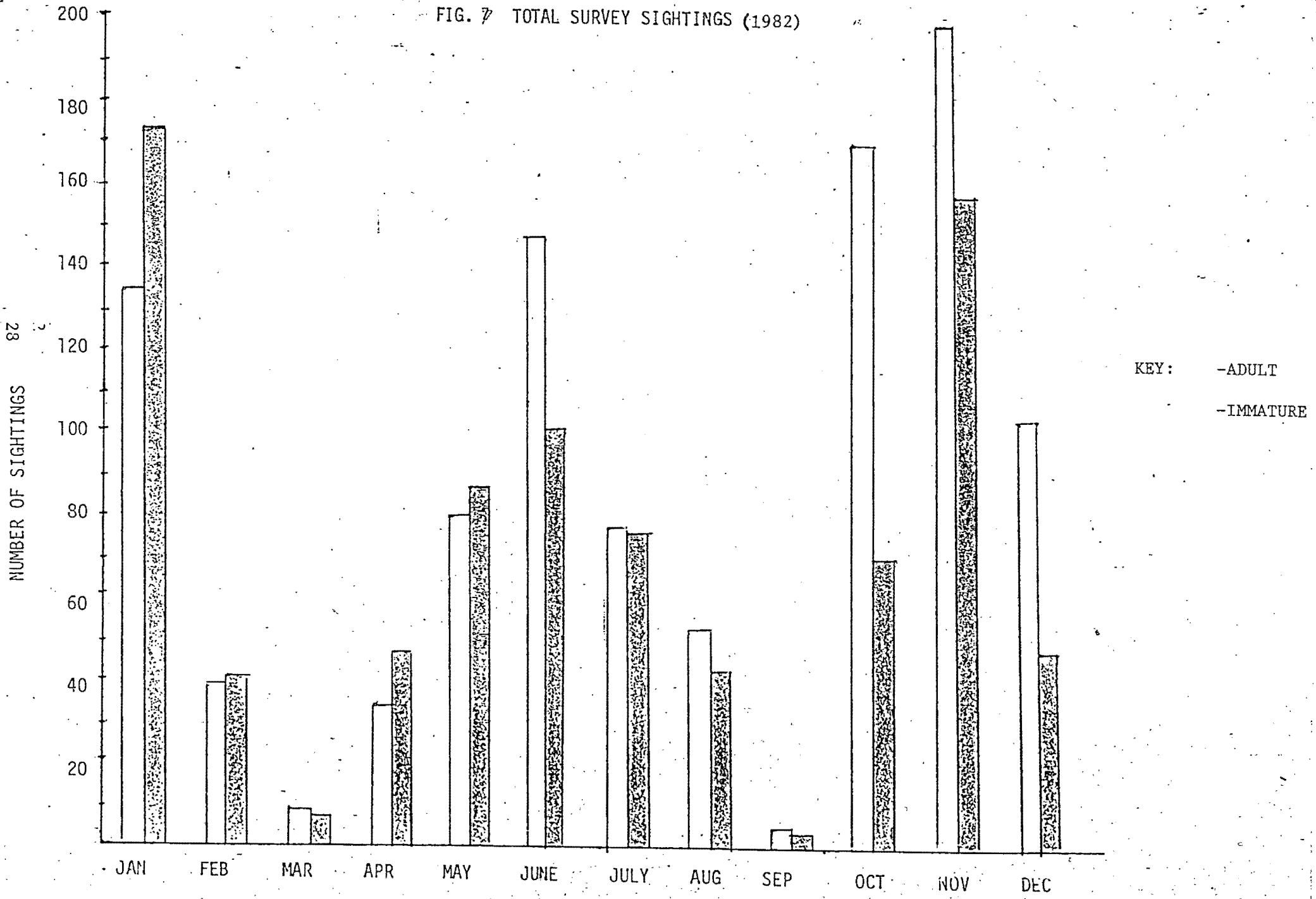
Perhaps because of the many biases affecting it, the 1983 graph shows a different trend than the analogous 1982 graph (see Figure 7). The expected apeces during the winter when food is scarce, and summer when adult birds are burdoned with feeding their maturing offspring, are present. Nadirs are predicted during less stressful times of the year such as springtime, and fall when the salmon runs fill the streams with fish and fish carcasses. This year's spring did seem characterized by decreased use of the dump by eagles, but, with the exception of August (where data was based on dump surveys only), there is not the predicted fall low. A possible explanation for this occurence could be increased use of the dump due to its proximity to Finger Bay. This year large concentrations of eagles fished Finger Bay, as opposed to last year when eagles seemed to aggregate at more remote streams. This could be due to the dramatic decrease (over ten fold) in the salmon run which forced eagles to fish the more productive Finger Bay stream.

Another notable difference between 1982 and 1983 population trends is that this year seems to be one month ahead of last year. Whether this is actually the case or merely a result of the biased data is unknown. Unfortunately, any significant effects this abberant year would have had on bald eagle populations or movements cannot be determined from the available survey data. It should be noted that movement and population trends exhibited by bald eagles around the Naval base cannot be applied to the entire Adak bald eagle population. No information is available on eagles elsewhere on the island and trends observed on the naval base are without a doubt heavily influenced by the presence of the dump and other food sources.

There were 21 records of banded eagle sightings. Fifteen of these were made during dump surveys and six were incidental sightings from FWS staff. Seven observations were of eagles banded this year as nestlings (see Appendix F for more information on these sightings, and histories of the banded eagles).

The problem of reading band numbers was addressed by Kline and Deines (1982). A system of using combinations of slender colored aluminum bands was proposed in the belief that determining colors would be easier than reading numbers for letters. This idea was abandoned upon the arrival of the colored annodized aluminum. The annodization was too thin (it was identical to aluminum used in 1982 bands which already appear an overall silver when seen in the field), and most of the metallic colors would have been difficult to distinguish in the field.

FIG. 7 TOTAL SURVEY SIGHTINGS (1982)



At the advice of Denny Zwiefelhofer (biologist at Kodiak NWR), bands were constructed from 1/8" thick two ply (red over white) plastic (see Appendix B). These bands appear to be staying on and are not too difficult to read. It appears we now have a satisfactory method for identifying eagles. The problem now remains in capturing eagles to band and subsequently sighting enough of them to obtain sufficient data to draw some conclusions.

E. Electrocution and Measurements

Twelve eagles were electrocuted on Adak as of October this year. This figure continues the downward trend seen since 1981 when the Navy's Public Works Department, in cooperation with the FWS, began the installation of perches on designated power poles (see Figure 8). It is not feasible or even necessary to install perches on every power pole, therefore criterion was established (location of poles, and orientation of live and ground lines) to rate poles as primary, secondary, or tertiary threats to eagles. Poles deemed to be potentially dangerous were identified on a blueprint map of the powerline system on the Naval Station and given to the Public Works Department. They will have perches installed as they have the time and manpower. Poles which caused an eagle electrocution, even though they may not have been identified as potentially dangerous will also have perches installed. Eventually all power lines on the Naval Station will be moved underground.

Figure 9 is a graph depicting the number of bald eagle electrocutions per month comparing years 1980 through 1983.

The problem of eagles congregating in the Naval Station area is aggravated by the deliberate feeding and baiting in of eagles that occurs especially at galleys and kitchens. Eagles are fed to lure them within picture taking range or merely for a diversion. Educating the public to the potential dangers both to themselves and the eagles reduces this problem. The Commanding Officer of the Naval Station has been very supportive of FWS efforts by issuing orders in the "Plan of the Day" to forbid feeding the eagles.

Seven of the 12 eagles electrocuted were killed early enough this year that their measurement data was analyzed by Kline and Deines (1982). One of the remaining five eagles, an adult in excellent condition, was saved for mounting and has not yet been measured or necropsied.

FIGURE 8. Line Graph Showing the Decrease in Bald Eagle Electrocutions on the Naval Station Since the Installation of Perches Over Power Poles in 1981.

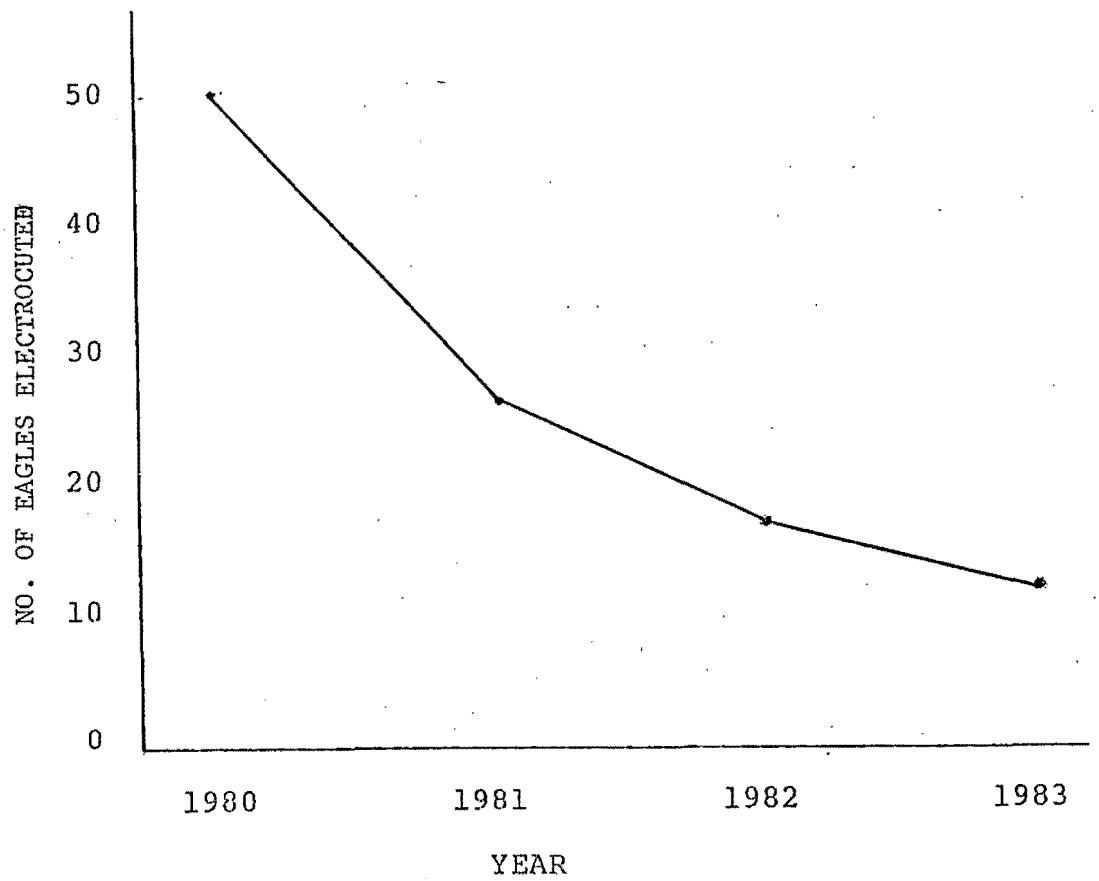
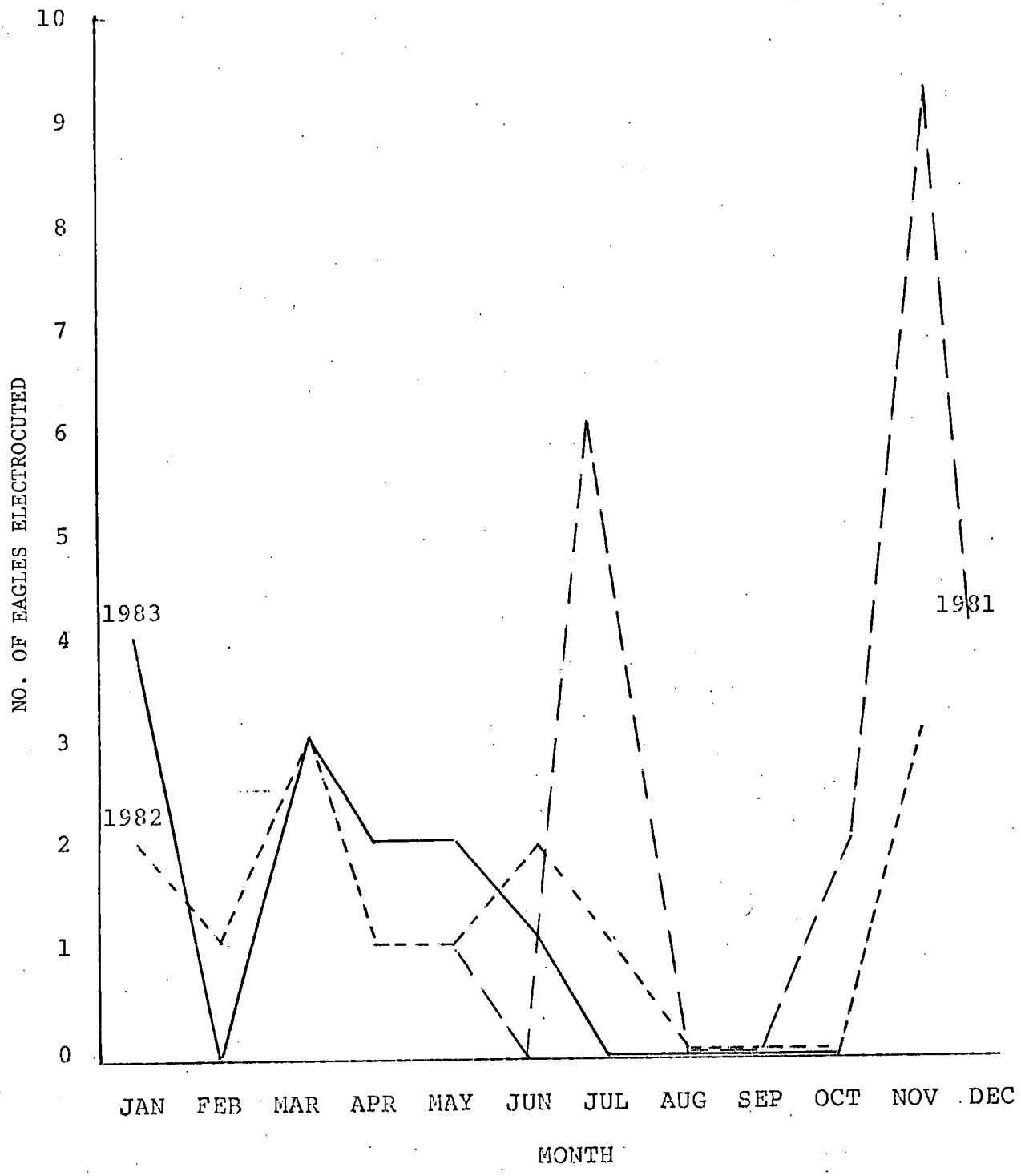


FIGURE 9. Line Graph Comparing Number of Bald Eagle Electrocutions per Month from 1981 Through 1983.



In addition to the 12 eagles electrocuted, one immature eagle was found at the dump, dead of unknown causes, and one young of the year was hit and killed by a Navy dump truck. The carcass found at the dump was too badly decomposed to necropsy. The eagle hit by the dump truck had severe internal injuries which made it impossible to determine the sex of the bird. Thus, only five eagle carcasses were available for additional measurement data. These five eagles were measured according to a revised and expanded measurement form that accompanies the electrocuted raptor data form (Appendix G). Descriptions of measurements taken can be found in the "Handbook of Electrocuted Raptor Measurements" (AIU-AMNWR files). These measurements, taken from Baldwin et al (1931), were chosen in hopes of discovering additional anatomical differences which can be used to distinguish male and female eagles in the hand. Eagle carcasses are measured and then necropsied to determine their sex. When data from sufficient sample sizes of both sexes have been collected, a students "T" test can be run to test the significance of the differences in means of measurements of males versus females. If a significant difference is found, calculation of confidence limits determines the reliability of basing a sex assignment on a particular measurement. In 1982 significant differences were found in two (tarsus width and mandible length) of the eight measurements taken. Both these measurements had non-overlapping 95% confidence limits (although in the case of mandible length the upper limit of males was the lower limit of females). It is hoped this measurement criterion (tarsus width 1.41-1.51 cm for males, 1.54-1.64 for females; and mandible length 7.15-7.83 cm for males and 7.83-8.76 for females) will prove to be an accurate predictor of eagle sex.

Only two of the four eagle carcasses necropsied were positively sexed. According to both necropsy and measurements, they were both males (see Table 9).

Difficulty in positively sexing eagle carcasses occurs in immature and non-breeding birds, or birds that have suffered severe internal trauma (such as the immature bird hit by a truck). More information in the form of diagrams, descriptions and/or instructions on location and identification of avian gonads is necessary to avoid further loss of important correlative data.

Statistical analyses of new measurements introduced in the "Handbook of Electrocuted Raptor Measurements" (AIU-AMNWR files) will pend accumulation of more data.

TABLE 9. Summary of 1983 Measurement Data Applied to the Measurement Criterion Established in 1982 for Sexing Bald Eagles.

Specimen Number	Age Class	Cause of Death	Tarsus Width	Mndbl. Lngth.	Sex	
					Pred.	Actual
50	BH	ELEC.	1.39	7.50	M	F
51*	AD	ELEC.	----- NO DATA AVAILABLE -----			
52	ES	ELEC.	-----	7.29	M	M
53	MT	ELEC.	1.31	6.78	M	M
54	BH	ELEC.	2.15	7.87	F	UNK
55**	MT	UNK	----- NO DATA AVAILABLE -----			
56***	BH	HIT BY TRUCK	1.90	7.11	UNK	UNK

* Saved for mounting; not yet necropsied.
** Badly decomposed carcass; unable to determine sex.
*** Massive internal trauma; unable to determine sex.

SUMMARY

The ongoing study of the bald eagle (Haliaeetus leucocephalus) on Adak Island, Alaska was divided into three major efforts in 1983.

In the winter eagles were baited to the Refuge Headquarters and trapped with padded leg hold traps. Only two eagles were captured. These eagles were measured, banded with both FWS bands and red aluminum numbered bands, and if their tails were white they were dyed for ready individual identification. This effort was cut short when three eagles were electrocuted on nearby power lines.

In the spring and summer months a bald eagle production survey was performed in the Kuluk Bay sample area. A nest survey and egg count from 20 April to 12 May found 15 viewable active nests with a total of 31 eggs, giving an average of 2.07 eggs per active nest. This figure extrapolated to the estimated 50 pair of breeding eagles on the island gives a total egg production figure of 103.5 for Adak in 1983. Nestling counts from 8-15 July resulted in a total of 13 nestlings from nine nests with nestlings. From this figure of 0.813 nestlings per active nest, an estimated nestling production on the island would be 41 nestlings. Eleven nestlings and/or fledglings were measured and banded. A fledgling count was not possible due to other refuge obligations, but subsequent sightings of seven of the eleven eaglets banded confirm their successful fledging.

Year-round vehicle and boat surveys on the Naval Station and vicinity were sporadic and incomplete this year due to weather conditions which closed off roads and denied access to many survey areas, and to higher priority off-island refuge activities. Nevertheless the predicted trends which follow seasonal events were discernable. Increased eagle use of the Naval Station area occurs during the harsh winter and in the summer when parent birds are feeding their growing young. Eagle visitation decreases in the less stressful spring and usually during the fall when the salmon run, thus fall; however, the decrease was not as pronounced. Perhaps this was due to the fact that there was not a large salmon run this year and eagles made more use of the productive Finger Bay stream than usual. Its proximity to the Naval base could have kept eagle attendance at the dump enforced.

Installation of perches on power poles by the Navy Public Works Department has continued as has the yearly decrease in eagle electrocutions since the implementation of this plan. Measurements taken from carcasses of electrocuted eagles were revised and expanded and are described in "Handbook of Electrocuted Raptor Measurements" (AIU-AMNWR files). So far too few specimens have been measured according to this handbook to provide an adequate sample size for statistical analyses.

The search for reliable anatomical measurements to correlate with eagle sex continues. Positively sexing immature, nonbreeding or internally damaged eagles through necropsy presents a problem and hopefully can be overcome soon to prevent further loss of valuable correlative data. Sexes of the two eagles that were positively sexed by necropsy did concur with the sexes predicted for these birds by tarsus width and mandible length criterion established by Kline and Deines (1982).

RECOMMENDATIONS

1. Continue dump surveys and consider expanding to include entire Naval Station area. These surveys will be especially important this next year when the Naval Station opens a new landfill site and closes the old one.

2. Obtain more information on accurate sex determination of raptors by necropsy.

3. Continue efforts to reduce eagle electrocutions on power lines both directly (through determination of hazardous poles and installation of perches) and indirectly (through improvement of waste disposal methods and public education).

The following recommendations will be implemented as Regional priorities, described in the Annual Work Plan Advices, permit:

4. Investigate new methods of capturing eagles (i.e. cannon nets, baited enclosures, etc.) and discontinue use of leg hold traps. Find suitable trapping sites both near the Naval Station and in more remote areas on Adak.

5. Construct more raptor restraint jackets and leg ties. Proper raptor hoods should be ordered or made to prevent eye injuries.

6. Follow the proposed production field schedule as precisely as weather permits. Preliminary surveys in the spring may aid in determining an early or late laying season (caused by weather or some such natural phenomenon) which will affect all subsequent life cycle events. Attempts to age nestlings when they are banded should help in determining optimum times for fledgling counts.

7. Continue obtaining production data from the Kuluk Bay sample area and conduct island-wide breeding pair censuses at least once every three years. Use of a helicopter for detection of active nests throughout the island would be desirable.

8. Collect data for Adak bald eagle nest history file.

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APPENDIX A

1983 SAMPLE AREA BALD EAGLE NEST DATA

NEST NO.	NEW/ REUSED	SUBSTRATE	ACCESS	NO. EGGS	NUMBER NESTLINGS
2	R	H/I	A	3	0
3A	N	SS/I	A	3	2
48A	N	R/M	A	2	1
4A	N	R/M	A	2	1
5A	N	CSS/I	A	2	0
7A	N	SS/I	A	2	1
55	N	H/M	A	1	0
1A	R	SS/M	I	U	1
51	N	H/M	A	2	2
8	R	SS/I	A	2	2
9	R	CSS/I	I	2	1
53	N	CSS/M	A	2	2
44	R	H/M	A	3	0
54	N	CSS/M	A	2	0
50	N	SS/M	A	2	0
13A	N	H/M	I	U	U
52	R	H/M	A	1	0

KEY TO SUBSTRATES:

R	RIDGE	/M	ON MAINLAND
H	HILLSIDE	/I	ON ISLET
SS	SEA STACK		
CSS	CONNECTED SEA STACK		

APPENDIX B

Two large (about 2 x 2-1/2 ft) sheets of 1/8" thick two ply flexible plastic (red over white) were provided by Dr. Forrest Lee of the Northern Prairie Wildlife Research Center for construction of eagle leg bands. Nine x three cm rectangular divisions were penciled onto one sheet. These dimensions allowed for a band diameter of about one inch and an overlap of about 1/4". In each of these rectangles a two figure code (a letter, A-Z, and a numeral, 1-0) would be engraved twice. Engraving of the bands was done at the Navy Exchange. One inch by one half inch figures engraved 1/16" deep were ordered.

After the sheets were engraved, the individual bands were cut. These rectangles were sanded smooth and graded at the ends so they would fit snugly together once glued. The bands were then heated one at a time in a regular oven for 2-4 minutes at about 200 F, until they were soft and pliable (the time and temperature can be varied). The soft band was wrapped evenly around a steel socket with a diameter of about one inch (any cylinder with a one inch diameter would do) immediately upon withdrawal from the oven, and then immersed in cold water. It helped to heat the socket with the band to prevent the band from cooling before it was properly bent around the socket. Gloves should be worn to prevent burning ones hands while rolling the pliable plastic around the hot cylinder. The band should be held tightly over the socket while being immersed in the water in order to prevent expansion.

These bands are somewhat difficult to spread to put on the eagles leg, but once glued on seem to provide a durable and readable means of identification.

Attached is a sanded but non-engraved example band.

APPENDIX C

CALCULATIONS OF NEW BALD EAGLE MEASUREMENT SUMMARIES INCLUDING DATA FROM 1983

① Wing Chord

$n = 53 + 113 + 2 = 168$

$\bar{x} = \frac{62.87(53) + 65.98(113) + 63.4 + 65.0}{168} = \frac{10916.25}{168} = 64.98$

$s = \sqrt{\frac{210151.08 + 494453.9 + 4019.56 + 4225 - \frac{(10916.25)^2}{168}}{167}}$ (710849.54) $= 4.61$ $\quad s^2 = 21.18$

② Diagonal Tarsus

$n = 54 + 111 + 3 = 168$

$\bar{x} = \frac{(10.08)54 + (10.04)111 + 10.3 + 10.64 + 10.5}{168} = \frac{1690.2}{168} = 10.06$

$s = \sqrt{\frac{5511.82 + 11273.87 + 106.09 + 113.21 + 110.25 - \frac{(1690.2)^2}{168}}{167}}$ (17004.62) $\quad s^2 = 0.662$

$= 0.814$

③ Total Tarsus

$n = 54 + 111 + 3 = 168$

$\bar{x} = \frac{54(11.31) + 111(11.24) + 10.88 + 11.39 + 11.60}{168} = \frac{1892.25}{169} = 11.26$

$s = \sqrt{\frac{14070.99 + 6932.98 + 118.37 + 179.73 + 134.56 - \frac{(1892.25)^2}{168}}{167}}$ (21366.63) $= 0.663$ $\quad s^2 = 0.440$

40

④ Tarsus Width

$n = 54 + 112 + 3 = 169$

$\bar{x} = \frac{54(1.51) + 112(1.5) + 1.47 + 1.45 + 1.53}{169} = \frac{253.99}{169} = 1.50$

$s = \sqrt{\frac{124.12 + 254.92 + 2.16 + 2.10 + 2.34 - \frac{(253.99)^2}{169}}{168}} = 0.153 \quad s^2 = 0.023$

⑤ Height of Bill

$n = 47 + 105 + 3 = 155$

$\bar{x} = \frac{47(3.87) + 105(3.86) + 3.76 + 3.69 + 3.85}{155} = \frac{598.49}{155} = 3.86$

$s = \sqrt{\frac{709.57 + 1570.39 + 14.14 + 13.62 + 14.82 - \frac{(598.49)^2}{155}}{154}} = 0.275 \quad s^2 = 0.075$

(2327.53)

⑥ Width of Bill at Base

$n = 47 + 104 + 3 = 154$

$\bar{x} = \frac{47(3.48) + 104(3.58) + 2.86 + 2.71 + 3.33}{154} = \frac{544.78}{154} = 3.54$

$s = \sqrt{\frac{580.97 + 1377.64 + 8.15 + 7.34 + 11.09 - \frac{(544.78)^2}{154}}{153}} = 0.616 \quad s^2 = 0.380$

(1985.27)

⑦ Width of Bill at Gape

$n = 47 + 101 + 3 = 151$

$\bar{x} = \frac{47(5.85) + 101(6.01) + 5.4 + 5.51 + 6.13}{151} = \frac{899}{151} = 5.95$

$s = \sqrt{\frac{1612.16 + 3658.6 + 29.16 + 30.36 + 37.58 - \frac{(899)^2}{151}}{150}} = 0.322 \quad s^2 = 0.104$

(5367.56)

⑧ Extent of Mandible Overlap

$n = 46 + 102 + 3 = 151$

$\bar{x} = \frac{46(1.53) + 102(1.46) + 1.62 + 1.38 + 1.73}{151} = \frac{224.03}{151} = 1.48$

$s = \sqrt{\frac{219.87 + 108.52 + 2.62 + 1.90 + 2.99 - \frac{(224.03)^2}{151}}{150}} = 0.153 \quad s^2 = 0.023$

(335.9)

⑨ Total Mandible Length

$n = 47 + 104 + 3 = 154$

$\bar{x} = \frac{47(7.47) + 104(7.5) + 7.59 + 7.14 + 8.31}{154} = \frac{1154.13}{154} = 7.49$

$s = \sqrt{\frac{2632.73 + 5874.37 + 57.61 + 50.98 + 69.06 - \frac{(1154.13)^2}{154}}{153}} = 0.480 \quad s^2 = 0.23$

(8684.75)

APPENDIX D NG DATA SHEET pg 1 of 1

REMARKS	DATE	wght. (kg)	Bill measurements vert. hgt. of bill (cm)	wdth. of bill a/base (cm)	wdth. of bill/a gape (cm)	ext. of man-dible (cm)	total man-dible (cm)	wing chord (cm)	Foot msmt. diag. tarsus (cm)	total tarsus (cm)	tarsus wdth.	Band #'s R USF&WS Band #	L col-ored band #	Tail marking left	center	right
NEST 48	7/8		3.49	3.01	5.28	0.96	7.11		9.64	10.49	1.33	629 11976	A1			
NEST 3A	"	3.8	3.69	2.88	5.16	0.87	7.03		10.35	11.83	1.48	977	A3			
"	"	3.7	3.64	2.86	5.47	0.86	7.39		10.35	11.85	1.36	978	A5			
NEST 53	7/9	4.0	3.45	2.48	5.37	0.92	7.04		9.74	11.29	1.34	979	A6			
"	"	3.1	3.40	2.86	5.39	0.93	7.16		9.28	10.89	1.20	980	A7			
NEST 7A	7/11	4.4	3.70	3.02	5.15	1.18	7.46		10.13	10.55	1.34	981	A8			
NEST 8	7/13	4.0	3.58	2.98	5.49	1.20	7.75		10.38	11.26	1.30	982	A9			
NEST 1A	"	4.5	3.51	3.03	5.27	0.93	7.25		9.32	10.80	1.28	983	A0			
NEST 52	7/14	6.5	3.98	3.22	5.70	1.08	7.90		10.86	12.15	1.53	984	B1			
"	"	3.0	3.03	2.36	4.93	1.00	7.03		9.08	9.94	1.42	985	B2			
NEST 4A	7/15	4.5	3.79	3.31	5.86	1.27	8.07		11.11	11.60	1.52	987	B3			

APPENDIX E

COMBINED DATA FROM VEHICLE, BOAT AND DUMP SURVEYS

MONTH	TYPE SURVEY	# ADULT EAGLES	# IMM EAGLES	TOTAL # EAGLES
JAN	D	30	53	83
FEB	B,D	27	27	54
MAR	V,D	40	23	73
APR	D	20	13	33
MAY	V,B,D	91	44	135
JUN	V,D	84	40	124
JUL	V,B,D	59	62	121
AUG	D	12	8	20
SEP	V,D,B	66	71	139

KEY: B BOAT SURVEY
D DUMP SURVEY
V VEHICLE SURVEY

APPENDIX F

BANDED EAGLE OBSERVATIONS AND HISTORIES

OBS. NO.	DATE OBS.	EAGLE BAND #	AGE CLASS	LOCATION OBS.	DATE BANDED	AGE WHEN BANDED
1	1/7	96	ES	DUMP	1/21/82	MT
2	1/7	93	MT	DUMP	1/21/82	MT
3	2/2	105	MT	BERING HILL	1/25/82	MT
4	2/17	80	AD	REFUGE HQ	1/07/82	AD
5	2/17	97	MT	REFUGE HQ	1/21/82	MT
6	3/3	122	MT	REFUGE HQ	2/11/82	BH
7	4/4	80	AD	DUMP	1/07/82	AD
8	4/15	92	MT	MITT LAKE	1/21/82	MT
9	4/15	93	MT	MITT LAKE	1/21/82	MT
10	6/29	133	BH	DUMP	7/10/82	NG
11	6/29	76	MT	DUMP	1/06/82	BH
12	6/29	93	ES	DUMP	1/21/82	MT
13	7/6	117	AD	DUMP	1/27/82	AD
14	8/10	117	AD	DUMP	1/27/82	AD
15	8/25	A8	BH	DUMP	7/11/83	NG
16	9/6	A0	BH	OLD ROBERTS	7/13/83	NG
17	9/16	A3	BH	MITT LAKE	7/08/83	NG
18	9/16	A6	BH	DUMP	7/09/83	NG
19	9/23	A6	BH	DUMP	7/09/83	NG
20	9/23	A7	BH	FINGER BAY	7/09/83	NG
21	9/23	A9	BH	FINGER BAY	7/13/83	NG

KEY TO AGE CLASSES:

NG	NESTLING
BH	BROWN-HEAD (FIRST YEAR)
MT	MOTTLED (SECOND/THIRD YEAR)
ES	EYE-STRIPE (FOURTH YEAR)
AD	ADULT (FIFTH YEAR +)

APPENDIX G

INDIVIDUAL ELECTROCUTED RAPTOR DATA SHEET

SPECIMEN # _____ DATE FOUND _____

BAND #/SEQUENCE _____

LOCATION FOUND (Note on map) _____

_____

DESCRIPTION OF ELECTROCUTING STRUCTURE (Include photo of structure and bird in photo section) _____

_____

NOTES (What occurred, circumstances, etc.) _____

_____

CONDITION OF CARCASS _____

_____

FATE OF CARCASS _____

_____

AGE CLASS _____ WEIGHT (Kg) _____

NECROPSY INFORMATION DATE _____

SEX _____ CONDITION OF GONADS _____

SUBCUTANEOUS FAT _____

STOMACH/CROP CONTENTS _____

_____

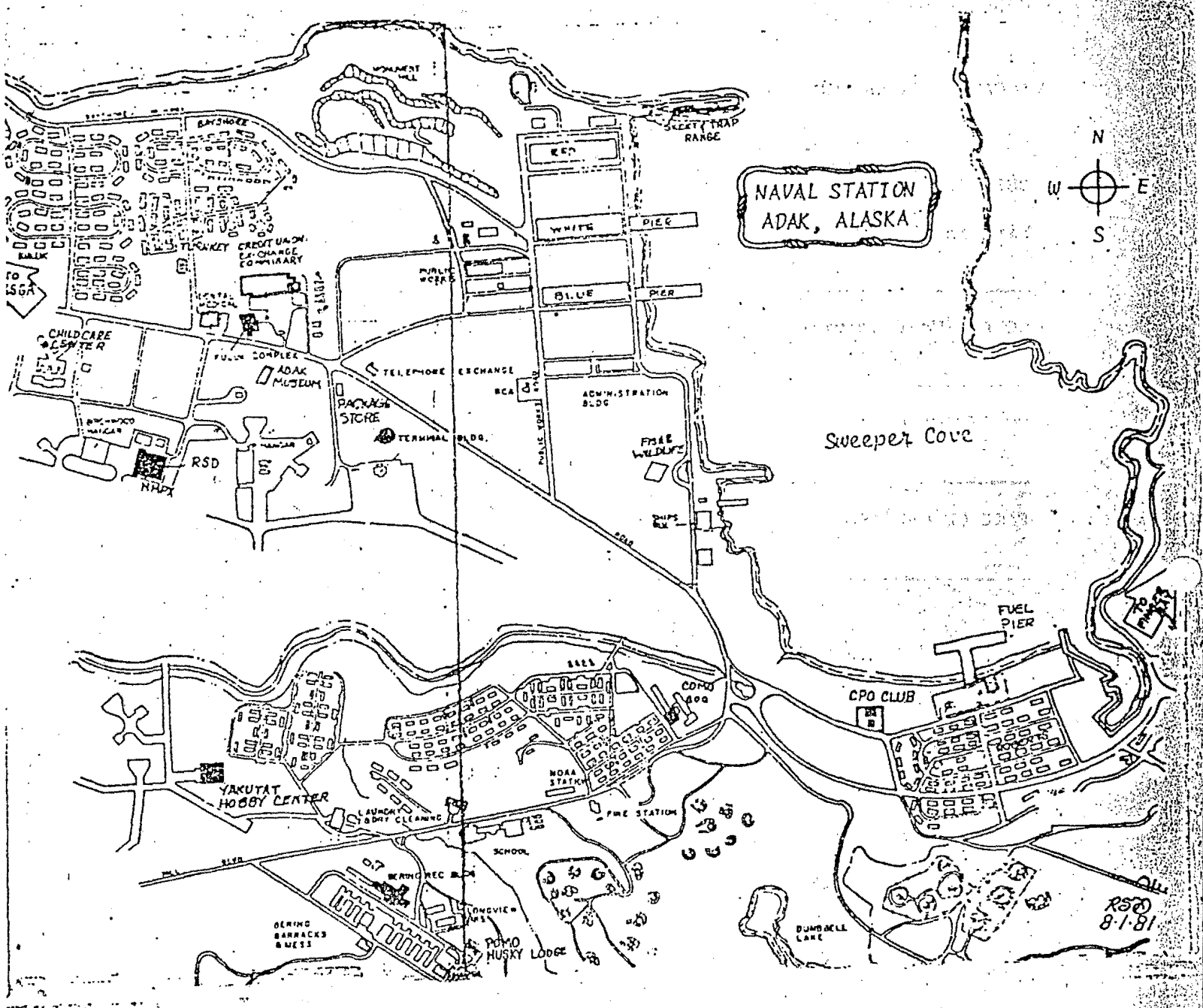
OTHER NOTES _____

_____

_____

_____

RECORD MEASUREMENTS ON ATTATCHED MEASUREMENT SHEET.


NAVAL STATION
ADAK, ALASKA
N
W
E
S
Sweeper Cove
RED
WHITE PIER
BLUE PIER
MONUMENT HILL
SKEET TRAP RANGE
BANSHORE
TURNKEY
CREDIT UNION
EXCHANGE
COMMISSARY
CHILDCARE CENTER
GYM COMPLEX
ADAK MUSEUM
TELEPHONE EXCHANGE
RCA
PACKAGE STORE
TERMINAL BLDG.
ADMIN. STATION BLDG
FISH & WILDLIFE
PUBLIC WORKS
RSD
NRPX
FUEL PIER
CPO CLUB
COMO 400
NOAA STATION
FIRE STATION
SCHOOL
YAKUTAT HOBBY CENTER
LAUNDRY & DRY CLEANING
BERING BARRACKS & MESS
COMO HUSKY LODGE
DUMBBELL LAKE
RSD 8-1-81

RAPTOR CARCASS MEASUREMENTS

See measurement handbook for descriptions of measurements and procedures. All measurements are to be in centimeters.

BODY

- Total Body Length _____
- Length of Body to Coccyx _____
- Length of Body to Pubis _____
- Interhumeral Width _____
- Interpubic Width _____
- ~~Length Between Pubic Bones~~ _____
- Girth _____
- Dorso-Ventral Diameter _____
- Length of Sternum _____

HEAD

- Length of Head _____
- Greatest Width of Head _____
- Interorbital Width _____
- Height of Head _____
- Length of Eye _____
- Length of Eye to Base of Bill _____
- Grtst. Diameter of Outer Ear _____
- Lst. Diameter of Outer Ear _____

BILL

- Length of Culmen W/out Cere _____
- Length of Total Culmen _____
- Length of Cere _____
- Length of Bill From Gape _____
- Height of Bill at Base _____
- Width of Bill at Base _____
- Width of Bill at Gape _____
- Grtst. Height of Maxilla _____
- Height of Nostril _____
- Length of Mandible _____
- Extent of Mandible Overlap _____
- Length of Exposed Ramus _____
- Length of Gonys _____

WINGS

- Wingspan With Feathers _____
- Wingspan W/out Feathers _____
- Wing Chord _____
- Length of Open Wing _____
- Breadth of Wing _____
- Length of Humerus _____
- Length of Forearm _____
- Length of Hand _____

TAIL

- Length of Tail _____
- Width of Tail at Base _____
- Graduation of Tail _____

LEG

- Length of Leg _____
- Length of Thigh _____
- Length of Tibia _____
- Length of Tarsus _____
- Diameter of Mid Tarsus _____
- Grtst. Width of Tarsus _____
- Exposed Portion of Leg _____
- Length of Mid Toe _____
- Length of Mid Talon _____
- Length of Hallux _____
- Length of Hallux Talon _____
- Length of Foot _____

FEATHER (1st R 1)

- Length of Quill (Flat.) _____
- Length of Quill (Unflat.) _____
- Width of Quill (Flat.) _____
- Width of Quill (Unflat.) _____
- Width of Outer Vane _____
- Width of Inner Vane _____