WATERFOWL SURVEY REPORT 1986
INNOKO NATIONAL WILDLIFE REFUGE

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INNOKO NATIONAL WILDLIFE REFUGE
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Introduction

Waterfowl nesting conditions on the Innoko in 1986 were much improved over the flooding and late spring of 1985. Light snowfall in the winter of '85-'86 accumulated only 1-2 ft throughout the Innoko basin. This, coupled with a dry May and June, allowed good conditions for successful nesting and hatching.

Breeding Pair Survey

The annual spring breeding pair survey, conducted by personnel from Waterfowl Investigations in Juneau, was completed on 31 May 1986. As expected, this survey showed a marked increase over 1985 duck populations. Total ducks observed were up 106% over the 1985 survey. Additionally, 1986 populations were 27% higher than the nine-year mean for this survey (Table 1). Major duck species encountered (in order of abundance) were pintail, wigeon, green-winged teal, shoveler, scaup and mallard.

Duck Brood Surveys

Methods

Brood survey sampling methods are described in the Refuge Inventory Plan #2, and follow standard techniques for brood surveys. Ths basic sampling unit is a 1-square-mile section. All lakes within each sample unit are surveyed on foot or by canoe.

Nineteen eighty-six was the second year randomly-selected sample units were surveyed, and the first year that 2 brood surveys were conducted; one early survey, and one late survey. The sample units were selected in 1985 using the following method:

> Townships were randomly selected using computer-generated numbers. Then a section in the township was randomly selected in the same manner. If the section contained surface water and was accessible by boat or float plane (within 1 mile), it was included; otherwise, it was rejected and the process was repeated from the first step of

Table 1. Waterfowl breeding pair population survey, Stratum 5-Innoko Basin. A comparison of population indices 1978-1986.

Species	Year									
	1978	1979	1980	1981	1982	1983	1984	1985	1986	Nine-year Mean
Mallard	17.6	13.2	12.2	10.3	6.4	8.3	24.7	13.2	14.9	13.4
Wigeon	65.5	43.4	74.3	40.5	21.7	50.9	45.1	18.4	60.9	46.7
Green-winged Teal	22.1	20.6	16.2	20.6	7.4	23.6	10.3	14.7	51.5	20.8
Shoveler	17.2	7.1	29.1	40.9	13.6	20.8	10.1	5.9	39.1	20.4
Pintail	95.8	57.5	133.5	127.9	69.5	67.7	106.3	71.9	100.6	92.3
Canvasback		0.8	1.5	3.0	0.8	1.9	2.2		1.9	1.3
Scaup	32.8	23.5	34.1	14.3	12.7	30.5	29.1	9.5	18.9	22.8
Goldeneye	11.1	17.9	8.5	1.7	3.4	13.6	16.2	10.2	8.5	10.1
Bufflehead	2.9	2.5	2.9	2.9		2.5	2.5		1.3	1.9
Oldsquaw	9.0	7.0	3.0	5.0	1.0	2.0	1.0	2.0		3.3
Scoter	7.5	8.8	7.0	6.0	9.9	11.3	4.2	2.9	6.2	7.1
Merganser		0.6	0.3		0.3		3.1	0.3	0.9	0.6
TOTAL	281.5	202.9	322.6	273.1	146.7	233.1	254.7	148.1	304.7	240.7

selecting a township. Townships were selected with replacement. Fifty sections were selected to ensure that enough sample areas would be available because all may not be as accessible as the map would indicate. A target of 34 sections was selected in 1985 because that represented 1% of the acreage in the Innoko (Stratum 5) portion of the Alaska-Yukon Waterfowl Breeding Population survey. If more than 34 sq. mi. can be sampled within the time frame, more will be selected.

In addition to the usual methods, a helicopter brood survey was conducted during the second brood count on 7 sample units, 2 of which had already been done on foot. All lake edges were searched similar to the ground survey. In addition, the middle of large, vegetated lakes were searched more intensively with the helicopter.

Results and Discussion

Two brood surveys were conducted in 1986; the first was 24 June - 1 July, and the second was 29 July - 4 August. Twenty-seven units were surveyed during the first period, and 34 during the second. We hoped to sample 46 plots during each survey. This was an optimistic goal which we were not sure could be accomplished with present logistics and personnel. We still do not know, since the refuge C-185 crashed 25 June, 2 days into the first survey. No one was injured but the program suffered a logistical set-back. Most of the plots were done by boat after this incident.

A very large increase in duck production was observed this year over 1985. This was expected because last year's flood left much nesting habitat covered with water well into June. Tables 2 and 3 summarize the data collected in the first and second brood surveys, respectively. Using the second brood count (because it is most-representative), the average number of broods/water body in 1986 was 0.8. In 1985, 0.1 broods/water body were observed. This is a 700% increase. Table 4 expresses the same data as broods/sq.mi. for the second brood survey. In 1986, there were 8.1 broods/sq.mi., while in 1985 only 1.0 broods/sq.mi. were observed-a 710% increase.

The data indicate that there was a 700% increase in broods from 1985 to 1986, but only a 106% increase in breeding pairs. This may not be as strange as it seems. Many ducks must have stayed on the Innoko breeding grounds long enough to be counted in the spring survey, but were not able to nest in 1985 because of the flooding.

Table 2. Early brood survey summary, Innoko National Wildlife Refuge, 1986.

Stratum: 5
Ponds Sampled: 235
1/4-mile sections of streams/rivers: 93.8
Total Water Bodies: 328.3

Plots: 27 Random Plots
Dates: 24 June - 1 July
Total miles of river/stream: 23.45
Brood Count: First

	CLASS I		CLASS II		CLASS III					
SPECIES	BROODS	AV. SIZE	BROODS	AV. SIZE	BROODS	AV. SIZE	BROODY HENS	TOTAL BROODS	AV. SIZE	BROODS PER WATER BODY
Mallard	3	5.7	0	0.0	0	0.0	1	3	5.7	0.00
Wigeon	10	6.8	1	7.0	0	0.0	7	11	6.8	0.03
G.W. Teal	3	2.7	0	0.0	0	0.0	5	3	2.7	0.00
Shoveler	7	7.6	1	6.0	0	0.0	6	8	7.4	0.02
Pintail	26	4.8	3	5.0	0	0.0	11	29	4.8	0.10
Subtotal	49	5.5	5	5.6	0	0.0	30	54	5.5	0.15
Scaup spp. Goldeneye Bufflehead W.W. Scoter S. Scoter	1	8.0	0	0.0	0	0.0	0	1	8.0	0.00
Subtotal	1	8.0	0	0.0	0	0.0	0	1	8.0	0.00
Unid. Duck	1	3.0	0	0.0	0	0.0	0	1	3.0	0.00
Total	51	5.6	6	5.0	0	0.0	30	57	5.5	0.15

Table 3. Late brood survey summary (including broods found off the plot) Innoko National Wildlife Refuge, 1986

Stratum: 5
Ponds Sampled: 276
1/4-mile sections of streams/rivers: 86.8
Total Water Bodies: 362.8

Plots 34 Random plots
Dates: 29 July - 4 August
Total miles of river/stream: 21.7
Brood Count: Second

	CLASS I		CLASS II		CLASS III					
SPECIES	BROODS	AV. SIZE	BROODS	AV. SIZE	BROODS	AV. SIZE	BROODY HENS	TOTAL BROODS	AV. SIZE	BROODS PER WATER BODY
Mallard	1	1.0	5	4.2	5	4.2	5	16	3.9	0.04
Wigeon	7	3.75	36	5.1	2	5.3	13	58	4.8	0.16
G.W. Teal	7	5.3	27	3.3	8	3.8	17	59	3.8	0.16
Shoveler	2	4.5	16	3.0	7	4.4	10	35	3.5	0.09
Pintail	5	5.75	36	3.7	17	4.1	10	68	3.9	0.18
Subtotal	22	4.8	120	3.9	39	4.1	55	236	4.0	0.65
Scaup spp.	10	4.7	17	6.6	2	5.5	0	29	5.75	0.08
Goldeneye										
Bufflehead	1	7.0	0	0	0	0	0	1	7.0	0.003
W.W. Scoter	1	2.0	0	0	0	0	0	1	2.0	0.003
S. Scoter	1	6.0	2	3.5	0	0	0	3	4.3	0.008
Subtotal	13	4.7	19	6.3	2	5.5	0	34	5.5	0.09
Unid. Duck	6	3.25	10	2.6	0	0	1	18*	3.0	0.05
Total	40	4.7	149	4.0	41	4.2	56	288	4.2	0.80

*Additional Broods added in the total were not classified and so did not fit in any other category.

Table 4. Late brood survey, summarized by one-square-mile sample units.

Plot	Mallard	Wigeon	Green-wing Teal	Shoveler	Pintail	Scaup	Scoter	Unidentified	Total
2									0
3									0
4	5	3	3			3	2		16
5	1	1	3	1					6
9	1	1			1				3
10									0
11			1						1
12									0
13	2	1	2	1	5	1		1	13
14									0
15	2	1	2	1	1				7
16			1						1
17			1		1	1		1	4
19		2	1	1	1	2			7
20		1		1			1		3
22				1					1
27		4	1	2	7	1			15
28		1	2	2	4			1	10
29									0
30			1	3	8	3			24
31		3	3	3		1		1	11
32		7	3		1	2			13
33	1				8	2			14
34			2	2	2	1		3	10
36			4						4
37		6	3	3	1	1		1	15
38		4	3	2	3			3	15
39			1				1		2
40		1							1
41			1						1
42	1	2	8	3	2	3			19
43		1							1
45	1	16	12	7	11	6		7*	60
46		1	1	1	7				10
TOTAL (34)	14	56	59	34	63	27	4	19	276
Broods/sq.mi.	0.4	1.6	1.7	1.0	4.1	1.5	0.1	0.5	8.1
Stand. Dev (s)	0.988	3.093	2.465	1.50	7.567	4.357	0.409	1.237	10.973
Variance	0.977	9.569	6.079	2.242	57.258	18.984	0.168	1.529	120.480
Confidence Interval at 0.80 level	+0.22	+0.68	+0.54	+0.33	+1.66	+0.96	+0.09	+0.27	+2.4
Confidence Interval(%)	54	42	32	33	41	64	90	54	30

*One Bufflehead brood included in Unidentified group to save space in the table.

Comparing Tables 2 and 3, it can be seen that the first survey recorded only one-fifth the number of broods counted on the second survey. The purpose of doing 2 counts is to catch both the early and late nesting ducks. Unfortunately, the first survey was about 1 week too early. Figure 1 shows the date of hatch by week of the year for the 6 major duck species. The first survey took place on the twenty-sixth week (25 June - 1 July), and the second on the thirty-first week (30 July - 5 August). It was hoped that the first survey would give a good estimate of dabbler production, because they normally nest earlier, and the second would estimate diver production and late-nesting dabblers. A good brood survey should be timed to commence about one week after the peak of hatch for the first survey, and after the last hatching date for the late survey. As can be seen in Figure 1, if pintails and scaup were all we were interested in, these survey dates would have sufficed. For wigeon, green-winged teal and mallards, the first survey should have been a week or two later. This would not have been possible this year, since white-fronted goose banding began towards the latter part of the twenth-seventh week, 7 July. In 1987, we will attempt to hold off about 1 week before we begin the first survey. This will of course depend on the phenology and banding time tables.

Regardless of problems with the first count, the second count did well at sampling both divers and dabblers. The second count alone, if timed properly, would suffice at sampling our duck population. The second count was particularly good at sampling scaup. The peak of hatch for this species was the twenty-seventh week, and remained strong through the twenty-ninth week (Fig. 1). Even with this late survey, only 4 scoter broods were observed. Scoters have never been observed in large numbers on the Innoko, particularly with broods. However, with no late surveys being done, it was possible that scoters had not yet hatched at the time of survey. It seems now that scoters are not an important breeder on the Innoko. A few more years of late surveys remain before confirming that, however. One problem with this survey being so late is that many dabblers, especially pintails and shovelers, were Class III's at the same time that molting ducks were in abundance. It is possible to separate Class III's from molters, but requires diligence in observation and additional training for less-experienced seasonals.

Figure 1a. Estimated hatching dates, by Julian week, on the Innoko National Wildlife Refuge. Julian week 22 was May 28 - June 3 in 1986.

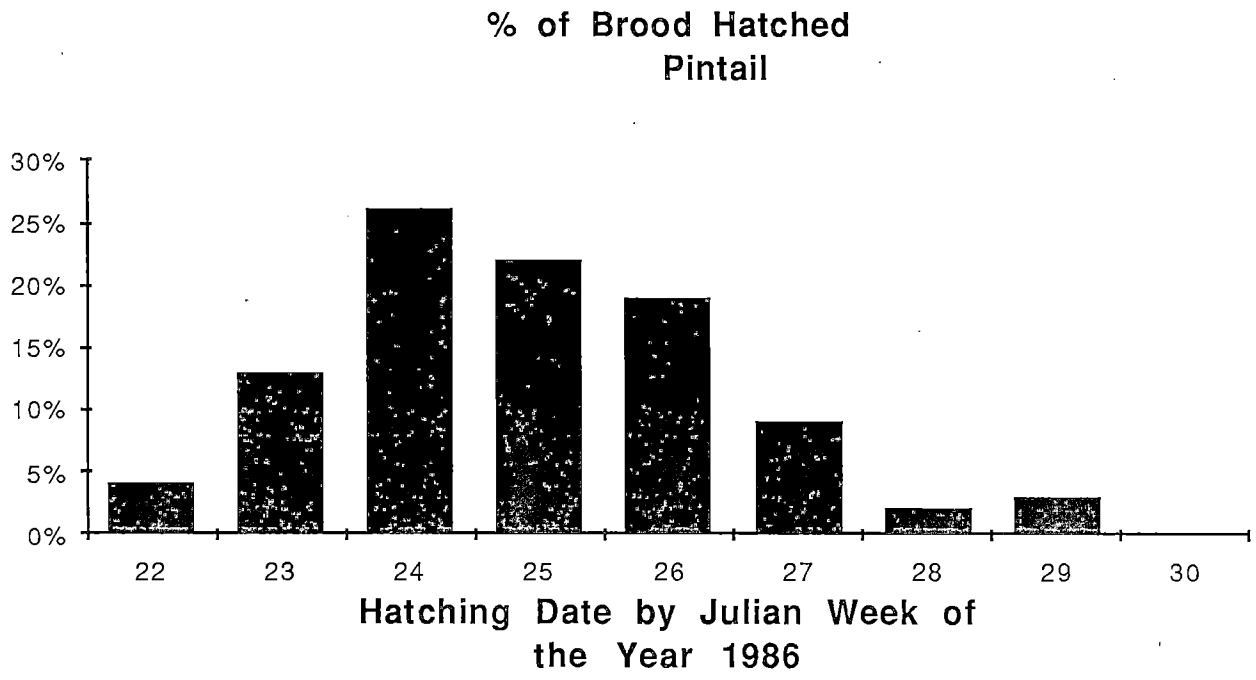


Figure 1b. Estimated hatching dates, by julian week, on the Innoko National Wildlife Refuge. Julian week 22 was May 28 - June 3 in 1986.

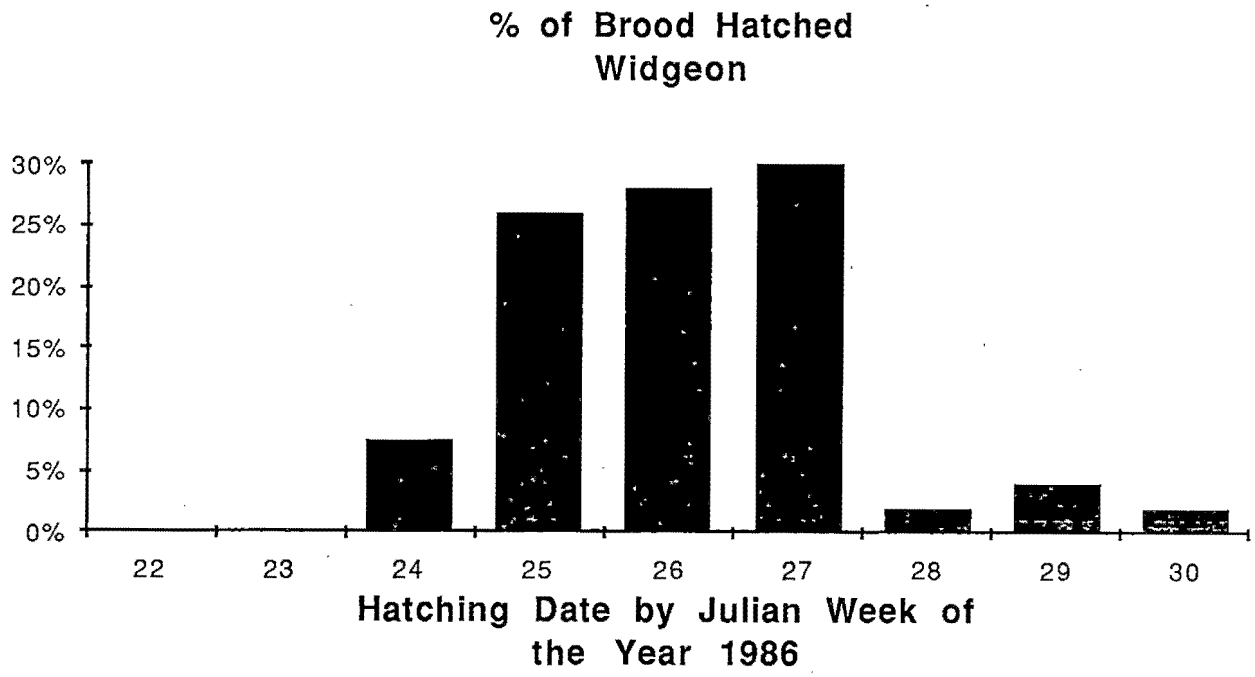


Figure 1c. Estimated hatching dates, by Julian week, on the Innoko National Wildlife Refuge. Julian week 22 was May 28 - June 3 in 1986.

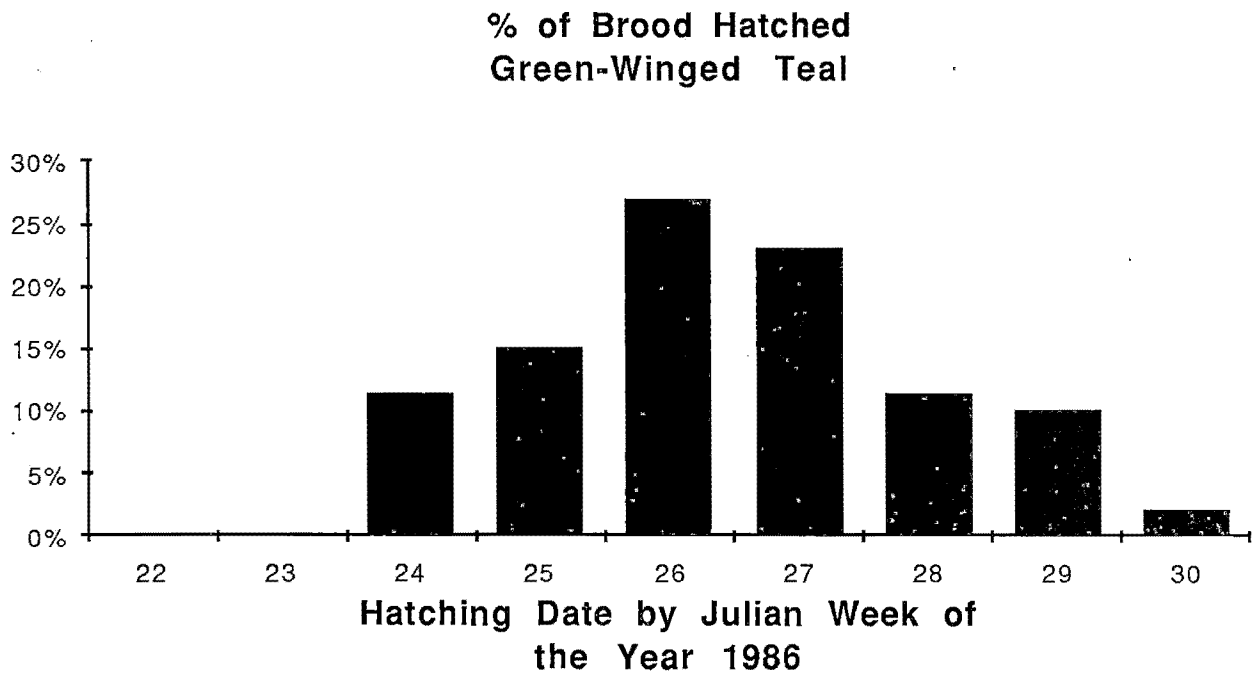


Figure 1d. Estimated hatching dates, by Julian week, on the Innoko National Wildlife Refuge. Julian week 22 was May 28 - June 3 in 1986.

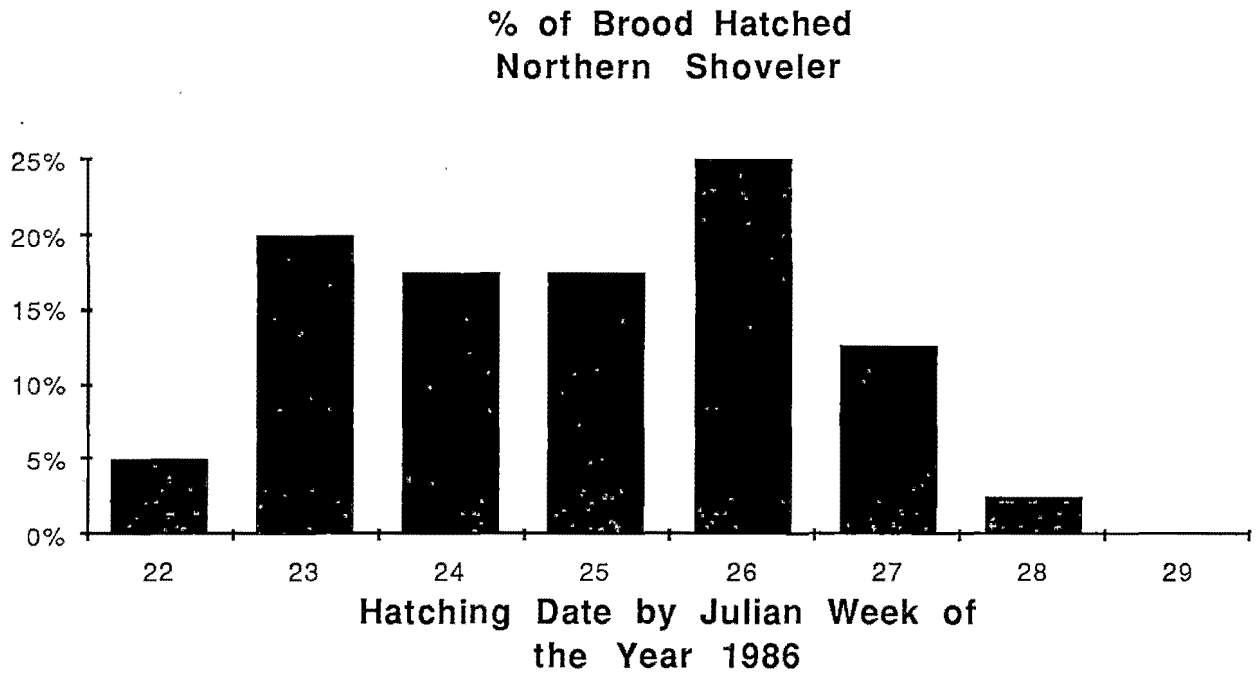


Figure 1e. Estimated hatching dates, by Julian week, on the Innoko National Wildlife Refuge. Julian week 22 was May 28 - June 3 in 1986.

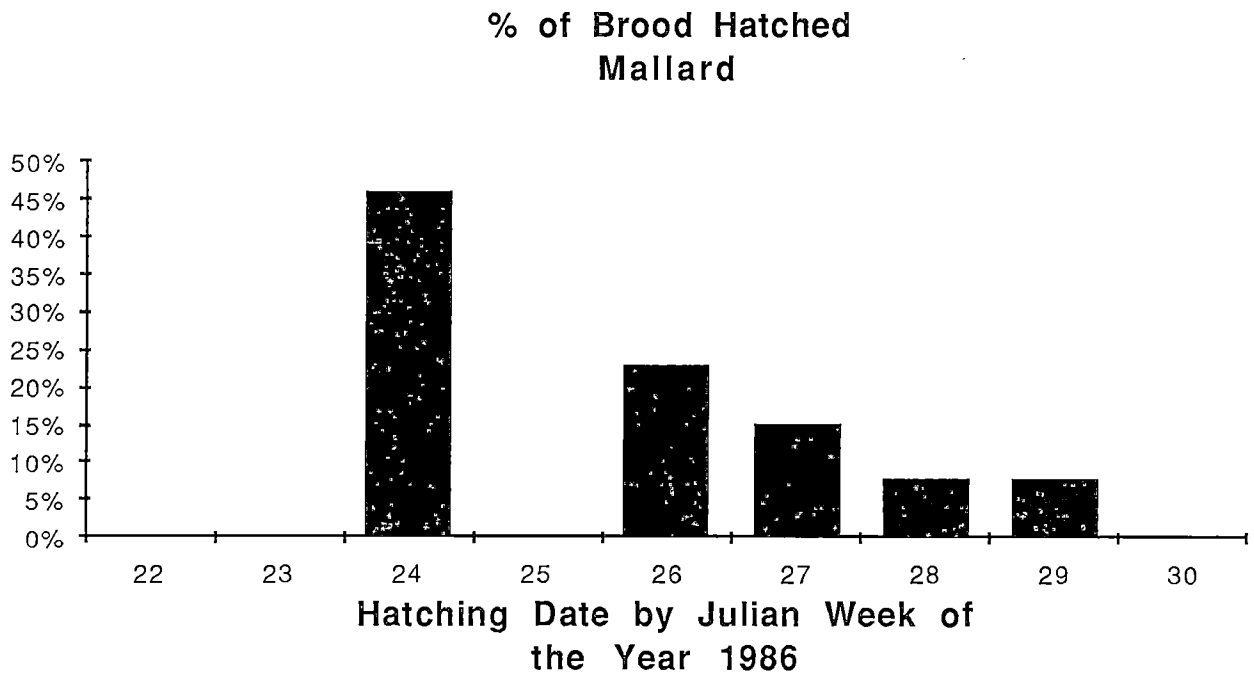
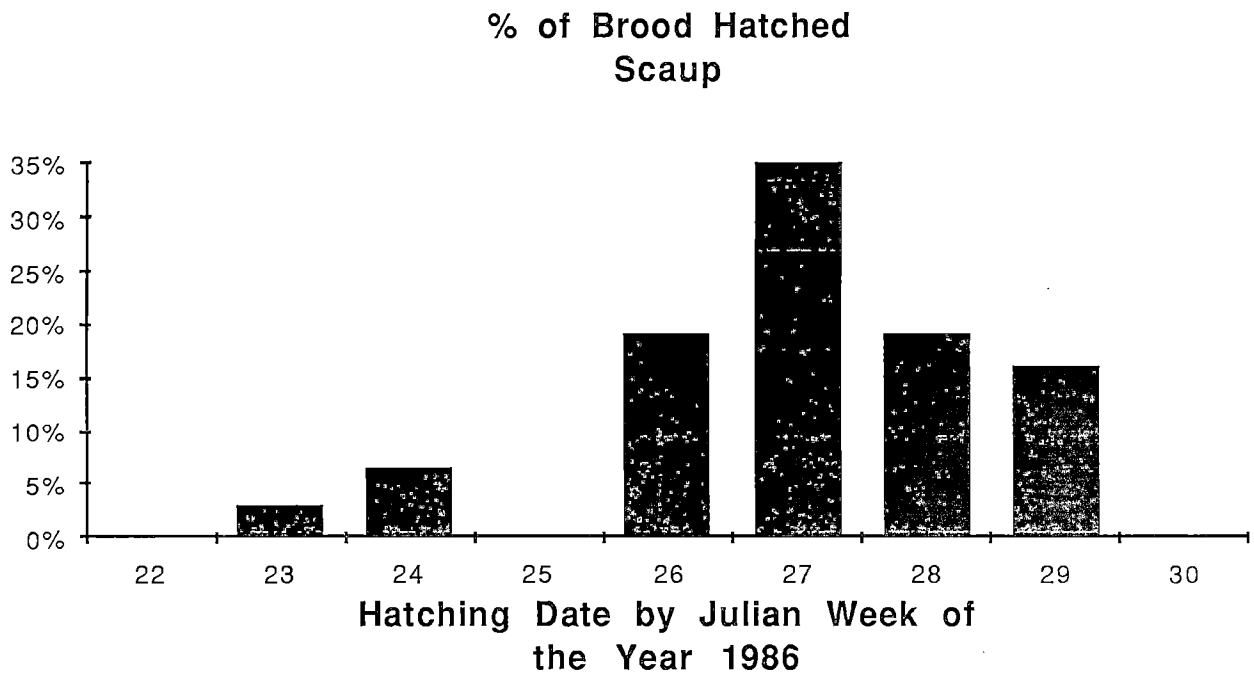


Figure 1f. Estimated hatching dates, by Julian week, on the Innoko National Wildlife Refuge. Julian week 22 was May 28 - June 3 in 1986.



The number and relative percentages of duck broods observed in the second random survey are listed in the following table:

Species	Broods Observed	Percent of Total
Pintail	68	25
Green-winged teal	59	22
Wigeon	58	21
Shoveler	35	13
Scaup	29	11
Mallard	16	6
Scoters	4	1
Bufflehead	1	0.4
Total	270	99.4*

*Eighteen unidentified broods were not included in this table.

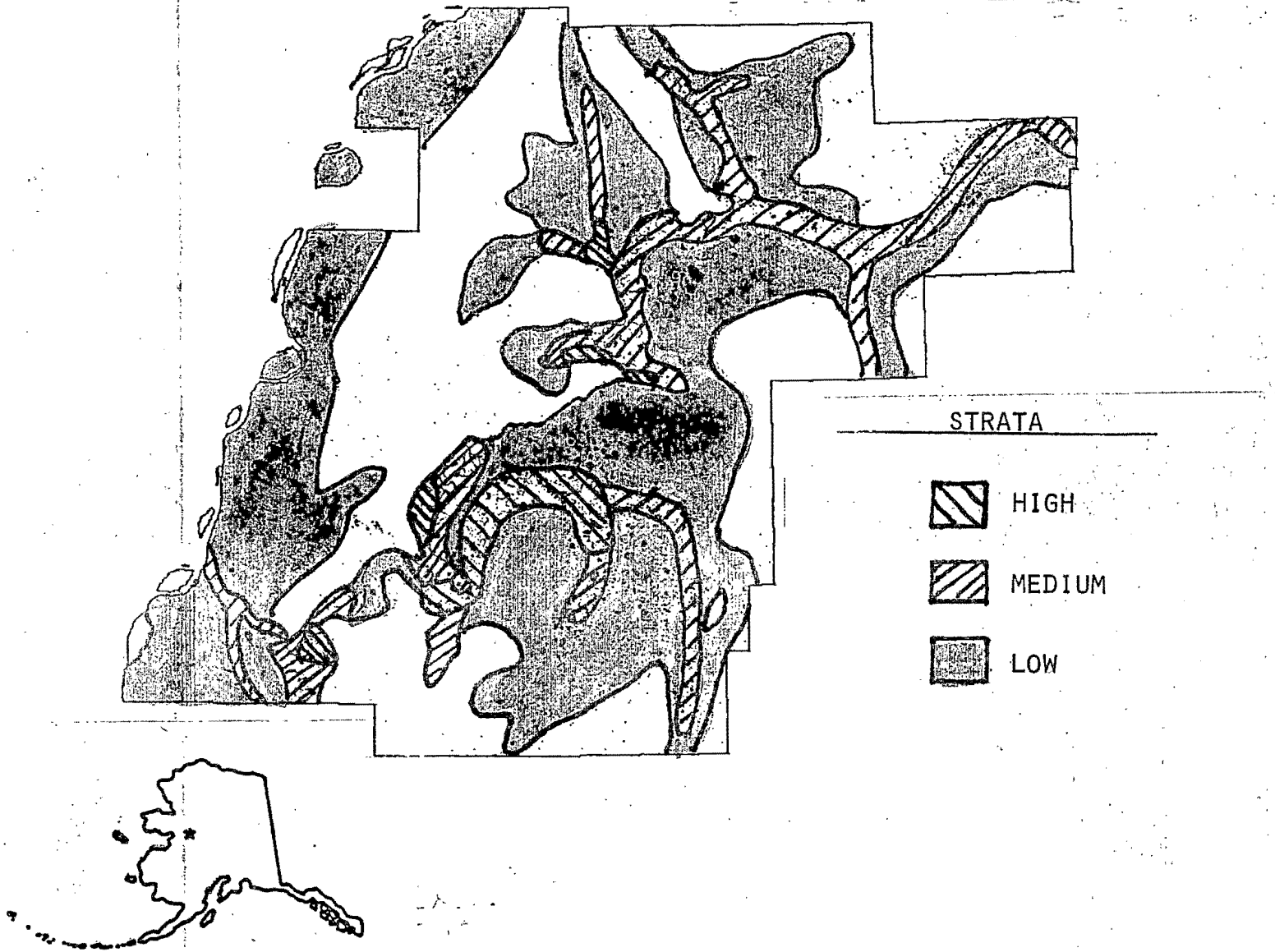
This survey, if used as an index of refuge duck production from year-to-year, will suffice for that purpose. This year's 8.1 broods/ sq. mi. will be a good basis on which to judge next year's production, if the same random samples are surveyed. A shortcoming of the current simple random sampling method is noted when an attempt is made to estimate total production on the refuge by extrapolating broods/sq.mi. to the entire wetland acreage. The problem is that our sampling scheme under-samples extensive areas of small lakes and streams because of inaccessibility. These areas are typically muskeg and upper reaches of small streams where productivity is usually low. This can cause a bias in overestimating the population and production of waterfowl.

An attempt was made this year to stratify the sample areas, based on numbers of broods observed, into high, medium, and low strata. We then used color-infra red photos and LandSat data and divided the refuge into these strate. Figure 2 shows these divisions. Although nearly half the refuge is wetland, approximately 80% of this area is low-density waterfowl habitat. Mean brood density from high to low strata ranges from 16.75 broods/sq. mi. to 1.25 broods/sq. mi (Table 5). Using Table 5 as a guide in an attempt to estimate total duck production for the refuge, we find an inconsistency. The simple random survey, without stratification, would estimate about 24,000 broods produced on the refuge (8.1 broods/ sq. mi. x 2905 sq. mi.). However, extrapolating within each strata and adding them up only gives about 8,000 broods produced on the refuge; only one-third of the 24,000. The lower number probably more

Table 5. Comparison of brood data collected in 3 possible strata, based on observed brood density and a combination of all strata (simple random survey). Innoko National Wildlife Refuge, 1986

Strata	Square Miles of Habitat	Sample Units Within Strata	Mean Broods/sq. mi.	Confidence interval at .80 level	
				+/-	%
High	165	12	16.75	5.37	32
Medium	440	14	5.42	2.18	40
Low	2300	8	1.25	0.58	46

FIGURE 2. WETLAND HABITAT, ON THE INNOKO NATIONAL WILDLIFE REFUGE, DIVIDED INTO 3 STRATA BASED ON DUCK PRODUCTION.



accurately represents reality, since the random sample is biased towards higher density habitat. Confidence intervals are so noticeably large that neither of the figures can be taken seriously for the time being, and are only presented here as ball park figures. We will continue to refine this survey in the future while relying on the Index as our most important product derived from it.

Two non-random sample areas were surveyed this year to estimate production on draw-down, "puddled" lakes. These lakes are river-connected with a shallow, uneven bottom which creates numerous, small lakes or puddles when the river drops in July and August. These are the most productive lakes on the refuge, but are very few in number, totalling 5-10 sq. mi. Most are in the Iditarod river area, though some are located on the lower Innoko. Because of their scarcity, they are not represented in the random survey, but because of their value, 2 sample areas totalling 1.14 sq. mi. were selected to track production in these areas. Table 6 records broods found on these sample areas. Here we found 29.75 broods/water body, compared to 0.8 broods/water body for the random survey. When worked out by area, "puddled" lakes produced over 100 broods/sq. mi, while the random survey averaged 8.1 broods/ sq. mi.

Vegetative and physiographic descriptions were filled out for each lake surveyed. We hope to use this information to further understand habitat preferences and use by waterfowl.

A helicopter brood survey was conducted on 7 sample units by Mike Smith on 1 August 1986. The idea of using a helicopter was mainly to survey those out-of-the-way muskeg plots which are very low in productivity and hard to walk. It was also to test sightability of broods from a helicopter. In order to do this, 2 of the sample units surveyed by helicopter were initially surveyed on foot. One lake on Plot 19, which was approximately 200 ft long by 75 ft wide, was observed to have 5 duck broods and about 40 molting shovelers on 30 July. The helicopter survey 2 days later missed one pintail brood that had no hen with them on the 30th, but picked up a wigeon brood not seen on the 30th. This was a shallow lake where the birds could not dive, and the helicopter was able to hold them on the water. The molting birds were separated from Class III broods by their behavior and lack of a decoying hen. It was not possible to enumerate the number of ducklings for any of the broods on this lake. There were simply too many birds milling around in a small area. The

Table 6. Second brood survey summary for non-randomly selected "puddled" lakes, Innoko National Wildlife Refuge, 1986.

Stratum: 5
Ponds Sampled: 3
1/4-mile sections of streams/rivers: 1.0
Total Water Bodies: 4

Plots Draw-down lakes 1 and 2
Dates: 1 August and 2 August
Total miles of river/stream: 0.25
Brood Count: Second

	CLASS I		CLASS II		CLASS III					
SPECIES	BROODS	AV. SIZE	BROODS	AV. SIZE	BROODS	AV. SIZE	BROODY HENS	TOTAL BROODS	AV. SIZE	BROODS PER WATER BODY
Mallard					1	4.2	2	3	3.9	0.75
Wigeon			13	5.1	2	4.5	2	17	4.8	4.25
G.W. Teal	6	5.3	11	3.3	1	3.8	9	27	3.8	6.75
Shoveler	4	4.5	10	3.0	3	4.4	10	27	3.5	6.75
Pintail			16	3.7	8	4.1	11	35	3.9	8.75
Subtotal	10	4.8	50	3.9	15	4.2	34	109	4.0	27.25
Scaup spp.	1	4.7			2	5.5	0	3	5.75	0.75
Goldeneye										
Bufflehead										
W.W. Scoter										
S. Scoter										
Subtotal	1		0		2			3		
Unid. Duck	0		4		1			7*		1.75
Total	11		54		18			119		29.75

*Additional Broods added in the total were not classified and so did not fit in any other category.

fact that most broods were found and an additional one picked up, however, would indicate that this technique may be useful. For high density lakes, a back seat observer would be very useful.

The low-density muskeg lakes were a different story. Here the helicopter was excellent. On these plots, no more than 1 or 2 broods (and usually none) could be expected on any lake. This type of plot is usually hard to get to, requires a lot of walking, has dangerous bogs, is easy to be disoriented in, and has few broods, so in-depth observation is not necessary. Lakes here are generally small, the helicopter noise immediately draws movement from a duck or brood on the lake it is approaching. This movement, since the lakes are generally devoid of other life keys the observer into the brood immediately. The helicopter then moves over for a closer look and the brood is identified. Even if the bird dives, the helicopter allows you to sit and wait for it to surface. The number of individuals in the brood should be enumerated immediately upon sighting and the species identified later. A back seat observer would be useful on these plots also, not so much to count ducks, as to keep track of the lakes and plot boundaries. An example of the efficiency of the helicopter survey on muskeg-type lakes is Plot 41. A crew of 3 took nearly 8 hours to survey this plot on the first survey; the helicopter survey took only 18 minutes and found one brood. The ground crew found none. Admittedly, the ground crew got lost on this plot, but that is easy to do in this terrain. Similar plots (22 and 39) took a ground crew 4-5 hours each while the helicopter survey was completed in 9 minutes each. All 7 sample units were surveyed in diverse areas of the refuge in 6 hours by one observer. This was in addition to collecting botany data on the same flight.

Helicopters are very expensive, but very efficient. We could not afford more than a day or two this year. If the money were available, we could not only increase our sample size, and thus lower our sample variance, but make the survey truely random by being able to reach and sample all units selected. This technique is not recommended, however, for high and medium duck density areas, as ground observation is more accurate in those areas.

Goose Production

Standardized goose production surveys have not been established on the Innoko. However, from general surveys and goose banding, we have derived the following information.

The first white-fronted goose broods were seen on Magitchlie Creek on 9 June 1986. The following week, both Canada and white-fronted broods were seen on the Mud River. On the lower Iditarod River, 10,000-20,000 geese molt each year. But proportionately few of these are family groups. The Iditarod basin is wide and flat, and floods nearly every year in May or even June in late years. Probably due to this, most geese nest in the higher reaches of streams and rivers on the refuge. Those observed to be good goose nesting areas are Grouch, No Name, Hather and Magitchlie Creeks and the Mud River. Other suspected nesting areas are the Dishna, upper Iditarod and Netletna Rivers.

Goose brood surveys are difficult to do since geese have a habit of congregating after the hatch with other family groups and molting, failed and non-breeders. This makes it difficult to pick out individual families and record brood sizes. An attempt was made this summer by Calvin Lensink to photograph molters and family groups from the air to determine if some kind of photographic inventory could be worked out. The results are still pending. Goose banding began on 7 July and continued through 17 July, with a few birds banded on 21 and 24 July. In all, 769 geese were banded; 549 white-fronts and 220 Canadas. Two drives which netted about 50 birds each were accomplished, while the rest were run down and caught with landing nets. Other drives were attempted, but failed and several drive sites were investigated for possible use nest year. Patsy Martin's black lab, Zephyr, assisted in catching the geese and was very useful, particularly after the birds had scattered and were hunkered in the grass.

The phenology of the molt on the Innoko has been pretty well figured out over the past several years, and is as follows: Failed and non-breeding White-fronts begin the molt first. In an average year, this is about 28 June - 1 July. They will regain flight capability about 15 July. Failed and non-breeding Canada geese begin molting about one week later 6-8 July. Timing of family group molting is not as clear, possibly because the groups are small, more-dispersed, and therefore less-visible. Molting is tied to the age of the goslings and would therefore be spread through the month of July, depending on hatching date. Generally though, family groups of each species begin molting about 1 week later than their non-breeding counterparts.