



Production and habitat use by Canada geese at Freezout Lake, Montana
by Daniel Lee Hook

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of
MASTER OF SCIENCE in Fish and Wildlife Management

Montana State University

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Abstract:

The production and use of nesting and brood habitat by Canada geese was studied from 1971 to 1972 at the Freezout Lake Management Area in northcentral Montana. Nesting increased 21.8 percent from 55 nests in 1971 to 67 nests in 1972. This accompanied a 10.7 percent increase in the total spring population and a longer nesting season. Average nest success for the two years was 70.5 percent with nest predation primarily by raccoons which accounted for 22.9 percent of nest loss. The average successful nest produced 5.44 goslings. Total production increased 12.7 percent from 1971 to 1972 (189-213). Two (33.3 percent) of the six neck-collared two-year-old females nested in 1971. Islands were the preferred nesting type with 54 (98.2 percent) and 59 (88.1 percent) of the nests being located on islands in 1971 and 1972, respectively. The decrease in relative use of islands as nest sites in 1972 occurred when only 48 percent of the available islands were utilized. In an effort to assess the effect of nest predation on island use and nest success, island vegetation, distance from shore, and water depth were studied. No significant differences were found in the vegetation of 17 islands used versus 15 islands not used as nest sites in Pond 4. 1972 nest site vegetation showed that residual vegetation provided the only effective cover for the early nesting geese. Analysis of the data on distance from shore and depth of water between the islands and the shore showed selection by the geese for islands 200 feet or more from the shore and for those in water greater than 10 inches in depth. It was also shown that nests on islands in water less than 100-200 feet offshore and those on islands in water less than 10 inches in depth were more likely to be destroyed. Islands which received repeated use in 1971 and 1972 experienced 80.3 percent nest success as opposed to those nested on only once which had 52.6 percent success. With fairly stable production from 1970 to 1972, it was suggested that a limited number of secure nesting islands in combination with nest predation was having a dampening effect on population growth. Three major brood areas were delineated on the main lake. The vegetation of these areas was cover mapped.

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AT FREEZOUT LAKE, MONTANA

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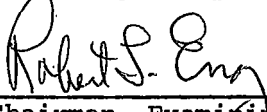
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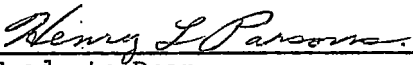
Approved:



Head, Major Department



Chairman, Examining Committee



Graduate Dean

MONTANA STATE UNIVERSITY
Bozeman, Montana

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ABSTRACT

The production and use of nesting and brood habitat by Canada geese was studied from 1971 to 1972 at the Freezout Lake Management Area in northcentral Montana. Nesting increased 21.8 percent from 55 nests in 1971 to 67 nests in 1972. This accompanied a 10.7 percent increase in the total spring population and a longer nesting season. Average nest success for the two years was 70.5 percent with nest predation primarily by raccoons which accounted for 22.9 percent of nest loss. The average successful nest produced 5.44 goslings. Total production increased 12.7 percent from 1971 to 1972 (189-213). Two (33.3 percent) of the six neck-collared two-year-old females nested in 1971. Islands were the preferred nesting type with 54 (98.2 percent) and 59 (88.1 percent) of the nests being located on islands in 1971 and 1972, respectively. The decrease in relative use of islands as nest sites in 1972 occurred when only 48 percent of the available islands were utilized. In an effort to assess the effect of nest predation on island use and nest success, island vegetation, distance from shore, and water depth were studied. No significant differences were found in the vegetation of 17 islands used versus 15 islands not used as nest sites in Pond 4. 1972 nest site vegetation showed that residual vegetation provided the only effective cover for the early nesting geese. Analysis of the data on distance from shore and depth of water between the islands and the shore showed selection by the geese for islands 200 feet or more from the shore and for those in water greater than 10 inches in depth. It was also shown that nests on islands in water less than 100-200 feet offshore and those on islands in water less than 10 inches in depth were more likely to be destroyed. Islands which received repeated use in 1971 and 1972 experienced 80.3 percent nest success as opposed to those nested on only once which had 52.6 percent success. With fairly stable production from 1970 to 1972, it was suggested that a limited number of secure nesting islands in combination with nest predation was having a dampening effect on population growth. Three major brood areas were delineated on the main lake. The vegetation of these areas was cover mapped.

INTRODUCTION

Several studies have shown preference by the Great Basin Canada goose (*Branta canadensis moffiti*) for islands as nest sites (Miller and Collins, 1953; Naylor, 1953; Geis, 1956; Craighead and Craighead, 1949). Construction of islands to encourage nesting can be a useful management practice.

At the Freezout Lake Management Area the opportunity existed to study a breeding population of Canada geese in man-made nesting habitat. From 1956 to 1969 a captive goose flock was maintained on the area. Releases of three-year-old Canada geese from this flock and additional releases of goslings from the Warm Springs State Game Farm provided the basis for the now free-flying goose flock. Objectives of the study were to determine the status and nesting success of the breeding population and to evaluate its nesting and brood habitat preference.

The field portion of the study was conducted on a part-time basis from April to June 1971, and on a full-time basis from June through August 1971, and March through August 1972.

DESCRIPTION OF THE STUDY AREA

Freezout Lake Management Area is a state waterfowl area approximately two miles northwest of Fairfield, Montana. The main lake and associated ponds lie in a glacial lake bed surrounded by rolling uplands on the western edge of the Fairfield Bench. Ellig (1955) gives a description of the area and relates some of the early problems with flooding prior to development.

The Montana Fish and Game Department began development of the lake as a waterfowl management area in 1953. A drainage ditch was dug from Freezout Lake through Priest Lake to the Teton River. Dikes and water control structures were built, and water was back-flooded against these dikes to form six ponds. During construction, islands were built in the six ponds with the use of a bulldozer.

The management area currently consists of Freezout Lake, six ponds and Priest Lake with a total of 4,881.2 surface acres of water and 47.2 miles of shoreline (Figure 1). Table 1 gives the surface acreage and length of shoreline for each of the water areas. In addition, there are approximately 6,500 acres of upland on the area which are used primarily for waterfowl lure crops, pheasant habitat, and waterfowl nesting habitat.

In 1971, there were 107 islands on the area. This decreased to 105 in 1972 with the loss of two in Pond 6 due to erosion by wave action. Three large natural islands are on the area, one each in

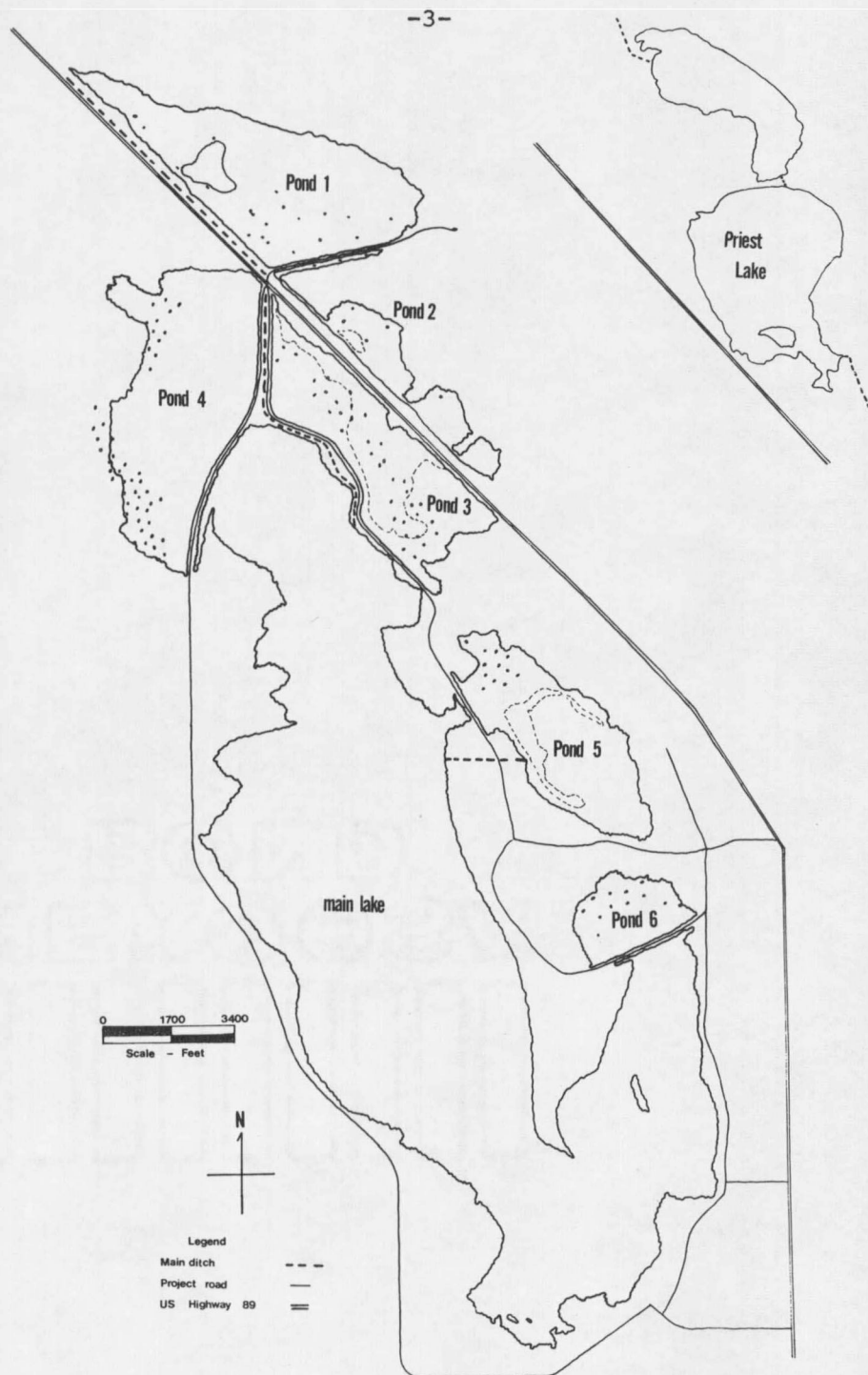


Figure 1. Map of Study Area Showing Ponds and Islands.

TABLE 1. SURFACE ACREAGE AND LENGTH OF SHORELINE FOR WATER AREAS ON FREEZOUT LAKE MANAGEMENT AREA.

Water Areas	Acres	Shoreline (miles)
Pond 1	437.84	4.35
Pond 2	122.73	4.92
Pond 3	198.72	5.21
Pond 4	470.50	4.35
Pond 5	288.58	3.55
Pond 6	107.47	1.71
main lake	2,803.63	17.00
Priest Lake	<u>451.72</u>	<u>6.12</u>
Total	4,881.19	47.21

the main lake, Priest Lake and Pond 1, measuring 5.1, 6.1 and 22.9 acres, respectively. The remainder of the islands are man-made except for two small natural islands in the south end of the main lake. The 60 man-made islands which were measured ranged in size from 9 x 28 feet to 77 x 149 feet.

The average daily temperature for the month of March over the past 10 years was 32.5 F. The average maximum daily temperature over this same period for March was 45.3 F. April was the first month of the year to reach an average daily temperature of 40 F or above with a 10 year average of 46.4 F.

METHODS

Nest surveys were conducted during April and May in 1971 and 1972. Due to the open nature of island vegetation at this time, a majority of nest sites were located by observing the goose on the nest. Incubation was assumed to have been initiated when a goose was repeatedly observed on a nest for two or more days. When incubation had been well established at most of the nest sites, a search was conducted of all the islands and areas of observed goose activity along the shore. During initial searches, clutch sizes and nesting progress were recorded at each nest. Thereafter, nest sites were left undisturbed until nesting activity was believed to have terminated, at which time the site was re-examined to determine the fate of the nest.

In 1971, bimonthly brood counts were conducted. In 1972, effort was made to make counts at one-week intervals. Brood observations were made with the aid of a 7x35 binocular and a 25X spotting scope. Gosling age was recorded after the method described by Yocum and Harris (1965).

To assess Canada goose breeding age, goslings were individually marked with plastic neck collars (Sherwood, 1966) in 1969, 1970 and 1971. The numbers of wild trapped goslings marked were as follows: 1969, 56 goslings, yellow collars with black symbols; 1970, 67 goslings, red collars with white symbols; 1971, 28 goslings, white collars with black symbols. In addition, 10 yearling geese released

from the captive flock in 1970 were marked with yellow collars.

Island vegetation was studied by running transects the length and width of all the islands in Pond 4 and all other small islands used by geese for nest sites. On the large island in Freezout Lake, which was approximately 150 x 876 feet, transects were run the length and width of the island, but recordings for the length of the island were made only at alternate 100 foot intervals. On the large island in Priest Lake, two bisecting 100 foot transects were placed at each nest site with one line perpendicular and the other parallel to the shore.

A modification of the method described by Daubenmire (1959) was used to measure vegetation. Canopy coverage of the vegetation was estimated at 5-foot intervals along a 100 foot tape within a 2 x 5 dm. frame and recorded by plant species according to the following classes: 1, 0-1%; 2, 1-5%; 3, 5-25%; 4, 25-50%; 5, 50-75%; 6, 75-95%; and 7, 95-100%. Height of vegetation was recorded at each plot with the use of a stake marked off at 3-inch intervals. The amount of bare ground, rock and litter was recorded for each plot. These transect measurements were made in July and August, 1971.

During the 1972 period of nesting activity, analysis of nest site vegetation was conducted. To keep disturbance to a minimum, only four plots were taken at each nest site. One 2 x 5 dm. plot was taken in each cardinal compass direction at a distance of two feet from the

nest to avoid any effects of nest construction on the vegetation. Canopy coverage was recorded for bare ground, rock, fallen litter, standing litter, living grass and living forbs. Height classes were recorded for standing litter, living grass and living forbs.

In 1972, the shoreline vegetation of the major brood areas was cover mapped. Canopy coverage was recorded in each type by taking 20 plots along a 100 foot tape.

Island water-depth measurements were taken at a point approximately halfway between the closest shore and each island. The measurements were then correlated to water levels recorded at the time of the nesting season to determine the water depth between each island and the closest shore during the nesting season.

The distance of each island to the closest shore was measured from 1966 aerial photographs. Distance to and height above water were recorded at each nest site in 1972 at the time when nests were re-examined to determine fate.

RESULTS

Nesting Population

The number of Canada geese observed on the area during the 1971 and 1972 nesting seasons is given in Table 2. Since no effort was made to separate territorial birds from the rest of the population, the number of pairs and singles could not be used as a direct index of the breeding population (Hanson and Eberhardt, 1971). Based on the number of nests located each year and discounting any renesting attempts, 51.4 percent of the total population nested in 1971. This increased to 56.5 percent of the April 14, 1972 census. The total spring population increased 10.7 percent from 1971 to 1972.

TABLE 2. BREEDING GROUND SURVEY (counts from ground)

Date		Pairs	Singles	Groups	Total
5/1 & 2	(1971)	63	39	49	214
3/22	(1972)	72	15	58	217
3/30 & 31	(1972)	68	13	80	229
4/6 & 7	(1972)	65	30	77	237
4/14	(1972)	67	50	53	237
4/27	(1972)	65	59	23	202*

*incomplete count

Nesting Phenology

In 1971, broods were back-dated to determine hatching dates. A 35-day interval was used to determine the dates of nest initiation. Four weeks were allowed for incubation, and one week was allowed for laying (Brakhage, 1965). Direct observation of incubating birds was used to determine hatching dates in 1972. The median date between each of the observations was used as a hatching date unless the exact date was known. The hatching date was back-dated to obtain the date of nest initiation. A 28-day interval was used as the incubation period and 1.5 days (Kossack, 1950) were allowed for each egg in a completed clutch. Hatching dates for 35 nests were obtained in this manner.

The nesting season extended for 57 days from March 30, to May 25, in 1971. The peak of nest initiation occurred during the last two days in March and the first week in April. The peak of hatching occurred during the first 10 days in May. The 1972 nesting season lasted for 81 days from March 19, to June 6. The peak of nest initiation occurred in the last week of March, and the peak of hatch in the last week of April and the first week in May.

The prolonged nesting of one bird which participated in nesting activities for a minimum of 67 days before deserting extended the 1972 season 14 days past the last recorded hatching date. If this one attempt was deleted, the 1972 nesting season would have extended 67 days. The primary difference in the length of the 1971 and 1972

nesting seasons was in the initiation date ($1\frac{1}{2}$ weeks later in 1971) since the last recorded hatching dates for both years were about the same; May 25, 1971 and May 24, 1972.

The mean daily temperature was 33.4 F one week prior to nest initiation in 1971. This had increased to 42.3 F during the first 10 days of nest initiation. In 1972, the mean daily temperature was 46.6 F one week prior to nest initiation. However, this decreased to 30.9 F during the first week of the nesting season. Hanson and Browning (1959) stated that goose nesting started with the occurrence of mean daily temperatures above 40 F. It would appear that the earlier nesting season in 1972 was related to warmer temperatures in March. The result of the below freezing temperatures during the first week of the nesting season will be discussed later regarding its effect of nest fate.

It would appear that the effect of cold weather prior to the beginning of nesting is one of shortening the entire nesting season as well as delaying it. As a result, production could be reduced by decreasing the overall nesting opportunity of the birds. This could take the form of a reduced renesting effort and a lower degree of nesting by the younger age classes. Klopman (1958) found that for Dog Lake, Manitoba late renesting may rarely occur when the nesting season is relatively late in initiation. Support for this could possibly be seen in my study since a higher percentage of the total

population engaged in nesting in 1972 as compared to 1971.

Nest Success

An increase of 21.8 percent was noted in the number of nests from 1971 to 1972 with an average nest success for the two years of 70.5 percent. A nest was considered successful if at least one egg hatched. A summary of nest fate is presented in Table 3.

TABLE 3. CANADA GOOSE NEST FATE AT FREEZOUT LAKE-1971 AND 1972.

Fate	1971		1972		Combined	
	No.	Percent	No.	Percent	No.	Percent
Hatched	40	72.7	46	68.7	86	70.5
Deserted	2	3.7	6	9.0	8	6.6
Destroyed	13	23.6	15	22.4	28	22.9
Total	55		67		122	

Nest desertion was relatively insignificant in 1971 while in 1972 it increased approximately three-fold. This increase in desertion was attributed to several days of freezing weather during the egg laying period. Nests deserted at this time commonly contained cracked eggs which had apparently frozen.

Destruction accounted for the major loss of nests in both years. Most of this was attributed to nest predation by raccoons (*Procyon lotor*). One incidence of coyote (*Canis latrans*) nest predation was

found in 1971. Identification of nest predators was based on the presence of tracks around the nest site and/or the appearance of the destroyed nest (Rearden, 1951). Striped skunks (*Mephitis mephitis*) were present on the area, but no nest destruction could be attributed to them.

During the two years of the study, 27 goose nests were located in nesting colonies of California gulls (*Larus californicus*) or ring-billed gulls (*Larus delawarensis*). No desertion or destruction of goose nests could be attributed to the activity of the gulls. Hanson and Eberhardt (1971) stated that protection from mammalian predators may actually be provided by the harassment activity of the gulls.

Raccoon predation of island nests appears to be related to the security level of the island as a nest site. Table 4 presents the fate of island nests by individual pond. With an increase in use in Pond 1 in 1972, success was reduced 50 percent with destruction accounting for 37.5 percent of nest loss. Every nest was destroyed in Pond 2 in both years indicating a very low security level for this pond. Only one nest was destroyed in Pond 3 in two years with desertion being the biggest factor in nest loss in 1972. Pond 4 had the largest number of nests, but also had a high rate of destruction and would thus appear to have a limited number of secure islands. Desertion was the only cause of nest loss in Pond 5 during both years. With a decrease in use of Pond 6 in 1972, the destruction rate went

TABLE 4. NEST FATE OF ISLAND NESTS BY INDIVIDUAL POND.

Fate	1971		1972		Combined	
	No.	Percent	No.	Percent	No.	Percent
Pond 1						
Hatched	5	100.0	4	50.0	9	69.2
Deserted			1	12.5	1	7.7
Destroyed			3	37.5	3	23.1
Total	5		8		13	
Pond 2						
Hatched						
Deserted						
Destroyed	2	100.0	3	100.0	5	100.0
Total	2		3		5	
Pond 3						
Hatched	5	100.0	6	66.6	11	78.6
Deserted			2	22.2	2	14.3
Destroyed			1	11.1	1	7.1
Total	5		9		14	
Pond 4						
Hatched	9	50.0	12	66.6	21	58.3
Deserted	1	5.6			1	2.8
Destroyed	8	44.4	6	33.3	14	38.9
Total	18		18		36	
Pond 5						
Hatched	5	100.0	4	66.6	9	81.8
Deserted			2	33.3	2	18.2
Destroyed						
Total	5		6		11	
Pond 6						
Hatched	6	75.0	4	80.0	10	76.9
Deserted			1	20.0	1	7.7
Destroyed	2	25.0			2	15.4
Total	8		5		13	
Main Lake						
Hatched	6	85.7	8	100.0	14	93.3
Deserted						
Destroyed	1	14.3			1	6.7
Total	7		8		15	
Priest Lake						
Hatched	3	75.0	2	100.0	5	83.4
Deserted	1	25.0			1	16.6
Destroyed						
Total	4		2		6	

from 25 percent to zero. The islands in the main lake and the island in Priest Lake appear to have a high security level with only one nest destroyed out of 21 nests for the two years.

Clutch Sizes

The mean clutch size for 68 successful nests was 5.44 based on the combined figures for 1971 and 1972. The 1971 mean clutch size for 27 nests was 5.00. This increased to 5.73 for 41 nests in 1972. Although there appeared to be a difference between the 1971 and 1972 mean clutch sizes, this was not significant based on the student's t-test ($P=0.05$).

Table 5 gives the frequency distribution of clutch sizes. The primary difference between 1971 and 1972 appears to be the increased number of clutches in the six and seven egg category. Hanson and Eberhardt (1971) found a tendency for average clutch sizes to increase or decrease with the number of nests. With an increase in the number of nests from 1971 to 1972, this same trend could be operating here.

Egg Success

Kalmbach (1939) stated that for managed areas a 70 percent hatch of eggs was a reasonable standard for Canada geese. For this study the two-year average hatch of all eggs was 72.4 percent. A total of 370 eggs was laid in 68 successful nests for which complete clutch sizes were obtained in the two years of the study. Hatching success

TABLE 5. FREQUENCY DISTRIBUTION OF CLUTCH SIZES BASED ON SUCCESSFUL NESTS.

Clutch Size	1971		1972		Combined	
	No.	Percent	No.	Percent	No.	Percent
3	4	14.8	4	9.8	8	11.8
4	3	11.1	2	4.9	5	7.2
5	12	44.4	5	12.2	17	25.0
6	5	18.5	20	48.8	25	36.8
7	3	11.1	10	24.3	13	19.1
Total	27		41		68	

for these eggs was 93 percent with 4.1 percent of the eggs being infertile. Infertility was based on the whole or partial suspension of the yolk in the albumen (Miller and Collins, 1953). Fertile eggs which contained dead embryos accounted for 1.4 percent of the eggs, and dead goslings made up 0.5 percent. Due to the cold weather early in the 1972 nesting season, a number of apparently frozen eggs were dropped from several nests. The average hatch per nest was 5.06 goslings for the two years.

Brood Production

In 1971, 189 goslings were raised to the flight stage. Production increased 12.7 percent in 1972 when 213 goslings were raised.

Broods produced in ponds 3, 4, 5, and 6 stayed in these ponds from a few days to four weeks before they crossed into the main lake. The broods hatched in Pond 1 and Priest Lake tended to stay on those areas during the brood rearing period. As the broods began moving onto the main lake, grouping of the broods occurred as well as the formation of gang broods. The average brood size increased from 5.17 on May 8, to 7.46 on May 30, 1972.

Clutch sizes were known for 41 successful nests in 1972. These nests hatched 219 eggs for a 5.34 average hatch per nest. Applying this average to five successful nests for which clutch sizes were not known gives a total hatch of 246 goslings. Using this figure and a survival of 213 goslings to flight, the goslings mortality from hatching to flight was 13 percent for 1972.

Nesting of Two-Year-Old Geese

Marked two-year-old geese were only available for study in 1971. Seven two-year-olds (six females and one male) were present during the nesting season. One female was marked outside of this study. Males accounted for 23 or 41 percent of the goslings banded in 1969 and females 33 or 59 percent. This shows a greater homing instinct for females similar to that shown by Surrendi (1970). Two (33.3 percent) known-age two-year-old females nested. Craighead and Stockstad (1964) found that between 27 and 36 percent of the marked two-year-

olds nested in the wild populations they studied.

Both of the birds that nested in this study were mated to unmarked birds of unknown age. One goose nested on an island in Pond 4 and hatched a clutch of six eggs. The other two-year-old female nested on the island in Priest Lake. She layed a clutch of four eggs which were finally deserted. Upon examination, all four eggs were found to be infertile. This goose was marked with a red neck-collar unlike the ones used to mark goslings in 1970. It is believed this bird was neck-collared in February, 1971 on the Browns Park Waterfowl Management Area in Utah. It was listed as a second year female at the time of banding (F. Clair Jensen, pers. comm.). In 1972, this bird nested as a three-year-old on the same island and hatched a clutch of seven eggs.

The remaining marked two-year-olds were all paired to unmarked geese of unknown age. One of the females made a false nesting attempt on an island in Pond 5. She constructed a scrape and was observed sitting on the island as if she were incubating a clutch. As the nesting season progressed, these birds were observed in groups with other nonbreeders. These groups of unsuccessful or nonbreeding geese left the area in June presumably to molt.

Nest Site Location

The types of nest sites used in 1971 and 1972 are given in Table 6. Two of the types, peninsulas and earth mounds, include structures originally built as islands but were not surrounded by water during the

TABLE 6. NEST SITE LOCATION.

Type	1971		1972	
	No.	Percent	No.	Percent
Islands	54	98.18	59	88.05
Peninsulas	1	1.82	5	7.46
Earth Mounds			1	1.49
Cattail			1	1.49
Other			1	1.49

nesting season. The type listed as other was an island nest in the old captive goose flock pen. Islands were the preferred nesting habitat for both years. The percentage of nests located on islands decreased by ten from 1971 to 1972 with an associated increase in the number of nests. It would appear that with the increased nesting pressure in 1972, there was an increased use of less preferred nest sites.

Table 7 gives the percentage of islands that were used as nest sites in each pond. Excluding the main lake and Priest Lake due to the small number of islands involved, a level of approximately 50 percent utilization of islands was achieved in 1972 with the exception of Pond 2.

TABLE 7. PERCENT OF ISLANDS IN EACH POND USED AS NEST SITES.

Ponds	1971		1972	
	No. of islands	Percent used	No. of islands	Percent used
Pond 1	20	25	20	40
Pond 2	8	25	8	25
Pond 3	18	22	18	50
Pond 4	34	52	34	47
Pond 5	12	42	12	50
Pond 6	11	73	9	56
main lake	3	100	3	100
Priest Lake	1	100	1	100
Total	107	42	105	48

Considering that islands are the preferred nesting habitat and that only 50 percent of the islands were used as nest sites, the increased use of less preferred nesting types in 1972 indicates that some factor or combination of factors was limiting the use of some of the islands as nest sites.

Island Vegetation

In 1971, island vegetation was studied to assess its importance in use by geese of islands as nest sites. Transects were run on all the islands in Pond 4 and all other islands used as nest sites.

One-way analysis of variance ($P=0.05$) was conducted on the average canopy coverage and frequency of occurrence of the different taxa for 17 islands used as nest sites and for 15 islands not used as nest sites in Pond 4 (Table 8). No significant differences were found. Analysis

TABLE 8. AVERAGE CANOPY COVERAGE AND FREQUENCY OF OCCURRENCE FOR VEGETATION ON ISLANDS IN POND 4.

Taxa	Canopy coverage		Frequency	
	Nest site islands	Unused islands	Nest site islands	Unused islands
Bare ground	14	14	69	66
Rock				
Litter	16	14	77	75
Foxtail barley				
<i>Hordeum jubatum</i>	8	9	36	42
Desert saltgrass				
<i>Distichlis stricta</i>	tr	tr	tr	tr
Common sowthistle				
<i>Sonchus oleraceus</i>	3	3	10	11
Canada thistle				
<i>Cirsium arvense</i>	1	1	6	4
Common salsify				
<i>Tragopogon dubius</i>	tr	tr	tr	tr
Wheatgrass				
<i>Agropyron intermedium</i>	2	6	11	20
Nuttall alkali-grass				
<i>Puccinellia nuttalliana</i>	tr	tr	2	tr
Alkali bulrush				
<i>Scirpus paludosus</i>	4	4	9	9
Summer cypress				
<i>Kochia scoparia</i>	25	23	69	73
Prairie pepperweed				
<i>Lepidium densiflorum</i>	tr	tr	5	1
Prickly lettuce				
<i>Lactuca serriola</i>	tr	tr	tr	1
Dotted blazingstar				
<i>Liatris punctata</i>	tr	tr	tr	tr
<i>Chenopodium</i> spp.	6	6	32	25
Spearleaf fleabane				
<i>Erigeron lonchophyllus</i>	tr	tr	3	3
Tumblemustard				
<i>Sisymbrium altissimum</i>	3	2	24	18
Yellow sweetclover				
<i>Melilotus officinalis</i>	tr	tr	tr	3
Red glasswort				
<i>Salicornia rubra</i>	tr	tr	3	2
Greasewood				
<i>Sarcobatus vermiculatus</i>	tr	tr	tr	tr
Unknown forb	3	4	14	15

was also conducted on the average canopy coverage per height class found for the two groups of islands (Table 9). Again, no significant difference was found.

In trying to determine the importance of nesting cover in the selection of islands as nest sites, it was felt that structure of the vegetation would be more important than species composition. It appears from the above results that the structure of the island vegetation as measured by canopy coverage and frequency of the taxa and canopy coverage per height class did not have any effect on the selection of islands for nest sites.

TABLE 9. CANOPY COVERAGE PER HEIGHT CLASS FOR ISLANDS IN POND 4.

Height Class	Nest Site Islands	Unused Islands
0-3 inches	2	3
4-6 inches	11	9
7-9 inches	16	19
10-12 inches	11	10
13-15 inches	6	6
16-18 inches	5	5
19-21 inches	3	4
22-24 inches	3	2
> 24 inches	2	4

Nest Site Vegetation

Since the transects in 1971 on island vegetation were conducted in July and August, it was felt that an assessment should be made of the nest site vegetation during the first part of the nesting season.

Table 10 presents these data for 1972 nest sites. From the table it can be seen that new plant growth accounted for only 17.3 percent of the canopy coverage at the nest site with bare ground and fallen and standing litter making up 75 percent of the canopy coverage. For those three cover types (standing litter, grass, and forbs) for which height measurements were made, it can be seen that most of the coverage provided by these types occurred under 12 inches in height.

It would appear that at the time the geese begin nesting activities, there is a minor amount of new plant growth which would have cover value. Residual vegetation in the form of standing litter would provide the only effective cover and even this would have little value due to its low nature. Keith (1961) showed that residual vegetation increased in importance with earlier nesting by ducks. In general, the nature of the island vegetation on this study area appears to have no appreciable effect on selection of islands for nest sites.

Relationships of Distance From Shore and Water Depth to Nesting on Islands

Distance from shore and water depth were two factors considered important in determining use of islands as nest sites and the fate of island nests. Sherwood (1965) found island nests to be vulnerable to mammalian predation when they occurred less than 200 feet offshore. He also noted that some islands which were an adequate distance from

TABLE 10. NEST SITE VEGETATION 1972.

	Canopy Coverage	Frequency (Nests)
Cover Type		
Bare Ground	24.39	98.38
Rock	2.07	11.29
Litter (fallen)	26.36	95.16
Litter (standing)	24.98	93.54
Grass	1.48	20.96
Forbs	15.79	80.64
Height Class		
0-3 inches	17.32	91.93
3-6 inches	6.37	54.83
6-9 inches	4.86	48.38
9-12 inches	2.37	12.90
12-15 inches	3.28	22.58
15-18 inches	2.10	9.67
18-21 inches	1.39	4.83
21-24 inches	1.94	17.74
> 24 inches	2.53	11.29

the shore were still unsafe as nest sites, because the depth of the water separating them from the shore was less than 12 inches. Hammond and Mann (1956) recommended that islands be placed several hundred feet offshore and in water 12-18 inches deep to reduce mammalian disturbance of island nests.

To test whether these two factors had any effect on island use or nest success, analysis of the data presented in Appendix Tables 14-19 was conducted by means of one-way analysis of variance ($P=0.05$). Analysis of the data on distance from shore was based on 50-foot intervals instead of the 100-foot intervals presented in the tables.

In relation to distance from shore, a significant difference was found between the islands used as nest sites and the total island distribution. A relatively low degree of use was observed for those islands within 200 feet of shore and a higher degree of use for those more than 200 feet offshore (Table 11). No significant differences were found as regards water depth for those islands used as nest sites versus the total islands available. A tendency was noted for less and greater use of islands which were in water under and over ten inches in depth, respectively (Table 12).

To further investigate the above relationships, similar analyses were made of the islands receiving repeated use as nest sites during both years of the study versus the total islands available. Significant differences were found for both distance from shore and water depth. When islands which were used both years are considered, the degree of use was lower for those less than 200 feet offshore (Table 11). It appears that a higher incidence of repeated use of islands for nesting occurred on islands located in water exceeding ten inches in depth (Table 12).

In comparing islands which had successful nests with all islands which had nest sites, no significant differences were found as regards distance from shore or water depth. Significant differences were found between islands with destroyed nests and the total nest site islands. A higher percentage of those islands within 100-200 feet of

TABLE 11. PERCENT OF ISLANDS IN EACH DISTANCE-FROM-SHORE CLASS AND THE DEGREE AND SUCCESS OF USE BY NESTING GEESE.

Type of Use	Distance-from-shore classes (feet)										
	0-100	101-200	201-300	301-400	401-500	501-600	601-700	701-800	801-900	901-1000	>1000
Nest site islands ^{a/}	18.8	34.4	46.9	55.6	59.1	68.4	5.0	33.3	0.0	87.5	62.5
Islands used both years ^{a/}	0.0	9.7	31.3	28.6	54.5	27.3	50.0	33.0	0.0	75.0	50.0
Islands with destroyed nests ^{b/}	100.0	33.3	20.0	21.4	15.4	36.3	0.0	0.0	0.0	29.6	0.0

^{a/} Percent of the total islands in each distance-from-shore class according to type of use.

^{b/} Percent of the islands with nest sites in each distance-from-shore class which had destroyed nests.

TABLE 12. PERCENT OF ISLANDS IN EACH WATER-DEPTH CLASS AND THE DEGREE AND SUCCESS OF USE BY NESTING GEESE.

Type of Use	Water-depth classes (inches)							
	0-3	4-6	7-9	10-12	13-15	16-18	19-21	>21
Nest site islands ^{a/}	33.3	39.6	37.3	57.9	54.2	55.6	66.7	100
Islands used both years ^{a/}	11.1	14.6	17.6	39.5	50.0	33.3	33.3	100
Islands with destroyed nests ^{b/}	83.3	38.9	44.4	0.0	15.4	37.5	0.0	0.0

^{a/} Percent of the total islands in each water-depth class according to type of use.

^{b/} Percent of the islands with nest sites in each water-depth class which had destroyed nests.

the shore and those in water under ten inches deep had destroyed nests (Tables 11 and 12).

In summary, it appears that selection for nest sites was directed toward islands in water deeper than ten inches and islands farther than 200 feet from the shore. This selection probably operates through experience or perpetuation based on success and a high degree of homing. Seventy-one percent of the islands which had successful nests in 1971 were again used for nesting in 1972 while only 50 percent of those with destroyed nests in 1971 were reused in 1972. It also appears that nest destruction was more likely to occur on islands in water less than ten inches in depth and those under 200 feet from the shore.

Island Spacing

To evaluate any possible effects that island spacing might have on the use of islands as nest sites, one-way analysis of variance ($P=0.05$) was conducted on the distance of nest site islands to the nearest island versus islands not used as nest sites to the nearest island. Data of the distance between nest site islands and the nearest island and between the nearest nest site island was also tested. No significant differences were found for either test. Sherwood (1965) found that the close spacing of islands prevented the use of some as nest sites, and he recommended a minimum of 150

feet between islands. For this study area the average distance between islands was 296 feet. It appears that the spacing of the islands on this area is adequate and under the present density of nesting geese is not preventing the use of islands as nest sites.

Distance to and Height Above Water of 1972 Nests

The distance to and height above water for 65 of the 1972 nests is given in Table 13. Thirty-seven (56.9 percent) of the nests were located within 15 feet of the shore, and 40 (61.5 percent) were within two feet above the surface of the water. Since flooding was not a problem, these two factors were not considered important in the selection of islands as nest sites or in nest success. Although a tendency was noted for nests to be located on or near the crest of the islands, it appeared that the values in the table were more related to the size and height of the islands. However, the figures may be useful in any future water level manipulations.

Nesting Density of Larger Islands

On the large islands in the main lake and Priest Lake which had more than one nest, a tendency for uniform spacing of nests was noted. The average distance between nests on the large island in the main lake in 1971 was 217 feet with a range of 202 to 231 feet. This decreased to an average of 161 feet in 1972 with a range of 144 to 168 feet. In 1971 the average distance between nests on the island

TABLE 13. DISTANCE TO AND HEIGHT ABOVE WATER OF 1972 NESTS.

Distance to Water			Height Above Water		
Scale	No.	Percent	Scale	No.	Percent
5 feet	8	12.3	6 inches	1	1.5
6-10 feet	19	29.2	7-12 inches	9	13.8
11-15 feet	10	15.4	13-18 inches	16	24.6
16-20 feet	6	9.2	19-24 inches	14	21.5
21-25 feet	8	12.3	>25 inches	25	38.5
>26 feet	14	21.5			

in Priest Lake was 263 feet with a range of 249 to 291 feet. The large island in the main lake had five nests in both 1971 and 1972 for a nesting density of one nest per 1.02 acres. Based on Sherwood's (1965) findings of island spacing and use by geese, this island may be approaching a maximum level of nesting at the present density which will allow complete success of nests. Much higher insular nesting densities have been recorded, but with increasing densities desertion also increases (Ewaschuk and Boag, 1972). With an increase in nesting pressure, this island may support a larger number of nests; but the effectiveness of any increase in nesting will depend on the rate of desertion due to intraspecific interaction.

Brood Area Location and Vegetation

Most broods spent one to four weeks on the pond nearest the nest site and then moved onto the main lake. As gang broods were formed and grouping of individual broods occurred, three major brood areas could be delineated on the main lake. Figure 2 shows these three areas and three less extensively used rearing areas on Pond 1 and Priest Lake. These areas could generally be described as low, moist areas of lush vegetation in and around bays. Broods consistently used these areas for feeding and loafing during the entire brood rearing period.

In 1972, the major brood areas were cover mapped with the aid of aerial photos, and a 100-foot transect was run in each type. The area around the island and bay in the southern end of Priest Lake was extensively used by broods but was not cover mapped.

The following cover types were delineated and listed according to dominant species of vegetation (20 to 80 percent canopy coverage). Other species occurring with coverage greater than ten percent but less than 20 percent are listed as subdominants.

- A. The dominant species in this type was sow thistle (*Sonchus oleraceus*). In Brood Area I, foxtail barley (*Hordeum jubatum*), desert saltgrass (*Distichlis stricta*), and an unknown forb were subdominants. Shore arrowgrass (*Triglochin maritima*) occurred as a subdominant in Brood Areas III and V.

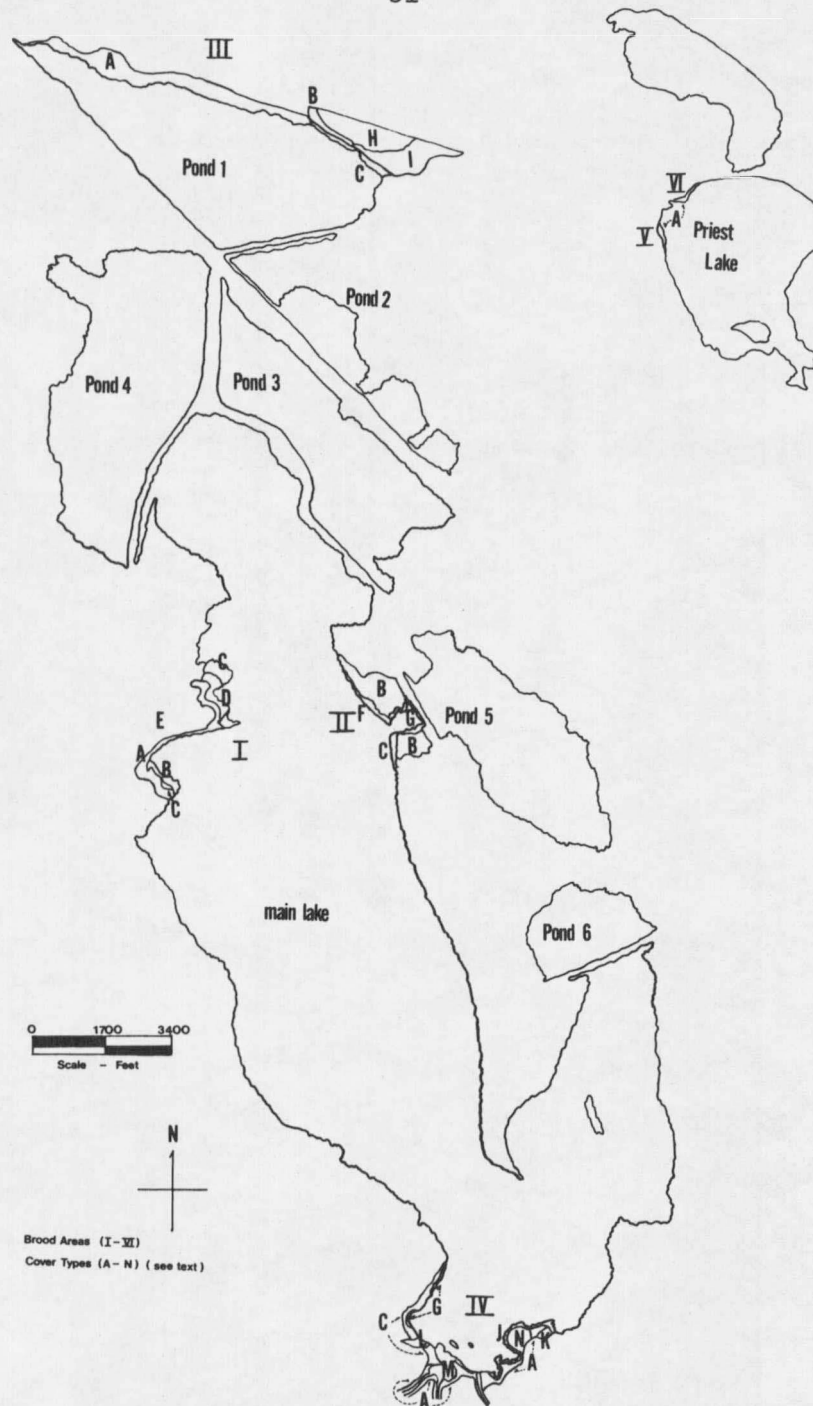


Figure 2. Cover Map and Location of Major Brood Areas.

In Brood Areas IV and VI foxtail barley and summer cypress (*Kochia scoparia*) were subdominants, respectively. Based on observations of use, it appears that sow thistle was of major importance in the diet of the goslings. It was one of the first plants to green up in the spring and provided lush dense vegetation. Further suggestion of the importance of this type is its widespread occurrence on areas selected for brood rearing.

- B. Foxtail barley and nuttall alkali-grass (*Puccinellia nuttalliana*) were the dominant species in this type. In Brood Areas I and II, summer cypress occurred as a subdominant along with these plants.
- C. In this type, summer cypress was the dominant species. Foxtail barley and desert saltgrass were subdominants in Brood Area I as were red glasswort (*Salicornia rubra*) and nuttall alkali-grass in Brood Areas II and IV, respectively. The early green growth of summer cypress appeared to be of importance as goslings were frequently observed feeding in this type.
- D. The dominant species in this type was nuttall alkali-grass with desert saltgrass being the subdominant.
- E. This cover type was upland prairie dominated by needle and thread grass (*Stipa comata*) and canby bluegrass (*Poa canbyi*).
- F. Summer cypress, Lamb's quarter (*Chenopodium album*), and

oakleaf goosefoot (*C. glaucum*) were the dominant species in this type. Although summer cypress may have been slightly more abundant than the two species of *Chenopodium*, all three were felt to be important in the diet of the goslings.

- G. The single dominant species in this type was alkali bulrush (*Scirpus paludosus*).
- H. This type was a cultivated area found only in Brood Area III. In 1972, it consisted of strips of wheatgrass (*Agropyron intermedium*), summer fallow, and barley (*Hordeum* spp.). Some use of the barley was observed as the geese approached the flight stage.
- I. This type was a dense stand of canby bluegrass in Brood Area III.
- J. *Chenopodium* spp. dominated this type which occurred as a narrow zone along the shore in Brood Area IV.
- K. Desert saltgrass formed a dense stand in this type in Brood Area IV.
- L. This type occurred in the broad bottom of a natural drainage that emptied into the main lake. The dominant species in this wet alkaline area was red glasswort.
- M. A dense stand of cattail (*Typha latifolia*) composed this cover type in Brood Area IV.
- N. Desert saltgrass, summer cypress, and foxtail barley were the

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dominant species in this type with all three species being of equal importance.

CONCLUSIONS AND RECOMMENDATIONS

The construction of islands at Freezout Lake coinciding with releases of goslings and three-year-old Canada geese has resulted in the establishment of a wild breeding population by seven years. Production by wild nesting birds has gone from ten goslings in 1962, when the first releases were made, to 213 in 1972.

It appears that mammalian nest predation is influencing the selection by geese of specific islands for nest sites. Twenty-eight islands received repeated use as nest sites in 1971 and 1972. These islands accounted for 56.6 percent of the nests in the two years of the study. They also accounted for 64 and 56 percent of the islands used as nest sites in 1971 and 1972, respectively. Two factors, the depth of the water around the islands and their distance from the shore, were felt to be important in the selection of these islands. Thus a strong selection was shown for islands that were in water at least ten inches deep and 200 or more feet from the shore.

The effect of this selection as regards nest success was that those islands which received repeated use in 1971 and 1972 experienced 80.3 percent nest success while those used only once in 1971 or 1972 had an average nest success of 52.6 percent. Only 39 and 41 islands met the requirements of being both over 200 feet from the shore and in water deeper than ten inches in 1971 and 1972, respectively. On a two year average 72.5 percent of these islands were used as nest sites

in either 1971 or 1972, 45 percent received repeated use while only 15.7 percent which did not meet these two requirements received repeated use.

Considering the lower success for the islands nested on only once compared to those receiving repeated use, a threshold value may be operating in relation to the security of the islands as nest sites and the resulting net production. The core of the production may be associated with a limited number of secure islands, while those geese nesting on the remaining islands are in a marginal situation with a much lower success rate. Thus, an increase in the number of nests under the present conditions will not result in a comparable increase in production. For example, the number of nests increased 21.8 percent from 1971 to 1972 while production only increased 12.7 percent.

Some change in nest site selection may be occurring. Thirty-nine of the 40 successful nests were on islands in 1971 and 40 of 46 in 1972. There was one successful shoreline nest in 1971 but six in 1972. When these figures are considered, it can be seen that the real increase in production in 1972 was due to the increased use and high success (75 percent) of shoreline areas. Although there may be a future increase in shoreline nesting, it is felt that the high success in 1972 was due to the small number of nests involved and that with increased use of this type these too will become more marginal.

With the initial releases in 1962, ten goslings were produced by the wild flock. Production increased to 111 in 1963 and then varied from a low of 38 in 1967 to 156 in 1969. During the last three years the production of young appears to have stabilized with 204, 189, and 213 goslings being produced in 1970, 1971, and 1972, respectively. The effect of limited secure nesting islands and nest predation appears to be one of dampening population growth. The potential for an increase in production will depend on whether the security level of the islands as nest sites can be raised and on the future effect nest predation has on production.

Since the distance of the islands from the shore is not a factor that can be easily managed, managing for higher water levels may provide adequate security for some additional islands as nest sites. The following are recommended water levels based on an elevation of 3700 feet that will place the islands in a minimum of 12 inches of water: Main Lake, 62.1; Pond 1, 67.0; Pond 2, 66.1; Pond 3, 65.0; Pond 4, 65.8; Pond 5, 66.1; Pond 6, 65.3; and Priest Lake, 57.2. These are recommended as minimum water levels that should be maintained during the waterfowl nesting season. In order to assess the effect that increased water levels may have on island use, nest success, surface acreage of ponds, and emergent vegetation, it is further recommended that continued observations be made. Where higher water levels may not be practical or effective, such as in Pond 2 or the

shallower areas of Pond 4, consideration might be given to deepening the area between the islands and the shore by means of a dragline or bulldozer. This of course will mean the drawing down of water levels to dry these areas and the temporary loss of production, but the future returns may make this acceptable.

It appears that the three key brood rearing areas on the main lake are adequate, but care should be taken to keep disturbance of these areas to a minimum. The major brood areas seem to have seven plant species that are fairly common to each. They are: sow thistle, summer cypress, lamb's quarter, oakleaf goosefoot, foxtail barley, nuttall alkali-grass, and desert saltgrass. Due to the importance of these species in the diet of the goslings, other areas where they occur should also be left undisturbed.

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APPENDIX

TABLE 14. COMPARISON OF ISLANDS WHICH WERE AND WERE NOT USED AS NEST SITES WITH RESPECT TO DISTANCE FROM SHORE.

Type of use		Distance to shore classes (feet)										Total	
		0-100	101-200	201-300	301-400	401-500	501-600	601-700	701-800	801-900	901-1000		>1000
Nest site islands													
1971	No.	1	12	8	8	5	5	1	1	0	3	2	46
	Percent	2.0	26.1	17.4	17.4	10.9	10.9	2.0	2.0	0.0	6.5	4.3	
1972	No.	2	9	7	7	8	8	1	1	0	4	3	50
	Percent	4.0	18.0	14.0	14.0	16.0	16.0	2.0	2.0	0.0	8.0	6.0	
Unused islands													
1971	No.	6	19	8	6	6	6	1	2	1	1	2	58
	Percent	10.3	32.8	13.8	10.3	10.3	10.3	1.7	3.4	1.7	1.7	3.4	
1972	No.	8	21	9	6	3	0	1	2	1	0	1	52
	Percent	15.4	40.4	17.3	11.5	5.8	0.0	2.0	3.8	2.0	0.0	2.0	
Total islands													
1971	No.	7	31	16	14	11	11	2	3	1	4	4	104
	Percent	6.7	29.8	15.4	13.5	10.6	10.6	2.0	2.9	1.0	3.8	3.8	
1972	No.	10	30	16	13	11	8	2	3	1	4	4	102
	Percent	9.8	29.4	15.7	12.7	10.8	7.8	2.0	3.0	1.0	4.0	4.0	

TABLE 15. ISLANDS RECEIVING REPEATED USE BY NESTING GEESE VERSUS ISLANDS NOT RECEIVING REPEATED USE (1971-1972).

Type of use	Distance to shore classes (feet)											Total
	0-100	101-200	201-300	301-400	401-500	501-600	601-700	701-800	801-900	901-1000	>1000	
Islands used both years												
No.	0	3	5	4	6	3	1	1	0	3	2	28
Percent	0.0	10.7	17.9	14.3	21.4	10.7	3.6	3.6	0.0	10.7	7.1	
Islands not used both years												
No.	7	28	11	10	5	8	1	2	1	1	2	76
Percent	9.2	36.8	14.5	13.2	6.6	10.5	1.3	2.6	1.3	1.3	2.6	
Total islands												
No.	7	31	16	14	11	11	2	3	1	4	4	104
Percent	6.7	29.8	15.4	13.5	10.6	10.6	2.0	2.9	1.0	3.8	3.8	

TABLE 16. ISLANDS WITH SUCCESSFUL NESTS VERSUS ISLANDS WITH DESTROYED NESTS.

Type of use		Distance to shore classes (feet)										Total	
		0-100	101-200	201-300	301-400	401-500	501-600	601-700	701-800	801-900	901-1000		>1000
Successful islands													
1971	No.	0	6	7	7	4	3	1	1	0	2	2	33
	Percent	0.0	18.2	21.2	21.2	12.1	9.1	3.0	3.0	0.0	6.1	6.1	
1972	No.	0	6	5	4	7	4	1	1	0	3	2	33
	Percent	0.0	18.2	15.2	12.1	21.2	12.1	3.0	3.0	0.0	9.1	6.1	
Destroyed islands													
1971	No.	1	5	1	1	1	2	0	0	0	1	0	12
	Percent	8.3	41.7	8.3	8.3	8.3	16.7	0.0	0.0	0.0	8.3	0.0	
1972	No.	2	1	2	2	1	2	0	0	0	1	0	11
	Percent	18.2	9.1	18.2	18.2	9.1	18.2	0.0	0.0	0.0	9.1	0.0	
Total islands with nests													
1971	No.	1	11	8	8	5	5	1	1	0	3	2	45
	Percent	2.2	24.4	17.8	17.8	11.1	11.1	2.2	2.2	0.0	6.7	4.4	
1972	No.	2	7	7	6	8	6	1	1	0	4	2	44
	Percent	4.5	15.9	15.9	13.6	18.2	13.6	2.3	2.3	0.0	9.1	4.5	

TABLE 17. COMPARISON OF ISLANDS WHICH WERE AND WERE NOT USED AS NEST SITES WITH RESPECT TO WATER DEPTH.

Type of use		Water-depth classes (inches)							Total	
		0-3	4-6	7-9	10-12	13-15	16-18	19-21		>21
Nest site islands										
1971	No.	2	14	6	10	8	2	0	2	44
	Percent	4.5	31.8	13.6	22.7	18.2	4.5	0.0	4.5	
1972	No.	4	5	13	12	5	8	2	1	50
	Percent	8.0	10.0	26.0	24.0	10.0	16.0	4.0	2.0	
Unused islands										
1971	No.	9	20	9	7	5	6	1	0	57
	Percent	15.8	35.1	15.8	12.3	8.8	10.5	1.8	0.0	
1972	No.	3	9	23	9	6	2	0	0	52
	Percent	5.8	17.3	44.2	17.3	11.5	3.8	0.0	0.0	
Total islands										
1971	No.	11	34	15	17	13	8	1	2	101
	Percent	10.9	33.7	14.9	16.8	12.9	7.9	1.0	2.0	
1972	No.	7	14	36	21	11	10	2	1	102
	Percent	6.9	13.7	35.3	20.6	10.8	9.8	2.0	1.0	

TABLE 18. ISLANDS RECEIVING REPEATED USE BY NESTING GEESE VERSUS ISLANDS NOT RECEIVING REPEATED USE (1971-1972).

Type of use		Water-depth classes (inches)							Total	
		0-3	4-6	7-9	10-12	13-15	16-18	19-21		>21
Islands used both years										
1971	No.	1	5	3	6	8	2	0	2	27
	Percent	3.7	18.5	11.1	22.2	29.6	7.4	0.0	7.4	
1972	No.	1	2	6	9	4	4	1	1	28
	Percent	3.6	7.1	21.4	32.1	14.3	14.3	3.6	3.6	
Islands not used both years										
1971	No.	10	29	12	11	5	6	1	0	74
	Percent	13.5	39.2	16.2	14.9	6.8	8.1	1.4	0.0	
1972	No.	6	12	30	12	7	6	1	0	74
	Percent	8.1	16.2	40.5	16.2	9.5	8.1	1.4	0.0	
Total islands										
1971	No.	11	34	15	17	13	8	1	2	101
	Percent	10.9	33.7	14.9	16.8	12.9	7.9	1.0	2.0	
1972	No.	7	14	36	21	11	10	2	1	102
	Percent	6.9	13.7	35.3	20.6	10.8	9.8	2.0	1.0	

TABLE 19. ISLANDS WITH SUCCESSFUL NESTS VERSUS ISLANDS WITH DESTROYED NESTS.

Type of use		Water-depth classes (inches)							Total	
		0-3	4-6	7-9	10-12	13-15	16-18	19-21		>21
Successful islands										
1971	No.	0	7	4	10	7	1	0	2	31
	Percent	0.0	22.6	12.9	32.3	22.6	3.2	0.0	6.5	
1972	No.	1	4	6	12	4	4	2	1	34
	Percent	2.9	11.8	17.6	35.3	11.8	11.8	5.9	2.9	
Destroyed islands										
1971	No.	2	6	2	0	1	1	0	0	12
	Percent	16.7	50.0	16.7	0.0	8.3	8.3	0.0	0.0	
1972	No.	3	1	6	0	1	2	0	0	13
	Percent	23.1	7.7	46.2	0.0	7.7	15.4	0.0	0.0	
Total islands with nests										
1971	No.	2	13	6	10	8	2	0	2	43
	Percent	4.7	30.2	14.0	23.2	18.6	4.7	0.0	4.7	
1972	No.	4	5	12	12	5	6	2	1	47
	Percent	8.5	10.6	25.5	25.5	10.6	12.8	4.3	2.1	

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Pond 1

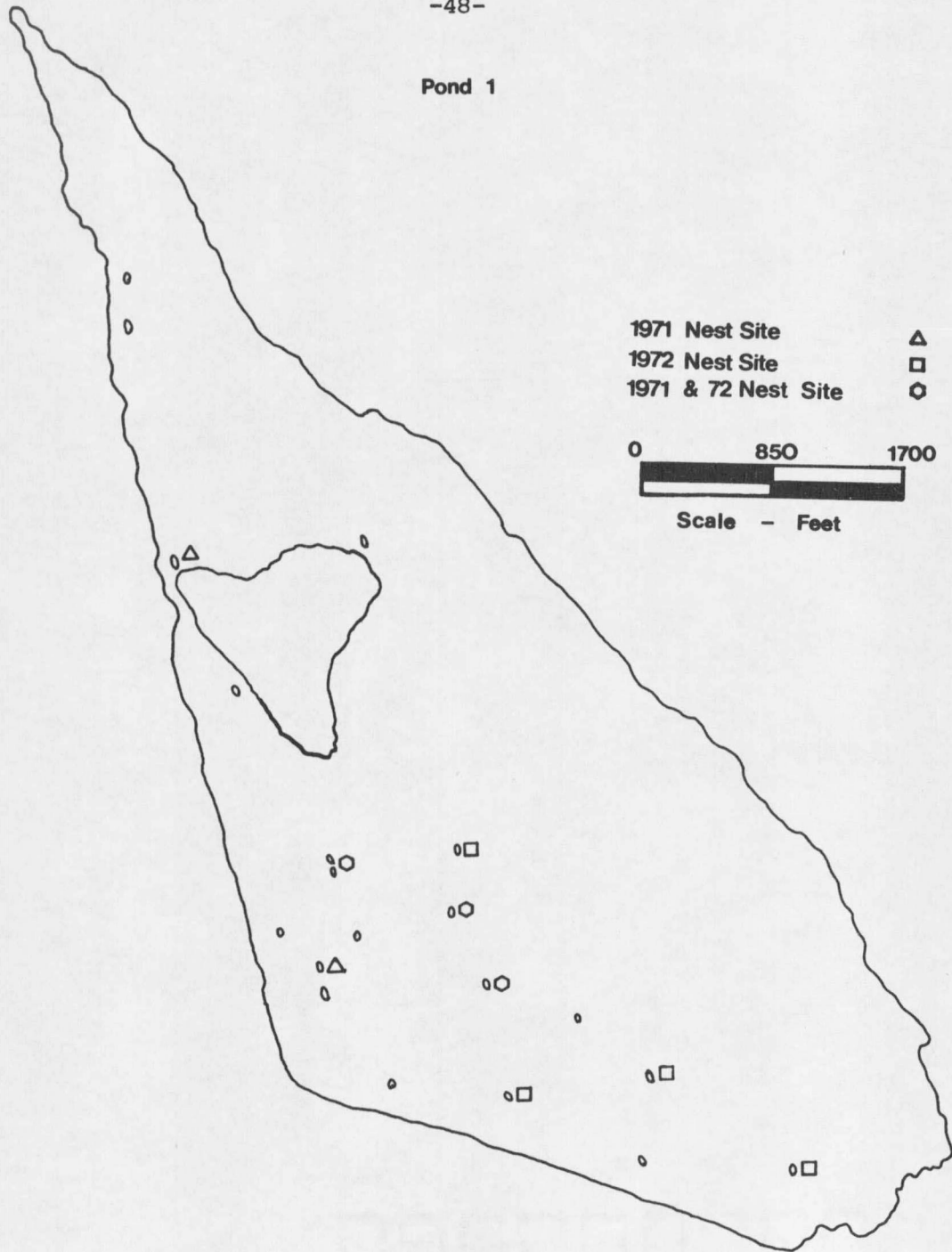


Figure 3. Map of Pond 1 Showing Location of Nest Sites.

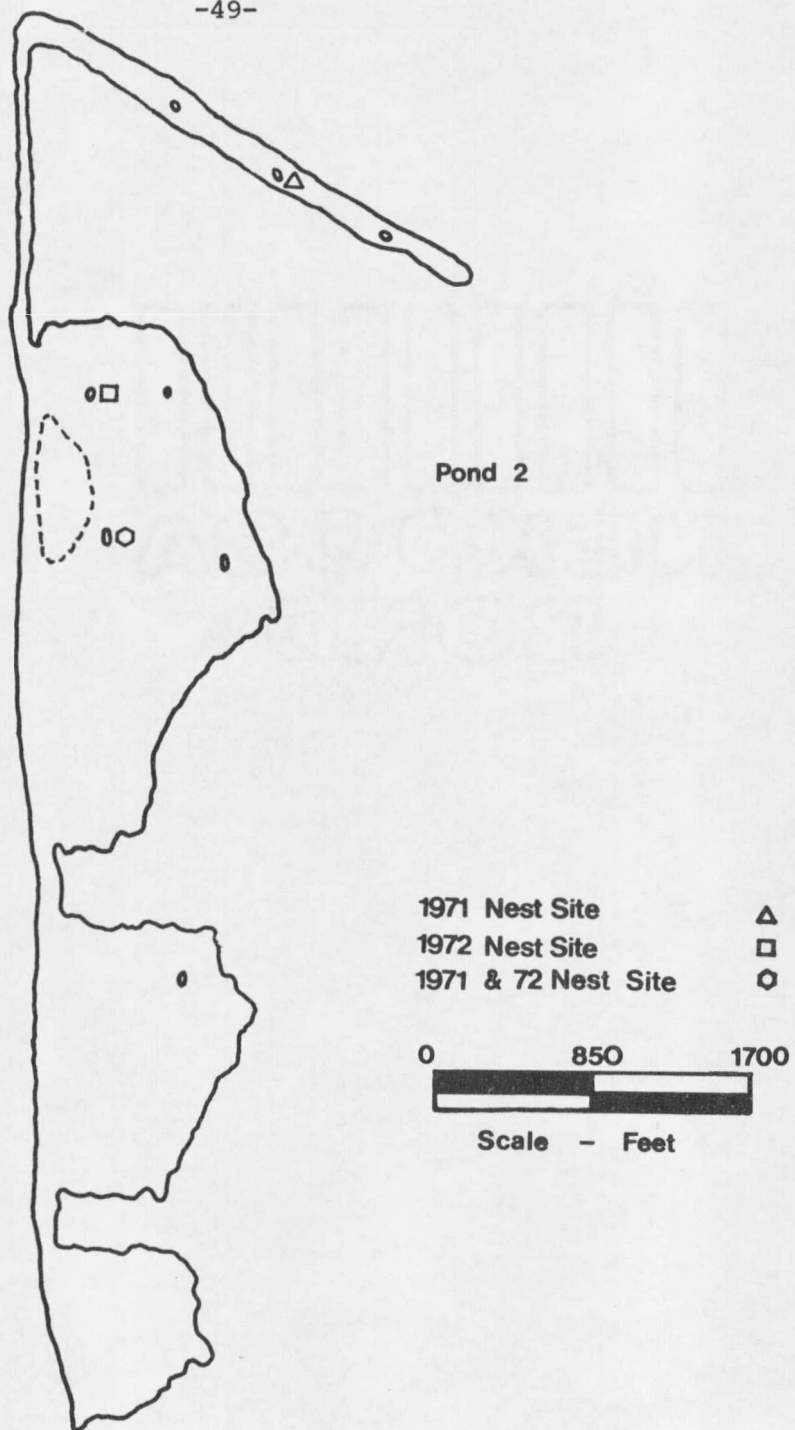


Figure 4. Map of Pond 2 Showing Location of Nest Sites.

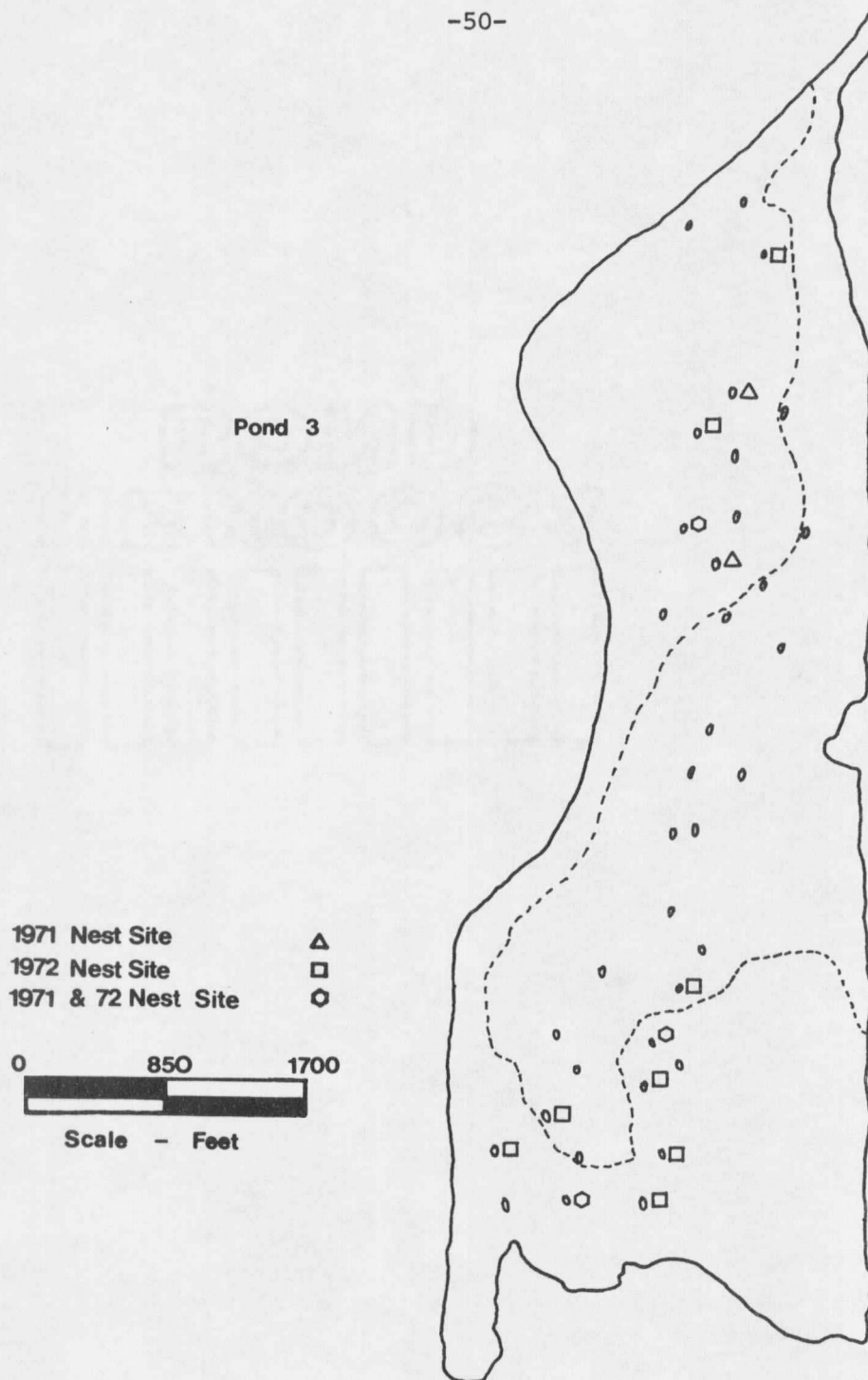


Figure 5. Map of Pond 3 Showing Location of Nest Sites.

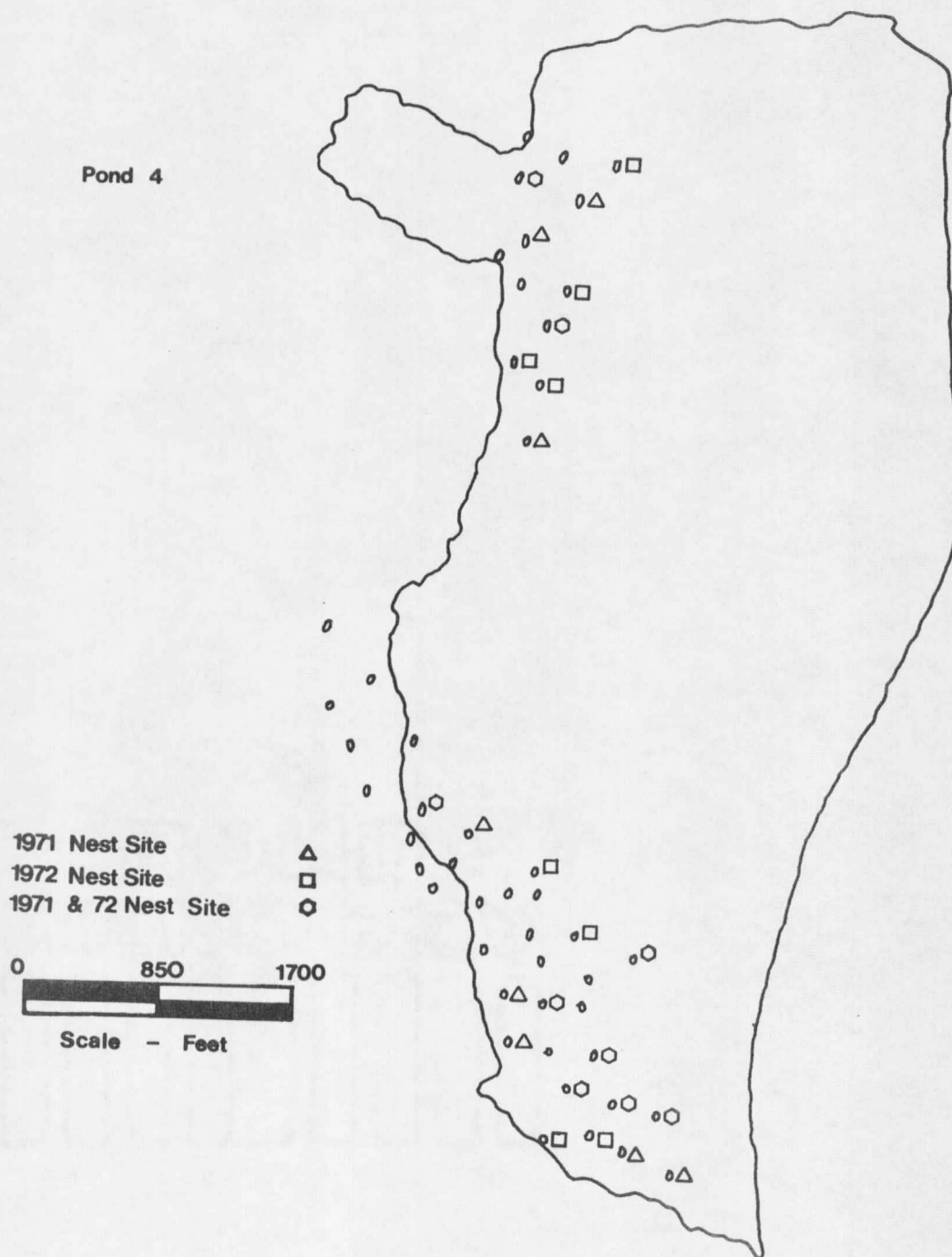


Figure 6. Map of Pond 4 Showing Location of Nest Sites.

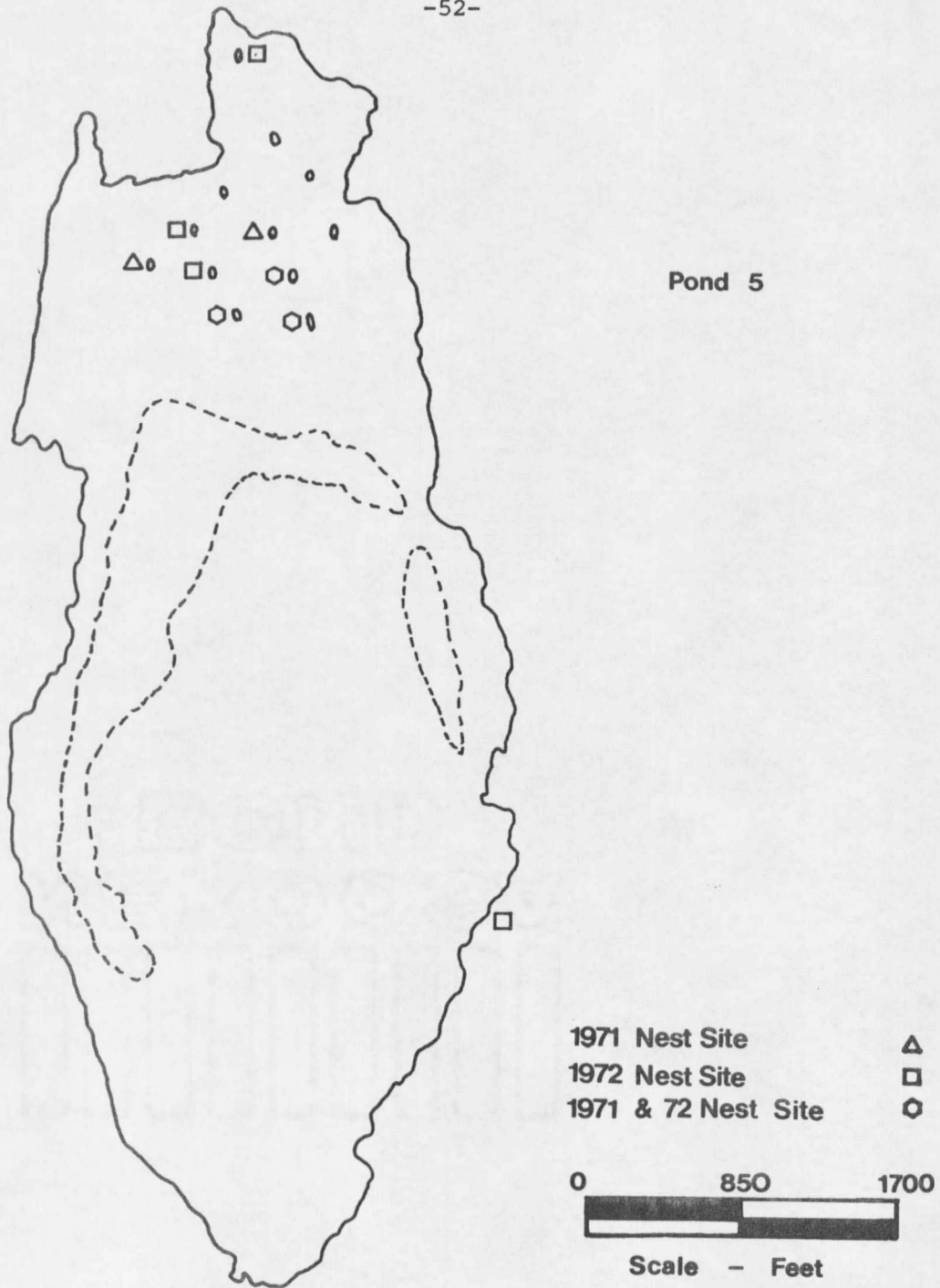


Figure 7. Map of Pond 5 Showing Location of Nest Sites.

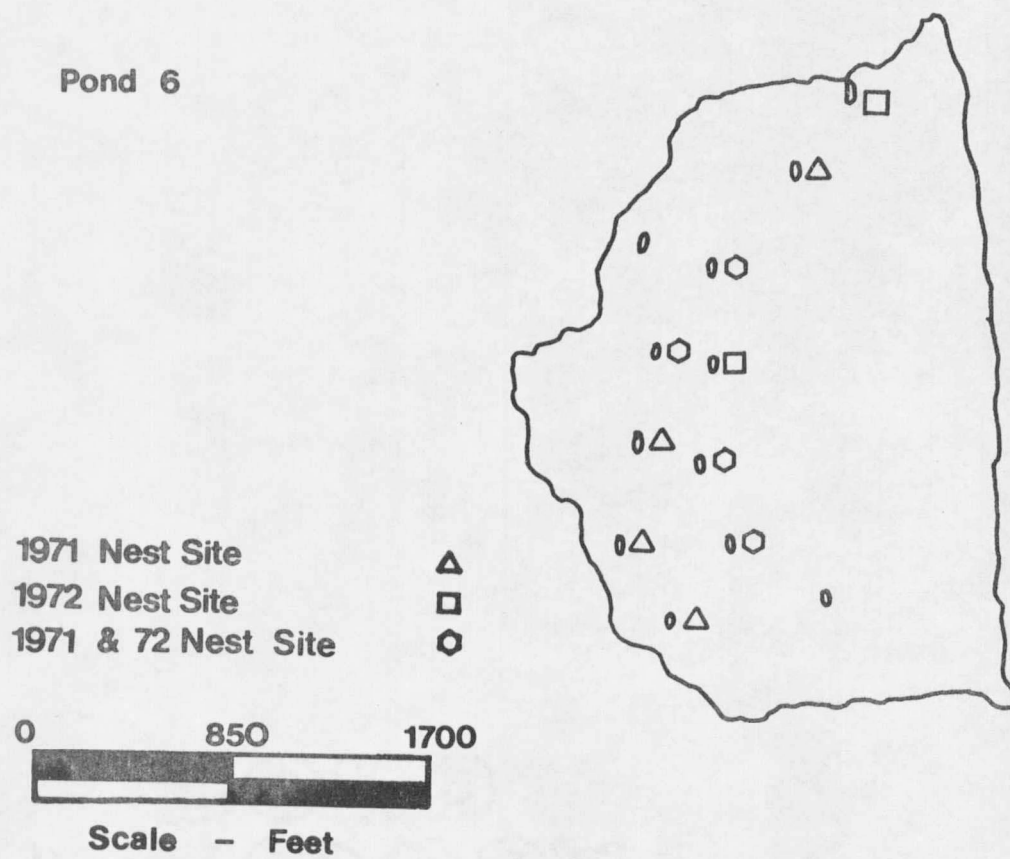


Figure 8. Map of Pond 6 Showing Location of Nest Sites.

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