Waterfowl nesting on islands in two ponds of the Canyon Ferry Wildlife Management Area, Montana
by Thomas Lee Carlsen

A thesis submitted 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:
Waterfowl nesting on artificial islands in 2 ponds of the Canyon Ferry Wildlife Management Area was studied from 1982-1983. A total of 37 nests of 4 species of ducks were found on islands in Ponds 3 and 4. The mallard (Anas platyrynchos) and the redhead (Aythya americana) were the 2 most common nesting species. A total of 222 nests of Canada geese (Branta canadensis moffittii) were located on islands in Pond 3 and 111 in Pond 4 during the course of the study. Physical characteristics of islands were measured to determine their possible influences on nesting densities, number of nests/island, nesting success and egg success. Nest site measurements were compared to analogous measurements made at random sites to investigate selection for particular nest site characteristics.

Nesting densities of ducks in Pond 3 averaged 49.8 nests/ha in 1983. Canada goose nesting densities in 1983 averaged 64.3 and 39.8 nests/ha in Ponds 3 and 4, respectively. Perimeter of the island was the most influential variable in determining waterfowl nesting densities. Islands with small perimeters had high nesting densities. Ducks selected islands averaging 0.07 ha in size. Canada geese used a wide range of island sizes and islands averaging 0.1 ha were able to support more than 1 nest. Nest success of ducks was 75.7% for the 2 years. Destruction by avian predators and flooding of nests were the main causes of failure. Nest success for geese on Ponds 3 and 4 in 1983 was 92.4% and 90.1%, respectively. Islands with more than 1 goose nest had a slightly lower nest success than islands with a single nest. The distance of the island to the mainland and the spacing of islands were not influential in nesting success. Ducks selected sites in dense, high vegetation offering concealment of the nest. Geese, nesting solitarily, selected nest sites with greater visibility than geese nesting on islands with more than 1 nest. Visual barriers, in the form of willow, allowed close spacing of nests on single islands as well as concentrated use of closely-spaced, small, dredged islands.

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A thesis submitted in partial fulfillment
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Master of Science

in

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2/27/84
Date

Robert S. Eng
Chairperson, Graduate Committee

Approved for the Major Department

2/28/84
Date

Robert S. Moore
Head, Major Department

Approved for the College of Graduate Studies

March 16, 1984
Date

Henry J. Parsons
Graduate Dean

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ABSTRACT

Waterfowl nesting on artificial islands in 2 ponds of the Canyon Ferry Wildlife Management Area was studied from 1982-1983. A total of 37 nests of 4 species of ducks were found on islands in Ponds 3 and 4. The mallard (Anas platyrynchos) and the redhead (Aythya americana) were the 2 most common nesting species. A total of 222 nests of Canada geese (Branta canadensis moffittii) were located on islands in Pond 3 and 111 in Pond 4 during the course of the study. Physical characteristics of islands were measured to determine their possible influences on nesting densities, number of nests/island, nesting success and egg success. Nest site measurements were compared to analogous measurements made at random sites to investigate selection for particular nest site characteristics. Nesting densities of ducks in Pond 3 averaged 49.8 nests/ha in 1983. Canada goose nesting densities in 1983 averaged 64.3 and 39.8 nests/ha in Ponds 3 and 4, respectively. Perimeter of the island was the most influential variable in determining waterfowl nesting densities. Islands with small perimeters had high nesting densities. Ducks selected islands averaging 0.07 ha in size. Canada geese used a wide range of island sizes and islands averaging 0.1 ha were able to support more than 1 nest. Nest success of ducks was 75.7% for the 2 years. Destruction by avian predators and flooding of nests were the main causes of failure. Nest success for geese on Ponds 3 and 4 in 1983 was 92.4% and 90.1%, respectively. Islands with more than 1 goose nest had a slightly lower nest success than islands with a single nest. The distance of the island to the mainland and the spacing of islands were not influential in nesting success. Ducks selected sites in dense, high vegetation offering concealment of the nest. Geese, nesting solitarily, selected nest sites with greater visibility than geese nesting on islands with more than 1 nest. Visual barriers, in the form of willow, allowed close spacing of nests on single islands as well as concentrated use of closely-spaced, small, dredged islands.

INTRODUCTION

The continued loss of waterfowl habitat through drainage has resulted in an effort in recent years to increase waterfowl nesting densities in smaller blocks of habitat. The construction of mammal-free nesting islands has proved an effective management tool towards achieving this objective. Several studies have shown waterfowl will readily accept islands as nesting areas and will nest at higher densities with greater success than on nearby mainland sites (Hammond and Mann 1956, Keith 1961, Duebbert 1966, 1982, Vermeer 1970, Ewaschuk and Boag 1972, Johnson et al. 1978, Giroux 1981, Duebbert et al. 1983). Hammond and Mann (1956) described criteria for the construction of islands for nesting waterfowl while Kaminski and Prince (1977) and Giroux (1981) reported on specific factors involving island selection, number of nests and nesting success.

The construction of a 4 pond system with artificial islands on the Canyon Ferry Wildlife Management Area (CFWMA) presented the opportunity to study island nesting by an expanding Canada goose population and a pioneering duck population. This study concentrated on the 2 ponds containing a majority of the islands as well as most of

the goose and duck nests. The specific objectives of the study were: (1) to determine species and numbers of ducks using the islands for nest sites; (2) to identify factors important in influencing the number and success of island nesting waterfowl; (3) to determine specific nest site preferences on the islands; (4) to compare the productivity of nesting waterfowl on the 2 ponds; and (5) to develop a sampling system for future use in searching for duck nests. Field work was conducted from mid-June to mid-August, 1982 and from mid-March to mid-August, 1983.

DESCRIPTION OF STUDY AREA

The study area consisted of Ponds 3 and 4 lying within the Canyon Ferry Wildlife Management Area (CFWMA) on the south end of Canyon Ferry Reservoir near Townsend, Montana (Figure 1). Construction of the reservoir was completed by the Bureau of Reclamation in 1954 as a power generating, flood control, irrigation and recreation project. The reservoir extends downsteam from Townsend 40 kilometers (km) (25 miles (mi)) to Canyon Ferry Dam about 27 km (17 mi) east of Helena, Montana. It has a surface area of 14,251 hectares (ha) (35200 acres (a)) and is 7.2 km (4.5 mi) at its widest point.

Original management of the reservoir called for maintaining high water levels to maximize power generation. To meet flood control needs, water management changed in 1966, calling for late season drawdowns exposing as much as 3683 ha (9100 a) of mud flats at the upper end of the reservoir (Denson et al. 1978). The strong winds prevalent in the area and the exposed mud flats created a serious dust problem, eventually resulting in the Bureau of Reclamation being cited by the State Department of Health in April, 1971 for exceeding state air pollution standards. Several methods to alleviate the

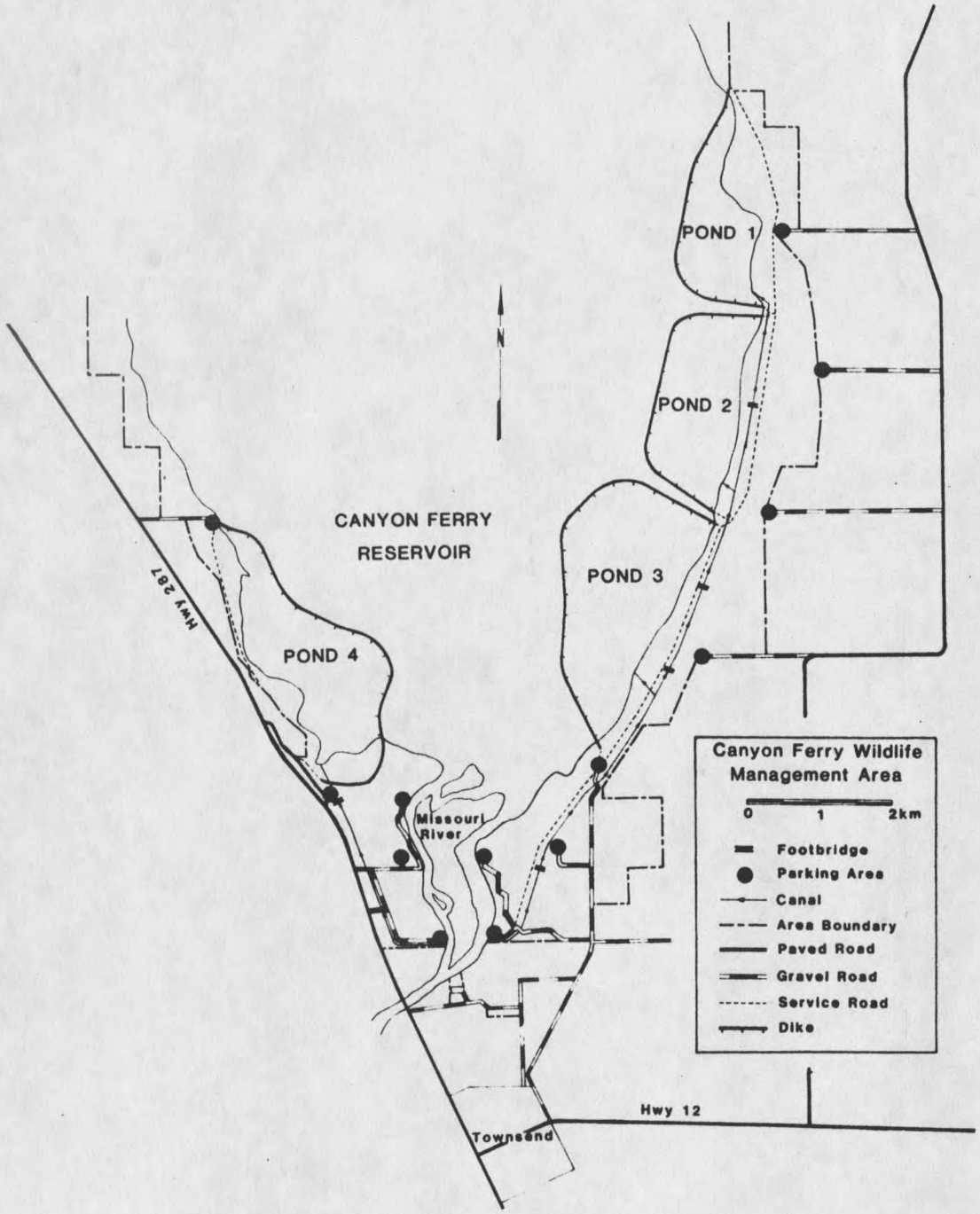

Figure 1. Map of Canyon Ferry Wildlife Management Area showing study area, Ponds 3 and 4.

dust problem had failed. That same year Congress authorized the Bureau to begin the Canyon Ferry Conservation and Wildlife Enhancement Project which resulted in the construction of 4 dikes enclosing 769 ha (1900 a) of the exposed area and the excavation of 1093 ha (2700 a) of material from the reservoir side of the dikes to be deposited within the 4 subimpoundments. The 2024 ha (5000 a) area plus the pond system thus created by the project was to be managed by the Montana Department of Fish, Wildlife, and Parks. Wildlife biologists had input into the design of the pond-island systems throughout the construction phase which began in 1973 and was completed in 1977. Islands were built by hauling material onto the ice during the winter and from dredged material being pumped into the ponds. Pond 3, with 149 ha (369 a) of surface area, contains about 240 islands (1.6 islands/ha) depending on the water level in the pond (Figure 2). Pond 4, which has 155 ha (384 a) of surface area, contains 61 islands (0.4 islands/ha) and a long dredged flat which is partially exposed during the goose nesting season (Figure 3). The islands in Pond 3 have a total area of 5.76 ha (14.23 a) and in Pond 4, 4.42 ha (10.93 a). Water levels in the ponds are maintained through inlet canals from the Missouri River and outlet gates on the dikes, and can be manipulated as long as the reservoir water level is below that of the ponds. When reservoir levels exceed those in

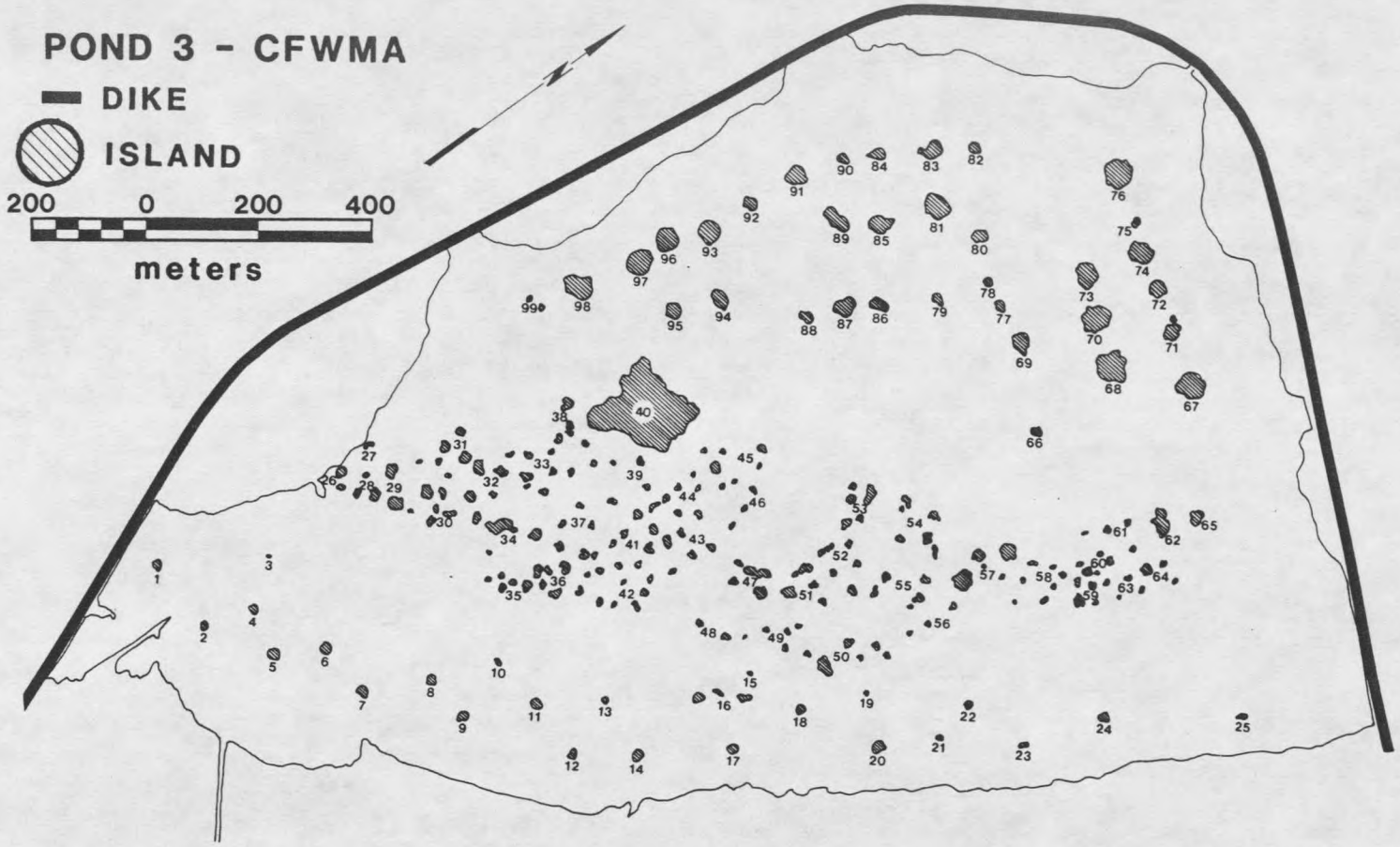

Figure 2. Map of Pond 3 on the CFWMA.

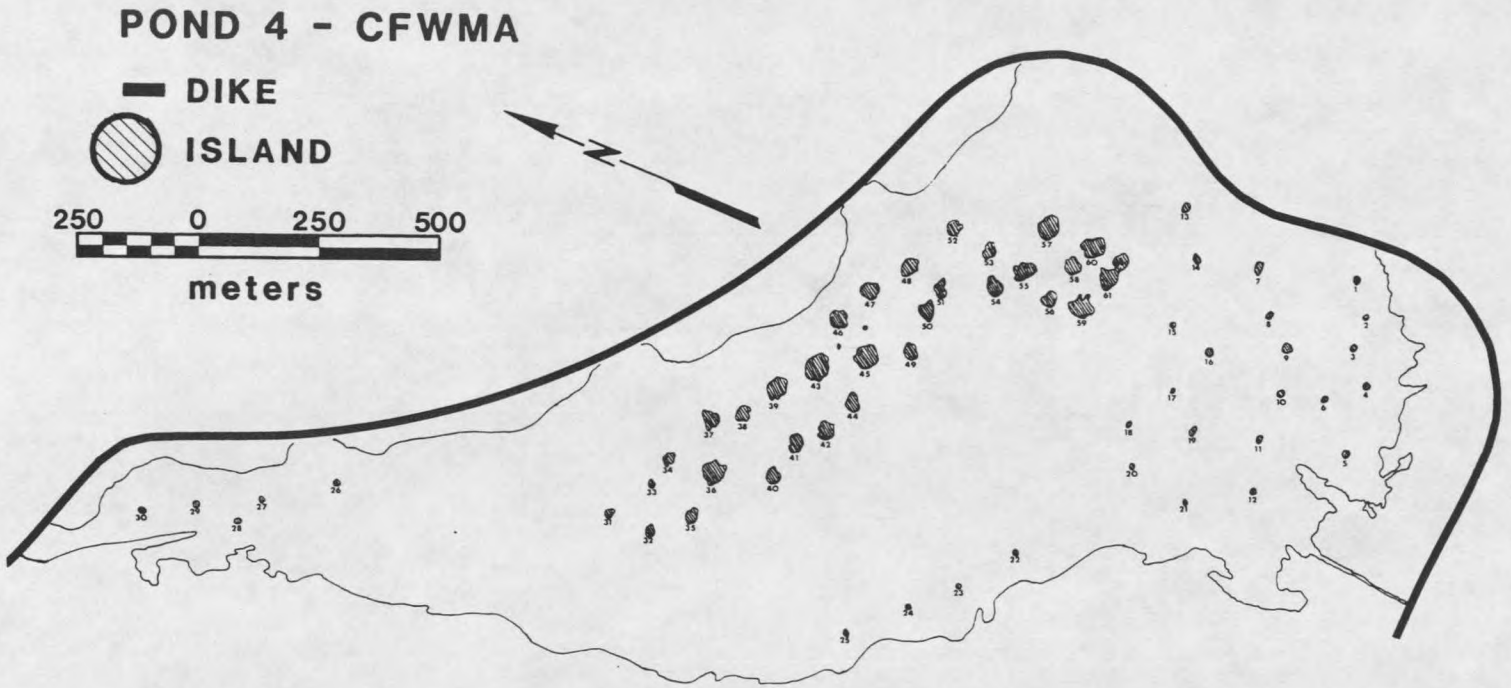

Figure 3. Map of Pond 4 on the CFWMA.

the ponds, seepage through the dikes occurs causing a rise in pond water levels.

The islands, constructed primarily from a gravel-silt material and being exposed to strong winds, pose a harsh environment for vegetation. Artificial seedings of grasses and legumes have been slow to become established. Vegetation on the islands consists mainly of willow (Salix spp.) and annual forbs. A list of plants occurring on the islands in both ponds can be found in Tables 27 and 28 in the Appendix.

Pond 4 was the first to be impounded and had islands available for nesting in 1974. Dike and island construction was completed on all ponds in 1977 and islands were available for nesting in 1978.

Emergent vegetation (Scirpus spp.) from local sources and purchased root stock have been transplanted in both study ponds and again has been slow to establish due to the harsh environment and fluctuating water levels.

High turbidity and fluctuating water levels likewise have impeded the establishment and expansion of submergent vegetation. Pond 3, the younger of the 2 study ponds, has a greater distribution and diversity of submergent vegetation. A species list of submergent plants found in the ponds appears in Table 29 in the Appendix.

METHODS

Systematic searches for duck nests were conducted at approximately 3 week intervals in 1982 and 1983. Two complete searches were made in 1982, beginning in mid June. Four searches were made in 1983, the first running concurrently with the goose nest search in late April. All islands were completely searched. When a hen was flushed, its species was determined, its eggs were counted, and the cover at its nest classified as willow, residual cover or new growth. Eggs were candled to determine the stage of development (Weller 1956), covered with the nest down to prevent cooling and lessen the chance of predation, and a field map drawn showing location of the nest. Duck species was determined at nests without an attending hen by characteristics of the down and contour feathers (Broley 1950).

All islands have been searched annually for goose nests since completion of the ponds. Islands in Ponds 3 and 4 were searched on April 26 and 27, 1982 and April 18 and 19, 1983 after observations indicated that a majority of nests were well into incubation. The attending goose was flushed, clutch size determined and eggs were covered with down. In 1983 cover at the nest was classified into 1 of

4 categories: structure (logs placed in the shape of a V), willow, exposed, or residual cover. Field maps showing the locations of the nests were drawn in 1983.

Duck nests were visited on or shortly after the projected hatching date to determine the nest fate. A nest was considered successful if at least 1 egg hatched. Terminology used by Miller and Collins (1953) was employed in presenting nesting data. Unhatched eggs were examined and classified as containing a dead embryo or being infertile (Kossack 1950). The predators of destroyed nests were identified from descriptions given by Rearden (1951). After nest fate was determined, nests were marked with flagging to facilitate relocation.

The fate of all 1982 goose nests was not determined due to the difficulty of relocating nests in new vegetation by late June. In 1983 the fate of all goose nests was determined approximately 3 weeks after the nest search.

In 1982 a representative sample of islands was selected which was felt to show variation in parameters being measured. Sixteen islands were sampled in Pond 3 and 15 in Pond 4. Island samples in both years included all islands with multiple goose nests and all islands with duck nests. In 1983 islands were stratified into 3 size groups and a random sample drawn from each group. A total of 46 islands in Pond 3 and 30 in Pond 4 were selected.

Island 40 in Pond 3, being somewhat anomalous because of its large size, was not included in statistical analyses but measurements were made at nest sites in the same manner as for those on other islands in 1983.

All nest measurements were made after nest fate was determined, to lessen the chance of desertion. New vegetation growth had started so vegetation measurements, while different than those present at the initiation of nesting, were relative between islands. Measurements made on both duck and goose nests were the average height of vegetation taken 0.5 meters (m) from the nest in each cardinal direction, and the distance from the nest to water. Density board readings using a modification of the method described by Jones (1968) were taken at duck nests in 1982 and duck and goose nests in 1983. The degrees of visibility to open water was determined for all goose nests and taken with a hand held compass 30 centimeters (cm) above the nest. Distance to the nearest neighbor and visual obstruction between nearest neighbors, using a method modified from Robel (1969), were made on islands with more than 1 goose nest. In 1983 the same measurements taken at nest sites were made at random sites located on sampled islands using a coordinate system.

Island measurements included area and perimeter of islands, distance of the island to the nearest shoreline, and between-island measurements made from air photos taken

in 1979. Canopy coverage was calculated using the line-intercept method along east-west and north-south transects in 1982 (Canfield 1941). The height of vegetation was recorded at intervals along the same transects. Maximum depth of water between islands and the nearest shoreline was measured. The maximum elevation of an island above the waterline was determined using a Stratolevel.

Water transparency readings using a Secchi disk and fluctuations in pond water elevations were made both years of the study.

Stepwise regression was used to analyse variation in nesting densities and hatchability of eggs. Stepwise discriminant analysis was used to classify islands by the number of nests per island and nest success. Analysis of variance was used to analyze nest site measurements. Random sites on islands with and without nests were analysed to detect differences between islands used or not used for nesting. Also, measurements at nest sites were compared to those at random sites on the same islands to determine if there was selection for particular habitat components. All percentage data were transformed using an angular transformation and a logarithmic transformation was used to linearize the regression function and to stabilize the variance of the error terms (Sokal and Rohlf

1981). All statistical tests were made using BMDP (Dixon 1983) statistical packages at the Montana State University Computer Center.

RESULTS

Nest Search

Four species of ducks, mallard (Anas platyrhynchos), gadwall (Anas strepera), pintail (Anas acuta), and redhead (Aythya americana) nested on islands both years of the study. Eleven duck nests were located in 1982, all in Pond 3. Twenty two nests in Pond 3 and 4 nests in Pond 4 were located in 1983. Nest locations in Ponds 3 and 4 for both years are shown in Figures 4 and 5, respectively. Nest locations by species and island are given for both years in Table 30 in the Appendix.

Canada goose nest surveys on the Missouri River and pond portions of the CFWMA since 1974 indicate a stable or slightly declining breeding segment on the river and a progressive colonization of the pond system (Table 1). The contribution of islands in Ponds 3 and 4 to the increase in the number of nests and the percent of islands used for nesting in each pond by year is shown in Table 2. Locations of goose nests in Ponds 3 and 4 for 1983 are shown in Figures 6 and 7, respectively.

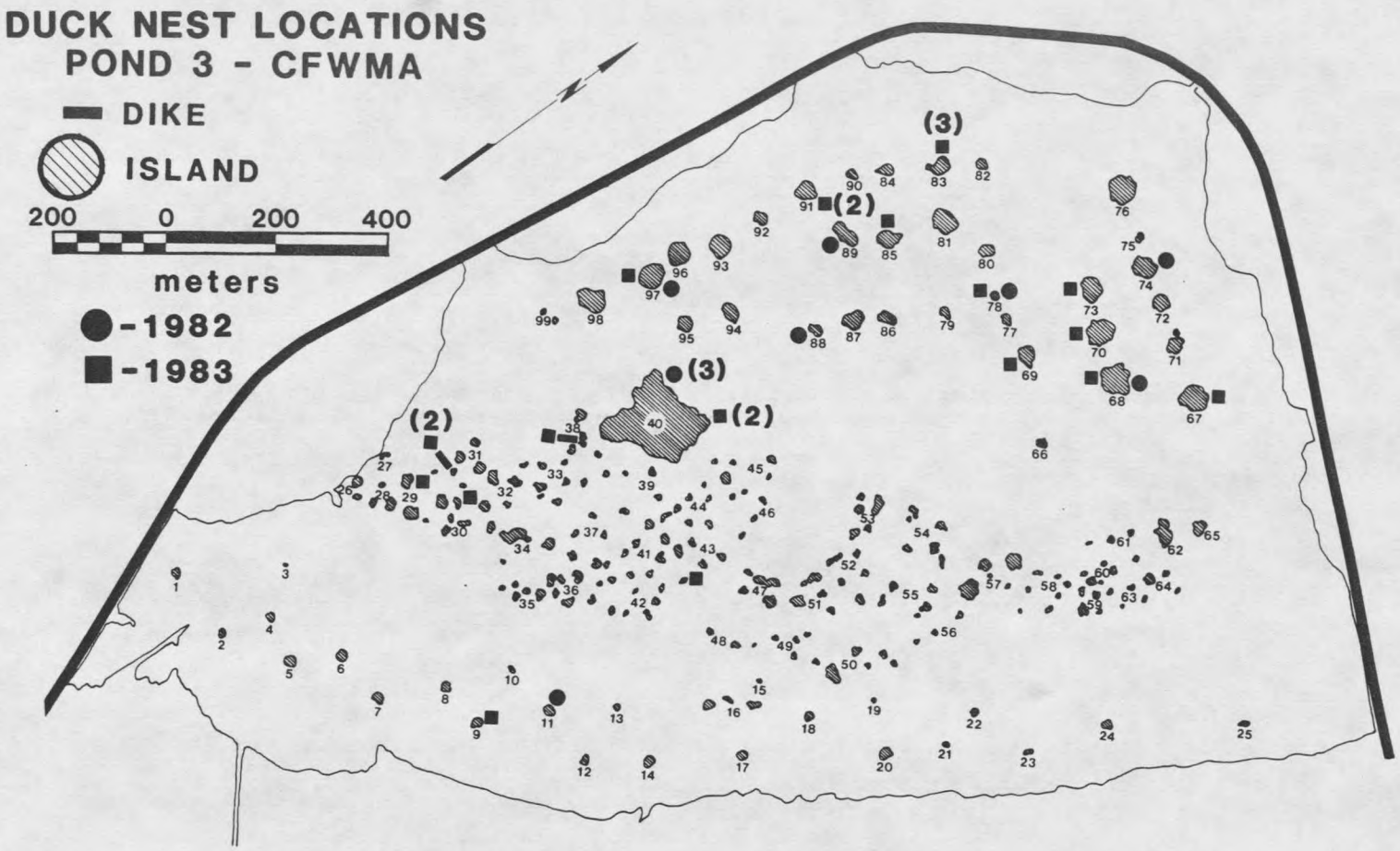

Figure 4. Duck nest locations in Pond 3, CFWMA, 1982-83. Numbers in parentheses indicate if there was more than 1 nest on an island.