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Great Basin Canada Goose Nesting on the Mid-Columbia River, Washington: An Historical Perspective and Update, 1981-1990

Abstract

Nesting of Great Basin Canada geese, *Branta canadensis moffiti*, on 20 islands in the Hanford Reach of the mid-Columbia River has been surveyed since 1953. Nest counts declined from over 300 in 1958 to a low of 108 in 1975. Since then, nest counts increased to a peak of 274 in 1989. The decline in 1960-1975 is attributed to the complete loss of Locke Island as nesting habitat caused by persistent coyote, *Canis latrans*, predation. In the early years, Locke Island alone accounted for 30 to 50% of the nests in the Hanford Reach. The increase in nest counts after 1975 reflects increasing nest density on islands downriver from Locke Island. Downriver islands were historically relatively free from coyotes. In 1989 and 1990, 70% of the nests were on five downriver islands near the city of Richland. The average annual nest count for 1981-1990 was 215. Eighty percent of the nests were successfully hatched. The occurrence of unsuccessful nests was attributed to depredation 8.4%, nest abandonment 7.7%, flooding 2.6%, and 0.5% of the unsuccessful nests had infertile eggs. These observations document year-to-year changes in the island nesting population of Canada geese along the last remaining unimpounded section of the Columbia River in the United States. Population changes are related to the changing environment, including coyote predation, in eastern Washington. These studies demonstrate the value of long-term monitoring in assessing environmental change.

Introduction

The nesting population of Great Basin Canada geese, *Branta canadensis moffiti*, along the mid-Columbia River on the U.S. Department of Energy Hanford Site (Hanford Reach) has been surveyed annually since 1953 (Hanson and Eberhardt 1971, Fitzner and Rickard 1983). This paper updates the survey by reviewing previous trends and providing new information obtained in the years 1981-1990. Prior to 1971, single-pass (once through) plutonium production reactors were operated along the Hanford Reach and released radionuclides into the Columbia River. Once the reactors were shutdown in early 1971, radionuclide concentrations in river water and biota declined (Cushing *et al.* 1981). Radionuclide concentrations in Canada goose eggs were very low in the years following reactor shutdown (Rickard and Sweany 1977, Rickard and Price 1990). Following reactor shutdown, recreational usage of the Columbia River increased, and regulated riverflows became more extreme. Woody vegetation, especially mulberry trees, *Morus alba*, and reed canary grass, *Phalaris arundinacea*, have flourished along the Hanford Reach shoreline (Fickeisen *et al.* 1980, Rickard *et al.* 1982). Dismantlement and cleanup of the old reactor areas is now a major mission of the Hanford Site. Surveys of the nesting performance of Canada geese provide information needed to evaluate population responses to a continually changing riverine environment.

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Study Area

The Hanford Reach of the Columbia River extending upstream from Richland, Washington (Figure 1) is the only unimpounded river segment upstream from Bonneville Dam. The area contains 20 islands that historically have been used as nesting habitat by Great Basin Canada geese. Maps of each of the nesting islands with major vegetation types were presented by Dewaard (1981). Information on the ecology of Canada goose broods in the Hanford Reach were described in Eberhardt *et al.* (1989). Some of the islands have changed vegetatively since 1970, particularly Islands 18, 19, and 20, as a result of raised pool elevations of Lake Wallula, the impoundment created by McNary dam in 1955. Here, the establishment of tree and shrub willows, *Salix* spp., and rank herbaceous species rooted in soil and mud substrates; e.g., reed canary grass have replaced the sparse, shortstatured plant communities rooted in cobble stones and gravels which were adapted to the historical seasonal flooding regime of the free-flowing Columbia River (Fickeisen *et al.* 1980). Accelerated slumping of the White Bluffs initiated by irrigation water seepage from the Columbia Basin Irrigation project has shortened the riverine distance between Locke Island and the bluffs and Island 7 is now connected to the bluffs by a land bridge.

Methods

Islands were searched for goose nests by walking the length and breadth of each. Search team sizes

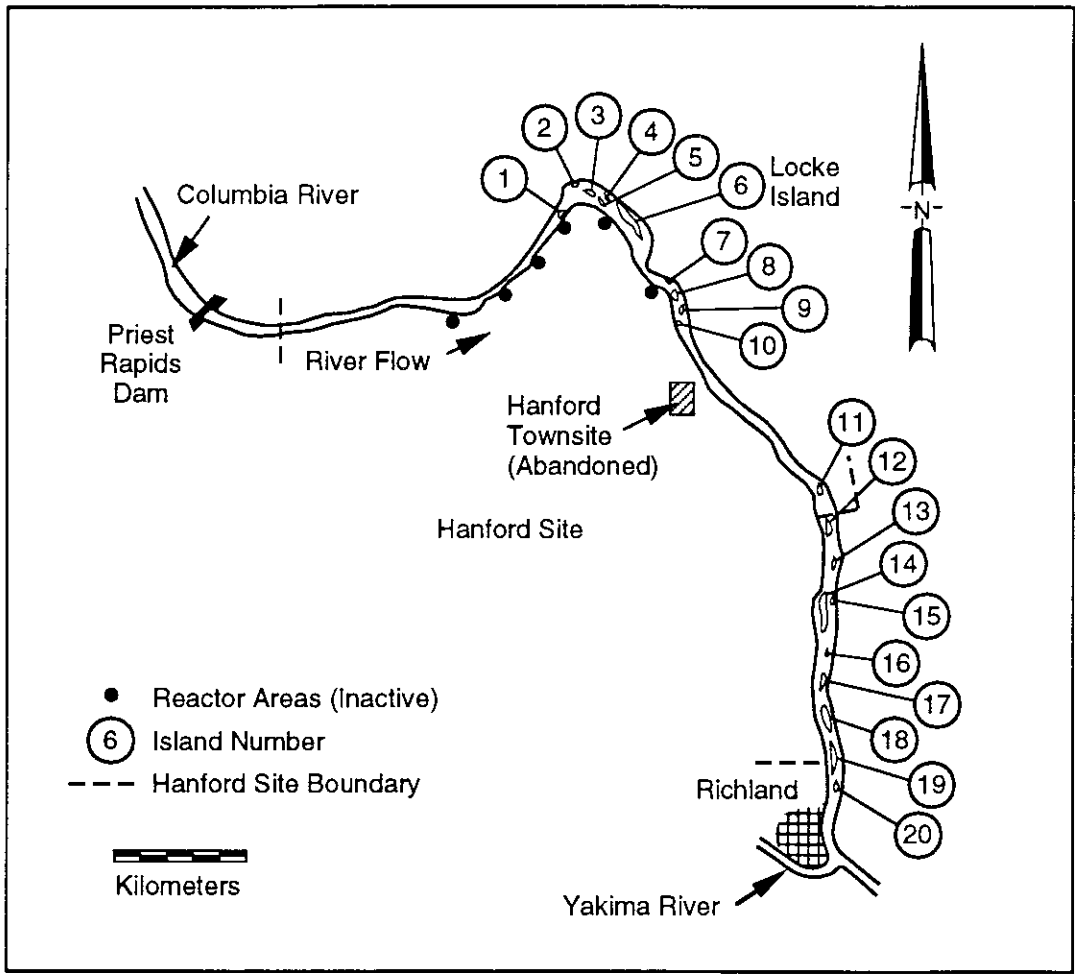

Figure 1. Map of the Columbia River upstream from Richland, Washington showing the distribution of 20 islands surveyed for goose nests. Upriver islands are numbered 1-10, downriver islands are numbered 11-20. Island number 6 is Locke Island.

varied but usually consisted of 2 to 6 persons. Each located nest was marked by an individually numbered willow wand stuck into the ground near the nest site. The location of each nest was described on a field data sheet with notes on substrate and dominant vegetation at each nest. The number of eggs in each nest was recorded. Nests were revisited at 10 to 14 day intervals. Searches were not made on days with inclement weather. A nest was judged to be successful if it contained the residues of egg shells with attached membranes characteristic of newly hatched eggs, filoplumes from natal down, pipped eggs or goslings. Unsuccessful nests were recorded as depredated, abandoned, flooded or as infertile. Eggs in abandoned nests were broken to tell if they contained embryos. Surveys began the first week of April and continued until all nests were accounted for in May.

Results and Discussion

Results of goose nesting surveys for the ten-year period, 1981-1990, are summarized in Table 1. The average number of nests initiated yearly was 215. Numbers tended to increase towards the end of the study period. The lowest count of 166 nests was recorded in 1981 and the highest, 274, was recorded in 1989. The lowest nest count ever recorded was in 1975 when only 108 nests were recorded (Fitzner and Rickard 1983). Since the

TABLE 1. Productivity Measurements of Canada Goose Nests on Islands on the Hanford Reach of the Columbia River, 1981-1990

Year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Average
Total Nests	166	170	236	208	193	173	254	220	274	254	215
Number Successful Nests	144	141	155	147	161	160	193	176	226	205	171
% Successful Nests	87	81	66	71	83	92	76	80	82	81	79
Number Abandoned Nests	17	17	25	17	10	6	36	19	8	11	16.6 (7.7%)
Number Depredated Nests	11	11	38	30	18	0	12	25	24	12	18.1 (8.4%)
Number Flooded Nests	0	0	0	1	0	5	9	0	16	24	5.5 (2.6%)
Fate Undetermined Nests	9	2	12	8	0	0	4	0	0	2	3.7 (1.7%)
Infertile Nests	0	0	6	3	0	2	0	0	0	0	1.1 (0.5%)
Average Clutch Size	6.13	6.15	6.11	5.92	6.06	6.06	6.10	6.18	5.93	5.89	6.05

mid-1970s, nest counts have increased, approaching the peak levels recorded in the 1950s (Figure 2A).

The general decline in numbers of nests from 1959-1975 is attributed to severe coyote, *Canis latrans*, depredation on the 10 upriver islands (Figure 1). For example, in 1957, there were 129 nests on Locke Island. In 1959, coyotes destroyed all 96 nests (Hanson and Eberhardt 1971). Since 1970, coyotes have been persistent if not permanent dwellers on Locke Island making it unacceptable as nesting habitat. Although an active coyote suppression program was practiced along the Columbia River from 1970-1980, by agents of the Washington Department of Wildlife, coyotes still persisted on Locke Island (Fitzner and Rickard 1983). Fitzner and Rickard hypothesized that overall nest counts would not regain the high levels seen in the 1950s unless Locke Island was restored as nesting habitat. This hypothesis proved incorrect as the geese compensated by increasing nesting densities on downriver islands that historically were relatively free from coyote depredation (Figure 2B). In 1989 and 1990, 70% of the goose nests were on five of the downriver islands, 12, 17, 18, 19, and 20 (Figure 1). In the 1950s, Locke Island alone accounted for 30 to 50% of the total nests.

The reasons for high nest depredation by coyotes at upriver islands and fewer incidents on downriver islands are not well understood. Upriver islands are not open to waterfowl hunting during the annual October to January hunting season and, therefore, serve as a refugium from shooting. The downriver islands, 11 to 18 are open to hunting and are heavily used by hunters. The presence of hunters may deter coyotes as the animals are vulnerable while swimming and are likely to be shot when seen on islands used for hunting. Islands 19 and 20 are located within the city limits of Richland where shooting is not allowed. Coyotes are rarely seen in this area of high public use. Distances between the shoreline and individual islands vary with changing water levels daily and seasonally as determined by hydroelectric power demands and availability of runoff in upriver watersheds. River flow and velocity and distance from an island to the river bank may be important factors in determining which islands are visited by coyotes. Unfortunately, little is known about the behavior of coyotes along the Columbia River.

Successful Nests

Although the numbers of nests initiated each year provides information concerning the abundance of nesting geese, the number of successfully hatched eggs indicates the number of young birds actually produced and an assessment of habitat quality. On average, 79.5% of the initiated nests successfully hatched. Only 66% and 71% of the nests initiated successfully hatched in 1983 and 1984, respectively. Increased human activity on the islands associated with a special study of brood ecology during these years (Eberhardt *et al.* 1987) may have been responsible, at least in part, for the

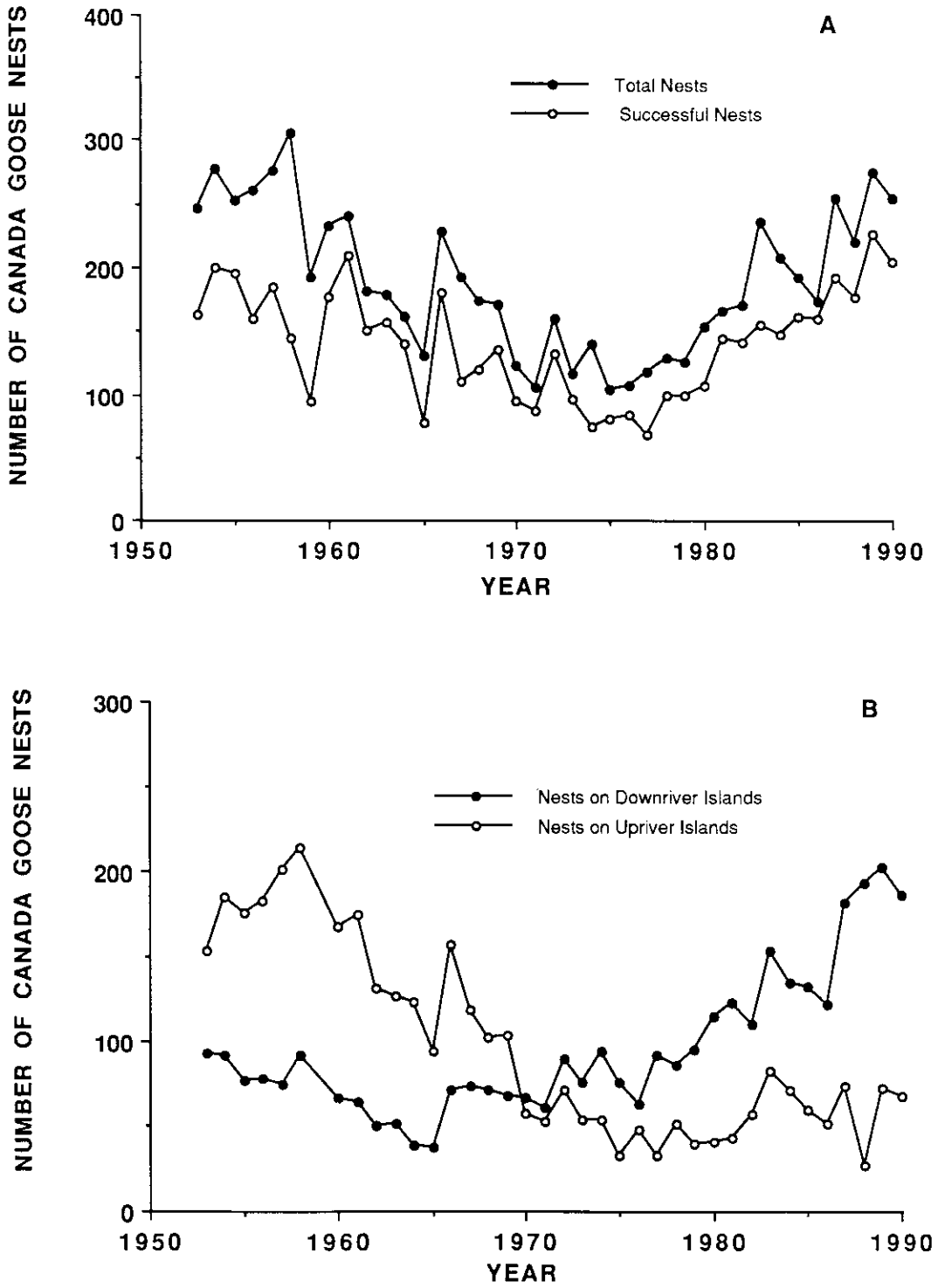

Figure 2. A) Total numbers of Great Basin Canada Goose nests initiated and successfully hatched on islands surveyed, 1953-1990. B) Total numbers of nests initiated on up- and downriver islands, 1953-1990.

lower hatching success. The 79.5% hatching success for the period 1981-1990 is higher than the 71% reported in 1950-1970 (Hanson and Eberhardt 1971) but is only slightly lower than the 82% reported in 1971-1981 (Fitzner and Rickard 1983). McCabe (1979) reported nesting success at 82% for Great Basin Canada geese nesting on the Umatilla National Wildlife Refuge on the Columbia River downriver from Richland. Ball *et al.* (1981) estimated nesting success statewide at 75%. Thus hatching success of Hanford Site nests is similar to other nesting areas in the state.

Unsuccessful Nests

Unsuccessful nests were classified as abandoned by the parent birds, destroyed by vertebrate predators, flooded by river water or failed to hatch because eggs were infertile (Table 1). A few nests were listed as undetermined because they could not be relocated. On average, 8.43% of unsuccessful nests were depredated, 7.74% abandoned, 2.56% flooded and 1.1% failed to hatch because they were not fertile (Table 1).

Although coyotes were responsible for most nest depredation observed in 1981-1990, common ravens, *Corvus corax*, and black-billed magpies, *Pica pica*, depredated some nests. In 1988, all 15 goose nests initiated on island 2 were depredated by ravens. A pair of ravens nested within 0.5 km of the island.

Nest losses to flooding were low during the first 8 years of the 1981-1990 survey period (Table 1). However, the average annual loss increased by a factor of 10 in 1989-1990. Whether or not nest losses by flooding will continue to increase remains to be seen. Nest losses to flooding were generally low in the 1950-1970 period but in 1956, 12% of the total nests were lost to flooding with most losses on upriver islands 2, 6, 8, and 9 (Hanson and Eberhardt 1971). In the 1980-1990 period, nest losses to flooding were mostly on downriver islands 18, 19, and 20.

Unsuccessful nests were abandoned by parent birds for various reasons including human visitations. Although the islands are posted with signs stating that human trespass is prohibited during the nesting season, these signs are not always heeded; for example in 1987, 36 nests were recorded as abandoned (Table 1). Most of these were on island 17. A fisherman accompanied by a free-roaming dog were observed on the island early in the nesting season. This visitation and possibly others are believed to be at least partially responsible for the increased nest abandonment observed on island 17 in 1987.

Clutch Size

The number of eggs laid per nest reflects the reproductive potential of the nesting population. Over the years, average clutch size has increased from 5.5 in 1953-1970 to 5.6 in 1971-1981, and 6.05 in 1981-1990 (Table 1). The increased average clutch size during the past decade may indicate a higher quality environment associated with the shifting of the nesting population from upriver to downriver islands. More attention needs to be paid to this parameter in future studies.

Conclusions

This paper documents several decades of observations on the island nesting behavior and success of Canada geese in the last unimpounded section of the Columbia River in the United States. Goose nesting has clearly shifted from upriver to downriver islands primarily in response to coyote predation. These observations demonstrate the value of long-term monitoring in assessing environmental change and may have implications in the development of management strategies for both predator and prey species.

Acknowledgements

On June 3, 1992, Richard E. Fitzner and Lester E. Eberhardt were killed in an airplane crash while conducting wildlife surveys. From 1970 through 1990, these men performed and supervised the annual goose nesting surveys on the Hanford Reach of the Columbia River. Their absence will be sorely missed. The long-term cooperation of U.S. Fish and Wildlife personnel from the McNary National Wildlife Refuge and biologists from the Washington Department of Wildlife during the goose surveys is greatly appreciated. The participation of many university students, and others that have helped in the surveys over the years is gratefully acknowledged. This work was supported by the U.S. Department of Energy under contract DE-AC06-76RLO 1830 with Battelle Memorial Institute.

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