UNIVERSITY OF MANITOBA

A STUDY OF THE BREEDING HABITAT AND PRODUCTIVITY OF CANVASBACK AND REDHEAD DUCKS IN SOUTHWESTERN MANITOBA AND THE USE OF REMOTE SENSING IN THE INTERPRETATION OF HABITAT

BY

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ABSTRACT

During 1974 and 1975, the nesting ecology and productivity of canvasback (Aythya valisineria) and redhead (Aythya americana) ducks were assessed in southwestern Manitoba. Multispectral remote sensing imagery was tested as a means of identifying canvasback and redhead nesting habitat based on the interpretability of habitat components.

Although canvasback and redhead breeding densities were evenly distributed throughout the study area, pronounced productivity differences were recorded between a 6.4 km^2 study block and a series of roadside transects. Canvasback productivity averaged 1.36 juveniles/pair on the study block and 3.68 juveniles/pair on the transects. Lower canvasback productivity for the study block was attributed to: poor habitat conditions (few semi-permanent and permanent ponds), a high incidence of predation by raccoons (Procyon lotor), and interference by parasitic redheads which reduced canvasback clutch sizes. Reduced redhead productivity on the study block was due to a low number of nest initiations relative to breeding densities coupled with a high incidence of nest desertions.

Canvasback and redhead nesting ecology differed significantly for the following habitat parameters: pond size ($P < 0.01$); pond permanency ($P < 0.01$); emergent vegetation type ($P < 0.05$); and pond nesting potential ($P < 0.01$).

Nesting success for both species increased significantly for nests located on the more permanent ponds ($P < 0.10$), dominated by reed

marsh emergent vegetation ($P < 0.01$) and rated either 'Good' or 'Excellent' in terms of nesting potential ($P < 0.01$).

Wetland habitat parameters were successfully interpreted on Ektachrome (2448) and Aerochrome (2443) imagery. The combination of these two types of imagery enhanced the interpretation of habitat parameters, especially for pond size, pond cover type, emergent vegetation type and pond permanency. The Aerochrome infrared photography was superior to the Ektachrome format for delineating wet areas, land-water boundaries, stressed vegetation and separation between emergent species. Emergents such as cattail (Typha latifolia)/bulrush (Scirpus acutus), whitetop (Scolochloa festucacea)/sedge (Carex atherodes), willows (Salix sp.) and broadleaf forb-rush vegetation had distinctive spectral signatures.

INTRODUCTION

Migratory waterfowl populations have fluctuated at low levels throughout the prairies since the drought period of the late 1950's and early 1960's. Continuing loss of waterfowl habitat to agricultural land use practices and increasing hunting pressure have been primarily responsible for maintaining these low populations (Burwell and Sugden 1964, Kiel et al. 1972). Canvasback (Aythya valisineria) duck populations have not as yet recovered from the decimating effects of the drought (Trauger 1974).

Canvasbacks and redheads (Aythya americana) are diving ducks belonging to the subfamily Aythyinae. Both species are native only to the North American continent. They exhibit similarities in size, appearance, feeding behavior and habitat, particularly nesting habitat.

Two of the key factors affecting waterfowl populations are habitat quantity and quality. To assess these variables extensive field surveys are needed which are time consuming, repetitive, expensive and require several highly trained observers. A relatively new technique, remote sensing, is being tested in wildlife studies. Remote sensing means reconnaissance at a distance with the use of aerial photographs.

There are several possibilities whereby remote sensing can be combined with field studies. Much of the information on habitat quality and quantity could be extracted directly from remote sensing imagery with limited and selected input from field surveys. Field investigations can concentrate on gathering population data at reduced costs.

To utilize remote sensing to its best advantage in assessing habitat quantity and quality for specific waterfowl species, ecological studies must be intricate components of these investigations. Canvasback and redhead nesting ecology in relation to habitat availability, habitat components leading to successful nesting and the productivity of the two species is reported here. The hypothesis tested in this study is as follows: if canvasback and redhead nesting ecology, in particular successful nesting, is identified in terms of physical habitat components, can those components be interpreted and identified from remote sensing imagery.

The objectives of this study were: (1) to investigate the relationship between canvasback and redhead ducks in their use of nesting habitat; (2) to identify habitat components resulting in successful nesting; (3) to assess the productivity of these two species in Canada Land Inventory-Waterfowl Capability Class 2; and (4) to develop an interpretation key from remote sensing imagery for wetland habitat components.

LITERATURE REVIEW

CANVASBACK AND REDHEAD BREEDING ECOLOGY

Distribution of Breeding Populations

Stewart et al. (1958) described the density and breeding range of the canvasback while Delacour (1959) did the same for the redhead. Two-thirds of the canvasback and redhead breeding populations are located in the prairie pothole region of North Dakota, Manitoba, Saskatchewan and Alberta.

Trauger (1974) stated that the canvasback population during the 1950's exceeded 400,000 birds, decreased drastically during the drought of 1959 to 1962 and reached its lowest level during 1971-1972 at less than 200,000 canvasbacks (Figure 1). Redhead breeding populations have averaged 649,000 over the period 1955-74, ranging from a low of 387,000 in 1963 to a high of 927,000 in 1965 (Bellrose 1976).

Breeding Ecology

Intensive studies on the breeding ecology of canvasbacks and redheads have been pursued throughout their breeding range. Hochbaum (1944) assessed the requirements of canvasbacks and determined the significance of territorial spacing on the Delta Marsh of Manitoba. Olson (1964b) compared canvasback and redhead productivity and interactions on three types of habitat in Manitoba (prairie potholes, a large marsh and a lake). Stoudt (1971) studied the habitat requirements of the canvasback during the breeding season in the aspen

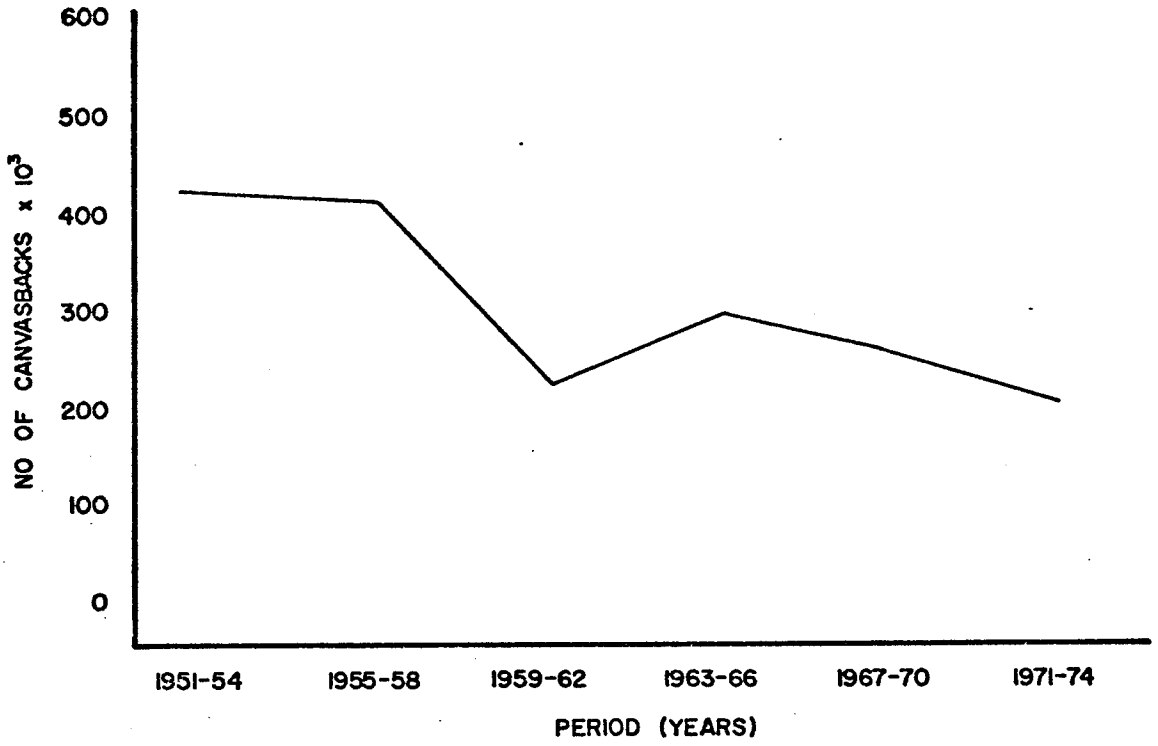

Figure 1. Canvasback populations wintering in the United States, 1951-1974. (Trauger 1974).

parkland of Saskatchewan. Sugden (1978) investigated the relationship between habitat characteristics, canvasback breeding populations and productivity on a Saskatchewan parkland study area. Low (1945) obtained ecological data for the redhead on the lakes, marshes and potholes of Iowa. Lokemoen (1966) studied the breeding behavior, habitat preferences and nesting success of the redhead on the potholes of western Montana. McKnight (1974) documented the nesting ecology of the redhead on the Fish Springs National Wildlife Refuge in Utah.

At Minnedosa, Manitoba, Dzubin (1955) observed that a pair of canvasbacks during the breeding season utilized an area consisting of several ponds. Different ponds were used for feeding, nesting, loafing or as waiting areas by the drakes. A waiting area was defined as a pond, group of ponds or part of a marsh where the drake awaits the hen during egg laying and early incubation. Dzubin (op. cit.) labelled this community relationship of ponds as a "home range" and estimated it to be in excess of 546 ha. (1300 ac.) for a pair of canvasbacks and at least 1344 ha. (3200 ac.) for a pair of redheads. In comparison the home range size for a pair of mallards (Anas platyrhynchos) was 294 ha. (700 ac.), for a pair of blue-winged teal (Anas discors) it was 105 ha. (250 ac.) and Poston (1974) found the home range of a pair of shovellers (Anas clypeata) averaged 32 ha. (76 ac.).

Canvasback and redhead ducks are described as overwater nesters, typically using emergent vegetation as nesting cover. These two species build their nests in clumps of cattail (Typha latifolia) or bulrush (Scirpus acutus) slightly above the water level and firmly attached to the surrounding vegetation (Kortright 1953). Investigations throughout the canvasback and redhead breeding range indicate the preference for

cattail and bulrush cover located in ponds 2 ha. (5 ac.) and less in size (Table 1).

According to Low (1945), ponds smaller than 2 ha. (5 ac.) containing the preferred nesting cover that were at a distance greater than 0.4 km. (.25 mi.) from a larger body of water were not used for nesting. He also noted that nest densities were greatest where 10-25% of the pond contained open water and no nests were recorded where there were no openings. Olson (1964b) found pothole habitat to contain three times as many canvasbacks as redheads while the large marshes held up to five times as many redheads as canvasbacks.

Significant use of willows as a nesting substrate was recorded by Olson (1964b), Smith (1971) and Sugden (1978). Stoudt (1971) attributes high usage of willows as being indicative of high water levels when other preferred nesting cover was flooded.

Dwyer (1970) suggested that the presence of trees bordering the shoreline of a pond could impede the flight of diving ducks thereby discouraging the use of wooded ponds. Though canvasbacks tended to use open ponds to a greater extent than wooded ponds (Stoudt 1971), Sugden (1978) suggested that woody shore growth did not have much influence on pond use by canvasbacks except on very small ponds.

Although most of the literature indicates that canvasbacks and redheads initiate their nests over water, there is some evidence of dryland nesting, (Hochbaum 1944). Keith (1961) recorded that 50% of all redhead nests and 11% of canvasback nests were constructed on dry ground sites. McKnight (1974) documented extensive (72%) dryland nesting by redheads at the Fish Springs National Wildlife Refuge in Utah.

Table 1. Physical Characteristics of Canvasback and Redhead Nesting Ponds.

Preferred nesting cover	Pond size	Species studied	Location of study	Author
Sedge, bulrush, cattail	2.0 ha.	Redhead	Iowa	Low (1945)
Cattail, bulrush, baltic rush		Redhead	Montana	Lokemoen (1966)
Willows, cattail, whitetop	86% < 1.7 ha.	Canvasback	Saskatchewan	Sugden (1972)
Cattail, bulrush, whitetop		Canvasback	Saskatchewan	Stoudt (1971)
Cattail, willows	0.8 ha. or less	Redhead and Canvasback	Manitoba	Olson (1964b)
Cattail, bulrush, whitetop	98% less than 2.0 ha.	Canvasback	Manitoba	Stoudt (1974)
Bulrush, phragmites, cattail		Redhead	Utah	Williams & Marshall (1938)
Cattail, baltic rush		Redhead and Canvasback	Alberta	Keith (1961)
Willows, cattail, sedge		Canvasback	Alberta	Smith (1971)
Cattail	67% < 0.8 ha.	Canvasback	Manitoba	Dzubin (1955)
Bulrush, cattail whitetop	over 0.2 ha.	Canvasback, Redhead	South Dakota	Evans & Black (1956)

Low (1945), Lokemoen (1966), Sugden (1978), Stoudt (1974) and Olson (1964b) obtained water depth measurements at nest sites and found averages ranging from 22.4 cm. (8.8 in.) to 32.3 cm. (12.7 in.).

Factors affecting nesting success

Nesting success of canvasbacks and redheads can be influenced by weather, predation and parasitism. Because these two species prefer overwater nesting sites, flooding or drought conditions can have disastrous effects on nest success. Smith (1971) noted a nest success of 46% in the predrought years of 1952-1958; a 32% success rate during the drought (1959-1963) and a 64% nest success during the postdrought years of 1964 and 1965. Olson (1964b) reported a 22% nest success rate during the three year period 1959 to 1961.

Williams and Marshall (1938) recorded a 26% loss of redhead nests due to flooding at Bear River Migratory Bird Refuge in Utah. In Iowa, Low (1945) found a 56% rate of nesting success and attributed most nest losses to desertion and flooding. He concluded that recession of water from below some nests and the parasitic behavior of redheads caused most desertions. Weller (1959) documented redhead parasitism and found this species to be a semi-parasite, meaning part of the population nested normally, part parasitically and part laid their eggs parasitically early in the nesting season but later nested normally. He considered this an unfavorable trait since an average of only 10 to 15% of redhead eggs hatched successfully in the hosts nest. Olson (1964b) concluded that the amount of parasitism in canvasback nests was directly proportional to the number of redheads in the breeding population. Stoudt (1974) reported that over a 12 year period 57% of the canvasback nests at Minnedosa were parasitized by redheads.

Redhead parasitism on canvasback nests tends to decrease canvasback productivity and increase redhead productivity (Olson 1964b). Joyner (1976) recorded that redhead parasitism significantly reduced egg success of mallard, pintail (Anas acuta) and cinnamon teal (Anas cyanoptera) nests.

Olson (1964b) and Stoudt (1974) considered the raccoon as being the major predator of both canvasback and redhead nests at Minnedosa. They felt that the increasing abundance of this animal may cause a permanent reduction in the productivity of prairie nesting waterfowl. Kiel et al. (1972) suggested that both increased raccoon predation and increased pothole drainage are factors contributing to the decline of the canvasback at Minnedosa. Stoudt (1971) recorded a 68% nesting success for canvasbacks at Redvers, Saskatchewan. He attributed this high level of success to the area being relatively free of raccoons (Procyon lotor).

Cowan (1973) documented the increase and expansion of the raccoon range in Manitoba. He found raccoons to spend 62% of their time in and around potholes during the spring, summer and fall. Raccoon activity was centered on seasonal and semi-permanent wetlands (Fritzell 1978). After extensive investigation of raccoon predatory activities, Llewellyn and Webster (1960) concluded that as raccoon populations increased so did their damage to waterfowl nests.

Smith (1971) noted duck nesting success of 47% at Lousana, Alberta. Predators accounted for 56% of nest losses. He suggested that the high predation rates were influenced by increasing agricultural modifications of the landscape which reduced the amount of nesting cover.

Several authors have questioned and investigated the effects of human disturbance on waterfowl nesting success. Hochbaum (1944) observed that hens flushed from their nests frequently defecated on their eggs, thereby leaving a scent for predators to pick up. Keith (1961) conducted a series of tests with randomly placed chicken eggs. Some were smeared with duck feces, some placed by means of a long pole so that no human tracks led directly to them and others were placed with tracks leading up to them. He found no significant differences for predation rates between the three groups of eggs. Hammond and Forward (1956) were of the opinion that nest markers placed near located nests increased predation rates while eggs scented with duck feces incurred no more predation than those unscented. Stoudt (1974) recorded no appreciable differences in predation between disturbed and undisturbed nests (i.e. flushing vs. non-flushing of the hen from the nest). Olson (1964b) thought that activities of investigators at canvasback and redhead nests were not a major factor in nest success. Hammond and Forward (1956) and Stoudt (1974) concluded, if adequate care was taken when approaching and leaving a nest, losses to predators could be minimized.

Canvasbacks and redhead populations, as well as other waterfowl species, are feeling the effects of the man induced long term drought (Trauger 1974). The demands for increased agricultural production have demanded the reclamation of wetlands. Burwell and Sugden (1964) indicated the extent of pond loss in the United States and Canada. Kiel et al. (1972) monitored the changes in waterfowl habitat in the aspen parkland of Manitoba as influenced by agricultural practices. Canvasback nest destruction or desertion could be caused by plowing, mowing, burning or tree and brush removal from pond edges according to Stoudt