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# BEAVER POPULATIONS AND THEIR RELATION TO WETLAND HABITAT AND BREEDING WATERFOWL IN MAINE

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*Abstract:* The influence of beaver (*Castor canadensis*) trapping on beaver and waterfowl densities and wetland habitat is not well understood, and this information is needed by managers trying to balance beaver densities and harvest and complaints of nuisance beaver with the abundance of wetlands and waterfowl. During 1988–92 in south-central Maine, we determined the density of beaver colonies and beaver harvest, wetland characteristics, and density of breeding pairs of waterfowl on a 111-km² site recently closed to beaver trapping and a similar site open to trapping. Density of beaver colonies increased from 0.15 to 0.32/km² (113%) on the untrapped site but changed little (0.19–0.20/km²) on the trapped site. The number of beaver dams maintained by beaver and the density of beaver colonies were correlated on the untrapped site ($r = 0.99$, n = 4, $P = 0.009$) but not on the trapped site ($r = -0.18$, n = 4, $P = 0.820$). Number of wetlands was correlated with the density of beaver colonies during 1989–92 on the untrapped site ($r = 0.92$, n = 4, $P = 0.081$) but not on the trapped site ($r = -0.13$, n = 4, $P = 0.875$). Total surface area of water on the untrapped site increased from 115 to 158 ha (36%); surface area of water remained stable on the trapped area. Species of waterfowl that increased on the untrapped site included Canada geese (*Branta canadensis*) (4–9/100 km²), hooded mergansers (*Lophodytes cucullatus*) (23–29/100 km²), and mallards (*Anas platyrhynchos*) (7–12/100 km²). Numbers of wetlands used by pairs of each species of waterfowl increased on the untrapped site. Overall, a ≥1-year closure of beaver trapping is sufficient to increase the density of beaver colonies, whereas a 2–3 year closure is necessary to increase wetland habitat. More than 3–4 years may be required to begin influencing the density of waterfowl and number of wetlands used by waterfowl.

*Key Words:* *Anas platyrhynchos*, *Anas rubripes*, beaver, black duck, *Branta canadensis*, Canada geese, *Castor canadensis*, hooded merganser, *Lophodytes cucullatus*, Maine, mallard, trapping, waterfowl, wetlands

## INTRODUCTION

Beaver (*Castor canadensis* Kuhl) are a primary influence on wetland creation, hydrology, and dynamics in North America (Naiman et al. 1988, Johnston and Naiman 1990). Beaver-created or influenced wetlands are attractive to a variety of wildlife species (Beard 1953, Hodgdon and Hunt 1955, Grover and Baldassarre 1995).

Waterfowl use beaver flowages because they produce an abundance of invertebrates (Reinecke and Owen 1980, McDowell and Naiman 1986) that provide protein for breeding pairs, nesting females, and young ducklings (Reinecke 1979). Also, beaver-impounded wetlands offer interspersion of cover and wa-

ter for isolation of territorial pairs (Ringelman and Longcore 1982) as well as brood-rearing habitat (Beard 1953, Hepp and Hair 1977, Ringelman and Longcore 1982). Flooding of timber increases structural diversity of wetlands, provides protection from predators, and creates nesting sites for cavity-nesting waterfowl (Hepp and Hair 1977). Creation and abandonment of wetlands by beaver provide natural changes in water level that influence rates of decomposition and release of nutrients, which stimulate plant growth and invertebrate production (Weller 1981). The relationship between beaver and American black ducks (*Anas rubripes* Brewster) is of particular concern because black duck numbers have declined since 1955 (Spencer 1979) and loss and degradation of wetland habitat may be a possible cause of this decline (Kirby 1988).

Despite their benefits to wetland dynamics and wildlife, beaver may damage property, and recreational trapping is the most cost-effective method for control of beavers (Purdy and Decker 1985). However, trapping may suppress populations and thus limit wetland habitat for wildlife (Knudson 1962, Ermer 1984, Gibbs et al. 1991). However, the influence of beaver trapping on beaver and waterfowl densities and wetland habitat is poorly known, and this information is needed by managers.

We conducted our study on a site recently closed to beaver trapping and an site open to trapping. On both study sites, the objectives were to (1) determine yearly changes in density of beaver colonies, (2) monitor annual numbers and morphology of wetlands, (3) examine the annual change in area of lifeforms of wetland vegetation, and (4) compare these data to annual changes in the density of breeding pairs of selected waterfowl species. We used waterfowl as an indicator of the influence of beaver on wildlife, although beaver create habitat for a diversity of wildlife species.

## STUDY SITES

We chose two 111-km$^2$ study sites in south-central Maine. From 1988 to 1992, the Dixmont Site was closed to trapping (untrapped site) and the Montville Site was open to trapping (trapped site). The untrapped and trapped sites have similar topography, are 12 km apart, and the former has a history of waterfowl studies (Ringelman 1980, Ringelman and Longcore 1982, Diefenbach and Owen 1989). The untrapped site was contained primarily within a single watershed, whereas the trapped site covered portions of 3 other watersheds. Both sites had numerous wetland complexes that were created or modified by beaver.

Upland areas at both sites were dominated by mixed, coniferous, and deciduous forests. Upland deciduous vegetation included birches (*Betula* spp), northern red oak (*Quercus rubra* Linnaeus), red maple (*Acer rubrum* Linnaeus), sugar maple (*A. saccharum* Marsh.), and trembling aspen (*Populus tremuloides* Michaux). Coniferous species included balsam fir (*Abies balsamea* Linnaeus), eastern hemlock (*Tsuga canadensis* Linnaeus), eastern white pine (*Pinus strobus* Linnaeus), and spruces (*Picea* spp.). Small-scale logging operations occurred on both sites, as did agricultural activity, mainly hay and corn.

The untrapped site (closed to trapping during our study) was comprised of portions of 4 townships; at least 70% of the area within the site was open to trapping each year for 10 years prior to the study. Townships are used as management units for beaver in Maine. The trapped site was closed to trapping in 1981, had a trapping season of 1–2 months between 1981 and 1984, and a 2-month season from 1985 to 1992. The untrapped site was closed to beaver trapping from March 1988 to December 1992. The trapped site remained open to trapping from 1 January to 28 February each year. Pre-closure data on beaver, wetlands, and waterfowl were available for the untrapped site for 1986 and 1987 but were not available for the trapped site, except for the density of beaver colonies in fall 1988.

## METHODS

### Beaver

On the untrapped site, we determined the density of active beaver colonies by ground-checking wetlands for evidence of beaver during July–August 1986–87. From 1988 to 1992, we determined the number of active lodges on both study sites by (1) an annual census (1–15 November) of active beaver lodges using a fixed-wing aircraft (Payne 1981), (2) an inspection of each lodge from the ground to verify activity, and (3) live-trapping beaver (25% of the lodges in fall of 1988, 50% in 1989, and 100% from 1990 to 1992).

On the trapped site, we determined the percent of lodges trapped each year. We contacted all trappers to verify harvest, and we compared the annual harvest of beaver to the mean pelt price of beaver each year (K. D. Elowe, Maine Dep. Inland Fish. Wildl., unpubl. data). Mean pelt price was calculated from monthly (Oct–Mar) surveys of Maine furdealers.

From July–December 1989–92, we classified the condition of the main beaver dam on all wetlands. We classified dams as (1) maintained by beaver with good water-holding ability, (2) unmaintained but holding some water, and (3) unmaintained dams having little water-holding ability.

On the trapped site, 3 large (10–50 ha) lacustrine