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# MANAGEMENT OF NATIONAL WILDLIFE REFUGES IN THE UNITED STATES: ITS IMPACTS ON BIRDS

National Wildlife Refuges administered by the U.S. Fish and Wildlife Service, Department of Interior, occur in 49 of the 50 states and encompass more than 13,678,860 ha. While much of the present refuge system was acquired for management of migratory waterfowl, refuges have been acquired for preservation of "endangered" species ranging from Whooping Cranes (*Grus americana*) to the Dusky Seaside Sparrow (*Ammospiza nigrescens*). Refuges have been acquired through withdrawal from the public domain, donations, outright purchase, leases, easements, and acceptance of lands administered by other agencies. Consequently due to the diversity of habitats and species, origin, location, etc., National Wildlife Refuges have different values to different interest groups. Despite having wildlife-oriented missions, some refuges have been managed for grazing, recreation such as boating, lumber products, commercial crops, etc. with frequent adverse effects on achieving desired wildlife objectives. Multiple and single uses of refuges contrary to initial objectives when refuges were acquired have resulted in internal and public criticism. These problems coupled with inadequate funding and staffing have led to outside review of the overall system (Leopold 1968). More recently intense dissatisfaction with the U.S. Fish and Wildlife Service's (USFWS) "management by objectives" approach to budgeting (resulting in no program specifically for refuges, continued inadequate funding of the refuge system, and a host of other alleged problems) has led to much internal and public commentary on the desired future of the refuge system. These problems led to preparation of draft and final environmental statements concerning operation of the National Wildlife Refuge System (USFWS 1976b). During 1976 and early 1977 The Conservation Committee of The Wilson Ornithological Society solicited comments on and reviewed major practices on National Wildlife Refuges. The complexity of the refuge system, funding restraints, inherent operational problems, legislative authority, etc. were such as to overwhelm the Committee. Consequently it was decided to identify major practices on refuges affecting birds that could conceivably be altered to enhance avian habitats and populations. The report relies heavily on the waterfowl literature as data concerning raptors, colonial waterbirds, and other non-game birds on refuges were generally not available.

## HISTORICAL PERSPECTIVE

President Theodore Roosevelt, by executive order on 14 March 1903, set aside Pelican Island as the first federal bird refuge. By the end of his first term in 1904, Roosevelt had created 51 wildlife refuges in 17 states and 3 territories. The Weeks-McLean Bill, attached as a rider to the Agricultural Appropriations Bill and signed unknowingly by outgoing President William Howard Taft, gave the federal government authority over migratory birds in March 1913. The intent of the Weeks-McLean Law, considered an unconstitutional invasion of state's rights, was given added authority by the Migratory Bird Treaty between the United States and Great Britain (for Canada) in 1916. Then, in 1918 Congress passed and President Woodrow Wilson signed the Migratory Bird Treaty Act.

The various treaties and laws were regulatory and, although migratory species responded with increased numbers for a time, it became clear that long-range problems and solutions were in protection of habitat. Refuges established by executive order were too few and scattered to insure the future of migratory species. The first attempt to

launch a program came in 1921 with bills that would establish a refuge system, a Migratory Bird Refuge Commission, and a one-dollar federal hunting stamp. Labeled as a "duck slaughter" bill, it failed 4 times in Congress. Finally, in 1929, a bill passed, but only after stripping it of any shooting ground provisions and the federal hunting stamp. It was to be funded with Congressional appropriations.

Concern for migratory species, especially waterfowl, increased as their numbers declined with the drought of the 1930's. Congress failed to appropriate funds for the refuge system authorized in 1929. As a result of increasing concern, the federal hunting stamp proposal was revised and finally passed in 1934. With a source of revenue and the leadership of Jay "Ding" Darling, the National Wildlife Refuge System advanced from a few scattered units to the system of 367 refuges that we have today.

Legislative authority, executive orders, and international treaties have given the federal government responsibilities for all species occurring on refuges. These range from elk (*Cervus canadensis*) on the National Elk Refuge in Wyoming, to the endangered Whooping Crane on the Aransas National Wildlife Refuge (NWR) in Texas. But, for all these responsibilities, the refuge system's major focus and objective has been the preservation and management of waterfowl. At the fiscal year 1974 level, 276 (75%) of all refuges were managed specifically for waterfowl production, migration, or wintering. Wildlife and Game Ranges and Big Game Refuges have principally been established by withdrawals from the public lands. Over 9.5 million hectares in 24 units are in this category. On 68 refuges, encompassing over 1.6 million hectares, management must be directed toward certain species of colonial nesting birds.

Maintenance of the National Wildlife Refuge System has not kept pace with the early interest shown in its establishment. During the system's expansion more than 11,000 people were engaged in developing critical wildlife habitat. But, this support was not so much for the refuges and their wildlife, as it was for the Civilian Conservation Corps and the jobs it created during the Depression. Recently, USFWS Director L. A. Greenwalt testified, "The National Wildlife Refuge System, as with most activities of our Service, has been underfunded for some time. The consequences are evident in facilities which are inadequate and poorly maintained. Too few people are available to do a proper job of refuge management." Much needed funding and personnel for the refuge system have been diverted to new responsibilities—energy research and development, wilderness studies, Youth Conservation Corps, endangered species, and marine mammals. These activities have not been funded on their own merit, but at the expense of the National Wildlife Refuge System. During the 1975 fiscal year, refuge field operations were funded at about $20 million, $7.1 million less than the 1970 funding level. The USFWS has estimated that, to fully develop the entire system to provide optimum wildlife and public benefits, $170 million would be needed. To maintain that level of operation, an additional $34 million and 2000 man-years of labor would be needed annually. The Carter administration has recommended a 30% increase in the level of funding for the USFWS. It proposes additional personnel ceilings under the Bicentennial Land Heritage Program.

## MAJOR REFUGE MANAGEMENT ACTIVITIES THAT AFFECT BIRDS

### Grazing

According to the Final Environmental Statement on the Operations of the National Wildlife Refuge System (USFWS 1976b), in Fiscal Year 1974 (1 July 1974–30 June 1975) 740 grazing permits were issued to private citizens for approximately 526,110 ha

of refuge land. These 740 permittees used 354,589 Animal Unit Months (AUM's). Grazing occurred on 103 refuges in 36 states, using 4% of the total area on National Wildlife Refuges. Areas grazed in addition to rangeland included native wet meadows and riparian sites which are used extensively by nesting waterfowl and other birds.

The number of hectares grazed in each flyway were: Atlantic—5,947, Mississippi—10,360, Central—158,321, and the Pacific—331,887. In addition, about 6475 ha were grazed in Alaska. Forty-five percent of the 1,157,235 ha of rangeland in the system were used by cattle. Nearly 70% of the total grazed area occurred in 3 states: Montana (8 refuges), Nevada (5 refuges), and Oregon (4 refuges).

Although a logical assumption would be that the high grazing use in the Pacific Flyway mostly occurs on big game refuges, such as Hart Mountain NWR, Oregon, Sheldon NWR, Nevada, and National Bison Range, Montana, such is not the case. Malheur NWR, Oregon, a waterfowl and waterbird production area, had 98,502 AUM's in 1974–75, or 27.8% of the national refuge AUM total. Hart Mountain NWR had only 11,000 AUM's or 3.1% of the national total. Sheldon NWR, which is considered overgrazed, had 24,000 AUM's (6.8%) while the National Bison Range had no cattle grazing.

The present USFWS policy is that grazing and haying programs be used to manipulate vegetation to maintain or increase wildlife productivity and species diversity over a sustained period of years at minimal cost to the government, and that grassland habitat should be maintained for the primary benefit of wildlife populations. Grazing and haying activities may be permitted to enhance, support, and contribute to established wildlife management objectives, but must not conflict with those objectives (USFWS 1976b). Unfortunately, when grazing is allowed, the USFWS frequently loses control of local situations due to intense political pressure at all levels of administration.

At least 55 waterfowl studies have shown that grazing is detrimental to waterfowl production. Only one study reported higher success on moderately grazed areas than on idle areas (Burgess et al. 1965). Anderson (1957) reported that 42.2% of the 116 nests on idle land in California hatched, while none of 7 on grazed land hatched. Glover (1956) found 24.4% nesting success on idle land and lightly grazed areas in Iowa, compared with 10.5% success on moderately and heavily grazed areas. One study had nest losses of 80% in light cover, compared with 29% in dense cover (Schranck 1972). Weller et al. (1958) reported that the effect of cattle grazing on vegetation in Utah was as serious as the lack of water. On Malheur NWR, Oregon, Greater Sandhill Crane (*Grus canadensis tabida*) nesting success in 1976 was 54.6% in mowed-grazed, 63.6% in mowed-ungrazed, and 84.2% in unmowed-ungrazed areas (C. D. Littlefield, unpubl. data).

Grazing was reduced sharply in some regions of the United States after a memorandum was released 22 December 1972 from the Director, USFWS. It stated "Recent research at the Northern Prairie Wildlife Research Station at Jamestown, North Dakota, indicates that haying and grazing are incompatible with upland nesting duck and ground nesting bird objectives. . . . While the recommendations apply primarily to the north central region of the United States and the southern Prairie Provinces of Canada, application of these practices on refuges in other geographic areas have demonstrated similar favorable response by waterfowl and other ground nesting birds."

In North Dakota, AUM's were reduced after this memo, but by 1975 had increased, with additional increases planned in the future. At J. Clark Salyer NWR, North Dakota, three-quarters to 1 AUM per acre (.4 ha) was used in 1976 (total 2600 AUM's), but present plans are to increase the use to 2 AUM's per acre. Other examples in North Dakota include Arrowwood NWR with 435 AUM's in 1971; 1109 in 1975; and 1650

projected for 1979. Upper Souris NWR had 2348 AUM's in 1971; 2348 in 1975; and 5634 are projected for 1979.

The most serious grazing problems on National Wildlife Refuges appear to occur in Oregon and Nevada because of local political pressure with over- or untimely grazing being typical of most western refuges. Examples given are but a small sample of the problems associated with this management "tool."

In 1948 on Malheur NWR, waterfowl production was 150,000 ducks, but in 1974 only 21,300 were produced. In 1948 AUM's were 74,385, increasing to 101,726 by 1951. In 1961 and 1971 AUM's were 122,404 and 123,807 respectively. As AUM's increased duck production decreased. From 1962 to 1972 the average number of ducks produced annually was 29,600. Mallards (*Anas platyrhynchos*), which are dependent on residual vegetation from the previous year for nesting cover, declined from 50,000 produced in 1949 to 2,120 in 1974. Some changes in grazing practices are presently occurring at Malheur. By 1975–76 AUM's had been reduced to 88,221. After considerable pressure from environmental groups in 1976, AUM's were reduced to 65,828. In addition, 1712 ha were mowed for hay. By 1977, 8782 ha were in "non-use," compared with 263 ha in 1962. At Malheur NWR the grazing program requires over 338 km of internal fences. In 1976, to protect river banks and dikes from severe cattle trampling, several km of additional 3-wire fences were placed between heavily grazed areas and canal and river banks. These new fences have resulted in many Sandhill Crane (*Grus canadensis*) pairs having their traditional territories bisected with barbed wire. Obviously, grazing in this situation does not enhance refuge objectives but instead creates conflicts with adverse effects on bird populations.

Wildlife collisions with fences are common. Mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), and numerous birds have been killed flying into or becoming entangled in fences. Greater Sandhill Cranes have been killed at Malheur and Grays Lake NWR, Idaho. Flightless young Whooping Cranes became entangled in barbed wire fences on a number of occasions at Grays Lake NWR, in 1975. One young Whooping Crane died in 1976 near Monte Vista NWR, Colorado, after colliding with a fence. At Red Rock Lakes NWR, Montana, several moose (*Alces alces*) calves have died from injuries sustained after becoming entangled in fences. At times, simple modification of fences can be beneficial. While over 20 km of interior fences have been removed at Grays Lake NWR, virtually all of the remaining fences have been modified from 4–5 to 3 wires. This has greatly improved movements of young cranes. Of importance is the obvious fact that fences have little value for wildlife. They are expensive and are placed on refuges primarily to enhance livestock grazing.

On many refuges, power lines transect nesting areas or bisect principal flight paths. Some of these power lines bring electricity to pumps that supply water for cattle. Power lines are a major mortality factor for swans, cranes, eagles, and other large birds. At Bosque del Apache NWR, New Mexico, aircraft markers have been placed on lines and some lines have been buried. Mortality has been dramatically reduced. On other refuges either the pumps should be removed or power line markers should be placed at strategic locations in wildlife use areas. Preferably the lines should be removed or buried.

At Stillwater NWR, Nevada, the USFWS operates the refuge with a cooperative agreement between the Bureau of Reclamation, Nevada Fish and Game Department, and the Truckee-Carson Irrigation District. Much of the 90,653 ha refuge is unfenced and cattle move onto the area freely. On the portion that is fenced, grazing is permitted for 11 months annually; total refuge AUM's is 15,000. Refuge areas are leased from the Bureau of Reclamation by the local irrigation district. Refuge personnel collect AUM

fees, issue permits, and count livestock on and off the refuge. In return, all fees collected are given to the irrigation district. Most grazing is determined by the district and attempts to reduce AUM's have failed (one permittee is a member of the irrigation district board).

Napier (1974) in his recommendation for Stillwater Marsh, stated "Grazing was used as a tool for opening up shorelines overgrown with dense stands of cattail and bulrush in Stillwater Marsh's early history. The result was increased duck production. Now, poor water conditions have resulted in a downward trend or elimination of emergents on some impoundments. Management is now aimed at encouraging emergent aquatic growth. Livestock grazing in the marsh is detrimental in this respect, for cattle heavily graze the emergent vegetation." Because the Bureau of Reclamation, a sister agency of the USFWS in the Department of Interior, owns the land, methods should be investigated to solve not only the grazing problems, but also the water deficiencies that presently exist on the refuge. Stillwater NWR is unique in that it provides marshland habitat in an area that has few wetlands.

Summer grazing continues, although at a greatly reduced level from 1975 and 1976, on Grays Lake NWR, Idaho, even though the endangered Whooping Crane is presently being introduced by transplanting their eggs into Greater Sandhill Crane nests. In 1975 two young Whooping Cranes disappeared within 2–3 days after large numbers of cattle were introduced into areas occupied by these chicks.

Improvements have been made on some refuges. Hart Mountain NWR, Oregon, began reducing AUM's in 1969 and in 1976 (11,000 AUM's) the number of pronghorn antelope young per 100 does was 59. On Sheldon NWR, Nevada (24,000 AUM's), immediately south of Hart Mountain NWR, the young-adult ratio was only 22/100 (E. McLaury, pers. comm.). Present plans are to reduce the number of AUM's at Sheldon.

At Bosque del Apache NWR, New Mexico, all grazing has been terminated. All internal fences have been removed and many pastures which had been "improved" for cattle have been converted to wildlife food crops or man-made marshes. Wintering Snow Geese (*Chen hyperborea*) have increased from a few hundred to over 21,000 in the past 10 years and Greater Sandhill Cranes have increased from 3200 to over 12,000.

At Ruby Lake NWR, Nevada, grazing occurs from 15 April through 1 January. Present plans are to reduce the 5200 AUM's by one-half. Wildlife changes that occur in the deferred and hayed-only areas will be monitored and compared with those in areas that continue to be grazed.

At Red Rock Lakes NWR, Montana, the management announced to local stockmen that there would be a 10% reduction annually in AUM's over a 5 year period. Surprisingly, little opposition was encountered and the program is in its third year, with AUM's now 30% fewer than the original 13,144.

Prescribed burning has been used in grassland management to maintain desired successional stages. To avoid the cost of fencing, issuance of permits, soil erosion, overfertilization (affecting water quality), and other aspects of grazing programs, burning could be used to accomplish the same objectives. This would also prevent the refuge system from becoming more involved with and influenced by local stockmen, grazing associations, and political pressure (Voight 1976).

**Haying**

In 1974–75, 16,714 ha were mowed for hay but ungrazed by 589 permittees on National Wildlife Refuges. In comparison with grazing, haying generally creates only minor conflicts with wildlife management. The 3 major grazing states had minimal hay acre-

ages in 1974–75. The Central Flyway was most important, with refuges in North Dakota (4521 ha) and Nebraska (4185 ha) being leaders in this practice (USFWS 1976b).

In some situations haying can be beneficial. Native grasslands that receive flood water in late spring can be mowed to discourage early nesting species. In areas with limited water supplies, channels can be mowed to allow for rapid water movement. Data from Malheur NWR, Oregon, have shown that Greater Sandhill Cranes, Canada Geese (*Branta canadensis*) and some species of ducks, feed and loaf in mowed areas, but prefer to nest in unmowed areas.

The major conflict with mowing is the time of year when it begins. Interviews with mower operators on private land in southeast Oregon in 1976 indicated high mortality of young birds from 1 to 15 July. Two operators estimated they had killed between 400 and 600 birds during this 2-week period. Most of these were shorebirds, but numerous waterfowl nests, young ducks, and crane chicks were also reported destroyed. One operator stated that he had killed 2 pronghorn antelope young in 1975. On Malheur NWR, 4.2% of the Mallards hatch after 16 July. Other species and hatching percentages are Gadwall (*Anas strepera*) 14.5%, Cinnamon Teal (*Anas cyanoptera*) 15.0%, and Redhead (*Aythya americana*) 13.4%. Many newly hatched broods are seen after 1 August. Younger Greater Sandhill Cranes suffer high mortality from mowing, especially early in the season. Young cranes lie down and hide in vegetation when approached and remain hidden until hit by the mower. Recently at Malheur NWR, haying has been delayed until 10 August to allow cranes time to fledge. In some areas on the refuge where flightless young are known to occur, mowing has been delayed even longer.

Many refuges begin mowing activities in July, with some possibly as early as late June. Until recently Medicine Lake NWR, Montana, initiated mowing on 15 June. Because of political pressure from one permittee, it was about 8 years before mowing was terminated after it was publicly announced that it was to be stopped within 2 years.

Data collected at Malheur NWR is potentially applicable to other waterfowl production areas. Refuges that allow mowing before 1 August are contributing to substantial losses of wildlife. Biological data on the effects on wildlife should be collected on refuges that have early mowing programs. To alleviate losses, haying should be delayed until 15 August. It is important to note that virtually no data are available regarding the impact of haying (or grazing) on other ground nesting birds.

**Farming**

Farming for production of cereal grains for waterfowl use has long been a major endeavor on many refuges. Other crops (including oranges!) are sometimes grown. In 1974 at least 131 refuges farmed about 65,966 ha (USFWS 1976b). Primary reasons for farming on refuges relate to providing supplemental foods for waterfowl during migration and wintering periods and for preventing crop damage outside refuge boundaries. The latter has not been overly successful when the large concentrations of waterfowl, especially geese, cranes, and ducks on some refuges are considered. Farming practices on refuges have been successful in concentrating birds, frequently too much so as witnessed by problems with shortstopping birds before traditional wintering areas are reached, crop damage problems adjacent to refuges, hunter firing lines leading to such problems as lead-poisoning dieoffs and slob behavior of hunters, and outbreaks of density dependent diseases such as fowl cholera and duck viral enteritis. Possible negative side effects of farming on National Wildlife Refuges may result from crop associated use of pesticides and herbicides.

In the near past many refuges were evaluated on number of days of use they provided

for waterfowl. Consequently the pressure was to show yearly increases in numbers of waterfowl using areas over longer time intervals. It is now recognized by some refuge managers and administrators that these goals were not beneficial to the waterfowl resource. Consequently, amount of land farmed on some refuges is decreasing with diversification from cereal grains becoming apparent. Goals of refuges should be reevaluated. It is probable that having the bulk of individual populations of birds on one refuge for long periods, such as is common with geese, is not healthful for the birds or beneficial to the overall management of the resource. Diversified and well dispersed refuges, especially in migration and wintering areas, are most desirable.

**Timber management**

Management of timber for the lumber and pulp industries on National Wildlife Refuge lands occurred on 21 refuges, primarily in the southeast and northeast in 1974. These 21 refuges reported a timber harvest from 12,141 ha (USFWS 1976b). While this may be a small portion of the overall refuge system, impacts on some refuges are extensive. As an example of the magnitude of these activities, the annual operating budget for Noxubee NWR, Mississippi, has in recent years been about $110,000, yet this 13,760 ha refuge has sold up to $250,000 worth of timber per year. The income goes into the Federal Treasury and does not come back to the refuge system. Timber management and some economic gain from the forests on National Wildlife Refuges is not inherently bad. The extent and type of management may be. For example, the USFWS slogan used to characterize timber management on southern National Wildlife Refuges is "all-age management in even-age units." This is a euphemism for clear-cutting. A booklet describing this management system on Noxubee NWR states: "The highly productive alluvial soils (growing mostly hardwood) are managed under a long rotation (120 years) and a frequent cutting cycle (15 years). The rotation age for upland areas (including both pine and hardwood) is 80 years, and a cutting cycle is 10 years." Thus, "all-age management" allows some hardwoods to grow to the age of 120 and some pines to grow to the age of 80. If such a plan was truly for "all-age" management, the rotation cycle should be based on the natural potential longevity of the trees involved. Sizes of clearcuts are stated in USFWS brochures to be limited to 12 ha though refuge foresters admit that some cuts approach 20 ha. Aside from rotation ages and sizes of cuts, there is enough controversy over the ecological effects of clearcutting (decreased diversity, etc.) that this practice seems inappropriate for management of a National Wildlife Refuge. In short, the forests of National Wildlife Refuges in the southeast are being managed to maximize economic return at the expense of those wildlife species such as Red-cockaded Woodpeckers (*Picoides borealis*) which require more mature forests. An important component of the southern forest ecosystems is being lost.

**Predator control**

Few data are available on predator problems on National Wildlife Refuges. In 1972 predator control through use of toxicants was discontinued on most public lands. Unfortunately, few comparative data were collected before 1972, and on most refuges little has been collected since 1972.

It is possible that many refuges have only minor predation problems, but some have high predation rates. Data have been collected on Greater Sandhill Cranes on Malheur NWR, Oregon, since 1966. After predator control through poisoning was terminated in 1972, production was greatly reduced from 1973 through 1975. From 236 pairs that nest on the refuge, only 2 young fledged in both 1973 and 1974. In 1975 only 17 fledged.

Common Ravens (*Corvus corax*) and raccoons (*Procyon lotor*) were the major egg consumers, while coyotes (*Canis latrans*) took eggs and young. In the winter of 1972–73 the black-tailed jackrabbit (*Lepus californicus*) population sharply declined and coyotes moved onto the refuge to find alternate food sources. One pond where more than 300 young Canada Geese were captured and banded in 1972 produced only 28 in 1973. It was not uncommon during mid-day in August to observe more than 45 coyotes along one 68 km road through the refuge. Coyotes normally cause only minor problems on Malheur when jackrabbit numbers are high. However, Common Ravens find ideal conditions in southeast Oregon. Numerous rimrocks provide nesting sites and the cattle industry and nesting birds provide an abundance of food. One roosting site on Malheur Lake in 1976 was being used by more than 800 ravens.

Two noteworthy predation incidents were documented in 1976. At Crescent Lake NWR, Nebraska, 2 of 5 Trumpeter Swans (*Olor buccinator*) that were to be released in 1977 were killed by raccoons or coyotes, and 26 Greater Sandhill Crane nests including 3 that contained transplanted Whooping Crane eggs, were destroyed by coyotes at Grays Lake NWR, Idaho. Predator problems have also been reported at Attwater Prairie Chicken NWR, Texas.

Many refuges are artificially developed with numerous canals, artificial ponds, nesting islands, water control structures, and other man-made elements to attract waterfowl and other birds and encourage nesting. Such an artificial environment also attracts large concentrations of predators, especially when predator control is being practiced on surrounding private lands. With habitat manipulation, species that require dense nesting cover are benefitted. But for species that nest in open situations and construct nests that are exposed during periods of absence, dense vegetation is of little value, and nests are especially vulnerable to avian predation. Many species of shorebirds and marsh birds fall into this category. On refuges that support breeding populations of species with low reproductive potential, predator management should be used to insure their continued survival.

Severe losses on some refuges will continue if predator populations remain unchanged. If nesting studies are not initiated to ascertain the impact of predation, present practices of non-control will continue. Whether California Gulls (*Larus californicus*) in Utah, Black-billed Magpies (*Pica pica*) in Colorado, striped skunks (*Mephitis mephitis*) and red foxes (*Vulpes fulva*) in North Dakota, Common Ravens in Oregon, etc., the impacts of predators on federal wildlife refuges need to be examined. If predators are a serious detriment to the production of other wildlife, their populations should be properly managed.

**Recreational activities**

*Fishing.*—In 1974 fishing was allowed on 171 refuges with fishing waters being stocked on at least 18 refuges (USFWS 1976b). Generally fishing is a recreational use of refuge wetlands that is compatible with the protection and management of birds. However, excessive use of shallow vegetated areas of lakes and streams by wading and boating fishermen can disturb feeding and nesting waterbirds. Many southern refuges, such as Noxubee NWR, prohibit fishing during the winter months in order to provide sanctuary for wintering waterfowl, though when nesting activities of resident species are beginning, the lakes are opened to fishing again. Prime nesting areas on many refuges are closed to fishing until about 1–15 July. Such dates are unrealistic on some refuges as nesting continues after these dates. Timing of fishing closures (if any) varies from refuge to refuge and no policy appears to have been formulated on this use of refuges above the

local level. In northern areas, fishing should be delayed until about 1 August with some presently open fishing waters being closed to protect late nesting species and their broods. In general fishing regulations on refuges are appropriate but some refuges allow use of trot lines upon which mergansers, loons, and diving ducks have inadvertantly been snared. This is an unnecessary abuse of National Wildlife Refuges.

*Boating.*—Various sizes and types of boats have been used on National Wildlife Refuges for many years in pursuit of refuge management goals and fishing. With the advent of motors and more leisure time, various publics have demanded and received access to National Wildlife Refuges for motor boating and water skiing. Presently 42 refuges permit high speed pleasure boating; mostly on areas where the USFWS has secondary control (USFWS 1976b). Obvious and documented impacts of high speed boating are shoreline degradation, disruption of nesting and feeding areas with loss of production of young, and displacement of water birds. These problems, especially loss of production of young, are especially pronounced at Ruby Lake NWR, Nevada, and have resulted in the preparation of an Environmental Impact Assessment on the effects of boating at this refuge (USFWS 1976a).

Ruby Lake NWR was established 2 July 1938 as a refuge and breeding ground for migratory birds and other wildlife. Most of the 15,229 ha area was purchased, with the remainder being withdrawn from the public domain. Boating was allowed for the purpose of fishing starting in the mid-1940's, with water skiing being allowed starting about 1955. Sizes of boats and motors and numbers of water skiers increased until the late 1960's when the USFWS moved to protect the waterfowl resource (principally nesting Canvasback, *Aythya valisineria*, and Redhead ducks) by restricting power boating. Since that time public and political pressures have prevented adequate restriction of power boating necessary to protect the waterfowl resource with concomitant decreases in production of over water nesting waterfowl. More recently commercial developments by large corporations have resulted in a proliferation of sub-divisions for recreational homes in the area near the refuge. Advertisements clearly indicate that Ruby Lake NWR and associated water related activities on the refuge are important inducements attracting people to purchase "ranchettes," etc. With increasing political and public demands for boating related activities on this refuge, it is quite obvious that the original purpose of the area has been lost. The future of this refuge is in dire straits and it may become a recreation area if public apathy cannot be changed to prevent local abuse of a national resource.

Boat related disturbances with no or little consideration of values of wetlands and associated water birds have no place on National Wildlife Refuges. When threatened or endangered species are impacted by such activities, closures of refuges to boats should be mandatory.

*Hunting.*—Sport hunting of wildlife was permitted on portions of 184 National Wildlife Refuges in 1974 (USFWS 1976b). Hunting was primarily for migratory waterfowl but also was allowed for resident game birds and big game species. Since hunters have provided funds for much of the prime wildlife habitat purchased for refuges, it is logical and rational that some level of hunting be allowed. Few refuges are completely open to sport hunting and it would appear that state and federal regulations on season length, bag limits, methods of taking, etc. are more than adequate to maintain avian resources. Where endangered species are involved, such as Whooping Cranes and Mexican Ducks (*Anas diazi*), it is difficult to see the rationale for sport hunting of look-alike species. Hunting of look-alike species on those few refuges where these potential problems exist should necessarily be reevaluated and probably discontinued.

**Other management problems**

A recurring problem on National Wildlife Refuges is the ease with which refuge lands can be abused by other federal agencies. Some refuges have been used as practice areas for low flying military aircraft, others as convenient and inexpensive routes for highway and utility rights-of-way. The advent of NEPA hopefully will eliminate some of this abuse, but problems still remain. For example, the USFWS had no objection to the channelization of the Yazoo River by the U.S. Army Corps of Engineers through Yazoo NWR, Mississippi.

A recent trend in refuge management has been to consolidate land holdings and to adjust refuge boundaries to facilitiate management. This has the effect of making a nice compact refuge rather than one with "fingers" extending into the surrounding non-refuge lands. While we appreciate the management problems involved, such consolidation often results in losses for wildlife. At one refuge the adjustments in land holdings were made by trading prime forest land for agricultural lands. In addition to the loss of not-soon-to-be-replaced forest habitat, the deal also resulted in a net loss in acreage to the refuge. Apparently it is easier to trade lands than it is for a refuge to either sell or purchase lands. Hence, based on market values, the refuge traded more acres of forest to obtain fewer acres of crop land. We feel that the increased edge and linear distances on more dispersed refuges can often provide habitat for larger wildlife populations than could compact refuges. An added benefit of such dispersed refuges is that they often provide an ecological archipelago that will allow wildlife the opportunity to disperse to other suitable habitats outside the refuge.

Some National Wildlife Refuges include areas of potential value as wilderness. Such areas should be identified and protected. Personnel at one refuge indicated that such an area occurred on their refuge, but that they were going to construct a road through the middle of it so that it would not qualify for wilderness status and so that current forest management practices could be continued. Such actions are deplorable.

In addition to management or lack of management on National Wildlife Refuges that affects birds, we feel compelled to point out a few refuge "management" practices that adversely affect ornithologists and bird-watchers. Refuges tend to be generally understaffed as a result of inadequate funding. One reflection of this problem is the operating schedule for most refuges. Refuge offices typically open at about 08:00 and close about 16:30 Monday through Friday and are closed on weekends. This is fine for carrying out wildlife management activities, but many refuges also receive large numbers of human visitors—most on weekends and after regular working hours. An open office with descriptive brochures and bird checklists could win a lot of support for the refuge system. Additionally, as some refuge managers see it their biggest problems are managing people. Perhaps these management problems would be fewer if refuge public relations were improved by tailoring refuge office hours to accommodate visitors and by providing informational materials.

Ornithologists seeking to conduct ecological research on National Wildlife Refuges are faced with an unwarranted number of bureaucratic problems. Not only are state and federal bird banding permits required, but the researcher must also obtain a refuge permit and file an annual report of his activities on the refuge. If permits were simply obtained by visiting or writing to refuge headquarters, the requirement would not seem unreasonable, but often this is not the case. Permit requests are often channelled through regional USFWS offices, sometimes through Washington, D.C., before a permit is granted—thus causing the researcher loss of valuable time. Collecting permits for refuges are particularly difficult to obtain—and perhaps justly so, were it not for the fact that

hunters are often given freedom to hunt game birds on refuges with no more difficulty than obtaining a state hunting license and a duck stamp. Another problem associated with conducting research on National Wildlife Refuges is the USFWS practice of frequently moving personnel from one refuge to another. As soon as a researcher has established a good working relationship with one refuge manager, he is often confronted with explaining his work and adjusting his research activities to conform to a new manager's interpretation of regulations. In all fairness, however, the legitimate ornithological researcher has much to gain from working on National Wildlife Refuges. Our experience has for the most part been that refuge personnel are eager to have research conducted on refuges and that they are willing to provide logistic support whenever possible.

## SUMMARY

National Wildlife Refuges administered by the U.S. Fish and Wildlife Service, Department of Interior are located in 49 of the 50 states and encompass more than 13,678,860 ha. While purchased or obtained for a variety of purposes including migratory birds (primarily waterfowl) and endangered species, National Wildlife Refuges are vitally important for maintenance of important habitats and overall conservation of many species of birds. Problems associated with management of National Wildlife Refuges include: (1) concentrating large numbers of birds which increases risk of catastrophic losses due to disease and other mortality factors and the opportunity for damage to items valued by man; (2) overgrazing by domestic livestock; (3) cropping for hay; (4) water oriented activities such as boating; (5) creation of monocultures by selective cropping or planting practices; (6) a lack of selective management of predators; (7) failure to consider impacts of artificial structures such as fences, powerlines, signs, etc.; and (8) inadequate manipulation of biological and mechanical tools useful for maintaining and improving habitats useful for birds. Major administrative problems include failure to clearly identify and support objectives of individual refuges and woefully inadequate funding for refuge staffing and maintenance.

## RECOMMENDATIONS

1. Creation of a National Wildlife Refuge Service equal to the U.S. Fish and Wildlife Service in the Department of Interior to manage National Wildlife Refuges would result in unnecessary bureaucracy, diversion of talent and funding, and would fragment a cohesive national policy for protecting habitat for wild animals. Administration and management of National Wildlife Refuges should continue as a function of the U.S. Fish and Wildlife Service, Department of Interior. However, the refuge system should be given full program status and administration should be streamlined with an Assistant Director directly responsible for the refuge program.
2. Funding for staffing and maintenance of National Wildlife Refuges has been woefully inadequate for many years. Adequate funding to maintain refuges should be strongly supported. Funding for enhancement of existing refuges is desperately needed as is funding for expansion of the refuge system. Funding should be increased for public relations and hiring of non-game biologists.
3. Objectives of each National Wildlife Refuge should be reevaluated with management being directed towards obtaining desired objectives once they are defined.
4. Uncontrolled grazing by domestic livestock has been documented to adversely affect nesting success and productivity of birds. Grazing of domestic livestock on National

Wildlife Refuges should be carefully evaluated and in many instances reduced to levels compatible with refuge objectives. Proper timing of grazing is critical and all summer grazing in production areas should be eliminated. Winter grazing should be allowed only for desirable habitat manipulation where controlled burning is not feasible. Refuges should not be managed for domestic livestock production.

5. Controlled burning has value for manipulating habitats and it should be further tested with effects documented. Where beneficial, controlled burning should be used in refuge management.
6. Unnecessary structures such as fences, powerlines, etc. should be removed within refuge boundaries where they have been documented to be hazardous to birds. All necessary structures should be marked with aircraft warning markers or other devices to prevent and reduce bird-object collisions.
7. Mowing of habitats for hay crops or other refuge objectives should be delayed until 1–15 August in production areas important to birds. Dates of mowing after 1 August should depend on locality and local condition. Management of refuges for commercial hay crops is not desirable.
8. Selective control of predators on refuges managed for birds should be implemented in areas where limited nesting and brood cover occurs or where severe local conditions exist. Management of production refuges should seek to prevent ecological situations favorable to maintaining or encouraging unnatural concentrations of predators.
9. Excessive or unnatural fall and winter concentrations of birds should be discouraged through habitat manipulation on refuges; such concentrations invite catastrophic losses and damage to private property.
10. Public recreation activities on National Wildlife Refuges should not be given preference over stated objectives of the refuges. Examples of undesirable activities when birds are nesting are boating, water skiing, and fishing. Non-human use areas are an integral part of the refuge concept and all human recreation activities should be meshed within the objectives of each refuge. Public visitation should be encouraged on portions of refuges with adequate staffing and suitable open hours.
11. Diversity of habitats should be encouraged on National Wildlife Refuges and practices that lead to large areas of monoculture should be discontinued. This is especially a problem in forested areas.
12. Forest management on National Wildlife Refuges should take into account the natural potential longevity of the tree species present and should provide for the needs of species characteristic of mature forest ecosystems.
13. Collection and compilation of data concerning the effects of management practices on avian species, especially non-waterfowl, should be an integral part of refuge management. Research into management procedures and other scientific endeavors should be encouraged on National Wildlife Refuges with improvement of permit procedures and requirements being immediately instigated.
14. Consideration should be given where feasible to include portions of some refuges in the Wilderness System to further protect unusual and unique habitats.

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