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CONSERVATION OF NORTH AMERICAN RALLIDS[1]

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The Rallidae are a diverse group in their habitat selection, yet most North American species occur in or near wetlands. As a consequence, most species are subject to habitat enhancement or perturbation from waterfowl management programs. The overall effects of these management programs relative to rallid conservation have been assessed for few species, and there is a need for synthesis of such information. In the cases of some species or races, population status is not known, and suggested directions for conservation and management are needed. Rare, endangered, or status undetermined species or races often occur in areas where related species are classified as game birds, and the effects of such hunting on rarer forms are not known. Their generally secretive nature, the endangered status of several races and populations, and continued loss of habitat and threats to present habitat, warrant an examination of the conservation status of the North American taxa in this group.

In 1977, a committee of the International Association of Fish and Wildlife Agencies summarized available information on management and biology of American Coots (*Fulica americana*), rails, and gallinules in North America (Holliman 1977). That summary was intended to provide relatively complete information on conservation of these species, and also to provide guidance for research within the U.S. Fish and Wildlife Service's (FWS) Accelerated Research Program for Webless Migratory Shore and Upland Game Birds (ARP). Subsequently, a number of rallid studies were funded under this program. The program was eliminated in 1982, following substantial research activities on North American rallids.

Since the demise of the ARP, additional research on rallids in North America has focused on an area the International Association of Fish and Wildlife Agencies report failed to cover in detail—that of endangered rallids in the U.S. and its possessions. Most of these studies have been

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of threatened and endangered taxa in western coastal marshes. This report updates and summarizes information on North American rallids since the ARP report and identifies the major conservation problems of this group with the intent of focusing future efforts on these priority issues. Consideration of island forms occurring within U.S. possessions is beyond the scope of this report, mainly because of the special conservation problems associated with their insular distribution. The major topics include habitat requirements, effects of habitat and hunting management techniques currently practiced on wetland areas, and conservation of endangered and threatened populations. Research needs are identified. Habitats of the American Coot are similar to those of several waterfowl species, and the biology of coots is considered only as it is typical of rails in general.

GENERAL HABITAT REQUIREMENTS OF NORTH AMERICAN RALLIDS

Nine species of Rallidae regularly breed in North America: Sora (*Porzana carolina*), Virginia Rail (*Rallus limicola*), King Rail (*R. elegans*), Clapper Rail (*R. longirostris*), Yellow Rail (*Coturnicops noveboracensis*), Black Rail (*Laterallus jamaicensis*), Common Moorhen (*Gallinula chloropus*), Purple Gallinule (*Porphyrula martinica*), and American Coot (AOU 1983). Habitats used by North American rallids may be defined generally as wetlands with a well-developed zone of emergent vegetation. Within this vegetative association, rallids occur along a cline defined by flooding duration and water depth during the breeding season (Weller 1979). The Black Rail usually occurs in dense emergent vegetation, wet meadows, moist soil, or high marsh (Wilbur 1974, Repking and Ohmart 1977, Manolis 1978). Plants frequently found in these habitats include pickelweed (*Salicornia* spp.), saltmeadow cordgrass (*Spartina patens*), and saltmarsh cordgrass (*S. alterniflora*) in coastal marshes, and small bulrushes (*Scirpus americanus* and *S. olneyi*) in inland sites. Black Rails and Yellow Rails are most often encountered in wet prairie or grassland sites during migration.

Yellow Rails breed in wet meadows and shallow sedge marshes, especially in *Carex lasiocarpa* (Stahlheim 1974, Bookhout and Stenzel 1987). In Michigan, vocalizing birds were at sites with water $\leq$46 cm deep, but nests were at sites with water $\leq$10 cm deep (Bookhout and Stenzel 1987). The principal winter habitats are moist coastal grasslands and marshes.

Soras and Virginia Rails breed in freshwater emergent wetlands with shallow and intermediate water depths (Pospichal and Marshall 1954, Griese et al. 1980, Johnson and Dinsmore 1986). The cover requirements of these species appear to be similar (Johnson and Dinsmore 1986). During migration, both species use low areas of flooded annual grasses or

forbs, although Virginia Rails apparently prefer shallower sites for foraging than do Soras (water depth of <10 cm vs <20 cm) (Sayre and Rundle 1984). Habitats of Soras and Virginia Rails in winter are poorly known, but include both freshwater and salt marshes (Odom 1977, Zimmerman 1977).

King Rails use a variety of vegetative associations ranging from freshwater, brackish, and coastal salt marshes to shrub swamps and upland fields near marshes (Meanley 1969); they nest in portions of marshes with shallow (0–25 cm) water. Depths at foraging sites of King Rails are typically <10 cm, and drying natural swales are extremely important for foraging during the brood period. The similar Clapper Rail uses habitat ranging from coastal high and low salt marsh to freshwater marshes (Mangold 1977). Ideal coastal habitat for Clapper Rails includes extensive emergent vegetation, nearby tidal flats for foraging, and tidal influence (Lewis and Garrison 1983). Most nesting by Clapper Rails occurs in edges between tall and moderate-height cordgrass, but nests are also built in freshwater marsh edge (Massey et al. 1984) and in the bases of shrubs within the marsh (Abbott 1940).

Common Moorhens occur in the highest density in semipermanently flooded wetlands that have narrow-leaved, persistent, emergent vegetation, an abundance of submerged vegetation for food, and equal coverage of vegetation and water (Brackney and Bookhout 1982). Moorhen habitats include deeper and more open water than those of other rallids, and water depth at nests averages about 40 cm (Miller 1946). Purple Gallinules breed in wetlands similar to those used by moorhens, and the margins are overgrown with herbage and shrubbery (Ripley 1977). Wetlands used by Purple Gallinules frequently have extensive beds of floating-leaved plants. Nest sites of Purple Gallinules have denser vegetation and shallower water than those of Common Moorhens (Reagan 1977). The Common Moorhen and the Purple Gallinule regularly nest in southern ricefields (Helm et al. 1987).

TRENDS IN WETLAND LOSS

Wetland loss unquestionably is the greatest continent-wide threat to rail populations. Originally, >87 million hectares of wetlands existed in the conterminous United States, but by the mid-1970s only 46% of these habitats remained (Shaw and Fredine 1956, Tiner 1984). The rate of loss continues at >160,000 hectares annually. The most threatened habitats include palustrine and riverine wetlands that are also most important to rails. Agricultural development is responsible for 87% of recent national wetland losses; urban, industrial, and reservoir development account for the rest (Tiner 1984).

Inland freshwater wetlands have been drained disproportionately, mainly

because of agricultural activities. Certain areas have undergone extensive losses, such as the natural wetlands of Iowa and California's Central Valley; <6% of the original wetland area in each area exists today (Bishop 1981, Gilmer et al. 1982). Other areas important to rails, such as Lake Erie marshes that have lost >50% of their original area since 1954 (Weeks 1974), have not been so heavily affected. The most extensive wetland losses that affect rail habitats occurred from the 1950s to the 1970s in Louisiana, Florida, Texas, Arkansas, and Mississippi (Tiner 1984). Coastal salt marshes in the East, despite some losses, remain largely unchanged (Meanley 1985). About 800,000 hectares of salt marshes occur from Maine to Key West, and several hundred thousand hectares are on the Gulf Coast. Conversely, >150,000 hectares of the salt marsh in the San Francisco Bay area have been destroyed, and the remainder is currently threatened by urbanization (U.S. Fish and Wildlife Service 1984). Rail habitats in the greatest jeopardy of loss or perturbation are (1) estuarine wetlands in the coastal zone, (2) Louisiana's coastal marshes, and (3) Florida's palustrine wetlands (Tiner 1984).

The recent passage of the 1985 Farm Act offers alternatives to wetland drainage for increased agricultural production. The "swampbuster" provision of this act provides for withholding federal agricultural subsidies from landowners who drain wetlands to produce crops. This provision would actually save federal monies, because the cost of retiring the land ($760/hectare) would be cheaper than the estimated crop subsidy payments on land areas drained. Initial rules for implementing the provision defined wetlands and specified that landowners who altered wetlands were ineligible for Farmer's Home Administration loans for a period of 10 years. Difficulties arose when final rules were proposed by the U.S. Department of Agriculture (USDA). First, drainage districts were not mentioned in the legislation, so landowners could legally finance wetland drainage through these entities. Second, the law exempted wetlands for which drainage work had "commenced" before 23 December 1985. This definition was questionable, and USDA was considering defining "commenced" as any area where plans existed for drainage, thus opening the way for continued unrestricted wetland drainage. Final rules published on 17 September 1987 defined drainage as "commenced" if some earthmoving had occurred, if a substantial amount of money had been committed to contractors, or if substantial purchase of supplies for drainage had been committed before 23 December 1985 (J. Goldman-Carter, pers. comm.). The rules limited this potential loophole in the legislation.

Other recently passed legislation will raise additional monies for wetlands acquisition by the U.S. Fish and Wildlife Service (FWS). Among the provisions of the Emergency Wetlands Resource Act of 1986 are a five-year gradual increase in duck stamp prices to $15, an entry fee for

specified national wildlife refuges (70% would go to wetlands acquisition), and transfer of duties on imported sporting arms and ammunition from the general treasury into funds for wetland acquisition.

EFFECTS OF HABITAT MANIPULATIONS ON RALLIDS

Waterfowl management.—A substantial proportion of wetlands used by rallids, especially during migration and in winter, occurs on national wildlife refuges (NWR). Wetlands of greatest importance to rallids (other than Common Moorhens, Purple Gallinules, and American Coots) are shallower and have greater coverage by emergent vegetation than those typically managed for waterfowl (Shaw and Fredine 1956, Fredrickson and Taylor 1982). Waterfowl management on wetlands used for breeding by inland rail species, however, can be compatible with maintenance of rail habitat (Johnson and Dinsmore 1986). Dewatering in northern breeding areas should occur before 15 April to avoid disrupting nest initiation by rails (Andrews 1973, Johnson and Dinsmore 1986). Gradual dewatering (and presumably presence of topographic diversity) provides a maximum edge between moist soil and marsh; this edge is preferred by foraging rails. Wetland management should also strive to maximize coverage by emergent perennial vegetation which serves as nesting habitat. Habitat for rails within a wetland complex can be provided every year by flooding different impoundments in different years (Andrews 1973).

During migration, management for rails differs from waterfowl management in the timing of flooding and drawdowns (Rundle and Fredrickson 1981). For the autumn migration, shallow flooding should commence in late summer in middle latitudes (vs late autumn or winter for waterfowl); migrating rails require a variety of shallow water depths, robust cover, and short-stemmed seed-producing plants (Rundle and Fredrickson 1981, Rundle and Sayre 1983). Flooding impoundments too deeply and too early results in early macrophyte senescence and loss of robust plant structure needed for cover. A result of deep winter flooding is that foraging ducks and ice and wave action eliminate robust cover (Fredrickson and Reid 1986).

Spring management for migrating rails includes flooding areas that have annual grasses and smartweeds (*Polygonum* spp.) or herbaceous perennial plants (Rundle and Fredrickson 1981). Flooding should be shallow (<15 cm), but some habitat is provided at greater depths up to 50 cm. Rail response is best when partial drawdowns concentrate invertebrate prey. This hydrologic regime also is excellent for late spring migrating dabbling ducks such as Blue-winged Teal (*Anas discors*) and Northern Shovelers

(*A. clypeata*). Land-leveling, whereby wetland management units are graded to allow easier irrigation, flooding, and drainage, has been practiced on some NWRs. This management practice should be eliminated because it minimizes the topographic diversity that provides the maximum amount of vegetation/water interface preferred by foraging rails.

Agriculture.—Agricultural rowcrops other than rice are often planted for waterfowl but have little value for rails (Rundle and Sayre 1983). Rice fields can be one component in the complex of wetland types for nesting King Rails (Meanley 1969), Common Moorhens, and Purple Gallinules (Helm et al. 1987). Wild rice in northern wetlands and middle-southern Atlantic coastal wetlands also provides habitat for migrating Soras (Fannucchi et al. 1986). Pesticides are a primary hazard to rails in this agricultural habitat. King Rails were formerly abundant in rice fields in the Arkansas Grand Prairie, but they have nearly disappeared from sites where pesticides (see below) have probably reduced the prey base of burrowing crayfish (*Procambarus* spp.) of this rail.

Harvest of wild and planted rice results in nest destruction and excessive disturbance to rails (Helm 1982, Fannucchi et al. 1986). Suggested solutions for this disturbance include planting later-maturing rice varieties (doubtful given economic constraints on farmers), leaving naturally vegetated areas fallow in association with planted fields, and establishing unharvested areas in wild rice beds. Damage to rice by nesting Common Moorhens and Purple Gallinules has been a problem to farmers in Louisiana, but it usually results in an insignificant loss of yield (Helm 1982). A few depredation permits, which allow shooting of these species in ricefields, have been issued.

Grazing.—Livestock grazing is usually detrimental to marsh habitat (especially for ground-nesting birds such as rails) unless it is extremely light (Todd 1977). Grazing reduces the height of emergent vegetation and has a greater effect on emergent vegetation near shore (Whyte and Cain 1979). Effects on Black Rail and Yellow Rail winter habitat, therefore, might be expected to be most severe because of their occupation of drier sites. Excessive grazing leads to loss of emergent cover, trampling, and disturbance of nesting pairs, and can have profound negative effects on rail use of wetlands (Whyte and Cain 1979). The effects of this practice on rails needs further study, especially in wintering areas.

Fire.—Fire has varied effects on rail habitats, depending on the species and wetland type under consideration. Fire can devastate habitats of some rallids, especially resident species, and may result in replacement of more desirable vegetation species by common reed (*Phragmites communis*) (Todd 1980). Fire is sometimes suggested as necessary to open marshes

choked by excessive dead vegetation. In marshes where a residual mat is required by nesting rails (e.g., Yuma Clapper Rails—Eddleman, unpubl. data), fire may destroy suitable habitat, the effects lasting for several years.

Seral stages required by nesting Yellow Rails must be maintained by fire, or these areas succeed to forest (Stenzel 1982). These sedge meadow communities are maintained by periodic fire. Areas not burned periodically recover from the infrequent fire slowly, because a greater mat of dead vegetation creates a hotter fire which destroys root structure.

Pesticides and contaminants.—Lead shot is a major contaminant that can potentially affect rails. Ingested lead shot was found in the gizzards of 7.4%–12.3% of Soras in Maryland and 1.8% of those collected in Missouri (Artmann and Martin 1975, Stendell et al. 1980). The highest incidences occurred in marshes with tidal action (which exposes lead shot in the substrate), refuge areas for waterfowl, and traditional hunting areas. This threat, possibly severe in local areas, will diminish as the FWS phases out the use of lead shot in favor of steel shot for waterfowl hunting by 1991.

The effects of most pesticides and contaminants on rails are poorly known. Clapper Rails have shown a high tolerance to DDT and DDD (LC_{50} in diet = 1612 ppm for males and 1896 ppm in females) (Van Velzen and Kreitzer 1975); sublethal effects were not studied. In Louisiana ricefields, nesting Common Moorhens and Purple Gallinules with high (2–13 ppm) residues of dieldrin showed no decrease in clutch size or hatchability of eggs (Causey et al. 1968). The effects of these levels of dieldrin on chick survival were not examined. Most potential pesticide/contaminant problems involving rallids have been localized in the East (Meanley 1985). The occurrence of selenium and other contaminants is of increasing concern in western wetlands. Selenium levels at Kesterson NWR are sufficient to cause severe hatching defects in coots, but heavy metal contamination has not been examined in detail at other wetland areas (U.S. Fish and Wildlife Service 1986).

Endangered and threatened rallid taxa may occur in areas of high contaminant levels. Potential problems with contaminants have been identified (U.S. Fish and Wildlife Service 1986) in a significant portion of the U.S. habitat for Light-footed Clapper Rails (*R. l. levipes*) (Tijuana Slough NWR), California Clapper Rail (*R. l. obsoletus*) (San Francisco Bay NWR and San Pablo Bay NWR), Yuma Clapper Rail (*R. l. yumanensis*) (Havasu, Cibola, Imperial, and Salton Sea NWRs) and California Black Rail (*Laterallus jamaicensis coturniculus*) (most of the mentioned refuges). Monitoring of contaminant levels in other wildlife and in Yuma Clapper Rails is being evaluated by FWS at present.

Seven eggs of Light-footed Clapper Rails were analyzed in 1983 and

DDE levels of 9.6 and 6.8 ppm were found in two; DDE concentrations of 8.0 ppm in Black-crowned Night Heron (*Nycticorax nycticorax*) eggs and 3.0 ppm in Brown Pelican (*Pelecanus occidentalis*) eggs have been associated with poor reproduction (H. M. Ohlendorf, pers. comm.). In the typical Light-footed Clapper Rail nest, one or two eggs disappear, and one or two others do not hatch with the rest, which may or may not be contaminant-related.

EFFECTS OF HUNTING AND TRAPPING ON RAIL POPULATIONS

Interest in hunting rails is low according to most resource managers (Zimmerman 1977). Most hunting pressure on rails has been on American Coots, Soras, Common Moorhens, and Clapper Rails (Ripley 1977, Martin 1979). Hunting seasons occur from early September through mid-December, depending on state regulations. Bag limits in recent years generally are 10–15 daily (Meanley 1985), depending on the species and the state. Coots are often covered under the waterfowl point system, being valued at 10–20 points, depending on the state. Black Rails have not been hunted since 1967, and the harvest was probably small when they were legally taken (Martin 1979). The season on Yellow Rails has been closed since 1968. Purple Gallinules have not been hunted in Florida since 1972. Clapper and King rails are hunted in most of the eastern and Gulf coastal states. The Common Moorhen is hunted in 43 states, and coots are hunted in 48 states. Sora hunting is an old tradition in coastal marshes in Connecticut, New Jersey, Maryland, and Virginia, but a drastic decline in birds, and consequently hunters, has occurred in recent years (Ripley 1977).

Trends in rail hunting by waterfowl hunters during the period 1964–1975 were summarized by Martin (1979). Numbers of hunters taking Soras and average number bagged showed no trend, although the number of hunters did decline in the Atlantic Flyway. Percentage of hunters who hunted other rails (mainly Clapper Rails) was up nationwide and in the Atlantic and Mississippi flyways; the average number of birds shot increased nationwide and in the Atlantic Flyway. During the same period, the proportion of waterfowl hunters that also hunted gallinules (mostly Common Moorhens) rose in the Atlantic, Mississippi, and Central flyways, and the average number of birds shot increased in the Mississippi Flyway. The proportion of waterfowl hunters that hunted coots rose in the Central and Pacific Flyways.

The average annual harvest of rallids by waterfowl hunters varied considerably in the years 1964–75 (Martin 1979). These figures underestimated total harvest of rails, because only 50% of Soras, 60% of other rails, and 75% of gallinules were taken by waterfowl hunters in the 1964–69

hunting seasons (Banks 1979). The remainder were harvested by non-waterfowl hunters. From 13,400 to 47,200 Soras were shot during 1964–75 by waterfowl hunters (Martin 1979). Common Moorhen harvest ranged from 10,100 to 63,500, coots from 765,700 to 1,659,800, and other rails (mostly Clapper rails, but also King and Virginia rails) ranged from 24,100 to 175,200. Five states (New Jersey, Louisiana, Florida, Virginia, and Iowa) harvested >2000 Soras. Fifty percent of the annual harvest of gallinules (including Common Moorhens) and other rails occurs in Louisiana, as does 25% of the coot harvest. The only other states reporting substantial numbers of rallids harvested are California and Wisconsin, which together account for 25% of the annual coot harvest.

Effects of the annual harvest on rail populations are unknown, although timing of hunting seasons after the peak of migration (Eddleman et al. 1985), the low interest of hunters, the difficulty of hunting rails, and the tendency for rails to run rather than fly (Holliman 1977) probably combine to keep the annual take well within sustainable levels. The effects of hunting on rare or endangered taxa are also unknown but probably have minimal impact on populations. Waterfowl hunting is allowed on several areas containing populations of Yuma Clapper Rails and California Black Rails, but hunting pressure is low on these areas, and both races are so seldom observed that such activity is probably of little danger to the rails.

Interest in hunting rallids may increase if waterfowl populations continue to decline (Holliman 1977). Research programs will be needed to monitor the harvest and obtain data on species composition and age and sex composition by population. Such procedures are available for other migratory game birds, especially waterfowl, but are currently nonexistent for rallids.

Banding data are scarce for rails, and only some eastern races of Clapper Rail have been banded in any numbers. The recovery rate of 1028 clappers banded in Virginia was 4.5% (Stewart 1954). The only significant information provided by these data was the location of wintering areas for migratory individuals.

A principal recommendation of the committee on rails and gallinules of the International Association of Fish and Wildlife Agencies was the institution of a hunting stamp for migratory game birds other than waterfowl, which would provide revenues for research and habitat acquisition, and a source of information on composition of harvested populations (Holliman 1977). This recommendation has not been implemented by the FWS or any state wildlife agency in the 10 years since it was suggested. If interest in hunting of rallids increases, this recommendation should be reconsidered because the FWS Accelerated Research Program for Migratory Shore and Upland Game Birds was eliminated by the budget cuts of 1982.

Trapping of furbearers is allowed on many NWRs. This activity sometimes results in mortalities of King, Clapper, and Virginia rails and Soras because the birds often use runways constructed by muskrats (Meanley 1969). On nine areas of Louisiana coastal marsh, 221 trappers took 127 birds, of which 61% were rails, 19% coots, 5% miscellaneous, including Purple Gallinules, and 15% ducks (Linscomb 1976). No significant difference was noted in catch of birds between #2 leghold traps and 220 conibear traps used in freshwater marsh, but conibear traps caught significantly more birds in brackish marshes, probably because of higher bird density in brackish marshes. Density of rails, water depth, and type of trap set were factors that affected catches of rails. Water depth may be the most important of these factors. Conibear traps set in runways at shallow sites where rails cannot avoid them, and leghold traps set at deeper sites where birds can't see them cause the greatest mortality (G. Linscomb, pers. comm.). Mortality of rails might be reduced by using conibear traps for deepwater sets and leghold traps for shallow water sets. Nonetheless, losses appear small overall (Parker 1983, Stocek and Cartwright 1985).

CONSERVATION OF ENDANGERED AND THREATENED POPULATIONS

Five taxa of North American rallids warrant special concern. Four of these, the Light-footed Clapper Rail, the California Clapper Rail, the Yuma Clapper Rail, and the California Black Rail are found on or near the West Coast. The three Clapper Rail races are on the federal endangered species list (U.S. Bureau of Sport Fisheries and Wildlife 1973). The California Black Rail is on the state endangered species lists of California and Arizona (Wilbur 1974, Arizona Game and Fish Commission 1978). The King Rail is also considered endangered or threatened by several eastern and midwestern states.

Light-footed Clapper Rail.—The Light-footed Clapper Rail formerly occurred in coastal salt marshes from Santa Barbara County, California, to San Quintin Bay, Baja California, Mexico. This rail has declined mainly because of habitat loss to development and other effects of urbanization (U.S. Fish and Wildlife Service 1985). The estimated amount of habitat in the U.S. formerly available to this race was 10,256 ha. Currently, <3500 ha remain, and some of the better areas have been lost. The current U.S. population is estimated at 143 pairs, and a drastic, partly unexplained decline occurred in 1985 (Zembal and Massey 1986). In the two major habitat tracts remaining in Mexico, at least 64 pairs are present at El Estero near Ensenada, and 179 pairs remain at Bahia de San Quintin. The biology of the subspecies has recently undergone extensive study, making it one of the best known of the races of Clapper Rail. Nonetheless, the recent declines and continuing severe threats to the remaining habitat make this the most endangered rallid in the U.S. Actions recommended

in the recently revised recovery plan for this race include restoration of tidal action in some marshes, nest-hummock construction, development and enhancement of high and low marsh habitats where they presently do not occur, minimizing human disturbance, and minimizing losses to native and introduced predators. Of these, the most critical need is to expand the area of potential habitat available to maintain several self-sustaining populations. As of the spring of 1986, 99 pairs (about 70% of the population) were concentrated in Upper Newport Bay; the next largest concentration comprised only 12 pairs. Agency cooperation is needed for managing marshes where populations currently occur. For example, the mouth of Tijuana Estuary silted shut in 1984–85, preventing tidal fluctuations necessary to maintain marsh vegetation. An emergency request by the FWS to dredge open the mouth of the estuary was denied by the U.S. Army Corps of Engineers. By the time the necessary permits were obtained, marsh edges had dried out, and water had stagnated. The known population was reduced to two birds before dredging re-opened the estuary.

California Clapper Rail.—Historically, the California Clapper Rail occurred from Humboldt County (possibly) to San Luis Obispo County in California (U.S. Fish and Wildlife Service 1984). The largest populations occurred within San Francisco Bay. The initial threat to this race was overharvest, but industry, agriculture, salt-evaporation-pond construction, and urbanization began to reduce the habitat in the early 1900s (U.S. Fish and Wildlife Service 1984). About 80% of the 73,500 ha of original habitat has been diked or destroyed. The threat of urban development to potentially restorable habitat, such as salt evaporation ponds, poses a major threat. Eighty percent of the total population occurs in south San Francisco Bay where development pressure is greatest (T. Harvey, pers. comm.). The race occurs in pickelweed and cordgrass marshes, and high marsh is required during winter flood tides. The race is under study by personnel of the San Francisco Bay NWR, and current estimates of the population range from 1000 to 1500 individuals. Actions to address the habitat needs of this race include preserving present marsh habitat, restoring tidal action to diked areas, increasing emergent plant coverage, securing adjacent upland habitat, and eliminating pollution (U.S. Fish and Wildlife Service 1984). Information needs include general biology of the subspecies, specific habitat requirements, and the effects of introduced predators, waterfowl management, flood control activities, and mosquito abatement programs on rail habitats. The major problems in the recovery of this subspecies are lack of personnel and money to institute management actions.

Yuma Clapper Rail.—This race differs from the other endangered races

of Clapper Rail in that it breeds in fresh and brackish water marshes on the lower Colorado River of western Arizona and southeastern California, the Colorado River Delta, the lower Gila River, the Salton Sea, and other scattered sites in southern Arizona (Todd 1986). Some taxonomists consider that the two races of Clapper Rails nesting on the west coast of Mexico (*R. l. rhizophorae* and *R. l. nayaritensis,* Banks and Tomlinson 1974) are also of this race (Ripley 1977). The subspecies breeds mainly in cattail (*Typha domingensis*) and bulrush (*Scirpus californicus*) marshes, but it also breeds in other mixed vegetation types (Anderson and Ohmart 1985). Originally, the race occurred in the Colorado River Delta in Mexico and possibly in marshes along the Colorado River (Cooke 1914, U.S. Fish and Wildlife Service 1983, Todd 1986). The present marsh habitat has developed mainly on silt deposits formed behind U.S. Bureau of Reclamation dams. The U.S. population of this race was thought to migrate into Mexico on the coasts of Sonora, Sinaloa, and Nayarit, but a substantial portion of the population (>70%) is resident (Eddleman, unpubl. data). An annual call-count survey is conducted, but coverage is sporadic and routes are not standardized. The latest population estimates are 548 (minimum) in the U.S. (Powell 1985) and 205 in the Colorado River Delta in northern Sonora and Baja California (Anonymous 1981). Most U.S. habitat is in NWRs and state wildlife management areas that are subject to water management practices of the U.S. Bureau of Reclamation. Habitat loss caused by dredging, rip-rapping of stream banks, and high water flows on the Colorado River is the principal threat to this race (Todd 1986). Mitigation projects have caused negative impacts on some marsh habitats used by the birds. Havasu, Cibola, and Imperial NWRs offer potential management opportunities for this race. Actions needed to improve the status of this subspecies include protection and enhancement of current habitat; clarification and evaluation of its population status, including standardization of the call-count survey; clarification of its migratory status; development and implementation of management plans for federal and state lands on which the race occurs; clarification of the taxonomic status of birds occurring along the west coast of Mexico; and cooperative efforts with Mexico to protect habitat in the Colorado River Delta and possible wintering areas along the west coasts of Sonora, Sinaloa, and Nayarit.

Black Rail.—The California Black Rail occurs in a variety of habitats, from high marsh (mainly pickelweed and bulrush marshes) along the California coast from San Francisco Bay into northern Baja California to freshwater marshes along the lower Colorado River, at Salton Sea, and on some canal banks in three-square bulrush (*Scirpus olneyi*) stands (Wilbur 1974, Repking and Ohmart 1977). Threats to the race include marsh

subsidence caused by groundwater removal, diking of salt marshes, water level fluctuation, and wildfires (Todd 1980, Manolis 1978). The current population size in California is unknown; the estimate for Arizona is 100–150 birds. Information needs for this race include a clarification of population status throughout its range and studies of its general biology. Enhancement of habitat of the three western Clapper Rail races would likely also benefit the California Black Rail. The status of the midwestern population of inland breeding Black Rails is unknown, but sightings and calls have been alarmingly low in the last 40 years in breeding areas and in Gulf Coast wintering areas.

King Rail.—King Rail populations have declined alarmingly in several areas of former abundance in the last 30 years (Ripley 1977). Population declines in the Arkansas rice belt were mentioned above. King Rails also have declined in the Smyrna River marshes in Delaware (because of replacement of cordgrass and bulrush by common reed), have disappeared from the vicinity of the Patuxent Wildlife Research Center in Maryland, and have declined in the Ruthven marshes of northwestern Iowa (Weller 1979). Such declines, although often directly tied to habitat degradation, are sometimes unexplained. A comprehensive survey of status and distribution may be needed to ascertain if range-wide declines have occurred. The Blue List, published in *American Birds* and based on reports of interested observers nation-wide (Tate 1986), has included the King Rail as a species of special concern since 1976. Outside Louisiana and Florida, the King Rail probably warrants threatened status.

RESEARCH NEEDS

Many of the current research needs remain the same as those identified a decade ago (Holliman 1977). A major need in conservation of rallids is additional research on several aspects of general biology and population dynamics. Additional information on gains or losses in wetland habitats of importance to rallids is needed. Experimental studies on the effects of various land management practices are needed, especially as they relate to waterfowl management, because most management for rallids would be in conjunction with these programs. Refinement of census techniques for breeding rails (especially use of playbacks of vocalizations) has occurred in several studies, but most suffer from lack of an independent index to actual breeding numbers. Telemetry or transect methods (Bart et al. 1984) show promise in this area. If interest in hunting rallids increases, information on migration routes, wintering areas and winter habitat needs, harvest trends and composition, and population trends will be needed to manage the harvest intelligently. The effects of pesticides and other contaminants on rallids need additional evaluation, particularly

regarding sublethal effects and the relation to food habits. Finally, research on endangered taxa should continue to develop habitat enhancement and conservation techniques.

SUMMARY AND RECOMMENDATIONS

Current programs and needs for conservation of the nine North American rallids were considered. These species generally require wetlands and occur along a cline of increasing substrate moisture level, from Black Rails (driest) to American Coots (most aquatic). Wetland loss is the primary threat to all the species, and recent legislation could potentially aid in conserving wetlands in the United States. Waterfowl management can be compatible with management for rails, but careful alternation of different manipulations within complexes of wetlands is needed to accommodate both groups. Agricultural rowcrops have little benefit for rails. Grazing and fire have variable effects on rallid habitat, depending on the species under consideration and the intensity and frequency of the disturbance. The effects of most pesticides and contaminants on rallids are poorly known, and further study is essential. At present levels, hunting and incidental trapping probably have little effect on most rail populations, but improved methods of monitoring the harvest are needed. Research needs for rallids are extensive and mostly involve basic biology.

We offer the following recommendations:

(1) The 1985 Farm Act should be enforced to protect a maximum acreage of wetlands from further agricultural drainage. The U.S. Congress should implement additional legislation to allow accelerated wetland acquisition by the FWS. The FWS, in turn, should emphasize acquisition of natural wetlands that have elevational diversity and a high percent coverage by emergent vegetation.

(2) The U.S. Congress should resume funding of the Accelerated Research Program for Migratory Shore and Upland Game Birds as the best way to fund research on habitat management for rallids.

(3) The FWS should institute a hunting stamp requirement for hunting of rails and other migratory game birds other than waterfowl. This program would provide a source for contacting the harvesting public for data, and the funds should be used for wetland preservation and acquisition.

(4) In cooperation with state wildlife agencies and interested individuals, the FWS should undertake reviews of the status and distribution of the King Rail and Black Rail.

(5) Mitigation or habitat enhancement work involving dredging operations in or near marshes inhabited by the Light-footed Clapper Rail, California Clapper Rail, Yuma Clapper Rail, and California Black Rail should be closely monitored by both agency biologists and independent

biologists to avoid excessive disturbance or marsh destruction. Habitat acquisition or enhancement for rallids should emphasize marshes in coastal California as a top priority for the Light-footed and California Clapper Rails and California Black Rail, because all of these taxa have a critical need for an expanded habitat base. NWRs which can provide habitat for the western Clapper Rails (including, but not limited to, Tijuana Slough, San Francisco Bay, San Pablo Bay, Salton Sea, Havasu, Cibola, and Imperial NWRs) should consider these birds as a top management priority. Experimental manipulation of water levels on diked marsh units should be examined as a possible management tool for the Yuma Clapper Rail.

(6) National wildlife refuges that provide potential habitat for substantial numbers of rails should strive to balance management strategies to maximize available habitat for rails and other waterbirds, where such management can be integrated into waterfowl management programs. (Some of these strategies, or references to them, may be found in this report.)

(7) Coastal wetlands operate as settling basins for the great variety of chemicals that are used or discarded in the watersheds feeding into them. Information about the presence of toxic chemicals in foods of rails and effects of various concentrations on reproduction and survival is needed for all rallids, and it is essential for the several endangered races of Clapper Rails.

(8) Whereas the use of lead shot by rail hunters is relatively minor when compared to that of waterfowl hunters, ballistics have now been developed for small, non-toxic shot, and it is suggested that federal guidelines include all wetland bird hunting in lead shot restrictions.

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CALL FOR PAPERS

A Symposium is planned for February 9–11, 1989 titled **"Kirtland's Warbler at the Crossroads—Extinction or Survival"** to be held in Lansing, Michigan. Topics for the symposium are open, but may include such things as Winter and Summer habitat requirements, Population dynamics, Economics of Kirtland's Warbler management techniques, and benefits to other species by Kirtland's Warbler management practices.

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Notification of acceptance will be made by Sept. 15, 1988. Requests for final abstracts will be made after final acceptance of papers.