

STATUS AND SPECIATION IN THE MEXICAN DUCK (*ANAS DIAZI*)

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THE basis for listing animal populations as in danger of extinction by both the U.S. Bureau of Sport Fisheries and Wildlife (1966) and the International Union for Conservation of Nature and Natural Resources (1966) is the currently accepted name of the species and subspecies taxonomic units. Inclusion of the subspecies, as well as the species, category permits the designation of many endangered populations that are in need of protection but which are conspecific with nonendangered ones. This also simplifies the problem of singling out for protection, populations such as the various endangered mallard-like ducks about which currently there is no agreement as to whether they should be considered subspecies of the Mallard or distinct species. The Mexican Duck (*Anas diazi*) is one of these.

There is the further problem of deciding whether the Mexican Duck itself is divisible into subspecies. For many years, the northern population of the Mexican Duck has been listed in standard references such as J. C. Phillips (1923), Peters (1931), Friedmann, Griscom, and Moore (1950), and American Ornithologists' Union (1957) as a distinct subspecies (*A. d. novimexicana*), although other authors, notably Hellmayr and Conover (1948), Delacour (1956), A. Phillips (1959) and Johnsgard (1961*a* and *b*) have considered this distinction unwarranted. Up to the present, no adequate analysis seems to have been made of the presumed characters separating the two. If *novimexicana* is a valid taxon, it is indeed in danger of extinction, although there is some question as to whether the species, *Anas diazi*, as a whole, is threatened. Since the priority of attention these ducks receive at the hands of wildlife managers depends on the status of specific recognized taxa, sound conclusions on their taxonomy are imperative.

OBJECTIVES

One of the purposes of the present study was to investigate the differences in the Mexican Duck populations to see if there is evidence for racially distinct groups. Another was evaluation of the taxonomic relationship of *Anas diazi* to the Mallard (*Anas platyrhynchos*). A third objective was to obtain current information on the distribution, abundance, and factors affecting survival of the various populations currently included under the name, *Anas diazi*.

PROCEDURES

Study of geographic variation of *Anas diazi* and morphological phases of its relationship to *platyrhynchos* was by comparison of specimens in the U. S. National Museum

supplemented by specimens borrowed from other museums. Specimens were compared in series on a large table in the Division of Birds of the U.S. National Museum under a Macbeth Examolite Fixture, Type TC440, a combination of artificial lights designed to simulate daylight quality. Determination of the characters of populations was based on adult specimens separated by sex and season. Specimens taken during the arbitrarily delimited breeding season (25 April through August) based on egg dates (Bent, 1923 and Lindsey, 1946) were segregated for comparison separately. This was considered necessary because even though the species is generally considered sedentary (Leopold, 1959), there is a probability of significant movement of populations during the nonbreeding season (Johnsgard, 1961*a*). Since a paucity of "breeding season" specimens was found in collections, additional birds were collected by the authors in Mexico during May 1966.

Study of morphological distinction from the Mallard was by direct comparison of specimens. To obtain information on current distribution and abundance, Baer searched for the species by ground and air surveys in Chihuahua and New Mexico in 1964 and 1965, and both authors examined most of the Mexican portion of the range by ground surveys in May 1966.

DISTRIBUTION AND STATUS

The original breeding distribution of the Mexican Duck extended from extreme southeastern Arizona (Gila River drainage) and central northern New Mexico (Rio Ariba County) southward in the Rio Grande Valley in New Mexico through central western Texas (near El Paso) and the Mexican highlands to the Trans-Mexican Volcanic Belt (as defined by Dickerman, 1963) from Jalisco and Nayarit east to Puebla (Leopold, 1959).

To a large extent, the Mexican Duck has disappeared as a breeding species from the avifauna of the United States. As far as known, it now breeds only locally along the Rio Grande and in extreme southwestern New Mexico and southeastern Arizona. Most areas where it formerly bred within the United States have been drained or otherwise disturbed to the extent they are no longer suitable habitat. Efforts are being made to redevelop suitable Mexican Duck breeding habitat at the La Joya State Game Management Area and the Bosque del Apache National Wildlife Refuge, both on the Rio Grande in Socorro County, New Mexico; also the San Simon Cienega, controlled by the Bureau of Land Management, in Hidalgo County, New Mexico, and adjoining section of Arizona. Although the Mexican Duck has been found in the past in Texas along the Rio Grande near El Paso, there are no definite records of nesting within that state. Charles Heumier (pers. comm.) is sure a few birds nest near Indian Hot Springs on the Rio Grande in Hudspeth County. He banded an immature male near the community of Lobo, 15 miles south of Van Horn, Texas, and reported that 35 were seen on the 1967-68 Christmas Bird Count on Balmorhea Lake, south of Pecos. These Texas localities, a marsh on the Gray's Ranch, 30 miles south of Animas in southwestern New Mexico and the La Joya and Bosque del Apache Refuge areas seem to be the only places where Mexican Ducks have

been found in a wild condition recently in the United States. Twenty of these birds were observed at Gray's Ranch from an airplane by Baer and Wellein on 2 November 1964, and four pairs, also from the air, on 3 May 1965. Other areas with potential Mexican Duck habitat noted on recent surveys in southwestern New Mexico and adjoining Chihuahua are the Slaughter Ranch on the international boundary in southwestern New Mexico, and Mimbres Lake about 14 miles west of Las Palomas, Chihuahua. In January 1965, Baer estimated at least 1,000 Mexican Ducks in a mountain valley lake in the vicinity of Babicora, central-western Chihuahua and collected three specimens, whereas in May 1966, our 2-day search in this area produced only one pair on the almost dried-up lake. Lago Babicora was reported to be completely full again in the winter of 1967-68, showing the great fluctuation in water level which takes place in this lake. Presence of Mexican Ducks in such lakes during the winter is no indication that they will nest there.

Our survey in Mexico during May 1966 indicated that the Mexican Duck is still present in small numbers and widely scattered in much of its former range during the breeding season; but sinks and potholes, which formerly produced much of the suitable habitat, are gone or are rapidly drying up because of overgrazing, drainage for farming, or diversion of water for human needs as pointed out by Leopold (1959) and Dickerman (1963). Much of the habitat today persists along rivers with copious flows of water such as the Conchos in Chihuahua, and around artificial impoundments or presas. The latter, however, are unreliable because of draw-down of waters in dry periods.

Johnsgard (1961*a*) has mapped the complete range of the Mexican Duck based on both specimens and acceptable sight records. His map (p. 4) agrees with the map of Leopold (1959, p. 173) in indicating an unbroken range between "New Mexican" (northern) and "Mexican" (southern duck populations). Actually, both maps show a rather wide break between records in central Chihuahua and those in central Durango; also one between the latter localities and the next records to the south in southern Nayarit and Aguascalientes. Although our May 1966 sight records for southern Chihuahua and southern Durango (cited beyond) narrowed these gaps somewhat, our observations tended to substantiate the impression that there are rather wide gaps in the distribution of this species in northern Mexico generally, probably chiefly as a result of scarcity of suitable habitat in those areas.

On the other hand, this is equally true of our experience in the southern part of the range of the Mexican Duck in the Trans-Mexican Volcanic Belt, considered by Leopold (1959) to be the center of abundance of the species. Actually, we found them at fewer localities in this area in May 1966, despite

more potential habitat, than we did further north. Large populations of people and livestock around water in this region could be a reason for scarcity of ducks. One area near Lake Chapala and another in Tlaxcala were the only ones where Mexican Ducks were noted south of the northern Jalisco area near Aguascalientes. However, in his much more intensive observation of nesting marshbirds in relatively recent years, Robert Dickerman (pers. comm.) found five Mexican Ducks on 2 August 1957 at Laguna Magdalena, Jalisco; a family of eight downy young (5 collected), 3 August 1957, at Lago Chapala, Jalisco; a pair with downy young, 10 July 1957, and three families plus many others seen, three downy young collected, 12 July; one adult collected 10 July 1957, at Laguna del Carmen, Puebla; 10-15 birds and a nest with 4 eggs, 8 July 1958, north of Maravatio, Michoacan; 20+ birds, 24-25 May 1961, at Laguna San Pedro Lagunillas, Nayarit. The extensive marshes near Lerma in the Toluca Valley, State of Mexico, which E. A. Goldman (1951) and George B. Saunders (pers. comm.) considered an important breeding area for the Mexican Duck in former times, and where Robert Dickerman has seen them in recent years, are practically gone and we saw none of this species there in 1966.

Earlier impressions of greater abundance of this species in more southern portions of its range may possibly have resulted in part from the concept that the species was essentially sedentary (Leopold, 1959) and that concentrations in that area of migrants or wandering birds from more northern areas during the nonbreeding season were actually a permanent population. That large concentrations of these ducks still do winter on some of the southern lakes is indicated by the record of at least 1,000 seen on a lake between Aqualuco and San Juanito, Jalisco, 21 and 22 January 1968, by Lytle Blankenship (pers. comm.). It would seem that so many birds must have congregated from a rather extensive breeding area, thereby supporting the idea of partial migration (Johnsgard, 1961a).

Localities, dates, and numbers of Mexican Ducks observed and collected by the authors in 1966 were: Lago Babicora, Chihuahua, small pond, 7 May, 2 (1 pair); Ciudad Guerrero, Chihuahua, small pond, 7 May, 4 (1 pair); Julimes, Chihuahua, Conchos River, 9 May, 6 (3 pairs); Julimes, Chihuahua, Conchos River, 27 May, 1 duck (2 nests with eggs found between 9 and 27 May reported to us); Boquilla, Chihuahua, Conchos River, 10 May, 6 (3 pairs); Parral, Chihuahua, lake south of town, 11 May, 1 duck; Ciudad Durango, Durango, lake 20 mi. north of city, 11 and 12 May, 4 (2 pairs); Ciudad Durango, Durango, lake 40 mi. southeast of city, 12 May, 6 (3 pairs); Jalisco, small lake 30 mi. south of Ciudad Aguascalientes, 13 May, 6 (3 pairs), 1 duck collected; Jalisco, small lake 30 mi. south of Ciudad Aguascalientes, 14 May, 15 ducks, 2 collected; Jalisco, small lake 30 mi. south of Ciudad Aguascalientes, 25 May, 12 (6 pairs), 1 duck collected; Jalisco, 3 small ponds 23 mi. south of Ciudad Aguascalientes, 25 May, 6 (3 pairs), 2 ducks collected; Jalisco, 3 small ponds 20 mi. southwest of Ciudad Aguascalientes, 25 May, 25 ducks, 3 collected; Jalisco, pond 50 mi. south of Ciudad Aguascalientes, 15

May, 2 (1 pair); Ciudad Tlaxcala, Tlaxcala, lake east of city, 19 May, 7 (3 pairs); Ciudad Tlaxcala, lake east of city, 18 May, 6 (3 pairs); Chapala, Jalisco, 6 mi. northwest, small pond, 23 May, 8 (4 pairs), 1 duck collected; Chapala, Jalisco, 6 mi. northwest, small pond, 24 May, 16 ducks; Las Delicias, Chihuahua, large lake, 28 May, 2 (1 pair); Las Delicias, Chihuahua, large lake, 29 May, 2 (lone), 1 collected; Las Delicias, Chihuahua, canal, 29 May, 17 (1 hen with 4 ducklings), 1 adult collected.

Localities in northern Jalisco south of Ciudad Aguascalientes and along the Rio Conchos and its tributaries in east-central Chihuahua were the most productive of records. The two nests with eggs found between 9 and 27 May at Julimes, Chihuahua, were reported to us by Señor Manuel Ramirez, former mayor of the town, whose observations were known by Baer to be reliable. The brood at Las Delicias, Chihuahua was found by Baer. These were the only places where we had definite evidence of Mexican Ducks nesting. In fact, in most other places, the occurrence of both members of the pair together at all hours of the day, and the incompletely developed gonads of specimens collected indicated that nesting had not started. It may be that nesting is delayed, as suggested by both Allan Phillips and Robert Dickerman (pers. comm.), until the beginning of the summer rains. Exceptions to this are especially favorable localities such as we noted along rivers and canals with a permanent and copious flow of water. The beginning of egg laying by captive Mexican Ducks in early April at the Bosque del Apache Refuge, New Mexico, where water is supplied artificially, but summer rains do not normally come until June or July, tends to support this theory. Although there are a few records of April and May nesting in New Mexico (Lindsey, 1946), initiation of egg-laying for the most part, both in that area and further south, appears from records of eggs and downy young to be after the first of June.

In all, 120 Mexican Ducks were seen in 14 of the 43 likely areas inspected in Mexico between 6 and 29 May 1966. Of these, 12 (7 males and 5 females) were collected. This seems like a very small and scattered population considering the distance traveled and special efforts to find these birds. This, together with the shortage of water in general and the disturbance of habitat by people and livestock almost everywhere, indicates that the survival of this species may be endangered.

MORPHOLOGICAL VARIATION

Viewed in series and individually from above, male Mexican Duck specimens of all seasonal and geographic groups showed a more pearly-gray wash on the tertials than females. Below, males showed a generally darker appearance, particularly on the chest, which was also more reddish brown. Several

males from New Mexico and Chihuahua showed traces of Mallard characteristics. This took the form of varying amounts of green on the head and vermiculation on the dorsal plumage.

The presence of varying amounts of bright yellow on the bills of four males and one female from New Mexico and northern Chihuahua is not understood. No specimen from the southern part of the range of *Anas diazi* showed this characteristic and only one out of many specimens of *Anas platyrhynchos* examined, a male from the State of Washington, showed a similar condition.

Breeding specimens (late April through August) differed from those taken at most other times of the year only in appearing slightly more worn in most birds. However, September specimens were the most worn of all.

Specimens of both sexes from south of Chihuahua, generally referred to as *Anas diazi diazi* (American Ornithologists' Union, 1957; and Friedmann, Griscom and Moore, 1950) appeared very similar to birds from Chihuahua northward, generally considered as representing *A. d. novimexicana*. Viewed in series, the southern specimens averaged very slightly darker and more brownish, less grayish, with feather edgings more rufescent, and less buffy below. This was due to an average darker color of light buffy portions of the feathers of the underparts and more heavy streaking of brown. When only specimens taken during the arbitrarily designated breeding season were included, the series was less variable and the differences between northern and southern groups slightly more pronounced. The differences were more pronounced in the males in which southern specimens were darker particularly on the posterior underparts and had less reddish brown chests. Pitelka (1948) noted similar differences in specimens available to him which were also used in the present study. As Pitelka pointed out, the irregular wavy barring of fulvous on the mantle, mentioned as a character of a northern form by previous investigators, is found in certain individuals in all populations and is of no taxonomic significance.

An effort was made to exclude all specimens which showed indication of hybridization with the Mallard from the series used for study of geographic variation. However, there is a possibility that the more grayish and paler coloration noted in the northern group resulted from infiltration of Mallard genes without resulting in obvious Mallard characteristics. In any case, the average color differences between northern and southern populations are too slight and individual differences in each series too great to permit identification of single birds as of northern or southern type. Furthermore, there appears to be virtually no difference in size, indicated by the following measurements, which would be of use in distinguishing these populations.

Northern specimens, *A. d. novimexicana* (?), all seasons

Adult Male (18 specimens): Wing, 260–289 (273.9) mm; tail, 75.4–90.7 (85.1); exposed culmen, 50.4–56.4 (53.0); tarsus, 40.1–47.4 (44.2); mid-toe without claw, 47.8–58.2 (52.0).

Adult Female (27 specimens): Wing, 237–271 (254.7) mm; tail, 68.1–88.6 (81.7); exposed culmen, 47.1–55.1 (51.0); tarsus, 38.3–49.3 (42.6); mid-toe without claw, 46.7–58.4 (51.7).

Southern specimens, *A. d. diazi* (?), all seasons

Adult Male (13 specimens): Wing, 260–282 (269.9) mm; tail, 76.0–95.0 (86.3); exposed culmen, 51.1–55.6 (53.3); tarsus, 43.1–48.4 (46.3); mid-toe without claw, 51.4–57.7 (53.7).

Adult Female (13 specimens): Wing, 232–268 (253.4) mm; tail, 80.0–89.5 (85.1); exposed culmen, 45.5–52.7 (50.3); tarsus 40.2–43.6 (42.0); mid-toe without claw, 47.3–53.1 (49.8).

Northern specimens, *A. d. novimexicana*, breeding season

Adult Male (5 specimens): Wing, 272–289 (278.4) mm; tail, 78.1–90.4 (84.1); exposed culmen, 51.6–56.4 (53.5); tarsus, 42.2–47.4 (45.0); mid-toe without claw, 50.3–54.1 (52.1).

Adult Female (13 specimens): Wing, 242–271 (254.4) mm; tail, 77.2–88.6 (82.6); exposed culmen, 47.1–55.1 (50.7); tarsus, 38.3–49.3 (42.8); mid-toe without claw, 46.7–58.4 (52.2).

Southern specimens, *A. d. diazi*, breeding season

Adult Male (10 specimens): Wing, 260–282 (269.1) mm; tail, 76.0–95.0 (86.0); exposed culmen, 51.1–55.6 (53.2); tarsus, 43.1–48.1 (46.0); mid-toe without claw, 51.4–55.1 (53.2).

Adult Female (13 specimens): Wing, 232–268 (253.4) mm; tail, 80.0–89.5 (85.1); exposed culmen, 45.5–52.7 (50.3); tarsus, 40.2–43.6 (42.0); mid-toe without claw, 47.3–53.1 (49.8).

In view of the lack of difference in either color or size that would make it possible to identify reliably a specimen as representing either northern or southern populations, we conclude that the “New Mexican Duck,” *Anas diazi novimexicana*, is not a valid subspecies and that the Mexican Duck is a monotypic species.

RELATIONSHIP TO THE MALLARD

The large number of specimens in collections which show morphological evidence of mixture of genes of *Anas diazi* and *Anas platyrhynchos* raises a question as to the specific relationship of the two. Lindsey (1946) and William Huey (pers. comm.) give evidence that individuals with mixed characteristics may be of fairly common occurrence. Lindsey noted that hybrids usually outnumber the pure Mexican Ducks wintering in Rio Grande Park, Albuquerque, New Mexico. Huey considers this situation abnormal because those ponds, which were associated with the Albuquerque Zoo, usually contained a mixture of domestic mallard-type birds. He says that among ducks trapped for banding at the State refuge at Radium Springs, New Mexico,

ratios of what were considered pure bred to hybrids were: 1959, 20/6; 1960, 15/11; and 1961, 23/11. There is no way of relating these figures to the proportion of hybrids to purebreds of either Mexican Ducks or Mallards in any given breeding population.

Opinions of systematists differ on how to handle this situation in the nomenclature. Nomenclatural treatments, such as Peters (1931), Hellmayr and Conover (1948), Friedmann, Griscom, and Moore (1950), and American Ornithologists' Union (1957), accord Mallards and Mexican Ducks distinct species rank while Delacour (1956), A. Phillips (1959, 1961), and Johnsgard (1961*a, b*) consider them conspecific. The difference of opinion is probably largely the result of differences in concept of what constitutes a species. The mere fact that hybridization occurs, of course, is not enough to deny specific rank. Practically all species of ducks will hybridize, especially if mates of their own species are unavailable. This happens frequently in captivity but rarely in the wild. The criterion we are following is that two populations are considered as distinct species if they do not ordinarily interbreed when they come together in the wild. It would appear that the Mexican Duck and the Mallard do interbreed when they come together in the wild, but there is still a question of the extent to which this occurs—whether it is the rule or the exception. Unfortunately, both Mexican Ducks and Mallards are so rare where they occur together during the breeding season that it is difficult to determine the incidence of their interbreeding. This rarity in itself results in a shortage of mates of the same type and is thus conducive to crossing with one of the other type. There is no doubt that we have here a borderline situation between species and racial status.

It seems likely that the sexually monomorphic Mexican Duck, like the Black Duck (*Anas rubripes*) differentiated from the wide-ranging dimorphic common Mallard in the past as a result of ecological or distance barriers to gene flow and different sets of selection factors as postulated by Johnsgard (1961*a*). In more recent times, this reproductive isolation appears to be breaking down, possibly due to man-induced habitat changes. As a result of these secondary junctions, hybridization of both Mexican and Black Ducks with Mallards is taking place. Whether this process progresses to the complete genetic amalgamation of the overlapping populations depends on the extent to which reproductive barriers have evolved during the periods of isolation. In the case of the Mexican Duck, factors possibly inhibiting, if not actually preventing crossing with Mallards, might be their lack of sexual dimorphism which would guide the female in choosing a mate of her own kind, different nesting habitat requirements, different climatic tolerance and different timing of reproductive condition based on rainfall cycles. Mallard and Mexican Ducks resemble one another chiefly in female plumage, but even in this there

are some rather distinct differences as indicated in detail by Huey (1961).

In assessing the species relationships of North American mallard-like ducks, Johnsgard (1961a), after detailed analytical studies, concluded that none of the described plumage or soft part characters, aside from sexual dimorphism of *platyrhychos*, were of absolute diagnostic value. Our much less detailed studies of plumage and soft parts agreed with his findings. Johnsgard noted that experimental breeding had shown that the genetic basis for sexual dimorphism in the Mallard is relatively simple and not sufficient to be considered as a basis for a species difference. No qualitative, only quantitative, differences were noted in courtship displays between Black Ducks and Mallards. This quantitative difference in behavior of Black Duck was thought possibly to compensate for lack of sexual plumage differentiation in mate selection. However, courting groups of the species normally remained almost completely segregated and hybrids tended to court with groups they most closely resembled. No observations of sexual behavior of Mexican Ducks were obtained but Johnsgard's notes on the Black Duck and Mallard are strongly reminiscent of Huber's (1923) observation that while flocking in winter and early spring, Mexican Ducks stayed together and did not mix with Mallards. Johnsgard (1963:538) concluded that it appears that isolating mechanisms in *Anas* are based primarily on male plumage or soft part features and associated courtship displays that exhibit these features. Still later, Johnsgard (1967:61) found that obvious Mallard \times Black Duck hybrids rarely exceed more than 2 per cent of combined populations indicating that assortive mating is operating effectively. Although similar data are unavailable for the incidence of Mallard \times Mexican Duck hybrids, if the assortive mating is due largely to the great difference in plumage pattern and color of the males, one might expect a similar incidence of mating inhibition between Mexican Ducks and Mallards as between Black Ducks and Mallards.

Only time and further study will show to what extent speciation has progressed in the case of the Mexican Duck. However, until it is demonstrated that the sexually monomorphic *diazi* and dimorphic *platyrhynchos* populations are freely interbreeding, and ducks of hybrid type definitely outnumber examples of apparently pure strains in breeding areas in the zone of contact, it would seem advisable to follow the concept of two distinct but closely related species, *Anas diazi* and *Anas platyrhynchos*. This concept would seem to agree with that of the semi-species as elucidated by Short (1969) who also thought these units should be considered taxonomically as species.

SUMMARY

1. Currently recognized northern and southern subspecies of the Mexican Duck are not based on sufficiently distinct or consistent size or color characters to be maintained. Therefore, the species is considered monotypic.

2. Although a borderline case in species distinctness, the Mexican Duck (*Anas diazi*) appears to have a certain amount of reproductive isolation from the Mallard (*Anas platyrhynchos*) in areas of sympatry. Therefore, it is considered as taxonomically a distinct species.

3. The Mexican Duck has virtually the same overall geographic distribution now as formerly which is southeastern Arizona, the Rio Grande Valley of New Mexico, and central-western Texas southward through the central highlands of Mexico to the Trans-Mexican Volcanic Belt south of Mexico City. However, it has disappeared as a breeding bird from much of this extensive area because of the drying up of its habitat. The trend of decline of the Mexican Duck and its breeding habitat, both in Mexico and the United States, indicates that it is probably in danger of extinction.

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