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EVALUATION OF AERIAL TRANSECT SURVEYS OF MOTTLED DUCKS

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ABSTRACT: Aerial counts of mottled ducks (*Anas fulvigula maculosa*) along random transects were used to establish population indices in Louisiana and southeastern Texas. Samples were stratified by habitat type, and replicated flights were made in February 1985, August 1985, and February 1986 to count mottled duck, occurring in strips on both sides of the aircraft. The August 1985 population index was 173% greater than the index of February 1985 and consistent with a post-breeding season increase in mottled duck numbers. The August survey also had a higher coefficient of variation, that probably resulted from the presence of large flocks of mottled ducks at that time of the year. The population index increased from 16,793 in February 1985 to 34,022 in February 1986. Other species of ducks were abundant in February, and observers had to differentiate between those species and mottled ducks. The mottled duck index was greater in 100-m strips than 200-m strips, but the coefficients of variation were similar. The 100-m strip is recommended for surveys made in February, because of the difficulty of differentiating mottled duck from other species at distances > 100 m.

The mottled duck (*Anas fulvigula maculosa*) breeds and winters along the coast of the Gulf of Mexico from the eastern edge of Louisiana to Veracruz, Mexico. Throughout this region mottled ducks use small bodies of water in broken marsh and associated agricultural land (Singleton 1953, Saunders and Saunders 1981). Some biologists have expressed concern that mottled duck numbers are declining because of habitat loss and heavy hunting pressure. Stutzenbaker (1984) noted a significant decline in mottled duck numbers in Texas during the 1970's and predicted that this trend would continue. Johnson et al. (1984) documented a decline in the numbers of the Florida subspecies (*A. f. fulvigula*).

An annual survey that will provide a reliable population index with minimal variation is needed to accurately monitor trends in mottled duck numbers so that informed management decisions concerning mottled ducks can be made. Johnson et al. (1984) concluded that a reliable population survey may be the most critical need of mottled duck management programs.

Aerial transects have been used to inventory mottled ducks for many years. Smith (1961) arbitrarily established and flew permanent transects without replicates to determine mottled duck densities in Louisiana in 1950, and Singleton (1953) used essentially the same method in Texas in 1952. Mottled ducks also have been included in annual mid-winter waterfowl surveys by the U.S. Fish and Wildlife Service and Louisiana Department of Wildlife and Fisheries (Voelzner et al. 1982). However, no estimate of the precision of the results could be made during any of these surveys because of the methdology used.

Early attempts to improve the results of aerial surveys centered on correction factors to account for the proportion of ducks unseen by aerial surveys. Aerial population estimates for large dabbling ducks were generally 15-30% of ground estimates based on intensive ground searches (Diem and Lu 1960, Marinson and Kaczynksi 1962). Other researchers used noisier, slower vehicles than airplanes to flush more birds. Bateman (1970) saw 50-100% more Louisiana mottled ducks from a helicopter than from an airplane but noted that the helicopter took twice as much time and was 4 times more expensive. Lotter and Cornwell (1968) found that airboat estimates were about 250% greater than airplane estimates of mottled ducks in Florida; many mottled ducks did not flush in response to an airplane. They also noted, however, that airboats were unacceptable because of expense, time, and noise disturbance.

Efforts to improve inventory methodology using aerial transects led to the application of stratified random sampling to breeding waterfowl surveys by Pospahala et al. (1974) and to wintering black duck (*Anas rubripes*) surveys by Conroy et al. (1988). Habitat-defined strata with sampling intensity based on expected populations as determined from mid-winter surveys were used for black duck surveys (Conroy et al. 1988). Random sampling was done with four or five replicate surveys. This procedure resulted in a population estimate with a known and low level of variation.

We tested an adaption of the method described by Cochran (1977) to determine trends in a mottled duck abundance along the Gulf Coast. The objectives of the study were to obtain a population index with a known variance, to compare indices within and between years, and to evaluate the effect of differences between observers and strip widths on survey precision and feasibility.

METHODS

The study area contained 23,293 km² of coastal marshes between Bay Boudreau in southeastern Louisiana and Galveston Bay in southeastern Texas and adjacent agricultural land of the coastal prairie in southwestern Louisiana and southeastern Texas. The northern boundary of the study area was several kilometers north of Interstate Highway 10, and the Gulf of Mexico was the southern boundary.

The survey area was divided into 6 strata based on habitat type. The composition and size of strata were 1) fresh, intermediate, and brackish (non-salt) coastal marshes of southeastern Louisiana (6,387 km²); 2) salt marsh of southeastern Louisiana (2,438 km²); 3) all coastal marsh of southwestern Louisiana (5,606 km²); 4(the agricultural zone of southwestern Louisiana (5,696 km²); 5) all coastal marsh of southeastern Texas (913 km²); and 6) the agricultural zone of southeastern Texas (2,253 km²; Chabreck 1972 and Gosselink et al. 1979).

Fresh, intermediate, and brackish marsh types in southeastern Louisiana were combined into a single stratum for two reasons. First, the marsh types were not evenly dispersed, and their position frequently changed because of the rapid salinization of large areas (Craig et al. 1979). Extensive preliminary surveys would have been required to accurately delineate the boundaries of each type. Second, available data on mottled duck distribution (Kausal and Wright 1982) indicated that mottled duck densities did not greatly differ among intermediate, fresh, and brackish marsh types and that densities were much lower in salt marsh than in other marsh types. Salt marsh in southwestern Louisiana and