A LOOK AT ULTRALIGHT AIRCRAFT FOR USE IN DEER CENSUS

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Ultralight aircraft because of their characteristics of low, slow flight, good ground visibility, low initial costs, and apparent economical operating costs appear suited to wildlife census and habitat reconnaissance. However, logistics for use of ultralights in wildlife work have yet to be worked out. Some constraints can be anticipated based on past experience with light aircraft and helicopters. But, only through systematic testing with an ultralight can its peculiar requirements be defined and satisfied.

The prime question to be answered is "Can an individual function as pilot, navigator, observer, and recorder simultaneously?" It is not "Can deer be seen from an ultralight," obviously they can. But, can they be counted in a systematic manner which satisfies biological and statistical criterion for extrapolating a sample into an estimate of population size? We hope to answer portions of these questions.

Introduction

Use of aircraft to census big game was begun as early as 1931 (Fuller 1950) and during the following years it has become a widely used technique under appropriate visibility conditions. Currently, some workers would suggest that aerial survey is the only practicable means of estimating the number of large animals inhabiting a large area. Although the estimate is usually inaccurate and often imprecise, it answers a broad range of ecological and management questions to an acceptable level of approximation (Caughley 1977).

Aircraft of various types have been tried in order to achieve acceptable sightability of animals involved. Early experience indicated that an airplane to be used in census of big game should have good maneuverability, low-cost operation, provide good ground visibility, be capable of slow flight, have a fairly high rate of climb, and be able to make short landing and takeoff runs (Saugstad 1942). Conditions were generally met by high-wing monoplanes of light aircraft varieties.

Use of helicopters to census big game was reported in 1950 by Buechner. He outlined advantages of helicopter over fixed-wing aircraft as greater maneuverability, flight at very slow speeds, and relative safety in low flight. However, even at that time, he expressed concern that high costs would limit their use.

Versatile flight capabilities of helicopters have permitted development of several management techniques primarily for large mammals and waterfowl. In some applications, such as capture situations and their specialized requirements, only the helicopter with its maneuverability and slow flight was appropriate. Helicopter use in lieu of fixed-wing aircraft has prompted several cost assessments because of its higher operational costs (Thompson and Baker 1981, Kaminski 1979). However, because of the better data gathering capabilities for some uses, helicopters often were viewed as the best alternative despite higher costs than fixed-wing aircraft.

A survey of wildlife agencies in 1978 indicated that in the United States approximately 65 percent of the hours of helicopter use was devoted to census and population survey, 13 percent to capture and relocation, and 6 percent to habitat reconnaissance and other surveys. The mean use reported by state agencies per year was about 90 hours. However, use in Texas was indicated to exceed 100 but was less than 500 hours annually (Thompson and Baker 1981).

Texas has an estimated 35 million acres of white-tailed deer habitat and 2.9 million acres of mule deer habitat suitable for aerial census. The Texas Parks and Wildlife Department (TPWD) conducted aerial white-tailed deer surveys with fixed-wing aircraft in the South Texas Plains, the western portion of the Edwards Plateau and the southwestern portion of the Rolling Plains. During 1981, a total of 7,559 miles of aerial transects were flown in these areas (Harwell and Gore 1982). A total of 1170 miles of aerial transects were flown for mule deer census in the Trans-Pecos region by TPWD in 1980 (Brownlee 1981).

An increasing number of private landowners are using aerial census for their individual ranches, although no measure of magnitude is available at this time. Several flying services and/or wildlife consultants are offering this service. Since inventory is one of the preliminary steps to resource management, a significant increase in census efforts by ranchers is anticipated due to increasing economic interest in deer management.

The Texas Parks and Wildlife Department in recognizing the reality of game habitat management on an individual ranch basis, has made provision for regulatory sanction of individual ranch management plans (Charles Winkler, TPWD, paper given at 1983 meeting of Texas Chapter, The Wildlife Society, Austin). One of the requirements for an approved deer management plan is yearly census of the ranch unit with an appropriate census technique.

Interest in the applicability of ultralight aircraft for use in deer census has grown with the wildlife biologist's and rancher's awareness of ultralights. However, at present, there is no systematic evaluation of this use, nor are there operational guidelines for non-biologist neophytes to aerial census of deer. Our evaluation will include four aspects of the question of applicability: (1) sampling procedures, (2) sightability of deer, (3) operational logistics, and (4) economics of operation.

Sampling Procedures

The practicing deer manager does not have a broad array of suitable methods for field use in population inventory. Aerial survey is a rough method of estimating the size of a population, but under appropriate circumstances, it is the best one available. Some efforts at refinement have been directed to increasing the precision by diligent application of statistical models. However, integral to statistical validity is the assumption that the observer counts all animals on each sampled unit, hence, no bias. Numerous studies have established the presence of bias under most circumstances.

A second group of biologists recognizing the aerial estimates are biased, treats aerial survey estimates as relative rather than absolute measures of abundance. To hold bias constant, methods are rigorously standardized and the indices obtained are used to estimate rate of population change. In some applications, this is appropriate. However, in order to set a quota of animals to be harvested and numbers of hunters to allow, population size must be estimated in absolute numbers. The census method must be designed to maximize accuracy even at the expense of precision (Caughley 1974).

Other workers have viewed inaccuracy or bias as the major problem and have attempted to correct the estimates for bias. Our intent is to follow this approach. Without evaluating the statistical models themselves, constraints imposed upon pilot-observer-navigator and aircraft by these models can be examined.

Before any area can be surveyed it must be divided into sampling units that are exhaustive and non-overlapping. The choice of units is usually a complex trade-off between maximizing safety and conditions of visibility while minimizing the time spent flying between units, navigation problems, observer and pilot fatigue and variability between sampling units. The commonest choice is a group of transects (Caughley 1977).

Sightability of Deer

Many influences have been identified which at times have a significant impact on an observer's ability to see deer and hence affect the accuracy of counting animals from the air. Width of census strip, altitude of flight and speed of flight each has an effect on an observer's ability to see and count animals (Caughley 1974, Caughley et al. 1976). Increasing each of these variables has a negative effect and these effects are generally additive.

Aerial surveyors have improved their techniques as they discover more about the method's shortcomings, usually by progressively reducing transect width and altitude of flight. For example, Caughley (1976) reported a progressive narrowing of transects in one study on elephants from 660 yards in 1965 to 110 yards in 1975.

A single optimum strip width for aerial census has not been determined. Observers report strip widths from 220 yards to 1320 yards in counting various large mammals in diverse habitats (Caughley et al. 1976). Texas deer biologists have settled on more narrow strip width, i.e., 110 yards (Beasom et al. 1981) or 100 yards (Harwell and Gore 1982, Brownlee 1981).

Even on relatively narrow strips all the deer present on the strip commonly are not seen by an observer. Beasom et al. (1981) compared the counts of deer along 55 yard wide strips adjacent to a helicopter's line of flight (inside) with simultaneous counts of similar width strips lying adjacent but outside the first strips. They found that the numbers of white-tailed deer observed in the outside strips compared to the inside strips were from 34 to 73 percent smaller. A correction factor of 25 percent was suggested for helicopter counts in South Texas brush habitat.

Flight altitudes have been reported from 152 feet to 604 feet in fixed-wing craft (Caughley et al. 1976) for various species and vegetative types and from 50 feet to 99 feet for helicopters (Kufeld et al. 1980). Texas workers report using 66 feet (Beasom 1971, Beasom et al. 1981) for helicopters and 150 feet (Harwell and Gore 1982) or 100 feet (Brownlee 1981) for fixed-wing aircraft.

The speed of flight is a constraint imposed by the limits of an aircraft's design. Since acceptable census counts have been reported for air speeds of 65 miles per hour (Harwell and Gore 1982) an ultra-light's low speed range of 25 to 30 miles per hour is within acceptable limits.

Aerial sightability of animals also is known to vary with time of day, season of year, vegetative type, topography and weather conditions as they affect animal movement, behavior and visibility. This has been demonstrated with moose (LeResche and Rausch 1974), elk (Lovass et al. 1966) and mule deer (Gilbert and Grieb 1957).

Visibility bias is also introduced when animals occur in groups, because larger groups have a greater probability of being observed than small groups (Samuel 1981). The presence of grouping in white-tails is strongly influenced by season of the year. Large groups are more common in winter than fall.

Aircraft presence and noise may affect animal behavior and sight-ability. Some animals flee from low-flying helicopters and others attempt to hide. Nesting raptors may even attempt to stoop on a slow moving helicopter close to their nest. The tolerance of different species under different situations must be determined by experience (Gilmer et al. 1981). Helicopter noise was viewed as favorable in flushing deer during strip census by Kufeld et al. (1979). However, loud aircraft noise has been reported as an intolerable disturbance factor in working with some other species (Thompson and Baker 1981).

Characteristics of individual observers affect the accuracy of aerial counts, not only degree of experience and ability to see animals, but also fatigue and susceptibility to motion sickness. Differences of 61 percent between inexperienced and experienced observer's counts were reported for mule deer census (Gilbert and Grieb 1957) and similar differences between observers were found in moose counts (LeResche and Rausch 1974). Even among trained observers, there were differences between individuals in their ability to see and count animals. However, Caughley (1976) suggested that these differences were consistent and hence could be mathematically corrected.

Fatigue and time of day were found to be significant influences on an observer's ability to count animals (Kufeld et al. 1979). Norton-Griffiths (1976) suggested flights of not more than 3 hours during the morning with short counting periods as one plan to avoid these problems. Gaughley's (1976) findings of no effect from fatigue within a 3-hour surveying session substantiates this suggestion.

Increased observer activity and responsibility increase fatigue. Gilmer et al. (1981) found in radio tracking animals from an aircraft that two hours appeared to be the limit that an individual could effectively monitor receiving equipment and do a satisfactory job of data recording, navigation and other functions.

Motion sickness induced from flight activities significantly detract from efficiency and ability to perform required functions. Consequently, the need for pilots experienced in flying for wildlife inventory was reported as important by several workers, both in terms of observer comfort and required piloting skills.

Fuller (1950) reported that the act of piloting a fixed-wing aircraft to hold a constant course, altitude and speed required full attention of the pilot and prevented him from counting animals. On the other hand, Beasom (1979) and Beasom et al. (1981) reported helicopter pilots acting as observers also.

Ultralight aircraft generally have flight durations of less than 3 hours unless equipped with additional gasoline capacity over that of standard tanks. Consequently, rests incidental to refueling stops are probable.

Even though experiences from use of other aircraft in various situations give reason to be optimistic about use of ultralights in aerial census, they do not sufficiently answer the question because they do not contain all the variables inherent to use of ultralights. Only systematic testing will accomplish this.

Operational Logistics

Rules governing the operation of ultralight vehicles in the U.S. are contained in the Federal Aviation Administration's Federal Air Regulations (FAR) PART 103. This rule defines a powered ultralight vehicle as weighing less than 254 pounds and limited to 5 gallons of fuel: having a maximum speed of not more than 55 knots (63 miles per hour); a power-off stall speed of not more than 24 knots (28mph); and limited to a single occupant. Ultralight aircraft meeting the above requirements are not required to have certificates of airworthiness nor to be registered, and their pilots are not required to be licensed. Those vehicles which exceed the criteria are considered aircraft for purposes of airworthiness certification and registration, and their pilots must be licensed. A two passenger ultralight falls in the latter category.

Operating rules are generally not restrictive to deer census flights. However, some may be important in particular applications. For example, operating rules restrict ultralight vehicles to daylight operations. They may be operated during twilight periods 30 minutes before official sunrise and 30 minutes after official sunset if the vehicle is equipped with an operating anticollision light and all operations are conducted in uncontrolled air space. Few ultralight pilots would have need to operate in controlled air space for deer census. However, they should definitely check on the presence of controlled air space such as Military Training Routes where "low level" combat tactics may be performed by jet aircraft. Pilots should be aware of the flight visibility requirements.

Costs

The purchase price for a new ultralight is decidedly below prices for new conventional aircraft. The numerous ultralight models range in price from $2,800 to $7,000. Most come in kit form requiring about 25 plus hours construction time. Although, some makes may be purchased factory built and dealer prepared for flight at an increased cost.

Operating costs of ultralights appear significantly less than conventional aircraft. One estimate of operating costs for an ultralight operating 50 hours per year was $10.50 per hour (Feinstein 1982). This compares favorably with $30.00 to $35.00 per hour for a light plane and pilot and $200.00 to $250.00 per hour for helicopter and pilot.

Equipment additional to the aircraft such as trailer for hauling flight safety equipment, flight instrumentation and data recording equipment plus flight training could add another $2,000 to $3,500 to the initial purchase.

LITERATURE CITED

Beasom, S.L. 1979. Precision in helicopter censusing of white-tailed deer. J. Wild. Manage. 43: 777-780.

Beasom, S.L., J.C. Hood and J.R. Cain. 1981. The effect of strip width on helicopter censusing of deer. J. Range Manage. 34: 36-37.

Brownlee, S. 1981. Big game harvest regulations--mule deer. Pittman-Robertson Job Completion Rep., Proj. W-109-R-4. Texas Parks and Wildlife Department, Austin, Texas.

Buechner, H.K. 1950. Use of the helicopter in wildlife work. J. Wildl. Manage. 14: 472-473.

Buechner, H.K. I.O. Buss and H.F. Bryan. 1951. Censusing elk from airplanes in the Blue Mountains of Washington, J. Wildl. Manage. 15: 81-87.

Caughley, G. 1974. Bias in aerial survey. J. Wildl. Manage. 38: 921-933.

Caughley, G., R. Sinclair and D. Scott-Kemmis. 1976. Experiments in aerial survey. J. Wildl. Manage. 40: 290-300.

Caughley, G. 1977. Analysis of vertebrate populations. John Wiley and Sons. London. 234 pp.

Caughley, G. 1977. Sampling in aerial survey. J. Wildl. Manage. 41: 605-615.

Eberhardt, L.L. 1968. A preliminary appraisal of line transects. J. Wildl. Manage. 32: 82-88.

Eberhardt, L.L. 1978. Transect methods for population studies. J. Wildl. Manage. 42: 1-31.

Feinstein, P. 1982. The ultralight alternative. Private Pilot, Feb. 34-37. pp.

Fuller, W.M. 1950. Aerial census of northern bison in Wood Buffalo Park and vicinity. J. Wildl. Manage. 14: 445-451.

Gilbert, P.F. and J.R. Grieb. 1957. Comparison of aerial and ground deer counts in Colorado. J. Wildl. Manage. 21: 33-37.

Gilmer, D.S., L.M. Cowardin, R.L. Duval, L.M. Mechlin, C.W. Shaiffer and V.B. Kuechle. 1981. Procedures for the use of aircraft in wildlife biotelemetry studies. Resource Pub. 140. U.S. Fish and Wildlife Service. Washington, D.C. 19 pp.

Harwell, W.F. and H.G. Gore. 1982. White-tailed deer population trends. Pittman-Robertson Job Completion Rep., Proj. W-109-R-5. Texas Parks and Wildlife Department, Austin, Texas. 78 pp.

Kaminski, R. M. 1979. Locating nesting waterfowl by helicopter. Wildl. Soc. Bull. 7: 194-197.

Kufeld, R.C., J. H. Olterman and D.C. Bowden. 1980. A helicopter quadrat census for mule deer on Uncompahgre Plateau, Colorado. J. Wildl. Manage. 44: 632-639.

Kushlan, J.A.. 1979. Effects of helicopter census on wading bird colonies. J. Wildl. Manage. 43: 756-759.

LeResche, R.E. and R.A. Rausch. 1974. Accuracy and precision of aerial moose censusing. J. Wildl. Manage. 38: 175-182.

Lovaas, AL., J.L. Egan and R.R. Knight. 1966. Aerial counting of two Montana elk herds. J. Wildl. Manage. 30: 364-369.

Norton-Griffiths, M. 1973. Counting the Serengeti migratory wildebeest using two-stage sampling. E. Aft. Wildl. J. 11 (2): 135-149.

Norton-Griffiths, M. 1976. Further aspects of bias in aerial census of large mammals. J. Wildl. Manage. 40: 368-371.

Routledge, R.D. 1981. The unreliability of population estimates from repeated, incomplete aerial surveys. J. Wildl. Manage. 45: 997-1000.

Samuel, M.D. 1981. Correction of visibility bias in aerial surveys where animals occur in groups. J. Wildl. Manage. 45: 993-997.

Saugstad, S. 1942. Aerial census of big game in North Dakota. N. Amer. Wildl. Conf. 7: 343-356.

Thompson, B.C. and B.W. Baker. 1981. Helicopter use by wildlife agencies in North America. Wildl. Soc. Bull. 9: 319-323.