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William D. Eldridge
Iowa State University

Paul N. Hinz
Iowa State University

Milton W. Weller
Iowa State University

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WILLIAM D. ELDRIDGE[1], PAUL N. HINZ[2] and MILTON W. WELLER[1]

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The Lake Odessa Public Hunting Area supports two systems of regulated waterfowl hunting. Control Area A consists of 55 marked blind sites which are chosen randomly by hunters during a daily drawing. Hunters using the second area, Control Area B, are not restricted to blind sites and a daily fee is not required, but all parties must possess a valid permit.

Hunter use of Control Area A was uniform throughout the 1972 and 1973 hunting seasons due to the better mallard (*Anas platy rhynchos*) shooting on that area. Control Area B hunter use decreased as the season progressed, reflecting the early migration of wood ducks (*Aix sponsa*) which were more prevalent. In 1973, a year of poor mallard production but good wood duck production, hunter use of Control Area B increased over the previous year as hunters sought wood ducks. Hunters using Control Area A belonged to higher income, education, and occupation brackets, spent more money on equipment, and drove further to hunt than hunters in Control Area B.

Hunter success was positively related to increasing values of vegetation parameters, but the dominant influence was not apparent. A heavy zone of annual emergent vegetation appeared to influence hunter success, but a lack of this zone could be compensated for with a strong representation of buttonbush (*Cephalanthus occidentalis*). Sites on medium-sized water areas (14-20 ac.) with a strong zone of annual emergent vegetation produced the highest success rates in 1972, but the same or similar sites produced low success rates in 1973 after severe loss of vegetation. Because of reduced annual emergent vegetation on the area and the receding zones of bottonbush, a summer drawdown of water level was recommended.

INDEX DESCRIPTORS: Waterfowl hunting, public hunting areas.

Increased hunting pressure and declining waterfowl populations often have resulted in poor hunting quality on public waterfowling areas. To prevent further deterioration, the use of crowded areas has been controlled by restricting the number of hunters and hunting sites. Some such system of controlled waterfowl hunting existed in one-half of the states by 1956 (Bednarik, 1957).

The Lake Odessa area is one of three controlled waterfowl hunting areas in Iowa designed primarily for duck hunting. Semicontrolled hunting, involving specified blind sites (Sieh and Aspelmeier, 1961), was initiated because of excessive hunting pressure. Abuses of that system and increasing hunting pressure led to further restrictions in 1972 when a controlled system was initiated on the most heavily-used portion of the area. Under the new system, a $2.00 daily fee was required of parties that received a blind site in the daily drawing (Control Area A). A free hunting area was established on the remaining public land, but all hunters were required to obtain a daily permit (Control Area B).

The two control systems at Lake Odessa offered an opportunity to: (1) compare hunter use, success, and harvest, (2) relate harvest to specific habitat parameters of blind sites that were present only on the fully controlled area, (3) compare socioeconomic characteristics of hunters using the two areas, and (4) determine hunters opinion of the control system on Area A versus the freelance hunting on Area B.

Field work was conducted during September through November in 1972 and 1973 and was funded by the Iowa Conservation Commission.

DESCRIPTION OF THE STUDY AREA

The Lake Odessa Public Hunting Area in Louisa County, Iowa, comprises approximately 3,100 acres of flooded deciduous forest immediately south of the Louisa Unit of the Mark Twain National Wildlife Refuge. The area is situated at the confluence of the Iowa and Mississippi Rivers which are major waterfowl migratory routes (Bellrose and Sieh, 1960). Leased from the United States Army Corps of Engineers in 1956, the area attracts large numbers of mallards and wood ducks which account for 80% of the fall harvest (Sieh and Aspelmeier, 1961).

The area consists of channels and openings in flooded bottomland timber. Dominant forest species include silver maple (*Acer saccarinum*), red maple (*Acer rubrum*), pin oak (*Quercus palustris*), river birch (*Betula nigra*), and sandbar willow (*Salix interior*). Extensive tracts of buttonbush (*Celphalanthus occidentalis*) extend beyond the forest canopy into more open areas; these tracts are gradually dying due to continued high water levels. Dominant annual emergent vegetation include water smartweed (*Polygonum punctatum*), sedges (*Carex* sp.), cutgrass (*Leersia oryzoides*), and barnyard grass (*Echinochloa muricata*).

METHODS

Harvest and Recreation Data

Recreational activities at Lake Odessa during the waterfowl season include hunting for waterfowl, deer and squirrels, and fishing and sight-seeing. Harvest information was determined from daily permits required at the two control area check stations. Data were recorded separately for each of the 55 blind sites on Control Area A.

Analysis of Blind-Site Habitat

Vegetation at the blind sites included forest canopy, buttonbush, annual emergents and occasionally floating vegetation. This zonation often completely or partially surrounded open water. On each of the 55 blind sites in Control Area A, vegetative characteristics and physical aspects of the water areas were measured to define conditions that might be related to waterfowl use.

Density, coverage, and total area were estimated for each zone of buttonbush. Only coverage and total area were estimated for emergent and floating vegetation. Area estimates of each vegetation zone were made with the use of a measuring rope and rangefinder. Density and coverage estimates were determined by sampling with a 0.5 m^2 quadrat. The following vegetative cover classes (Daubenmire, 1968) were used to analyze each quadrat: Class 1 = 0-5%, Class 2 = 5-25%, Class 3 = 25-50%, Class 4 = 50-75%, Class 5 = 75-95%, Class 6 = 95-100%. Additional vegetative parameters measured included the

[1]Department of Zoology and Entomology, Iowa State University, Ames, Iowa 50011. Present addresses: Eldridge — Correo Islote Rupanco, Osorno, Chile; Weller — Department of Entomology, Fisheries, and Wildlife, University of Minnesota, St. Paul, MN 55108

[2]Department of Statistics, Iowa State University, Ames, Iowa 50011.

number of species occurring in each quadrat and the number of vertical strata based on plant life forms ranging from floating vegetation to forest canopy.

A measuring rope 200 feet long was placed parallel to and extending through the center of each belt of emergent vegetation. The blind site stake served as a reference point for placement of the rope. Ten numbers from one to 200 were chosen from a table of random numbers for each zone. One meter square quadrats were placed one meter from the corresponding rope number on the side toward open water. The measuring rope was centered in the vegetation zones on the opposite side of the blind site opening, where the sampling procedure was repeated. The entire process resulted in 20 readings for each zone totaling 10 square meters per zone for each site.

Three measurements of water were obtained at each site: (1) water area free of vegetation, (2) area of open forest canopy, including emergent vegetation and buttonbush, and (3) area of the nearest water body connected to the site by a channel or a break in the forest canopy. Water areas were measured with the use of aerial photographs and a polar planimeter. Because the water area free of vegetation sometimes was difficult to ascertain from aerial photographs, on-the-site measurements with a range finder also were used.

Grouping of Blind Sites for Analysis

Data on water area size and vegetative coverage at each blind site were used to "cluster" blind sites into smaller groups. A common clustering program, the Unweighted Pair Group Method using arithmetic averages (UPGMA), was used to analyze the data (McCammon and Wenniger, 1970). The computerprinted dendrogram indicated the similarity among blind sites utilizing the following data sets: (1) all vegetative parameters measured at the site, (2) three water area measurements for each site, and (3) a combination of vegetation and size measurements.

Because the data input did not include the shapes of the various sites, groups of similar blind sites as indicated on the dendrogram were refined from field notes. Blind sites that would not fit the refined groups were eliminated. Final groupings of blind sites were compared in terms of hunter success (defined as the average number of ducks harvested per hunter hour).

Hunter Acceptance and Socioeconomic Surveys

Hunter acceptance of the control system on Area A was measured by a questionnaire distributed at the check station in 1972. One hunter from every five parties was asked to fill in the questionnaire. Due to repeats and refusals, approximately one in ten parties actually were sampled, resulting in 154 usable questionnaires. After the 1972 season, additional information on acceptance of the control system was obtained from mail survey cards distributed to Lake Odessa hunters who succeeded at shooting ducks. Although the survey was designed to obtain harvest information, space was reserved for comments. Comments of hunters responding to the survey were recorded as favorable or non-favorable.

A questionnaire to determine the socioeconomic status of the hunter populations using the two control areas was distributed at the check station in 1973. Questions involving expenditures on hunting equipment also were included. In Control Area A, the questionnaire was distributed to one hunter from every party that received a multiple of five in the daily drawing. In Control Area B, a questionnaire was distributed to one hunter from every party having a multiple of five as a permit number. About one hundred usable forms were obtained from each area.

RESULTS

Harvest Data

Data on harvest by species for both areas during 1972 and 1973 are presented in Table 1. With the exception of wood ducks, the harvest of most species in 1973 was lower than in 1972. Primary reasons for the decline in 1973 were fewer ducks and a shorter season.

Control Area A consistently provided better mallard shooting than Control Area B, probably because it is located closer to the Mark Twain National Refuge, and the larger water areas or vegetation appear more attractive to mallards. Control Area B consistently provided better wood duck shooting because wood ducks prefer small water areas, and Area B had 8.25 miles of waterways that averaged 90 feet or less in width while Area A had only 3.38 miles.

Table 1. *Total kill by species and control area for 1972 and 1973.*

	1972		1973	
	Control Area A (% total)	**Control Area B (% total)**	**Control Area A (% total)**	**Control Area B (% total)**
Mallard	3,303 (79.42)	1,698 (67.62)	2,229 (66.47)	1,200 (37.11)
Wood Duck	238 (5.72)	538 (21.42)	750 (22.36)	1,848 (57.14)
American Wigeon	117 (2.81)	111 (4.42)	54 (1.62)	65 (2.01)
Gadwall	74 (1.78)	53 (2.11)	30 (0.90)	30 (0.93)
Ring-necked Duck	77 (1.85)	27 (1.07)	35 (0.96)	11 (0.34)
Blue-winged Teal	68 (1.64)	17 (0.68)	35 (1.05)	10 (0.31)
Lesser Scaup	74 (1.78)	12 (0.48)	36 (1.08)	8 (0.25)
Northern Pintail	74 (1.78)	6 (0.24)	46 (1.38)	8 (0.25)
Green-winged Teal	35 (0.84)	19 (0.75)	54 (1.62)	24 (0.74)
Black Duck	42 (1.01)	11 (0.43)	33 (0.96)	15 (0.46)
Northern Shoveler	33 (0.89)	13 (0.52)	17 (0.50)	10 (0.31)
Bufflehead	7 (0.17)	4 (0.16)	2 (0.04)	0 (0.00)
Ruddy Duck	7 (0.17)	0 (0.00)	4 (0.09)	0 (0.00)
Common Goldeneye	4 (0.09)	0 (0.00)	3 (0.07)	0 (0.00)
Common Merganser	3 (0.07)	0 (0.00)	0 (0.00)	0 (0.00)
Hooded Merganser	2 (0.05)	1 (0.04)	5 (0.15)	5 (0.15)
White-winged Scoter	1 (0.02)	0 (0.00)	2 (0.06)	0 (0.00)
Greater Scaup	1 (0.02)	1 (0.04)	0 (0.00)	0 (0.00)
Redhead	1 (0.02)	0 (0.00)	6 (0.17)	0 (0.00)
Canvasback	1 (0.02)	0 (0.00)	12 (0.35)	0 (0.00)
Total	4,162(100.00)	2,516 (99.98)	3,353(100.15)	3,235 (99.99)

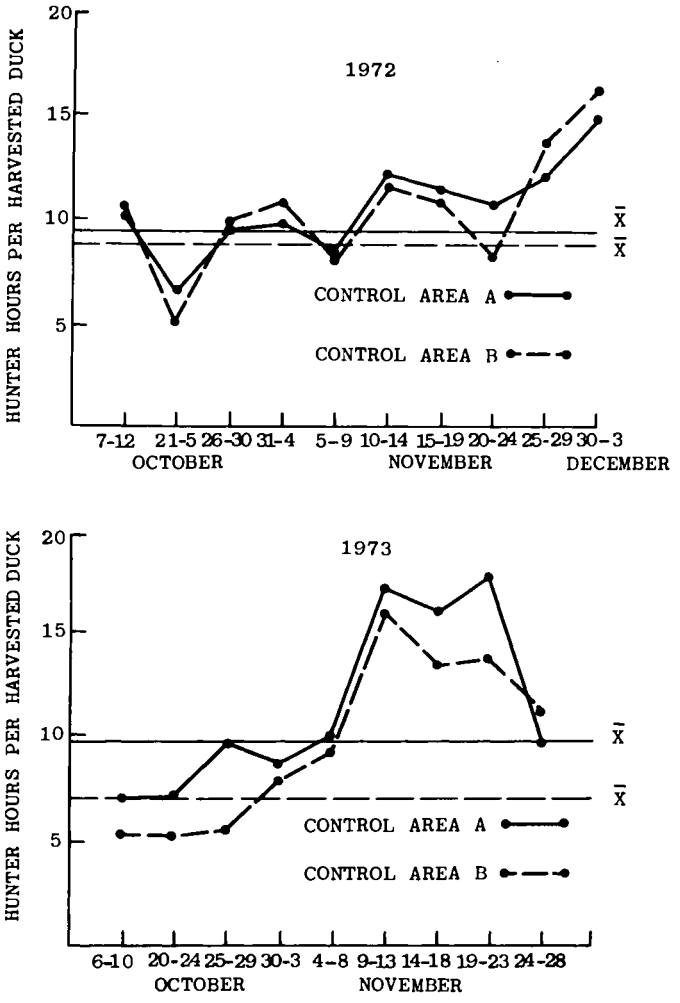
*Common names from American Ornithologist's Union Checklist of North American Birds, 1957; 1973.

Table 2. *Hunters, hunter hours, and hours/bird by control area for 1972 and 1973.*

	Control Area A		**Control Area B**		**Total**	
	1972	**1973**	**1972**	**1973**	**1972**	**1973**
Hunters	6,068	5,612	3,902	4,559	9,970	10,171
Hunter hours	39,398	33,080	22,531	23,272	61,920	56,352
Hours/duck harvested	9.47	9.97	8.81	7.19	9.23	8.60
Hours/mallard harvested	12.00	16.00	13.21	20.34	12.15	16.43
Hours/wood duck harvested	169.32	44.20	46.13	12.70	79.54	21.69

Recreation

The number of ducks harvested may not reflect the true value of the hunting experience, but it is one of few measurements of this dominantly aesthetic situation (Dimmich and Klimstra, 1964). Areas A and B were compared by: (1) the number of hunters using each area, (2) the time spent by hunters on each area, and (3) the hunter success (hunter hours per duck). Table 2 indicates the total number of hunters, hunter hours, and hunter hours per duck harvested for each area in 1972 and 1973. Although hunter hours per duck harvested decreased in 1973, most of the decrease can be attributed to improved wood duck hunting. Hunters prefer mallards to wood ducks, so the number of hunter hours per mallard harvested, rather than duck harvested, may better reflect hunter opinion.



1. Hunter hours per harvested duck, Lake Odessa, 1972 and 1973 seasons.

Figure 1 illustrates the number of hunter hours required to harvest one duck throughout each season. The two control areas follow similar trends each year, which indicates that control regulations have not influenced hunter opportunities to harvest a duck. However, assuming that an increase in hunters, boat traffic, and distractions such as fishermen results in a lower success rate (Teer, 1952; Van Dan Akker and Wilson, 1951), the restrictive regulations on the more heavily used Control Area A may be improving success by minimizing competition. Figure 2 depicts the number of hunters by season and area. In both years, hunter use declined on Control Area B because of the early migration of wood ducks, resulting in an average of 5.9 hunters per acre per day on Control Area A compared to 2.1 on Control Area B in 1973.

An important consideration of controlled hunting is the effect on other forms of recreation in the area. Because regulations on Control Area A required that a person pay $2.00 and remain within 40 yards of a hunting site stake, the only form of recreation that occurred on this area was waterfowl hunting. Control Area B received use from fishermen each day and occasional use from deer hunters, squirrel hunters, and sight-seers. The user-hours for each form of recreation in Control Area B, except waterfowl hunting, are listed in Table 3.

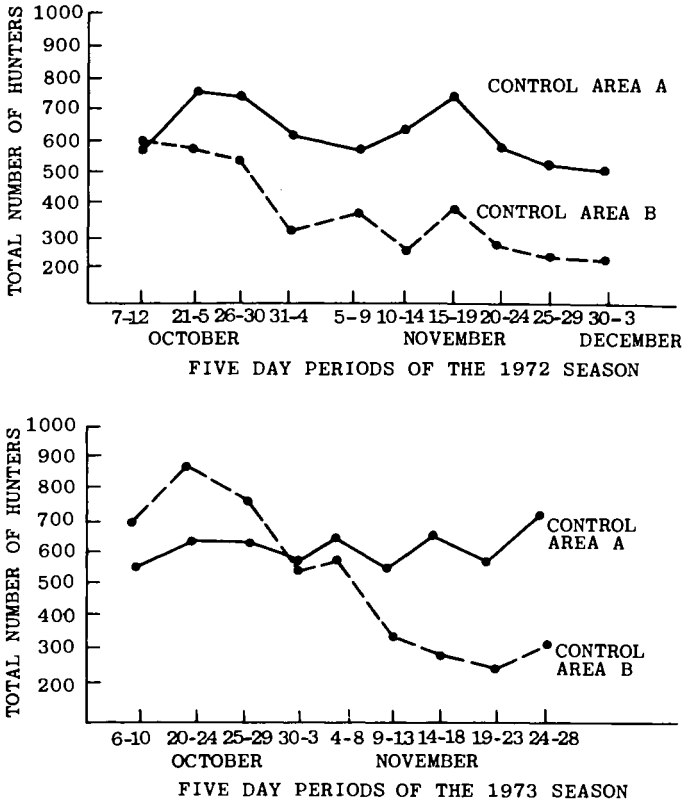
Socioeconomic Information

Sociologists have demonstrated relationships between socioeconomic characteristics and recreation participation (Doll and Phillips, 1972; Klessig and Hale, 1972). Age, occupation, education, and income have been used to estimate future recreational demands (Outdoor Recreation Resources Review Commission, 1962). Certain socioeconomic characteristics also are related to the willingness to pay (Moeller and Engelken, 1972). To determine whether Control Area A regulations were reflected in socioeconomic characteristics of the hunters, a questionnaire was distributed to hunters on both control areas. Results of the survey are presented in Table 4.

After wood ducks migrated early in the season, most hunters consistently used either Area A or B during the last 40 days of the 1973 season, but not both. Thirteen percent of the hunters who utilized Control Area A more than five times also used Control Area B more than three times. The small percentage of interchange of hunters would have a minor effect on survey results (Table 4).

Table 3. *Number of participants and participant hours other than duck hunting at Lake Odessa during the 1972 and 1973 duck seasons.*

	1972 Control Area B		1973 Control Area B	
	Participants	Participant Hours	Participants	Participant Hours
Fishing	307	1,479	751	3,720
Deer hunting	25	240	10	54
Sight-seeing	13	28	12	23
Squirrel hunting	3	12	12	36



2. Chronology of hunter use at Lake Odessa, 1972 and 1973 seasons.

Table 4. *Results of 1973 socioeconomic survey expressed in percent.*

	Control Area A	Control Area B
Hunters with total family incomes over $15,000 per year	44	16
Hunters with white collar occupations	56	40
Hunters with four years or more of college education	25	13
Hunters living in cities of 50,000 or more	35	17
Hunters living on farms	5	6
Average number of years of waterfowl hunting (in years)	13.0	11.6

Table 5. *Average equipment expenditures during 1971 and 1972 by Control Area hunters.*

	Control Area A		Control Area B	
Item	Expense	Percent hunters buying	Expense	Percent hunters buying
Blind boat	$1,273.40	79	$806.66	58
Gun, decoys, dog, clothing, and footwear	220.17	91	126.10	74

The difference in total family income was significant between the two hunter populations ($P<.01$) and a greater influence than either occupation or education. Income is generally strongly related to recreation participation because the decision to purchase the necessary equipment to hunt and the rate at which one hunts seem to be governed by income (Doll and Phillips, 1972; Phillips, Doll and Rogers, 1970; Owens, 1965). Increased expenses on Control Area A that cause the over-representation of higher income groups include: (1) the required $2.00 daily fee, (2) the lack of a walk-in access, necessitating a boat, and (3) the cost of a blind. Moreover, random blind site selection in Control Area A allowed long-distance travelers an equal chance with local hunters for a desirable site. Table 5 indicates recent, average expenditures on boats and equipment by Control Area A and B hunters, reflecting the higher expenses and resulting higher incomes of Control Area A hunters. Differences were significant in each expense category ($P<.01$).

The significance of the difference in proportions of hunters having total family incomes over $15,000 using Control Area A and Control Area B was tested with a chi-square test. This difference was significant at the $P<.01$ level and was greater than differences in either occupation or education. The cost of hunting Control Area A probably is the reason for the difference. As a more direct measure of willingness to pay, each respondent answered a question on the suitability of the $2.00 daily hunting fee. The majority of hunters surveyed in both areas indicated the fee was satisfactory, but 25% of Control Area B hunters and 10% of Control Area A hunters felt the fee was too high, a significant difference ($P<.05$). Four percent of the Control Area A hunters and none of the Control Area B hunters indicated the fee was too low, an insignificant difference.

Table 4 provides data indicating that few Lake Odessa hunters lived on farms, and that Area A was favored by hunters from larger cities. Hunters who came the greatest distance tended to hunt on Area A, as the average distance to Lake Odessa was 61.2 miles and 36.7 miles for Control Area A and B hunters, respectively, a significant difference ($P<.05$).

There is a strong association among occupational, income, and educational characteristics of a group of individuals (Doll and Phillips, 1972; Sendak and Bond, 1970). More Control Area A hunters were concentrated in the "white-collar" occupational and income brackets; these hunters also were better educated. Education has also been correlated with the willingness to pay for fishing privileges where occupation was not (Moeller and Engleken, 1973).

The survey data indicate a trend by "blue-collar" workers to avoid Control Area A; however, this may not have been due to restrictive regulations or the daily fee. It is not known whether Control Area B hunters preferred that habitat regardless of the regulations, a question that could be answered by switching regulations.

Previous hunting experience at Lake Odessa was not significantly different between the two control areas. Most hunters had used the area from the time the original controls were established in 1960, and there were few new hunters for the 1972 season in spite of the change in regulations.

A summary of opinions of Control Area A hunters concerning the 1972 control regulations are presented in Table 6. Information on hunter experience at Lake Odessa and bag on the day of questioning was obtained concurrently to determine whether such factors might bias their statements.

Table 6. *Opinions of 1972 hunters concerning Control Area A regulations from a post-season mail survey and a check station survey.*

	Percent Check station	Mail	Mean ducks shot on day of survey	Mean years at Odessa
Favorable	61.1	79.6	1.41	11.11
Unfavorable	23.1	20.4	0.47	9.53
Same as old system	15.8	—	1.13	6.78

Data on Habitats at Blind Sites

An attempt was made to use hunter success to determine specific characteristics of blind sites that proved attractive to waterfowl. Because vegetation and size were thought important in determining use of an area by waterfowl, groups of blind sites based on size and vegetation parameters individually, and a combination of the two, were related to hunter success.

In addition, several variables influence hunter success seasonally or from year to year. These include differences in migration chronology, weather, food availability, hunter ability, early-season vulnerability of ducks to hunting, and annual production. Several assumptions were necessary in this study: (1) hunter ability was uniform on all days and in all groups of blind sites, (2) flight patterns over the public hunting area randomly affected hunter success of the various blind groups, (3) food values for individual plant species of the annual emergent zones at the various sites were similar and varied uniformly as the season progressed, (4) the number of unreported ducks was uniform for all blind group comparisons, (5) competition did not affect hunter success, (6) migration chronology, weather conditions, and early season vulnerability of ducks to hunting affected groups of sites uniformly.

Analysis of Blind Groups Based on Vegetation

Five groups of blind sites based on vegetative parameters only were compared by mean hunter success in 1972 and 1973. The vegetative parameters varied from year to year on some sites, resulting in different groups for each year. Higher hunter success rates were observed in groups with the highest values for vegetation parameters. When mean values of individual parameters were plotted in order against group success, a trend of increased success with higher values was obvious for all parameters except floating vegetation. In 1973, when differences in success rates among the groups were insignificant, the number of plant species and strata did not appear to be directly related to success.

Table 7. *Averages of size and vegetation in 1972 resulting from clustering of data at blinds.*

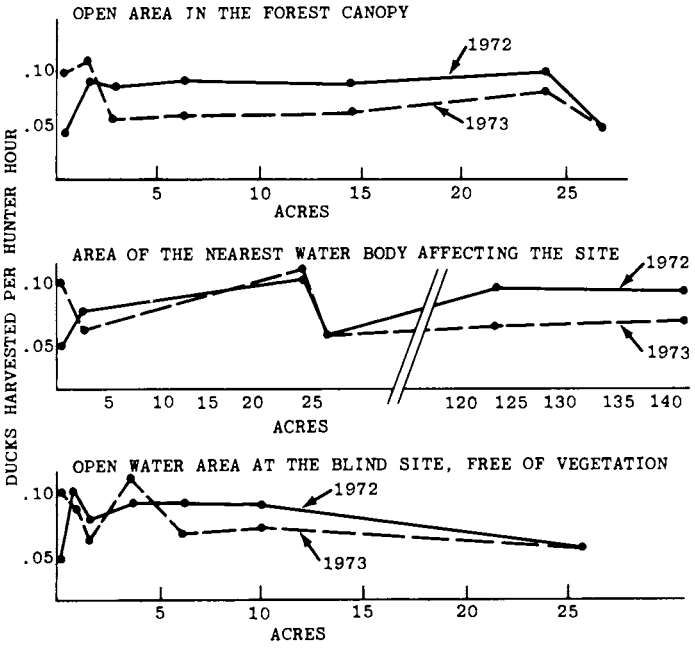
Blind group	Ducks per hour	No. species	No. strata	Buttonbush Percent cover	Buttonbush Density	Annual Emerg. Percent cover	Annual Emerg. Size ft²	Size of opening in forest (acres)	Nearest body of water (acres)	Size of water opening free of vegetation (acres)
I	0.04	2.37	2.50	1.01	0.02	3.38	75	146.35	60.75	60.75
II	0.09	2.40	3.20	26.43	0.69	10.74	140	7.06	53.20	2.72
III	0.12	6.50	4.75	19.80	5.25	52.75	13,750	12.98	32.35	1.11
IV	0.06	3.66	3.50	30.50	4.17	18.10	650	1.06	1.06	0.53

Analysis of Blind Groups Based on Size

Seven groups of blind sites, based on the three parameters of size of water areas and vegetative coverage were compared by differences in mean hunter success. The same groups and sites were used in both years.

Blinds located on small, isolated potholes or on large, lake-like areas were least successful in 1972; those located on wide channels and "fingers" extending from larger water areas were very successful. Differences in success rates were significant ($P<.01$) among all size groups each year. A noticeable difference in hunter success on small, isolated potholes occurred in 1973. Ranked lowest in success during the 1972 season, the group consisting of these sites was second in 1973.

Groups were ranked in order of size for each parameter and plotted against success in Figure 3. In 1972, the amount of open water at each site and the open area in the forest canopy indicate decreased success with extreme values. The size of the nearest water body associated with the site did not indicate a clear relationship to success. The trends observed in 1972 were not apparent in 1973 when small areas in all three categories were best (Figure 3).



3. Relationship between ducks harvested per hunter hour and size and type of water area on Control Area A.

Analysis of Blind Site Groups Based on Combined Size and Vegetation Parameters

The characteristics of blind site groupings that result when vegetation and size parameters are considered together are listed below, and may be compared to averages for each size or vegetative parameter listed in Table 7.

Group I — Sites rank lowest in all vegetation parameters and highest in each size parameter. Individual sites are located along uniform shorelines of large water areas. Emergent vegetation is nearly absent, and buttonbush zones are restricted to narrow, broken bands along the shoreline. This group ranked lowest in success with .04 harvested ducks per hunter hour.

Group II — Sites are located in "fingers" or extensions of large water areas. Emergent vegetation zones are poorly represented, but the buttonbush zone ranks highest among all groups in coverage, density, and size. This group ranks second in success with .09 harvested ducks per hunter hour.

Group III — Blinds are located in wide channels that connect larger water bodies. The buttonbush zone is well represented, and the emergent zone ranks highest among all groups. This group ranks highest in success with .12 harvested ducks per hunter hour.

Group IV — Sites are located in small, isolated potholes or narrow waterways. The buttonbush and emergent zones are average, but floating vegetation ranks highest among all groups. Success rank was third with .06 harvested ducks per hunter hour.

In summary, blind group I, with the lowest success rate, ranks largest in size and lowest in vegetation (see Table 7). Blind groups II and III, with the highest success rates, have medium size and high vegetation values. Group IV, with combination of small size and dense vegetation, produced the poorest hunter success. These conclusions, based on one study, are tentative.

MANAGEMENT IMPLICATIONS

1. Restrictive regulations involving a marked blind site system and a daily fee should not be extended to Control Area B for the following reasons: a) Control Area B serves as an alternate area for Control Area A hunters and for those who hunt wood ducks via walking or by boat. b) Extension of Control Area A regulations to Area B might also discourage lower income hunters who now use that area or those who have a general dislike for regulations. c) Hunter use of Control Area B steadily decreases as the season progresses and problems of competition decrease. d) Other forms of recreation, particularly fishing, are eliminated by control regulations used in Control Area A.

2. Periodic summer drawdowns are needed to encourage the growth of emergent vegetation attractive to ducks, but are not always possible on this area because of water levels and control structures. Groups of blind sites based on parameters of vegetation and size and vegetation combined indicated a positive relationship of vegetation to hunter success. However, excessive vegetation may reduce success. Planting annual, emergent vegetation has been shown to increase hunter success on small clearings in flooded forests (Merz and Brakhage, 1964). A decrease in annual emergent vegetation on larger areas also resulted in a

relative decrease in hunter success from year to year.

Smartweed, rice cutgrass, and barnyard grass are dominant plants of the naturally occurring zone of annual emergent vegetation at Lake Odessa. These plants are preferred natural foods of ducks in the fall and, with the exception of marsh smartweed, retain seeds late in the season (Anderson, 1959). Because these plants establish naturally on exposed mudflats, artificial planting during a drawdown would not be necessary at most sites. Experimental plantings could be attempted on particularly unproductive sites and where natural vegetation fails to establish.

Observations by local residents suggest that the buttonbush zone of vegetation is gradually receding at Lake Odessa due to continued high water levels. Buttonbush is a common but not heavily utilized fall duck food and has not been recommended for waterfowl areas because it competes with more desirable species (Anderson, 1959). Because annual emergent vegetation is generally lacking at Lake Odessa, the buttonbush zone probably provides cover, if not food. Analysis of vegetation parameters revealed that sites with extensive zones of buttonbush maintained relatively high success rates from year to year in the absence of annual emergent vegetation.

3. A limited establishment of new sites is possible and is only recommended for isolated areas as need arises. Because of the increased time required to complete the daily drawing, extensive establishment of new blind sites would be impractical. However, extensive areas of isolated, flooded timber exist in Control Area A. Small clearings on these areas (1-2 acres) can provide excellent wood duck hunting in the early season. Clearings of 3-4 acres would be needed to attract mallards, particularly in years when annual emergent vegetation is abundant on other areas. Because hunter use tends to decrease on smaller areas as the seasons progress, these sites could be eliminated from the daily drawing later in the season.

The medium-sized areas (14-20 acres) are heavily utilized by hunters and produce the highest hunter success when emergent or buttonbush zones are present. However, there are few possibilities of new sites that would not interfere with existing sites.

Although new sites could be established along uniform shorelines, and would not interfere with other sites, such sites were utilized least by hunters and produced low success rates. Creation of additional sites of this type is not advisable unless manipulation of vegetation at sites on uniform shorelines led to increased success rates.

The concept of "carrying capacity" has been applied to user fee recreational areas (Moeller and Engelken, 1973). Carrying capacity was defined as the amount of recreation an area can sustain without a substantial reduction in the quality of the recreational experience. By imposing restrictions and fees, the state assumes some responsibility to maintain hunting quality. It is, therefore, desirable to establish new sites only where they are blocked from the view of other sites.

4. Complaints from hunters about early shooting, leaving blinds, and other violations of control regulations infer that checks should be made at least every two weeks.

5. Adjustment of the daily fee or season fee should not be used as a method of restricting hunting pressure. The amount of the daily fee has a significant effect on the use a recreational area receives (Lapage, 1968). A study of Wisconsin hunters indicated that willingness of waterfowl hunters to pay for hunting declines sharply at $4.00 per man per day (Klessig and Hale, 1972). Pressure can be diverted from high use recreational areas by raising user fees (Lapage, 1968) but, because waterfowl hunters hunt as a group and invest heavily in equipment, a considerable increase from the current $2.00 party fee would be required to produce a limiting effect on hunter use. Moreover, legal problems arise when a public agency operates a recreational area for profit (Hines, 1965).

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