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ABSTRACT: We surveyed 29 wild rice growers, representing 96% of the California acreage grown in 1993, to determine current practices for blackbird damage control. Twenty-seven growers (93%) had blackbird damage. The period of greatest damage and most intensive control was July through September. Red-winged blackbirds *(Agelaius phoeniceus)* most frequently caused damage, but three other species of blackbirds and the European starling *(Sturnis vulgaris)* were also identified. Most growers (72%) reported 1 to 10% yield loss. Average loss ranged from $121 to $309/ha, and from $14,530 to $32,061/grower. Most growers (97%) attempted to control blackbirds for an average of 3.5 months during the growing season, relying primarily on shotguns, propane cannons, shellcrackers or bird bombs, and patrols. Growers in northeastern California tended to rate these techniques as more effective than growers in the Sacramento Valley, possibly due to the larger field sizes in the Valley. Average effectiveness ratings for all techniques indicated little better than slight control for the techniques used, suggesting grower dissatisfaction with the available techniques. Average cost for control averaged $86.21/ha, which was among the highest costs for any single aspect of wild rice production.

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INTRODUCTION

Wild rice *(Zizania palustris)* is an emergent-aquatic grass native to North America. In the wild it grows along the edges of slow-moving streams and shallow lakes in the Upper Mississippi-Great Lakes region of the United States and Canada (Archibold et al. 1985). Within the past 25 years wild rice has become a crop of commercial importance with three distinct production systems: natural stands, managed natural stands, and cultivated paddies (Hayes et al. 1989). The major production areas for wild rice are Canada, California, and Minnesota, with paddy-grown wild rice from the latter two states accounting for the majority of production (e.g., more than 95% of the 1985 world production of 15,200 metric tons of unprocessed grain).

Wild rice is not native to California. It was introduced in 1972 using seeds from Minnesota. Commercial acreage of wild rice increased rapidly from 970 ha in 1982 to a peak of about 7300 ha in 1986. California has been the leading producer of wild rice since 1986 with yields that range from about 1120 to over 2240 kg/ha (1000 to 2000 lb/ac). There are three separate production areas in California differentiated by geographic or climatic factors: the Sacramento Valley, northeastern California, and the Clear Lake region in the northern Coast Range (hereafter referred to as SV, NC, and CL, respectively). An eight-county region (including Butte, Colusa, Placer, Sacramento, San Joaquin, Sutter, Tehama, and Yuba counties) centered in the SV produces the majority of wild rice in California. The NC production region includes parts of Shasta, Modoc, and Lassen counties. The CL production area occurs in Lake County. In 1993, 41 growers harvested about 6800 metric tons (15 million lb) of wild rice from 3920 ha (9685 ac) in California (M. Androus, Calif. Wild Rice Program, Personal Communication).

From the early days of paddy cultivation, wild rice growers have been plagued by bird damage. Waterbirds such as ducks, coots, and swans forage on sprouting wild rice early in the growing season. Blackbirds (family Icteridae), however, due to their numbers and extended presence during the growing season are considered by growers to be the primary vertebrate pests of wild rice. Blackbirds, such as the red-winged blackbird *(Agelaius phoeniceus)* or the yellow-headed blackbird *(Xanthocephalus xanthocephalus),* are highly adapted to wetland habitats, such as cattail *(Typha* spp.) and bulrush *(Scirpus* spp.) marshes (Orians 1980). Wild rice grown in flooded paddies and reaching heights of 1.5 to 2.4 m (5 to 8 ft) provides the same resources to blackbirds as their natural habitats. Blackbirds use wild rice for loafing and escape cover, as nighttime roosts, and for nest sites. Wild rice paddies provide the same emergent insects important in the diet of blackbirds on natural wetlands and also one additional resource, namely the wild rice grain. Wild rice seed is consumed by blackbirds during the milk, dough, and mature stages of growth. Wild rice in the mature stages also easily shatters or falls off the seed head as a result of bird movements within the crop, resulting in additional crop loss.

Wild rice growers have not been able to control blackbirds to their satisfaction and are seeking improved control techniques. The purpose of this study is to provide baseline information on current control practices and costs, ratings of effectiveness, and loss estimates suffered by wild rice growers in California prior to initiating research and development of new control techniques and strategies.

METHODS

We attempted to survey all known growers (n = 41) producing wild rice in California in 1993. We sent a questionnaire consisting of a cover letter and 11 questions to growers in late summer 1993. We followed up with phone calls or personal interviews of nonrespondents in January 1994.

We examined results for the state overall, but also compared results from the two largest production areas

(SV and NC) for any differences and similarities. With only one grower active in the CL production area, results from that region were combined with those from the SV based on similarities in climate and cultivation practices. We used standard parametric statistics to compare data when assumptions of normality and equal variances were met. If necessary we induced normality using transformations.

We derived monetary estimates of loss based on a standardized yield of 1569 kg/ha (1400 lb/ac) after bird damage, a value of $0.20/kg ($0.45/lb) for unprocessed rice, and the acreage cultivated and yield loss estimates provided by the individual growers. Two estimates of monetary loss were calculated based on the low and high limits of the yield loss category selected by each grower.

RESULTS

Twenty-nine people, representing 71% of the wild rice growers in California, participated in the survey. Ten responses were from the SV, eighteen from NC, and one from the CL region.

Farm Size and Operations

The 29 growers grew 3753 ha (9274 ac) of wild rice, representing 96% of the total 1993 acreage. SV had 2012 ha (4971 ac) while NC had 1741 ha (4303 ac) of wild rice. The average size/operation was greater in the SV than in NC (182.9 ha ± 57.5 SE vs. 96.7 ha ± 52.3 SE, $t = 2.48$, $P = 0.02$, $df = 27$). Overall, 66% of the growers (n = 19) grew 81 ha (200 ac) or less of wild rice. Two growers, one from SV with 670 ha (1655 ac) and one from NC with 971 ha (2400 ac) accounted for 44 % of the total area cultivated.

Wild rice growth phenology resulted in seedling emergence above the water surface at most sites in May and June (Table 1). However, seedlings emerged at three SV sites in March, suggesting the potential for earlier planting dates in the SV than NC. The earlier planting dates in SV are reflected in the early harvest at three sites in June and July, while no harvesting occurred in NC until August.

Birds: Chronology and Species Composition

All growers except two in NC indicated they had blackbird problems. For most growers the birds first appeared in the wild rice by July (Table 2). All sites in SV reported birds by the end of July, while birds continued to first appear at six sites in NC in August and September. For most growers August was the period of greatest damage. Two growers in SV reported the heaviest damage in May and June, suggesting early plantings were not immune to damage. When asked where the blackbirds came from growers responded with multiple answers. Ten growers said the blackbirds stayed around the wild rice fields all year; 18 growers said they stayed in the wetland areas near the wild rice fields; 19 growers said they were migratory and came seasonally; one grower didn't know where they came from. Not surprisingly, responses to this question suggest growers do not have a clear understanding of the origins or movement patterns of the blackbirds.

Red-winged blackbirds were the most frequently identified by growers as causing damage (Table 3). Twenty-three growers indicated other blackbirds besides red-wings were also present including yellow-headed blackbirds, tri-colored blackbirds *(Agelaius tricolor),* and Brewer's blackbirds *(Euphagus cyanocephalus).* Although not a blackbird of the family Icteridae, six growers indicated a "blackbird," the European starling *(Sturnis vulgaris),* caused damage. Nine of 11 growers (82%) in SV reported blackbirds nesting in the wild rice compared to only 7 of 18 growers (39%) in NC. One grower in NC didn't know if blackbirds nested in the crop.

Table 1. Number of growers reporting the timing of wild rice seedling emergence above the water surface and harvest operations in California overall and by production region in 1993.

	Emergence			Harvest		
Month	SV[A]	NC[B]	Statewide	SV	NC	Statewide
March	3	1	4	0	0	0
April	0	3	3	0	0	0
May	3	5	8	0	0	0
June	5	7	12	2	0	2
July	0	1	1	1	0	1
August	0	0	0	6	9	15
September	0	0	0	2	7	1
October	0	0	0	0	1	1

[A]SV = Sacramento Valley and Clear Lake production areas.
[B]NC = Northeastern California production area.

Table 2. Number of growers reporting timing of blackbird appearance in wild rice fields and periods of most damage in California overall and by production region in 1993.

	Birds First Appear			Period of Most Damage		
Month	SV[A]	NC[B]	Statewide	SV	NC	Statewide
March	0	1	1	0	0	0
April	1	0	1	0	0	0
May	1	2	3	1	0	1
June	2	3	5	1	0	1
July	7	6	13	2	3	5
August	0	5	5	7	10	17
September	0	1	1	0	5	5
October	0	0	0	0	0	0

[A]SV = Sacramento Valley and Clear Lake production areas.
[B]NC = Northeastern California production area.

Table 3. Number of growers reporting on species of birds causing damage in wild rice fields in 1993.

	Region		
Species	SV[A]	NC[B]	Statewide
Red-winged blackbird	11	16	27
Yellow-headed blackbird	8	10	18
Tri-colored blackbird	8	6	14
Brewer's blackbird	6	9	15
European starling	3	3	6
Unknown	1	3	4

[A]SV = Sacramento Valley and Clear Lake production areas.
[B]NC = Northeastern California production area.

Damage Estimates

None of the growers reported receiving less than 1 % yield loss from blackbirds, even though two reported not having problems with blackbirds. Twenty-one growers (72%) reported yield loss in the 1 to 10% range (Figure 1). Two growers, one from each region, reported losses in the 26 to 50% range.

The calculated average loss statewide ranged from a low estimate of $14,530/grower to a high estimate of $32,061/grower (Table 4). Growers in SV lost more ($P < 0.05$) money individually than those in NC ($17,583 to $36,643 vs. $12,665 to $29,261) probably due to the larger field sizes in SV. The average loss/ha ranged from $121 to $309/ha ($49 to $125/ac) statewide, and did not differ significantly ($P > 0.05$) between the two regions. The total wild rice crop loss for the state ranged from about $420,000 to $930,000.

Control Techniques

Twenty-eight (97%) growers indicated they were attempting to control blackbirds. The one grower not controlling was in NC. The average duration spent controlling blackbirds statewide was 3.5 months +_ 0.33 SE. There was no difference in the time spent between SV and NC ($t = -0.11$, $P = 0.91$, $df = 26$). For most growers the period of most intensive control was in August (Table 5), which concurred with the period of most damage (Table 2). The continuance of intensive control in September and October in NC again reflects the later harvest there compared to SV.

Table 4. Low and high estimates of average monetary loss per wild rice grower and per hectare by region and statewide in California in 1993.

	Region		
Loss ($)	SV[A]	NC[B]	Statewide
Low ave. loss/grower	17,583	12,665	14,530
SE	5,823	6,174	4,378
High ave. loss/grower	36,643	29,261	32,061
SE	9,866	13,326	8,976
Total losses, low estimate	193,411	227,969	421,381
Total losses, high estimate	403,071	526,691	929,762
Low ave. loss/ha	133	111	121
SE	25	44	30
High ave. loss/ha	336	292	309
SE	131	84	72

[A]SV = Sacramento Valley and Clear Lake production areas.
[B]NC = Northeastern California production area.

Table 5. Number of wild rice growers reporting periods of most intensive blackbird control in the major production areas and statewide in California in 1993.

	Region		
Month	SV[A]	NC[B]	Statewide
March	0	0	0
April	0	1	1
May	1	1	2
June	3	1	4
July	4	3	7
August	8	14	22
September	0	8	8
October	0	1	1

[A]SV = Sacramento Valley and Clear Lake production areas.
[B]NC = Northeastern California production area.

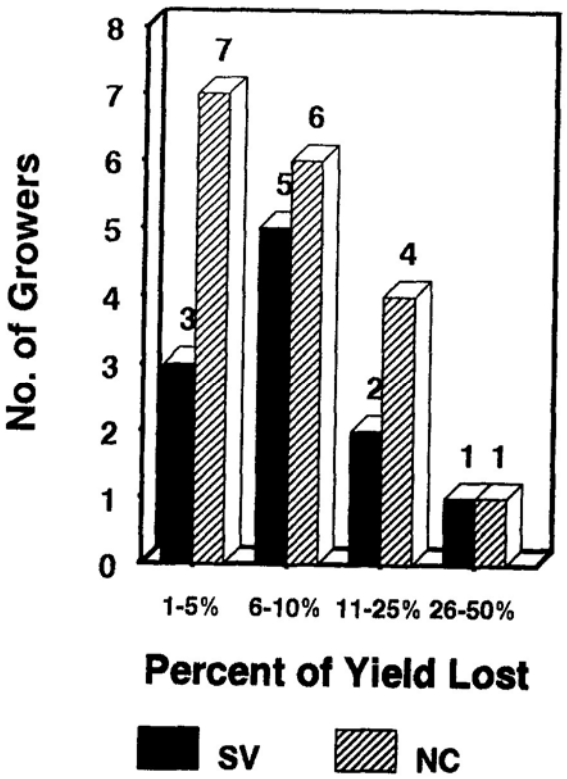

Figure 1. Grower estimates of percentage of wild rice lost in 1993 due to blackbird damage. SV = Sacramento Valley and Clear Lake production areas. NC - Northeastern California production area.

Growers used a variety of control techniques (Table 6), with most relying on shotguns, propane cannons, shellcrackers or bird bombs and whistles, and either walking or vehicle patrols. Overall most rated shotguns as giving moderate to excellent control, but a greater proportion of the NC growers (87%) rated them highly compared to SV growers (56%). Similarly, more NC growers (52%) also favorably rated patrols compared to SV growers (18%). Overall most rated propane cannons as giving no or slight control, with none of the SV growers considering them as very effective. The use of aircraft to haze birds was not widely used, but was rated as moderately to highly effective by five of six growers. Shooting to scare birds with either .22 or large caliber rifles was used more frequently in the SV than NC. The large caliber rifles were used only in the SV and were moderately to highly effective. Techniques deemed ineffective included kites, balloons, model airplanes, electronic noisemakers, and Sevanna (a cayenne pepper and garlic repellent). Techniques not used included trapping, poisons, nest destruction, frightening agents, or barriers such as netting. Overall growers used an average of 4.75 different control techniques ±_ .42 SE during the growing season with no difference in the number used between the regions (t = 1.19, P = 0.12, df = 26).

For all control techniques combined growers in NC gave higher effectiveness ratings than growers in SV (t = -3.07, P = 0.003, df = 124). Nonetheless, average effectiveness ratings indicated less than moderate control overall with values of 1.20 _+ 0.12 SE for SV and 1.66 +_ 0.01 SE for NC. There was no relationship between the average effectiveness rating and the number of techniques used (r^2 = 0.02, t = -0.70, P = 0.49, df = 25).

Overall the cost/ha for control averaged $86.21/ha _+ 12.55 SE ($34.89/ac ± 5.08 SE) and there was no difference in the cost/ha between the regions (t = -8.17, P = 0.94, df = 22). Control costs ranged from a low of $8.65/ha ($3.50/ac) to a high of $296.52/ha ($120/ac). Shotgunning was the single most expensive technique averaging $53.97/ha ± 8.45 SE ($21.84/ac ± 3.42 SE) with no difference spent on this technique between the regions (t = -1.40, P = 0.09, df = 22).

Research Ideas

When asked to suggest subjects for future research, most growers (86%) wanted research in the area of population control, including electrocution, biological pathogens, trapping, birth control, nest destruction, improved shot loads, and toxicants. Thirteen growers (45%) wanted research on scare techniques using biosonics, falcons, silent scare devices, and smoke or fire. Seven growers (24%) suggested studies on the biology and behavior of the blackbirds such as food habits, migration and local movements. Three growers each (10%) suggested research on repellents, lure crops, and damage (including loss estimates and reduction of shattering loss).

DISCUSSION

There were a number of similarities between the regions regarding blackbirds and control. Our survey showed that most growers, regardless of geographic location, had blackbird problems. Red-winged blackbirds were most common, but three other species of blackbirds and the European starling also caused damage. The widespread reporting of tri-colored blackbirds from both major production areas is cause for concern. Unlike the other blackbird species or the starling, current regulations require a permit to kill tri-colors, making species identification critical. Shotgunning is commonly used by growers. However, if applied by personnel without prior education as to species identification and control regulations, shooting could result in the indiscriminate killing of any "blackbird." Both growers and agencies involved with wildlife damage management should increase their educational efforts regarding species identification, and growers should obtain the necessary permits for protection against any accidental kills.

For both regions most damage occurred before or during the harvest period of July through September, which was also the period of the most intensive control efforts. The amount lost was the same for both regions, averaging $121 to $309/ha, although SV growers individually lost more due to the larger size of their operations. Growers in both regions on the average used the same number of control techniques (4.75), spent about the same amount per hectare for control ($86.21/ha), and

Table 6. Number of wild rice growers from the major production areas in California reporting use and effectiveness of control techniques, and average costs per hectare ($) in 1993.

	Sacramento Valley[A]					Northeastern California				
	Effectiveness[B]					Effectiveness				
Technique	0	1	2	3	Cost/ha	0	1	2	3	Cost/ha
ELIMINATION										
Shotgun	0	5	4	1	37.61	0	3	11	2	62.47
NOISE										
Propane cannon	2	6	0	0	6.40	0	8	3	1	12.60
Mobile propane cannon	0	0	0	0	--	0	0	1	0	14.83
Shellcracker or bird bombs	1	2	1	0	2.82	0	1	6	0	7.41
.22 rifle	1	2	1	0	2.54	1	0	2	1	7.29
Large caliber rifle	0	1	2	1	4.35	0	0	0	0	--
Electronic bird calls	0	0	2	0	12.36	0	0	0	0	--
Electronic noise makers	1	1	0	1	13.59	1	0	0	0	na
Radio	1	0	0	0	na	0	0	1	1	12.36
PATROLS										
Vehicle	2	5	1	0	10.53	0	5	8	2	16.26
Walking	2	0	1	0	0	1	5	2	0	8.03
VISUAL SCARING										
Model airplane	0	0	0	0	--	1	0	0	0	na
Aircraft	1	0	2	2	13.44	0	0	0	1	2.47
Kites/Balloons	1	0	0	0	na	1	0	0	0	0.62
Scarecrows	0	1	0	0	1.24	0	0	1	0	1.24
Aluminum reflectors	0	1	0	0	1.24	0	0	0	0	--
REPELLENTS										
Sevanna	1	0	0	0	123.55	0	0	0	0	--

[A] = Sacramento Valley includes Clear Lake production area.
[B] = Effectiveness ratings: 0=no control; 1=slight control; 2=moderate control; 3=excellent control.

mostly relied on four primary control techniques (shotguns, propane cannons, shellcrackers or bird bombs, and patrols). Average expenses for blackbird control were among the highest individual costs for wild rice prior to harvest, being exceeded only by costs for planting and land leveling (D. Marcum and P. Livingston 1992, unpublished manuscript).

A number of differences were also apparent between the regions. Growers in NC tended to rate shotguns, propane cannons, shellcrackers, .22 rifles, and patrols higher than growers from SV. The basis for this lies in the smaller-sized paddies that characterize the smaller wild rice operations of NC compared to SV (D. Marcum, pers. obs.). Due to the relatively flat topography of the SV, paddies there are often laser-leveled and large, with no access to the interior portions. Due to the more varied topography and the limited land available for wild rice, paddies in NC are usually smaller, irregularly shaped, and have better access for vehicle and foot patrols. The smaller size of NC paddies allows growers to move birds from the central portions of the paddies using the above mentioned techniques, whereas they are less effective in the large SV paddies. However, larger paddies and plantings in SV allow growers to use large caliber rifles to move birds. Three of four growers rated this technique as giving moderate to excellent control. No growers in NC used large caliber rifles, probably in part due to small paddy size.

Based on our survey, we recommend that growers improve their species identification skills, and make increased use of potentially effective techniques that are little-used or unused including nest destruction, aircraft hazing, and shooting with rifles from towers. SV growers should consider designing fields with better access to the central portions to improve the effectiveness of shotguns and scaring devices. There has been no systematic study on the use of biosonics for blackbird control or on the use of lure crops planted near wild rice; research should be conducted on those subjects. A standardized technique to measure damage should be developed. A reliable estimate of losses would allow growers to use cost-benefit analyses to determine the amounts to spend for control. Finally, research into the basic biology and behavior of the blackbirds is required. There is no current information on food habits in wild rice areas, local or seasonal movements, or habitat use. An improved basic understanding of the pest species could result in an effective bait for use in trapping or as a toxicant carrier, and suggest the appropriate season or locale for application.

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LITERATURE CITED

ARCHIBOLD, O. W., B. J. WEICHEL, and J. E. FITZGIBBON. 1985. Factors in the ecology of wild rice in northern Saskatchewan. Canadian Geographer 29(2): 100-112.

HAYES, P. M., R. E. STUCKER, and G. G. W ANDRE Y. 1989. The domestication of American wildrice *(Zizania palustris,* Poaceae). Eco. Bot. 43(2):203-214.

ORIANS, G. H. 1980. Some adaptations of marsh-nesting blackbirds. Princeton Univ. Press, Princeton, N. J. 295 pp.