

# WORLD BIRD DAMAGE PROBLEMS

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**ABSTRACT:** There is a lack of information on bird-caused economic losses on a worldwide basis. Some estimates are available for specific problems in the United States, Canada, and parts of Oceania and Europe, but loss estimates are almost totally lacking in Latin America, Asia, and Africa. To justify development of control programs, it is desirable that reliable data on losses be obtained. Such data are helpful at all levels of decision-making about bird control, from research to implementation.

Bird damage situations throughout the world are similar, involving many of the same crops and genera of birds.

This report summarizes major damage problems reported for each continent in tabular form. Agricultural problems are emphasized; other examples are given including bird hazard to aircraft, predation by undesirable species, urban and rural roost problems, birds as carriers or transmitters of disease, and beneficial aspects of some species.

Control methods are not reviewed.

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Administrators, farmers, researchers, managers, politicians, and others often have difficulty in adequately expressing bird-caused losses in terms of bushels, dollars, or some other meaningful units. World bird damage problems are numerous, costly, and varied, but often similar from continent to continent. This paper is an attempt to better define the situation and simultaneously issue a call to responsible and interested individuals to contribute their expertise and knowledge in delineating losses and problems. Loss information on a national or worldwide scale is sorely lacking; and most loss figures are very seldom based on facts.

Only a few workers have attempted to estimate losses and describe problems adequately. This is often due to lack of funds, lack of awareness, misinformation, individual biases, cultural or social situations, politics, and a multitude of other variables. In North America, and to a lesser extent in Europe and Oceania there has been, in recent years, an increasing awareness and accounting of bird-caused losses and problems. In most other parts of the world, little or no information is available.

To justify damage control programs, responsible individuals should first have information on losses to evaluate the overall effect and related costs of control measures. They should also decide the economic status of species; whether it is harmful, beneficial, or a combination of both. Most reported bird damage problems are obvious, others suspect, and some totally misdescribed. Frequently birds are blamed for damage that is attributable in part or wholly to insects, plant diseases, or mammals. As the cost-benefit ratio is the basis for determining the real value of any control method, loss data dictate the type of control sought and the measure by which success or failure should be judged (Besser *et al.*, 1971).

Bird damage situations occur where there is an economic loss, a threat to human health and safety, or a nuisance problem. This includes damage to man directly and indirectly; it involves his crops, livestock, homes, buildings, and his general well-being. The problem is worldwide and has serious economic and human implications. This paper does not touch on control methods; it is intended to provide an overview of damage situations and economic losses to agriculture and other interests of man.

Examples of major world bird damage problems are summarized in Tables 1-6. Because of the large number of references used to gather information for this paper, most literature citations are included in the tables but omitted from the text. Common and scientific names of species mentioned in the text and tables, and other important damaging species are listed in the appendix.

## Agricultural Crops

**Cereal Grains.** Probably the most important bird problem to a cereal crop in the United States is damage caused by the red-winged blackbird to ripening corn (Table 1). Objective surveys conducted in 1970 and 1971 showed nationwide losses of \$15 and \$20 million. Damage to emerging corn by common grackles and ring-necked pheasants may be even more important; losses in 1971 may have ranged from \$6 to \$49 million. Regional examples of significant bird damage to cereal grains in the United States include: blackbird damage to rice in 22 counties in Arkansas in 1963 (\$4.2 million); blackbird and sparrow damage to grain sorghum in 23 states in 1974 (\$5.8 million); and a \$0.35 million loss to wheat in Arkansas in 1963.

In Canada, losses to agriculture, primarily wheat, amounted to \$86 million in 10 provinces to seed-eating birds and \$33 million in 4 provinces to waterfowl (Table 1). Losses were most significant in Ontario (\$40 million), Quebec (\$24 million), and Manitoba (\$21 million).

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Table 1. Examples of reported economic losses in the United States and Canada.

Location	Year	Crops	Loss	Major Species	Remarks	Reference
<u>Canada</u>						
10 provinces		"Agriculture"	\$85.8 million	Seed-eating birds	\$24 million Quebec; \$40 million Ontario; \$15 million Manitoba;	Alsager 1976
4 provinces		"Agriculture"	\$33.2 million	Waterfowl	\$18 million Saskatchewan \$ 9 million Manitoba	Alsager 1976
Ontario		Sweet Cherries	\$44,500; 2.8%	Starlings, grackles	Niagara Peninsula	Virgo 1971
<u>United States</u>						
Nationwide	1971	Corn	\$20 million; 6.8 million bu	Blackbirds	24 states; 2,500 fields examined	Stone 1972
	1971	Emerging Corn	\$6-49 million; 32.5 million bu	Blackbirds, crows, pheasants	Questionnaire survey in 25 states	Stone and Mott 1973
	1974	Grain, Sorghum	\$5.8 million	Blackbirds, sparrows	Questionnaire survey in 23 states	Knittle and Guarino 1976
	1972	Blueberries	\$1.6-2.1 million	Starlings, grackles, robins	5% of crop; 14 states	Mott and Stone 1973
	1972	Grapes	\$4.4 million	Starlings, sparrows, finches	Questionnaire survey in 13 states	Cruse et al. 1976
		Cable damage	\$0.25 million/year	"Woodpeckers"	Bell Telephone Co.; costs to replace damaged cable	Cogelia 1976
		Utility pole damage	\$191,000/year	Pileated, Red-headed, Ladder-backed, and Golden-fronted Woodpeckers	One private company; problem also occurs in Japan, Norway, Finland	Rumsey 1973
Arkansas	1963	Oats	\$122,884	Blackbirds		Agric.Ext. Serv. 1964
	1963	Rice	\$4.2 million	Blackbirds	22 counties	Meanley 1971
	1968	Wheat	\$197,504	Blackbirds		Pierce 1970
California		Almonds	\$85,000 one season	Common Crow	Tulare County; also damage walnuts and pistachios	Simpson 1972
	1973	Grapes	\$4.0 million	Starlings, finches	9 counties	DeHaven 1974
	1964	Livestock Feedlot	\$1,000/day	Starlings	One million starlings at lot	Levingston 1967
	1971	Rice	\$75,000	Blackbirds	Sacramento Valley	DeHaven 1971
	1942	Rice	\$600,000	Waterfowl, blackbirds	Questionnaire survey of 835 rice growers; 12 counties	Anonymous 1943
		Miscellaneous	\$12.75 million	"Birds"	Data from California Dept. of Food and Agric.	Clark 1976
Colorado		Livestock Feedlot	\$84/1,000 starlings; \$2/1,000 Redwings	Starlings, blackbirds		Besser et al. 1968

Table 1. Examples of reported economic losses in the United States and Canada. (cont'd.)

Location	Year	Crops	Loss	Major Species	Remarks	Reference
Louisiana		Pecans	\$1 million/year	Crows		Louisiana Farm Bureau 1972
Michigan	1974	Cherries	\$1.8-4.3 million	Starlings, robins, orioles		Stone 1973a
Minnesota, North Dakota	1972	Sunflowers	1.2%	Blackbirds	18 counties	Stone 1973b
New Jersey		Miscellaneous	\$0.85 million	"Birds"	Extension survey; Burlington County	Congressional Record-Senate 1962
Ohio	1975	Corn	\$2.2 million	Blackbirds	U.S. Fish and Wildlife Service survey	Winters 1975
Oklahoma	1970	Peanuts	As high as \$36/acre	Blackbirds	Grackle most important species	Mott <i>et al.</i> 1972
		Sorghum, Corn, Pecans	\$7.7 million	Crows	Questionnaire survey in 73 counties; 7.5% sorghum; 6.0% corn; 8.4% pecans; \$1 per crow	Imler and Kalmbach 1939
Oregon		Sheep (lambs)	72 lambs	Common Raven	2,000-ewe ranch; ravens kill lambs by pecking eyes	Larsen and Dietrich 1970
Virginia		Miscellaneous	\$5.0 million/year	"Birds"		Dudderar and Nelson 1970
Wyoming		Sheep (lambs)	9%	Golden Eagles	Carbon and Sweetwater counties; total predation was 24%; eagles kill only spring lambs	Tigner and Larsen 1977

Table 2. Examples of reported bird damage to agriculture in Latin America.

Location	Crops	Major Species	Remarks	Reference
Argentina	Grains	Blackbirds, parrots doves, ducks	Includes rice, wheat, corn, sunflowers, sorghum, and soybeans	Bucher and Bedano 1976
Bolivia	Corn	Parakeets	Problem serious in Chuquisaca and Tarija departments	Mitchell 1978
Chile	Cereal grains, pastures	Geese		Elias 1977
Colombia	Grains	Parrots, doves, blackbirds, ducks, Dickcissel	Includes rice, corn, sorghum, and wheat	Elias 1977
	Emerging Soybeans	Eared Dove	Serious problem in Cauca Valley	De Grazio and Besser 1970
Costa Rica	Rice	Dickcissel	The supreme pest of rice fields-North American migrant	De Grazio and Besser 1970
Dominican Republic		Black-headed Weaver	\$7.0 million loss in 1971; also corn and sorghum; introduced species	Peña 1977b
Guayana	Emerging Rice	Blue-winged Teal	North American migrant	Grist and Lever 1969
Guatemala	Emerging Corn	Great-tailed Grackle		De Grazio and Besser 1970

Table 2. Examples of reported bird damage to agriculture in Latin America. (cont'd.)

Location	Crops	Major Species	Remarks	Reference
Hispaniola	Rice, Corn, Sorghum, Peas, Tomatoes	Black-headed Weaver	\$30 million loss in 1971	Peña 1977a
Honduras	Grains	Parrots, doves, blackbirds	Includes corn, sorghum, and wheat	Elias 1977
	African Oil Palm	Black Vulture, Turkey Vulture		Elias 1977
Mexico	Grains	Blackbirds, doves, Dickcissel, ducks	Includes sorghum, soybeans, wheat, corn, and rice	Elias 1977
	Emerging Corn	Great-tailed Grackle, Brown-headed Cowbird		De Grazio and Besser 1970
	Sorghum	Cowbirds, grackles, yellowheads	A major problem in highland plateau states-yellowheads damage emerging sorghum	De Grazio and Besser 1970
Nicaragua		Orange-fronted Parakeet	Perennial problem in Leon area	De Grazio and Besser 1970
Peru	Rice, Wheat, Sorghum	Parrot-billed Seedeater, Drab Seedeater, Greater Red-breasted Meadow Lark	Problem of major severity	Mitchell 1977
Trinidad	Rice	Dickcissel		De Grazio and Besser 1970
Uruguay	Sunflowers	Parakeets, doves	\$2.2 million loss in 1975-76 season; 100,000 tons	La Mañana 1978
	Emerging Wheat	Doves	\$250,000 in 1974	De Grazio and Besser 1975
Venezuela	Rice	Dickcissel, Bobolink	Growers consider birds a virtual plague; North American migrants	De Grazio and Besser 1970
		White-faced Tree Duck	Severe problems in Calobozo district; special hunting season established	De Grazio and Besser 1970

In Latin America, grain sorghum, corn, rice, and wheat are the cereals most frequently damaged (Table 2). Other examples include up to 80% loss of rice in Argentina to the brown pintail and chestnut-capped blackbird; \$7.0 million loss to rice by black-headed weavers in 1971 in the Dominican Republic; and \$0.25 million loss to emerging wheat primarily by the eared dove in 1974 in Uruguay. One of the most widespread problems is white-faced tree duck damage to emerging rice; it occurs in Argentina, Colombia, Nicaragua, Surinam, Uruguay, and Venezuela. Another widespread problem is psittid damage to corn and sorghum. The dickcissel is an important pest of rice and sorghum in Central America and northern South America.

In Europe, the wood pigeon causes a serious problem to cereals, especially wheat in England (Table 3). It is also a problem in The Netherlands. In France, the rook and carrion crow are major pests to cereals. House sparrows and tree sparrows are a problem in Germany and The Netherlands; the mallard damages rice in Bulgaria.

In Asia, rice is the grain most often damaged (Table 4). Major species causing problems throughout most of Asia are the munias, sparrows, weavers, crows, psittids, and waterfowl. In Borneo, the pin-tailed parrot finch is a serious rice pest. In Pakistan, 20% of the rice crop was reported lost to white-headed munias; up to 50% loss has been caused by weavers in Thailand. Other significant cereal damage caused by a variety of species occur to sorghum in India and Pakistan, barley in Korea, millet in Korea and Pakistan, and wheat and corn in Nepal.

In the Near East, in Turkey, house and tree sparrows cause major problems to wheat. In Israel, three species of larks cause problems in wheat and barley.

In Africa, the principal vertebrate pest is the red-billed quelea (Table 5). It has the probable distinction of being the most numerous and perhaps the most destructive vertebrate pest in the world. It affects the economics of more than 25 African nations. The cereals most often damaged by quelea are wheat, rice, millet, and sorghum. Examples of serious losses in Africa are: house sparrow damage to rice in Egypt, sorghum damage by laughing and cape turtle doves in Botswana, damage to wheat (\$0.7 million in 1952) by quelea and other species in Kenya, 1.2 million tons of rice lost annually in

Table 3. Examples reported of bird damage to agriculture in Europe.

Location	Crops	Major Species	Remarks	Reference
Bulgaria	Rice	Mallard		Grist and Lever 1969
England	Cereal grains	Wood Pigeon	£1-2 million loss annually; wheat damage most important	Seubert 1964, Wright 1959, Moore 1970
	Fruits	Common Bullfinch	A problem since 1618; disbud flowering fruits, especially gooseberries, apples, pears	Wright 1959, Seubert 1964, Newton 1968, Summers 1975
	Duck farm	European Starling	Loss of pelleted duck feed; £33,000, 1,000 tons/year	Wright 1973
Finland	Fruits	Fieldfare, Black-bird, European Starling, Carrion Crow, House Sparrow	Strawberries most frequently damaged; red and black currants second and third	Myllymaki and Tenovuo 1977
France	Cereals, Pears, Apples	Rook, Carrion Crow	Most important bird problem	Seubert 1964
	Fruits	Common Bullfinch	Disbud flowering fruit trees; 5-15,000 francs on 1 ha in 1 month	Mahieu and Le Gouais 1968
Germany	Grapes, Cherries	European Starling	Most important problem; \$2.5 million annually	Seubert 1964, Jackson 1968
	Cereals	House Sparrow, crows		Jackson 1968
The Netherlands	Fruits, grains, seed beds	European Starling	Most important problem	Seubert 1964
	Grains, Peas	Wood Pigeon	Includes damage to emerging peas	Seubert 1964

Table 4. Examples of reported economic losses to agriculture in Asia.

Location	Crops	Major Species	Remarks	Reference
Bangladesh	Rice	Weavers, finches		Reidinger 1977
Borneo (Highlands)		Pin-tailed Parrot Finch, finches	The most dreaded pest	Grist and Lever 1969
India	Cereal grains	Parakeet, sparrows, crows, buntings, weavers		Pearson 1967c
Indonesia	Rice	Streaked Weaver		Grist and Lever 1969
Japan		Tree Sparrow, Spot-bill Duck	Sparrow damage excessive	Ugdagawa 1970
Korea-1973	Emerging and ripening grains	Sparrows, pheasants, doves	Questionnaire survey; doves most important species	Howard <i>et al.</i> 1975
Malaysia	Rice	Java Sparrow		Grist and Lever 1969
Nepal	Corn and emerging Wheat	Rose-ringed and Alexandrine Parakeets, Scaly-breasted and Chestnut Munia		Fall 1975
Pakistan	Rice	White-headed Munia, Baya and Streaked Weaver	20% loss	Grist and Lever 1969, Khan 1974
	Millet, Wheat, Sunflowers, Sorghum	House Sparrow, Rose-ringed Parakeet, Baya and Streaked Weaver, Collared Dove	80% sorghum loss in 1974; house sparrow the principal pest	Khan 1974
Philippines	Rice and other grains	Scaly-breasted, Chestnut, and White-bellied Munias, Tree Sparrow		Fall <i>et al.</i> 1972, Benigno <i>et al.</i> 1975

Table 4. Examples of reported economic losses to agriculture in Asia.(cont'd.)

Location	Crops	Major Species	Remarks	Reference
Solomon Islands	Rice	Black Coot		Grist and Lever 1969
Thailand		Scaly-breasted, Chestnut, and White-bellied Munias, Tree and Plain-backed Sparrows, Baya and Streaked Weaver	Up to 50% loss	Jackson 1978
Vietnam		"Parrots"		Grist and Lever 1969

Table 5. Examples of reported economic losses to agriculture in Africa.

Location	Crops	Major Species	Remarks	Reference
Botswana	Sorghum	Laughing Dove, Cape Turtle Dove	Field and storage losses	Irving and Beasley 1975
Cameroon	Emerging and ripening Rice and Wheat, Millet, Sorghum	Red-billed Quelea, Golden Sparrow, Tree Duck, Crowned Crane, Ruff, "Weavers", "Starlings"		De Grazio et al. 1971, De Grazio 1972
Chad	Rice, Wheat, Millet, Corn, Sorghum	Red-billed Quelea, Golden Sparrow, "Weavers", "Starlings"		De Grazio et al. 1971, De Grazio 1972
Ethiopia	Millet, Rice, Sorghum	Red-billed Quelea, Golden Sparrow, "Weavers"		De Grazio 1973
Ghana	Coconut, Oil Palm	"Weavers"	30-40% defoliation damage at experiment station	De Grazio 1972
Kenya	Wheat, Rice, Millet, Sorghum	Red-billed Quelea, "Doves", "Weavers", "Starlings"	In 1952, \$0.7 million loss; 100,000 bags	Pearson 1967c, De Grazio 1973, De Grazio and DeHaven 1974
Liberia	Rice	"Weavers", "Mannikins"		De Grazio et al. 1971, De Grazio 1972
Libya	Wheat, Barley, Millet, Sorghum	"Sparrows"		Pearson 1967c
Mali	Rice, Sorghum	Red-billed Quelea, "Weavers", "Parrots"	Irrigated rice schemes have annual damage	De Grazio et al. 1971, De Grazio 1972
Malawi	Rice	Red-billed Quelea, "Weavers"		De Grazio et al. 1971
Mauritania	Date Palm	"Weavers"		De Grazio 1972
Madagascar	Rice	Red Fody	1.2 million tons lost annually	Pearson 1967c
Morocco	Wheat, Rice, Sunflowers	House Sparrow, Spanish Sparrow	Wheat loss most severe; \$4.0 million loss	De Grazio et al. 1971, Correspondence in DWRC file
	Olives	European Starling, Thrush		De Grazio et al. 1971
Nigeria	Rice, Wheat, Millet, Sorghum, Corn, Palms	Red-billed Quelea, Golden Sparrow, "Starlings", "Doves", "Weavers"	\$2.8 million/year loss in one province	De Grazio et al. 1971, Ward and Jones 1977, Pearson 1967c
Niger	Millet, Rice	Red-billed Quelea, "Weavers", "Waterfowl"		De Grazio et al. 1971, Grist and Lever 1969
Senegal	Rice, Sorghum, other grains	Red-billed Quelea, Golden Sparrow, Ruff, "Weavers", "Starlings", "Doves"	100,000-200,000 tons of grains lost	Bruggers 1976, De Grazio 1972, Pearson 1967c

Table 5. Examples of reported economic losses to agriculture in Africa. (cont'd.)

Location	Crops	Major Species	Remarks	Reference
South Africa	Cereals	Red-billed Quelea	Most notorious example of a bird damage problem; \$1.4 million loss of sorghum in 1953.	Hey 1964, Pearson 1967a
Somalia	Rice, Millet, Sorghum	Red-billed Quelea, Golden Sparrow, Red Bishop, "Weavers"	\$150/acre; great pests of rice	Jackson 1978, Holcomb 1976, De Grazio 1973
Sudan	Sorghum	Red-billed Quelea	\$200,000 "Sudanese pounds" annually	Schmutterer 1969
Sudan	Cereals	Red-billed Quelea, "Doves", Black-breasted Lark, "Bishops" "Waterfowl"	Includes waterfowl damage to emerging rice	Beshir 1976
Tunisia	Wheat, Olives	Spanish Sparrow, European Starling	Starling damage to olives-15,000 metric tons	Bortoli 1969, Touzeau 1958
Tanzania	Wheat, Rice, Millet, Sorghum	Red-billed Quelea, Chestnut Weaver, "Weavers", "Doves"		De Grazio 1973

Madagascar caused by the red fody, severe wheat loss in Morocco caused by house and Spanish sparrows, an instance of \$2.8 million lost in one province in 1 year in Nigeria to quelea and other species, 100,000 to 200,000 tons of cereals lost annually in Senegal. Quelea are implicated in the most notorious bird damage problem to cereals in South Africa--a \$1.5 million loss in sorghum. Quelea also cause a \$150/acre loss to rice in Somalia, and an annual loss of 200,000 Sudanese pounds to sorghum in Sudan. Other species that cause damage to cereals in Africa include doves, weavers, waterfowl, starlings, ruffs, crowned cranes, psittids, bishops, crows, and black-breasted larks.

In Oceania, rice and wheat are the cereals most frequently damaged by the house sparrow in New Zealand, and by psittids, crows, and waterfowl in Australia (Table 6). In New Guinea, the spotted tree duck, whistling tree duck, black duck, and pied goose damage both emerging and ripening rice.

**Oil Crops.** In the United States, blackbird damage to sunflowers is becoming an increasingly important problem, particularly in the Dakotas and Minnesota. The problem is also evident in parts of Canada.

In Latin America, psittid damage to sunflowers is widespread and occurs in Argentina, Bolivia, Brazil, Paraguay, and Uruguay. It is most acute in Uruguay where, in 1974, \$0.6 million was lost to the monk parakeet. Damage to sunflowers is also caused by the house sparrow in France and Turkey, by the tree sparrow in Korea, by the rose-ringed parakeet, house sparrow, and baya weaver in Pakistan, and by the house and tree sparrow in Morocco.

There are no reported instances of bird damage to soybeans or oil palm in the United States or Canada. In Latin America, the eared dove is a major pest to emerging soybeans in Argentina, Colombia, and Uruguay, and the white-winged dove to soybeans in Honduras, Mexico, and Nicaragua. Black and turkey vultures cause damage to oil palm fruits in Colombia and Honduras. In Malaysia, parakeets damage oil palm. In Africa, weavers are a problem to coconut, oil and date palm in Ghana, Mauritania, and Nigeria.

**Fruits.** Bird damage to fruits is an important problem in the United States and Canada. Examples of major losses include \$4.4 million to grapes in 13 states in 1972, primarily by starlings, sparrows, and finches; \$1.6-2.1 million to blueberries in 14 states in 1972, primarily by starlings, common grackles and robins; \$1.8-4.3 million to cherries in Michigan in 1974, primarily by starlings, robins, and Baltimore orioles; and \$0.04 million to cherries in the Niagara Peninsula, Ontario, in 1965, primarily by starlings and common grackles.

In Latin America, monk parakeets damage a variety of fruits in Argentina, Bolivia, Brazil, Paraguay, and Uruguay. The brown jay is implicated in Costa Rica. Psittids attack mangoes in Honduras and Mexico.

In Europe, bird damage to various fruits is probably the most important and widespread problem. The common bullfinch removes buds of fruit trees throughout Europe and is a great problem to the fruit industry. For example, in France, bullfinches can cause losses of up to 5,000-15,000 francs per hectare per month. Losses to orchards and vineyards by the European starling are estimated at \$2.5 million annually in Germany. In Finland, strawberries and currants are the most frequently damaged fruits, primarily by the fieldfare, blackbird, and European starling. Other important species that damage fruit in Europe are the wood pigeon, house and tree sparrows, tits, rook, carrion crow, woodpeckers, blackbird, jackdaw, black-billed magpie, and Eurasian Jay.

Table 6. Examples of reported economic losses to agriculture in Oceania.

Location	Crops	Loss	Major Species	Remarks	Reference
New Zealand	Wheat	13-44,000 NZ \$ 5% (2.6-8.4%)	House Sparrow	Hawk's Bay 1968; eleven wheat fields given in example	Dawson 1970
	Fruits		Blackbird, Thrush, Starling, White Eye, House Sparrow	Questionnaire survey; 1966-67 season; strawberries, grapes, cherries, apples, pears	Dawson and Bull 1970
Australia (North)	Rice		Long-billed Corella, Black Cockatoo		Grist and Lever 1969
New South Wales			Sulphur-crested Cockatoo, Common Starling, Australian Crow, sparrows		Grist and Lever 1969
Australia (North)			Pied Goose		Grist and Lever 1969
New South Wales			European Coot, Eastern Swamp Hen, Black Duck, Australian Wood Duck, Gray Teal, Dusky Moorhen, Black-tailed Native Hen		Grist and Lever 1969
Australia	Wheat		Parrots, corellas, galaks		Wheeler 1977
New Guinea	Emerging and ripening Rice		Spotted Tree Duck, Whistling Tree Duck, Black Duck, Magpie Goose		Grist and Lever 1969

In the Near East, in Turkey, starling damage to green and ripening olives can be as high as 20%, and damage to the young fruit stage of watermelons by the magpie, jackdaw, and hooded crow is 90% in some areas. The house sparrow is a problem in vineyards and the European goldfinch disbuds apple trees in Palestine. Losses to fruits are caused by parrots, finches, and crows in Bangladesh, and by crows in Korea. Rose-ringed parakeets damage mangoes and guava in Pakistan.

In Africa, the European starling and a thrush damage olives and the white-vented bulbul is a problem on fruit in Northeast Africa. In South Africa, the European starling, redwing starling, and cape sparrow cause problems. Various sparrows and weavers are a problem in Sudan. In Tunisia, the European starling damages olives to the extent of 15,000 metric tons per year.

Fruit problems in Oceania are reported from New Zealand where damage to strawberries, grapes, cherries, apples, and pears is caused by the blackbird, thrush, common myna, gray-backed white-eye, and house sparrow.

Nuts. Bird damage to nut crops is an important problem in many parts of the United States. Examples of significant losses are: \$1.0 million annually to pecans in Louisiana and \$0.085 million in one season to almonds in Tulare County, California, by the common crow; \$150/acre to pistachios in Tulare County, California, by the scrub jay; and up to \$36/acre to peanuts in Oklahoma by common grackles and other species. Serious nut damage has not been reported from any other countries with the exception of pied crow damage to peanuts in Northeast Africa.

Truck and Vegetable Crops. Bird damage to truck and vegetable crops is usually considered a minor problem, however, there are exceptions. For example, a \$60,000 loss of emerging lettuce to the American widgeon occurred in California in 1 week and a \$76,956 loss of vegetable crops to birds occurred in Massachusetts in 1974. There are a variety of species and crops involved in California.

Other examples include black-headed weaver damage to peas and tomatoes in the Dominican Republic; blackbird damage to garbanzo beans in Mexico; wood pigeon, tit, crow, and starling damage to garden crops in England, France, and The Netherlands; sparrows on peas and beans in Egypt; larks on vegetables in Palestine; greenfinches and buntings on sesame and cabbage in Korea; parakeets on mustard in Pakistan; and sparrows and bishops on vegetables in Sudan.

**Livestock Feedlots.** Most reported damage in livestock feedlots occurs primarily in the United States. In Colorado, feed losses to starlings were calculated at \$84 per 1,000 birds, and in California at \$1,000 per day. In Arkansas, there was a loss to blackbirds of \$221,344 in 1963. In England, one example was given at a duck farm where starlings consumed 1,000 tons of pelleted duck feed in one year amounting to 33,000.

#### Bird Hazard to Aircraft

Hazard to aircraft is probably the most important bird problem in terms of human safety and economics. It is estimated that worldwide losses amount to \$1.0 billion annually (Jerome, 1976). In North America, from 1960 to 1972, losses were calculated to be more than \$100 million (Solman, 1973). In 1968, the U.S. Air Force estimated that costs of replacement parts were between \$10 and \$20 million (Solman, 1970). In England, the Royal Air Force estimated their losses at \$1.0 million annually; in Germany, the Air Force estimated losses in 1966 at \$15 million (Jacoby, 1970). The first record of a bird-aircraft collision resulting in a human death occurred in 1912 in California (Solman, 1973). There are other instances of human deaths, including 62 lives lost in Boston in 1960 (Pearson, 1967a). The two most common species causing bird-aircraft problems are gulls and European starlings, although there are a variety of species involved.

#### Predation on Desirable Species

From an economic standpoint, bird predation is a minor factor except in certain local situations. Examples are predation on eggs and young of shorebirds by herring gulls along the New England Coast (Spencer, 1972), and grackle and jay predation on white-winged dove eggs and young in South Texas and Mexico (Cotton and Trefethen, 1968). Predation on lambs by eagles, ravens, and crows occurs worldwide. Some examples of losses are 23 lambs killed by golden eagles in 23 days in 1974 in Montana (Balser, 1978); 72 lambs killed by common ravens on a 2,000-ewe ranch in Oregon in 1966 (Larsen and Dietrich, 1970); 3,362 lambs and adults of 413,383 sheep lost in 1963 in South Africa to pied crows and cape ravens (Rowley, 1969); and 17 healthy lambs killed at one site in August-September 1963 in Australia by Australian ravens and crows (Rowley, 1969).

#### Urban and Rural Roost Problems

Urban and rural roost problems are widespread. Birds in these nuisance situations cause general irritation to residents, are a threat to aircraft and local crops, represent a potential health hazard, cause power failures, and cause damage to trees, structures, and equipment. Some examples of bird problems in urban areas include tree roosts in residential areas of Denver, Colorado (Pearson, 1967b), Ames, Iowa (Bliese, 1959), and cities in Germany (Seubert, 1964). Species most often associated with this problem are starlings, blackbirds, pigeons, and sparrows. Examples of rural roosts that caused problems include a 4- to 5-million blackbird and starling roost at Ft. Campbell, Kentucky, in 1975 (Free, 1975), and a 3-million blackbird and starling roost at Green Briar, Tennessee (Eisman, 1975).

#### Birds as Carriers or Transmitters of Diseases

Stefferd (1966) speculates that the introduction of diseased rock pigeons may have contributed to the extinction of the passenger pigeon. Species such as starlings, sparrows, pigeons, domestic waterfowl, blackbirds, and Psittids may play a role as a source of infection of diseases like duck plague, histoplasmosis, avian tuberculosis, cryptococcosis, salmonellosis, transmissible gastroenteritis (TGE), ornithosis, Newcastle disease, encephalitis, and other diseases that affect man and his domestic animals (Friend and Pearson, 1973; Spear, 1962; Rankin and McDiarmid, 1968; Steele and Galton, 1971; Siegmund, 1973; Delaplane, 1956; Olsen, 1956; Parsons, 1968).

#### Beneficial Aspects and Displacement of Desirable Species

Most species implicated in damage situations are not harmful at all times or seasons of the year. During some periods of the year they are beneficial. White-winged doves that cause damage to cereals in Mexico and Nicaragua are highly valued by hunters (Cotton and Trefethen, 1968). Snail hawks help control snails that damage rice plants in Surinam, and crested mynas consume army worms in the Philippines (Grist and Lever, 1969).

Some species causing displacement of beneficial species include the starling which causes nest abandonment of the downy and acorn woodpeckers in the United States (Howard, 1959; Williams and Schwab, 1973), and the skylark in New Zealand (Howard, 1959). The brown-headed cowbird parasitizes Kirtland's warbler nests in Michigan (Winters, 1973).

#### Miscellaneous Problems

Another example of a widespread bird problem is the predation of fish by various fish-eating birds. In 1939, 38 states in the United States reported fry losses amounting to about \$228,000 per year (Lagler, 1939).

Birds, primarily pigeons and sparrows, can cause fires in buildings by carrying lighted cigarettes or other flammable material to their nests. In one instance, it was speculated that if 1% of undetermined fires were caused by birds, annual losses amount to \$8.5 million (Schneider and Fall, 1970).

Woodpeckers cause significant damage to cables, wooden utility poles, buildings, and shingles. In 1 year, one private company in the United States had \$191,000 in damage to utility poles that was caused by pileated, red-headed, ladder-backed, and golden-fronted woodpeckers (Rumsey, 1973).

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#### APPENDIX 1. Common and scientific names of birds.

Common Name	Scientific Name	Common Name	Scientific Name
<u>UNITED STATES AND CANADA</u>			
Canada Goose	<u>Branta canadensis</u>	Snail Hawk	<u>Rosthramus sociabilis</u>
American Widgeon	<u>Mareca americana</u>	White-winged Dove	<u>Zenaida asiatica</u>
Golden Eagle	<u>Aquila chryseatos</u>	Eared Dove	<u>Zenaida auriculata</u>
Sparrow Hawk	<u>Falco sparverius</u>	"Doves"	<u>Leptotilia spp.</u>
Ring-necked Pheasant	<u>Phasianus colchicus</u>	Picazuro Pigeon	<u>Columba picazuro</u>
"Gulls"	Laridae	Spot-winged Pigeon	<u>Columba maculosa</u>
Herring Gull	<u>Larus argentatus</u>	Monk Parakeet	<u>Myiopsitta monachus</u>
Glaucous-winged Gull	<u>Larus glaucescens</u>	Green-rumped Parrotlet	<u>Forpus passerinus</u>
Rock Pigeon	<u>Columba livia</u>	Orange-fronted Parakeet	<u>Aratinga canicularis</u>
Passenger Pigeon	<u>Ectopistes migratorius</u>	Brown Jay	<u>Psilorhinus mexicanus</u>
White-winged Dove	<u>Zenaida asiatica</u>	Green Jay	<u>Cyanocorax yncas</u>
Pileated Woodpecker	<u>Dryocopus pileatus</u>	Magpie Jay	<u>Calocitta formosa</u>
Red-headed Woodpecker	<u>Melanerpes erythrocephalus</u>	Mexican Crow	<u>Corvus imparatus</u>
Ladder-backed Woodpecker	<u>Dendrocopos scalaris</u>	Thrush	<u>Turdus spp.</u>
Golden-fronted Woodpecker	<u>Centurus aurifrons</u>	Chestnut-capped Blackbird	<u>Agelaius ruficapillus</u>
Acorn Woodpecker	<u>Melanerpes formicivorus</u>	Shiny Cowbird	<u>Molothrus bonariensis</u>
Downy Woodpecker	<u>Dendrocopos pubescens</u>	Yellow-hooded Blackbird	<u>Agelaius icterocephalus</u>
"Flickers"	<u>Colaptes spp.</u>	Red-breasted Blackbird	<u>Leistes militaris</u>
Scrub Jay	<u>Aphelocoma coerulescens</u>	Bobolink	<u>Dolichonyx oryzivorus</u>
Common Raven	<u>Corvus corax</u>	Great-tailed Grackle	<u>Cassidix mexicanus</u>
American Robin	<u>Turdus migratorius</u>	Yellow-headed Blackbird	<u>Xanthocephalus xanthocephalus</u>
European Starling	<u>Sturnus vulgaris</u>	Brown-headed Cowbird	<u>Molothrus ater</u>
Kirtland's Warbler	<u>Dendroica kirtlandii</u>	Greater Red-breasted Meadow-lark	<u>Pezites militaris</u>
Red-winged Blackbird	<u>Agelaius phoeniceus</u>	Black-headed Weaver	<u>Ploceus cucullatus</u>
Common Grackle	<u>Quiscalus quiscula</u>	Dickcissel	<u>Spiza americana</u>
Common Crow	<u>Corvus brachyrhynchos</u>	Parrot-billed Seedeater	<u>Sporophilia peruviana</u>
Brown-headed Cowbird	<u>Molothrus ater</u>	Drab Seedeater	<u>Sporophilia simplex</u>
"Orioles"	<u>Icterus spp.</u>	<u>EUROPE</u>	
Baltimore Oriole	<u>Icterus galbula</u>	Mallard	<u>Anas platyrhynchos</u>
House Sparrow	<u>Passer domesticus</u>	European Oyster-catcher	<u>Haematopus ostralegus</u>
"Finches"	<u>Carpodacus spp.</u>	Lapwing	<u>Vanellus vanellus</u>
<u>LATIN AMERICA</u>			
White-faced Tree Duck	<u>Dendrocygna viduata</u>	Golden Plover	<u>Pluvialis dominica</u>
Brown Pintail	<u>Anas georgica</u>		
"Geese"	<u>Chleophaga spp.</u>		
Blue-winged Teal	<u>Anas discors</u>		
Black Vulture	<u>Coragyps atratus</u>		
Turkey Vulture	<u>Coragyps aura</u>		

## APPENDIX 1. Common and scientific names of birds. (cont'd.)

Common Name	Scientific Name	Common Name	Scientific Name
Herring Gull	<u>Larus argentatus</u>	Tree Sparrow	<u>Passer montanus</u>
Black-headed Gull	<u>Larus ridibundus</u>	Java Sparrow	<u>Padda oryzivora</u>
Common Gull	Laridae	Chestnut Munia	<u>Londhura malacca</u>
Wood Pigeon	<u>Columba palumbus</u>	Plain-backed Sparrow	<u>Passer flaveolus</u>
Rock Pigeon	<u>Columba livia</u>	"Finches"	Fringillidae
Swift	<u>Apus apus</u>	Black-headed Bunting	<u>Emberiza melanocephala</u>
Carrion Crow	<u>Corvus corone</u>	"Greenfinches"	<u>Carduelis</u> spp.
Rook	<u>Corvus frugilegus</u>	"Buntings"	<u>Emberiza</u> spp.
Jackdaw	<u>Corvus monedula</u>	European Goldfinch	<u>Carduelis carduelis</u>
"Crows"	<u>Corvus</u> spp.		AFRICA
Black-billed Magpie	<u>Pica pica</u>	Marabou Stork	<u>Leptoptilos crumeniferus</u>
Eurasian Jay	<u>Garrulus glandarius</u>	"Tree Ducks"	<u>Dendrocygna</u> spp.
"Tits"	<u>Parus</u> spp.	Egyptian Goose	<u>Alopochen aegyptiacus</u>
Fieldfare	<u>Turdus pilaris</u>	Spur-winged Goose	<u>Plectropterus gambensis</u>
Blackbird	<u>Turdus merula</u>	Garganey Teal	<u>Anas querquedula</u>
European Starling	<u>Sturnus vulgaris</u>	White-faced Tree Duck	<u>Dendrocygna viduata</u>
House Sparrow	<u>Passer domesticus</u>	Vultures	Cathartidae
Tree Sparrow	<u>Passer montanus</u>	Black Eagle	<u>Pteroaetus verreauxi</u>
Common Bullfinch	<u>Pyrrhula pyrrhula</u>	Crowned Crane	<u>Balearica regulorum</u>
	ASIA	Ruff	<u>Philomachus pugnax</u>
Spotbill Duck	<u>Anas poecilorhyncha</u>	Black-tailed Godwit	<u>Limosa limosa</u>
Vulture	Cathartidae	Laughing Dove	<u>Streptopelia senegalensis</u>
Ring-necked Pheasant	<u>Phasianus colchicus</u>	Cape Turtle Dove	<u>Streptopelia capicola</u>
Oriental Turtle Dove	<u>Streptopelia orientalis</u>	Pink-headed Turtle Dove	<u>Streptopelia roseogrisea</u>
"Doves"	Columbidae	African Mourning Dove	<u>Streptopelia decipiens</u>
Collared Dove	<u>Streptopelia decaocto</u>	"Doves"	Columbidae
"Parrots"	Psittacidae	"Parrots"	Psittacidae
Alexandrine Parakeet	<u>Psittacula eupatria</u>	Rose-ringed Parakeet	<u>Psittacula krameri</u>
"Parakeets"	Psittacidae	Black-breasted Lark	<u>Melanocorypha bimaculata</u>
Rose-ringed Parakeet	<u>Psittacula krameri</u>	Cape Raven	<u>Corvus albicollis</u>
"Larks"	Alaudidae	Pied Cow	<u>Corvus albus</u>
House Crow	<u>Corvus splendens</u>	White-vented Bulbul	<u>Pycnonotus barbatus</u>
"Crows"	<u>Corvus</u> spp.	"Thrush"	<u>Turdus</u> spp.
Black-billed Magpie	<u>Pica pica</u>	"Glossy Starlings"	<u>Lamprolornis</u> spp.
Hooded Crow	<u>Corvus cornix</u>	European Starling	<u>Sturnus vulgaris</u>
Jackdaw	<u>Corvus monedula</u>	Redwing Starling	<u>Onychognathus morio</u>
Crested Myna	<u>Acridotheres cristatellus</u>	Red-billed Quelea	<u>Quelea quelea</u>
European Starling	<u>Sturnus vulgaris</u>	Golden Sparrow	<u>Passer luteus</u>
Scaly-breasted Munia	<u>Lonchura punctulata</u>	"Weavers"	Ploceidae
White-headed Munia	<u>Lonchura maja</u>	Red Bishop	<u>Euplectes orix</u>
White-bellied Munia	<u>Londhura leucogastra</u>	House Sparrow	<u>Passer domesticus</u>
"Weavers"	Ploceidae	Spanish Sparrow	<u>Passer hispaniolensis</u>
Pin-tailed Parrot Finch	<u>Erythrura prasina</u>	Red-headed Quelea	<u>Quelea ervthrops</u>
House Sparrow	<u>Passer domesticus</u>	Cardinal Quelea	<u>Quelea cardinalis</u>
Baya Weaver	<u>Ploceus philippinus</u>	Chestnut Weaver	<u>Ploceus rubiginosus</u>
Streaked Weaver	<u>Ploceus manyar</u>	Gray-headed Sparrow	<u>Passer griseus</u>
		White-browed Sparrow Weaver	<u>Plocepasser mahali</u>

## APPENDIX 1. Common and scientific names of birds. (cont'd.)

Common Name	Scientific Name	Common Name	Scientific Name
"Mannikins"	<u>Plocepasser mahali</u>	Dusky Moorhen	<u>Gallinula tenebrosa</u>
"Sparrows"	Ploceidae	Black-tailed Native Hen	<u>Tribonyx ventralis</u>
Red Fody	<u>Foudia madagascariensis</u>	Black-backed Gull	<u>Larus fuscus</u>
Napoleon Bishop	<u>Euplectes afra</u>	Red-billed Gull	<u>Larus sp.</u>
Black-headed Weaver	<u>Ploceus cucullatus</u>	Sulphur-crested Cockatoo	<u>Cacatua galerita</u>
Buffalo Weaver	<u>Bubalornis albirostris</u>	"Parrots"	Psittacidae
Tree Sparrow	<u>Passer montanus</u>	"Corellas"	<u>Cacatua spp.</u>
Yellow-backed Weaver	<u>Ploceus capitalis</u>	"Galaks"	Psittacidae
Cape Sparrow	<u>Passer melanurus</u>	Long-billed Corella	<u>Cacatua tenuirostris</u>
Black-winged Bishop	<u>Euplectes hordeacea</u>	Black Cockatoo	<u>Calyptorhynchus funereus</u>
Masked Weaver	<u>Ploceus taeniopterus</u>	Skylark	<u>Alauda arvensis</u>
Cinnamon Weaver	<u>Ploceus badius</u>	Australian Crow	<u>Corvus ceciliae</u>
Yellow-fronted Canary	<u>Serinus mozambicus</u>	Australian Raven	<u>Corvus coronoides</u>
	<u>OCEANIA</u>	Crow	<u>Corvus mellori</u>
Pied Goose	<u>Anseranas semipalmata</u>	Blackbird	<u>Turdus merula</u>
Gray Teal	<u>Anas gibberiformes</u>	"Thrush"	<u>Turdus ericetorum</u>
Black Duck	<u>Anas superciliosa</u>	European Starling	<u>Sturnus vulgaris</u>
Australian Wood Duck	<u>Chenonetta jubata</u>	Common Myna	<u>Acridotheres tristis</u>
Spotted Tree Duck	<u>Dendrocygna guttata</u>	Gray-backed White-eye	<u>Zosterops lateralis</u>
Whistling Tree Duck	<u>Dendrocygna arcuata</u>	House Sparrow	<u>Passer domesticus</u>
European Coot	<u>Fulica atra</u>	"Sparrows"	Ploceidae
Eastern Swamp Hen	<u>Porphyrio melanotus</u>		

## LITERATURE CITED

- AGRICULTURAL EXTENSION SERVICE. 1964. Arkansas state summary on blackbird damage (1963). Univ. of Arkansas and U.S. Dep. Agric. 1 p.
- ALSAGER, D.E. 1976. The role of the private investigator in vertebrate pest problems in Canada. Proc. 7th Vertebr. Pest Conf., Monterey, Calif., pp. 26-34.
- ANONYMOUS. 1943. Survey damage to California rice crop by migratory wild fowl. Rice J. 46(10):16-18.
- BALSER, D.E. 1978. Personal communication.
- BENIGNO, E.A., P.L. ALVIOLA III, F.F. SANCHEZ, M.M. HOQUE, and G.V. LLAGUNO. 1975. Damage potential of three species of Philippine weavers (Lochura). Kalikasan (Philipp. J. Biol.) 4:141-144.
- BESSER, J.F., J.W. DE GRAZIO, and J.L. GUARINO. 1968. Cost of wintering starlings and red-winged blackbirds at feedlots. J. Wildl. Manage. 32(1):179-180.
- \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, D.F. MOTT, W.C. ROYALL, and C.P. STONE. 1971. Fundamentals of bird damage research in agricultural crops. Unpublished Syllabus, Chapter 10. In DWRC files. 70 p.
- BESHIR, S.A. 1976. Personal communication.
- BLIESE, J.C.W. 1959. Four years of battle at blackbird roosts: a discussion of methods and results at Ames, Iowa. Iowa Bird Life XXIX(2):30-31.
- BORTOLI, L. 1969. Contribution a l'etude du probleme des oiseaux granivores en Tanisie. Bull. de la Faculte d'Agronomie No. 22-23, Janvier, Juillet:33-153.
- BRUGGERS, R.L. 1976. Protecting ripening sorghum with methiocarb from bird damage in Senegal. Proc. 7th Bird Control Semin., Bowling Green, Ohio. pp. 267-274.
- BUCHER, E.H., and P.E. BEDANO. 1976. Bird damage problems in Argentina. International Studies on Sparrows 9(1):3-16. Dziekanów Lesny.

- CLARK, D.O. 1976. An overview of depredating bird damage control in California. Proc. 7th Bird Control Semin., Bowling Green, Ohio, pp. 21-27.
- COGELIA, N.J. 1976. Personal communication to Keith LaVoie, DWRC.
- CONGRESSIONAL RECORD-SENATE. 1962. Blackbirds: A national problem. pp. 20337-39. Oct. 1.
- CORRESPONDENCE IN DWRC FILES.
- COTTOM, C., and J.B. TREFETHEN. (Eds.) 1968. Whitewings. D. Van Nostrand Co., Inc., Princeton, New Jersey. 348 p.
- CRASE, F.T., C.P. STONE, R.W. DEHAVEN, and D.F. MOTT. 1976. Bird damage to grapes in the United States with emphasis on California. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Wildl. 197. 18 p.
- DAWSON, D.G. 1970. Estimation of grain loss to sparrows (Passer domesticus) in New Zealand. N. Z. J. Agric. Res. 13:681-688.
- \_\_\_\_\_, and P.C. BULL. 1970. A questionnaire survey of bird damage to fruit. N. Z. J. Agric. Res. 13:362-371.
- DE GRAZIO, J.W. 1972. Unpublished Annual Report. In DWRC files. 13 p.
- \_\_\_\_\_. 1973. Unpublished Annual Report. In DWRC files. 21 p.
- \_\_\_\_\_. 1978. DWRC files.
- \_\_\_\_\_, and J.F. BESSER. 1970. Bird damage problems in Latin America. Proc. 4th Vertebr. Pest Conf., Sacramento, Calif. pp. 162-167.
- \_\_\_\_\_, and \_\_\_\_\_. 1975. Field Investigations of Monk parakeet damage to sunflowers and corn in Uruguay. Trip Report. DWRC files.
- \_\_\_\_\_, \_\_\_\_\_, and E.W. SCHAFER. 1971. Unpublished Annual Report. In DWRC files. 25 p.
- \_\_\_\_\_, and R.W. DEHAVEN. 1974. Unpublished Annual Report. In DWRC files. 28 p.
- DEHAVEN, R.W. 1971. Blackbirds and the California rice crop. Rice J. 74(8):1-4.
- \_\_\_\_\_. 1974. Bird damage to wine grapes in central California, 1973. Proc. 6th Vertebr. Pest Conf., Anaheim, Calif. pp. 248-252.
- DUDDERAR, G.R., and J.W. NELSON, JR. 1970. Experimental control techniques using avicide 3 chloro-P-toluidine. Proc. 5th Bird Control Semin., Bowling Green, Ohio. pp. 124-127.
- EISMAN, R.M. 1975. Event notification report: b, March. Smithson. Inst., Center for Short-lived Phenomenon. Cambridge, Mass. 2 pp.
- ELIAS, D.J. 1977. (Compiler). Vertebrate pests and Latin American agriculture. Interim Rep. In DWRC files. 52 p.
- FALL, M.W. 1975. Vertebrate pests: problems and needs in Nepal. Trip Rep. In DWRC files. 18 p.
- \_\_\_\_\_, G.A. HOOD, and J.W. DE GRAZIO. 1972. Vertebrate pest management workshops in Southeast Asia and Philippine research activities. Trip Rep. In DWRC files. 38 p.
- FREE, A.C. 1975. Bye, bye blackbird. Defenders of Wildlife 50(3):232-237.
- FRIEND, M., and G.L. PEARSON. 1973. Duck plague: the present situation. Proc. West. Assoc. State Game Fish Comm., Salt Lake City, Utah. 53:315-325.
- GRIST, D.H., and R.J.A.W. LEVER. 1969. Pests of rice. Longmans, Green and Co., Ltd., London. 520 p.
- HEY, D. 1964. The control of vertebrate problem animals in the province of the Cape of Good Hope, Republic of South Africa. Proc. 2nd Vertebr. Pest Conf., Anaheim, Calif. pp. 57-70.
- HOLCOMB, L.G. 1976. Experimental use of Av-Alarm for repelling Quelea from rice in Somalia. Proc. 7th Bird Control Semin., Bowling Green, Ohio. pp. 275-278.
- HOWARD, W.E. 1959. The European starling in California. Calif. Dep. Agric. Bull., Vol XLVIII(3):171-179.
- \_\_\_\_\_, J.S. PARK, Y.M. SHIN, and W.S. CHO. 1975. Rodent control in Republic of Korea. Inst. Agric. Sci. Office of Rural Development. 278 p.

- IMLER, R.H., and E.R. KALMBACH. 1939. Crow damage to fall grain crops in Oklahoma in 1937. Bur. Biol. Surv., U.S. Dep. Agric. Leaflet BS-123. 15 p.
- IRVING, N.S., and J.S.S. BEASLEY. 1975. The problem of damage to sorghum by doves in Botswana. Report 1972-1974. Center for Overseas Pest Research, London. 13 p.
- JACKSON, W.B. 1968. Introductory comments. Proc. 4th Bird Control Semin., Bowling Green, Ohio. pp. 1-3.
- \_\_\_\_\_. 1978. Bird and rodent depredations to crops and damage to stored foods: a world view. Bull. Eur. Plant Prot. Organ. (in press).
- JACOBY, V.E. 1970. Some publications received from Dr. V.E. Jacoby, Moscow, USSR Assoc. Comm. on Bird Hazards to Aircraft. Natl. Res. Council, Field Note No. 52. Ottawa, Canada. October. 34 p.
- JEROME, E.A. 1976. Bird strikes: Menace to pilots. Flights Operations Magazine. March. pp. 29-32.
- KHAN, A.A. 1974. Bird damage to farm crops in Pakistan with special reference to sunflower (Helianthus annuus). Vertebr. Pest Control Res. Cen., Karachi, Pakistan. 10 p.
- KNITTLE, C.E., and J.L. GUARINO. 1976. A 1974 questionnaire survey of bird damage to ripening grain sorghum in the United States. Sorghum Newsl. 19:93-94.
- LAGLER, K.F. 1939. The control of fish predators at hatcheries and rearing stations. J. Wildl. Manage. 3(3):169-179.
- LA MAÑANA, Montevideo, Uruguay (newspaper). Jan. 8, 1978. Girasol: preven buena cosecha y es conveniente combatir plagas.
- LARSEN, K.H., and J.H. DIETRICH. 1970. Reduction of a raven population on lambing grounds with DRC-1339. J. Wildl. Manage. 34(1):200-204.
- LEVINGSTON, P.E. 1967. Winter starling control with DRC-1339. Proc. 3rd Vertebr. Pest Conf., San Francisco, Calif. pp. 100-103.
- LOUISIANA FARM BUREAU FEDERATION, INC. 1972. In DWRC files. Letter to C. Stone, June 12. Baton Rouge, LA.
- MAHIEU, N., and J. LE GOUVAIS. 1968. The bullfinch in the orchards of the Loire-Atlantique. Phytoma 20(194):43-45.
- MEANLEY, B. 1971. Blackbirds and the southern rice crop. U.S. Fish Wildl. Serv. Resour. Publ. 100. 64 p.
- MITCHELL, G.C. 1977. Agricultural pests in Latin America: birds and rodents in Peru and Nicaragua. Trip Rep. In DWRC files. 4 p.
- \_\_\_\_\_. 1978. Personal communication. DWRC.
- MOORE, N.W. 1970. New factors controlling populations of land vertebrates in Great Britain. Proc. 4th Vertebr. Pest Conf., Sacramento, Calif. pp. 9-14.
- MOTT, D.F., J.F. BESSER, R.R. WEST, and J.W. DE GRAZIO. 1972. Bird damage to peanuts and methods for alleviating the problem. Proc. 5th Vertebr. Pest Conf., Fresno, Calif. pp. 118-120.
- \_\_\_\_\_, and C.P. STONE. 1973. Bird damage to blueberries in the United States. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Wildl. 172. 15 p.
- MYLLYMAKI, A., and R. TENOVUO. 1977. Bird damage to cultivated fruit crops in Finland. OEPP Conference Paris, Oct. 1977. 2 p.
- NEWTON, I. 1968. Bullfinches and fruit buds. pp. 199-209. In The Problems of Birds as Pests. Inst. Biol. (Lond.) Symp. No. 17. (Murton and Wright, eds.). Academic Press, London. 254 p.
- OLSEN, O.L. 1956. Newcastle disease. The Yearbook of Agriculture. U.S. Dep. Agric., Gov. Print Off., Washington, D.C. pp. 459-462.
- PARSONS, M.A. 1968. Birds, encephalitis, and ectoparasites. Proc. 4th Bird Control Semin., Bowling Green, Ohio. pp. 19-28.
- PEARSON, E.W. 1967a. Birds and airports. Proc. 3rd Vertebr. Pest Conf., San Francisco, Calif. pp. 79-86.
- \_\_\_\_\_. 1967b. Dispersal of urban roosts with records of starling distress calls. J. Wildl. Manage. 31(3):502-506.

- PEARSON, E.W. 1967c. Birds. In Damage to food supplies in the diet-deficient regions of the world. In DWRC files. pp. 14-17.
- PENA, M. 1977a. Proposal for studying and establishing a control program for Madam Sarah (Ploceus cucullatus) in Hispaniola. National Zoological Park, Santo Domingo, Dominican Republic. 7 p.
- \_\_\_\_\_. 1977b. Introduccion, distribucion, biologia, etologia y control de la Madame Sarah en la Hispaniola. Agro 6(43):31-40. (Dominican Republic).
- PIERCE, R.A. 1970. Bird depredations on rice and other grains in Arkansas. Proc. 5th Bird Control Semin., Bowling Green, Ohio. pp. 101-109.
- RANKIN, J.D., and A. MCDIARMID. 1968. Mycobacterial infections in free-living wild animals. Proc. Symp. Zool. Soc. Lond. No. 24. pp. 119-131. Academic Press, London.
- REIDINGER, R.F. 1977. The status of rodent research and control in Bangladesh and recommendations. Trip Rep. In DWRC files. 34 p.
- RUMSEY, R.L. 1973. Woodpecker damage to wooden utility poles. Ph.D. Dissertation. Louisiana State University. 128 p.
- SCHMUTTERER, H. 1969. Pests of crops in northeast and central Africa. Gustav Fischer Verlag, Stuttgart. 296 p.
- SCHNEIDER, D.E., and M.F. FALL. 1970. The role of bird management in fire protection. Proc. 5th Bird Control Semin., Bowling Green, Ohio. pp. 53-55.
- SEUBERT, J.L. 1964. Highlights of bird control research in England, France, Holland, and Germany. Proc. 2nd Vertebr. Pest Conf., Anaheim, Calif. pp. 150-159.
- SIEGMUND, O.H. (Ed.) 1973. The Merck Veterinary Manual. 4th Ed. Merck and Co., Inc., Rakway, New Jersey. 1600 p.
- SIMPSON, G. 1972. Some approaches to controlling depredations by crows and jays in Tulare County. Proc. 5th Vertebr. Pest Conf., Fresno, Calif. pp. 112-117.
- SOLMAN, V.E.F. 1970. Current work on bird hazards to aircraft. Proc. 4th Vertebr. Control Semin., Sacramento, Calif. pp. 184-187.
- \_\_\_\_\_. 1973. Influence of garbage dumps near airports on the bird hazard to aircraft problem. Natl. Res. Council. Canada, Field Note, No. 66. pp. 2,7.
- SPEAR, P.J. 1962. Concluding remarks of appreciation with comments on histoplasmosis and cryptococcosis. Proc. 2nd Vertebr. Pest Conf., Sacramento, Calif. pp. 372-389.
- SPENCER, D.A. 1972. Keynote address-vertebrates, a resource needing management. Proc. 5th Vertebr. Pest Conf., Fresno, California. pp. 2-6.
- STEELE, J.H., and M.M. GALTON. 1971. Salmonellosis. pp. 54-55. In Infectious and Parasitic Diseases of Wild Birds. Iowa State University Press, Ames, Iowa. 344 p.
- STEFFERUD, A. (Ed.) 1966. Birds in our lives. pp. 350-351. U.S. Dep. Inter. U.S. Gov. Print. Off. Washington, D.C. 561 p.
- STONE, C.P. 1972. Blackbirds vs. corn. The Farm Quarterly, Fall. p. 61.
- \_\_\_\_\_. 1973a. Bird damage to tart cherries in Michigan, 1972. Proc. 6th Bird Control Semin., Bowling Green, Ohio. pp. 19-23.
- \_\_\_\_\_. 1973b. Bird damage to agricultural crops in the United States—a current summary. Proc. 6th Bird Control Semin., Bowling Green, Ohio. pp. 264-267.
- \_\_\_\_\_, and D.F. MOTT. 1973. Bird damage to sprouting corn in the United States. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Wildl. 173. 26 p.
- SUMMERS, D.D.B. 1975. In Pest infestation control laboratory report 1971-1973. Ministry of Agriculture, Fisheries and Food, Pest Infestation Control Laboratory, London. 286 p.
- TIGNER, J.R., and G.E. LARSON. 1977. Sheep losses on selected ranches in southern Wyoming. J. Range Manage. 30(4):244-252.
- TOUZEAU, J. 1958. The starling problem in Tunisia from the standpoint of a method of control. English translation. Secretary of State for Agriculture, Tunisia. In DWRC files. 7 p.
- UDAGAWA, T. 1970. Some vertebrate pest problems in Japan. Proc. 4th Vertebr. Pest Conf., Sacramento, Calif. pp. 148-149.

- VIRGO, B.D. 1971. Bird damage to sweet cherries in the Niagara Peninsula, Ontario. *Can. J. Plant Sci.* 51:415-423.
- WARD, P., and P.J. JONES. 1977. *Quelea investigations project. Nigeria Final Report 1972-1975.* Center for Overseas Pest Research, London. 57 p.
- WHEELER, S. 1977. Personal communication to J.F. Besser, DWRC.
- WILLIAMS, R.E., and R.G. SCHWAB. 1973. Tests of a potential method for starlings to bait stations. *Proc. 6th Bird Control Semin., Bowling Green, Ohio.* pp. 164-168.
- WINTERS, R.O. 1973. Cowbird trapping and the Kirtland's warbler. *Proc. 6th Bird Control Semin., Bowling Green, Ohio.* pp. 102-104.
- \_\_\_\_\_. 1975. 1975 assessment of blackbird depredations on field corn in Ohio. U.S. Dep. Inter. Fish Wildl. Serv. Rep. 6 p.
- WRIGHT, E.N. 1959. Bird damage to horticultural crops. *J.R. Hortic. Soc.* LXXXIV(9):426-434.
- \_\_\_\_\_. 1973. Experiments to control starling damage at intensive animal husbandry units. *OEPP/EPO Bull. No. 9.* pp. 85-89.