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W. T. MOKEAN,

A Preliminary Analysis of Waterfowl Recoveries
In Colorado with Notes on Trapping
and Banding

by
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Completion Report - Federal Aid Project W-37-R
Game Bird Survey (Work Plan No. II, Job No. 10)

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PREFACE

This report analyzes banding recoveries for waterfowl banded in Colorado primarily since 1944 and was prepared as a completion report under Federal Aid Project W-37-R-8, Game Bird Surveys (Work Plan No. II, Job No. 10) in cooperation with the Game Management Division of the Colorado Department of Game and Fish.

Emphasis has been placed mainly on recoveries shot by hunters, although breeding season recoveries are given consideration where sufficient in number to give what is believed to be significant data.

ACKNOWLEDGEMENTS

This report is possible only through the efforts of many Federal, State and cooperative banders, hunters and others who reported their recoveries, the Fish and Wildlife Service banding office personnel who processed the recovery reports and clerks of the Game Management Division of the Colorado Game and Fish Department who coded the recovery reports and handled the IBM statistical analysis of the data.

Most Federal waterfowl banding in Colorado has been by personnel of the Wildlife Research Laboratory in Denver headed by E. R. Kalmbach until 1953 when he retired and was succeeded by Paul F. Hickie. Mr. Ralph H. Imler and Johnson A. Neff have done most of the actual Federal banding assisted by other Federal and State employees. Mr. Neff generously made available the use of the laboratory banding records. In 1953, Mr. Charles R. Bryant, refuge manager, and his staff at the Monte Vista National Wildlife Refuge commenced banding and have cooperated in an exchange of banding information.

The Colorado Game and Fish Department banding has been conducted under C. N. Feast, director until 1952, and Thomas L. Kimball, director since 1952. Most banding has been financed as federal aid projects under the supervision of Federal Aid Coordinators E. K. Brown (until 1951) and Laurence E. Riordan (since 1951). The first banding permit was held by Jack C. Culbreath, then Education Manager. In recent years master banding permits have been held by the leader of the game bird surveys project (W-37-R), Harry J. Figge (until 1953) and Wayne W. Sandfort (since 1953). In April, 1955, a separate waterfowl project (W-88-R) was initiated and the master banding permit transferred to Jack R. Grieb, project leader. Wildlife Conservation Officer, Gurney I. Crawford, designed the basic traps used to catch most of the waterfowl banded in Colorado and has undoubtedly banded more ducks and geese in the State than any other bander. Some of the wardens and game technicians who have participated in the waterfowl banding program are B. D. Baker, H. M. Boeker, W. L. Flinn, J. R. Grieb, R. G. Kinghorn, F. C. Kleinschnitz, W. Mansfield, D. H. Nolting, I. R. Poley, R. A. Ryder, W. W. Sandfort, H. Stiehm, H. M. Swope, W. B. Wells, P. C. Steele and L. W. Triplet.

The writer is grateful to Dr. Lee E. Yeager, leader of the Colorado Cooperative Wildlife Research Unit at Colorado A & M College, Fort Collins, for permission to use data collected by Unit personnel. Dr. Yeager holds the Unit's master banding permit. Messrs. R. A. Ryder, J. R. Grieb, and L. G. Frary have headed the Unit's banding project assisted by other students.

Special appreciation is extended to the staff of the Bird Banding Office of the U. S. Fish and Wildlife Service for their prompt and accurate processing of banding schedules and recovery reports.

Mr. Gilbert N. Hunter, State Game Manager, permitted the use of his division's statistical clerks and machines in compiling some 9300 recovery reports, using IBM cards and sorting machines. Pilots of the Game Management Division, Messrs. I. L. Boeker, N. L. Hughes, K. Milyard, C. P. Matteson, and D. Owens, especially, collected the aerial census data referred to in this report.

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A Preliminary Analysis of Waterfowl Banding Returns in Colorado
with Notes on Trapping and Banding

Chapter 1. - Introduction

I. Brief History of Waterfowl Banding in Colorado

Waterfowl banding, at least on a large scale, is comparatively recent in Colorado. As early as 1938, Lloyd W. Triplet, then of the Biological Survey, banded and released 27 ducks of 7 species at the Russell Lakes near Saguache while studying an outbreak of botulism. However, the first large-scale banding of waterfowl was probably that done in the San Luis Valley in 1940, by personnel of the Denver Wildlife Research Laboratory. In February, 1940, Fish and Wildlife Service personnel of the laboratory banded 348 mallards, two pintails, and one baldpate at Fluckey Springs near LaJara. This study was initiated in an effort to learn more about the wintering ducks in the San Luis Valley which at that time were creating a considerable crop depredations problems. (Kalmbach and Imler, 1945).

No additional waterfowl banding was conducted in Colorado until late in 1944, when the staff of the Wildlife Research Laboratory assisted by personnel from the Colorado Game and Fish Department instituted a duck banding project to study the movements of mallards involved in crop depredation in north-central and eastern Colorado. Begun in November, 1944, this project was terminated at the end of February, 1949, with a total of 11,090 ducks banded, mostly at what are known as the Valmont Reservoirs near Boulder (Neff, 1948 and 1950).

In 1946, the Federal Aid Division of the Colorado Game and Fish Department instituted its own banding project. Wildlife Conservation Officer, Gurney I. Crawford, who had earlier assisted Johnson Neff and Ralph Imler at Boulder, trapped and banded on the South Platte in the Sedgwick area while Jack Culbreath worked at points nearer Denver. From 1947 until 1955, the project leader of the Game Bird Surveys Project (W-37-R) held the master banding permit for the State and was assisted by as many as twelve other department employees. In 1947, banding activities were extended to the Rocky Mountain Arsenal near Denver while in 1948, banding was commenced on the Arkansas River. In 1949, banding was resumed in the San Luis Valley (Ryder, 1951) and in 1952, started in Delta County on the Western Slope. In 1953 banding was initiated at Bonny Reservoir on the South Republican River near the Kansas line. The first large-scale banding of geese in Colorado was commenced at Two Buttes Reservoir near Springfield in 1950 (Anonymous, 1952 and Ryder, 1955). Some ducks were also banded in 1952-1954 in conjunction with the goose banding. Smaller numbers of flightless adults and young waterfowl were banded in the Yampa Valley and Brown's Park during the summers of 1952 and 1953. In the summer of 1954, emphasis was shifted from bait trapping to drive trapping when flightless young and adult waterfowl were banded in North Park. This later banding was done cooperatively by the State Game and Fish Department and the U. S. Fish and Wildlife Service. The primary banding sites are located in Figure 1.

During the winters of 1949-52, waterfowl banding was conducted by the Colorado Cooperative Wildlife Research Unit in the Fort Collins area (Frary, 1952), and in 1953, a banding program was also started at the then, newly created Monte Vista Federal Wildlife Refuge.

II. Trapping and Banding Techniques

Most of the waterfowl banded in Colorado have been trapped in the winter using various types of grain-baited traps. Practically all winter trapsites have been located on warm-water areas frequented by large flocks of waterfowl, predominately mallards. Although some relatively small V-entrance and modified clover-leaf traps have been used, most of the winter banded ducks were trapped in variations of a type of trap developed by Wildlife Conservation Officer Crawford, and referred to as a Colorado Duck Trap. This trap was designed especially for dabbling ducks. Generally it is built half on land and half in the water and consists of two main compartments, a grain-baited feed lane on land and a holding compartment on the water side. On the beachside, waterfowl are baited through small entrances into the feed lane compartment and after feeding try to leave or seek water to wash down the grain they have eaten. To reach the water the ducks must walk up a gently sloping ramp and pass through a narrow gap between the roof and the ramp. Some modifications were built with one or two relatively narrow ramps at either end of the feed lane, others had full-length ramps, while other traps had no true ramps but were built with feed lanes that extended out over the holding compartments. The waterfowl after once entering the feed lane find it difficult to find the small entrances to escape because of a baffling arrangement of willows constructed about the small openings. After once entering the holding compartment, escape is very difficult due to the small gap between the top of the ramps and the roof and to the over-hang of the ramp or feed lane. Traps of the Crawford design have varied from as large as 160' x 80' x 7' to as small as 4' x 8' x 1' (see figures 2 and 3).

Most geese banded in Colorado have been caught in large traps similar in design to the Colorado Duck traps only with cord netting roofs (see figure 4). Recently motor-type cannon nets have been obtained for waterfowl trapping. An ingenious radio-controlled firing device has been developed and described by Grieb and Sheldon (1955a and b).

Drive traps such as developed by the Fish and Wildlife Service were used in North Park to catch flightless adults and young on the breeding grounds (see figure 5). Incidental catches have been made during the breeding season by hand, by retrievers, and fish nets.

Live decoys and preliminary baiting were found to aid materially in increasing catches. Various baits have been used, barley, corn, and sorghums being favored by most state personnel. Rallying waterfowl from resting sites in the trapping areas has been used to increase waterfowl useage of the trapsites. Removal from the traps has been generally by means of a compartmented "catch-box" or a simple tube of woven wire, the waterfowl being driven into confined spaces on the land side of the trap.

COLORADO

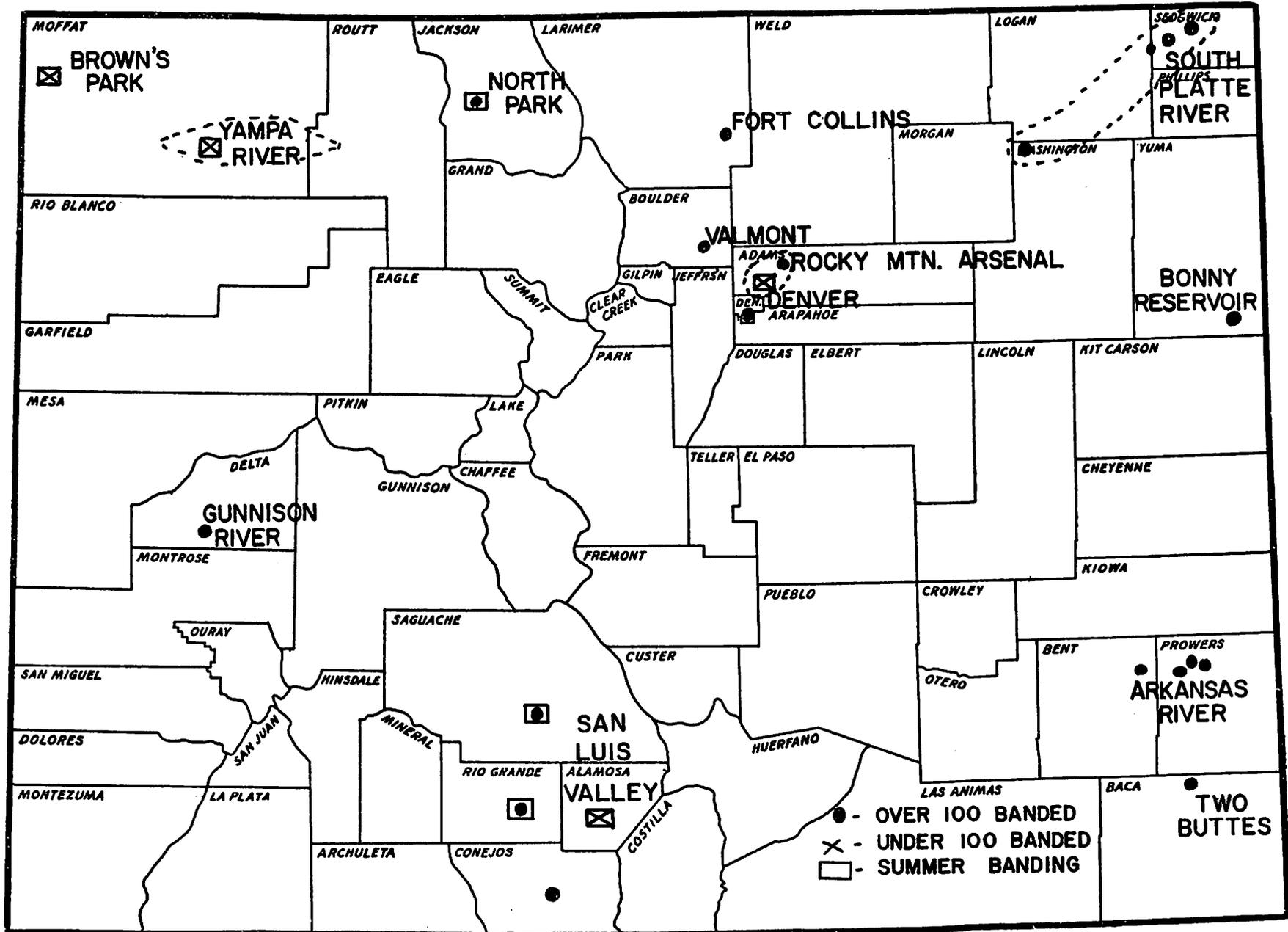


Fig. 1. Primary Waterfowl Banding Sites in Colorado and Their Relative Importance

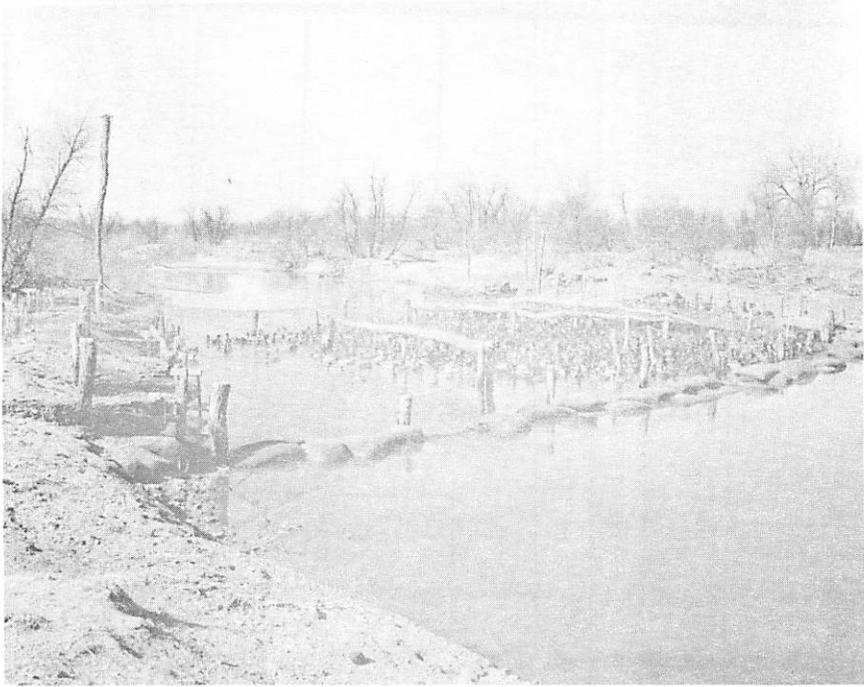


Figure 2. A Large Colorado Duck Trap Designed by Wildlife Conservation Officer, Gurney I. Crawford, in Operation on the South Platte River near Sedgwick, Colorado.

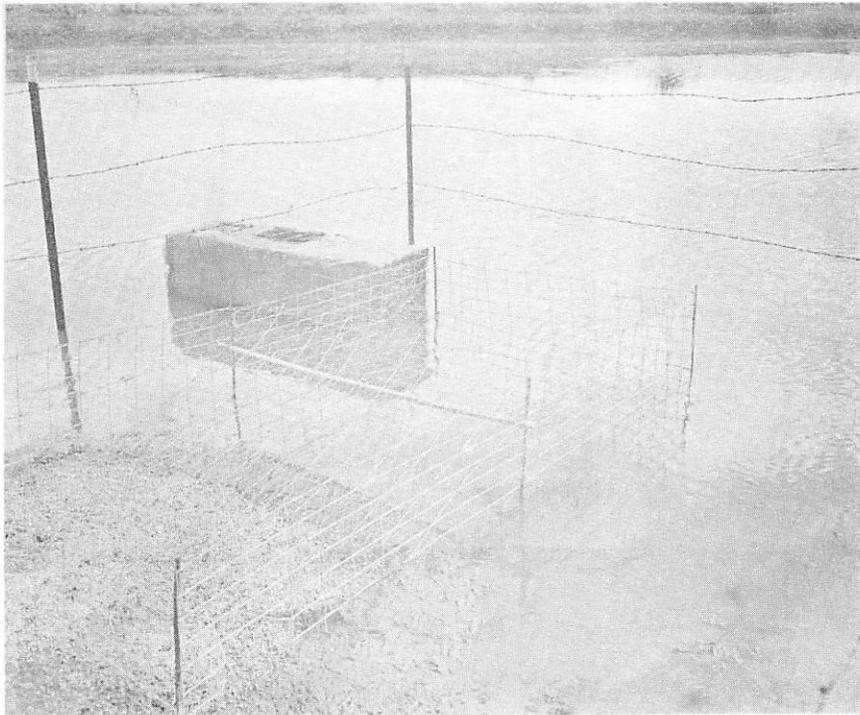


Figure 3. A Small (4' by 8') Colorado Duck Trap Used in Summer Banding.



Figure 4. Goose Trap Designed by Wildlife Conservation Officer, Crawford, is used on Two Buttes Reservoir, Colorado.

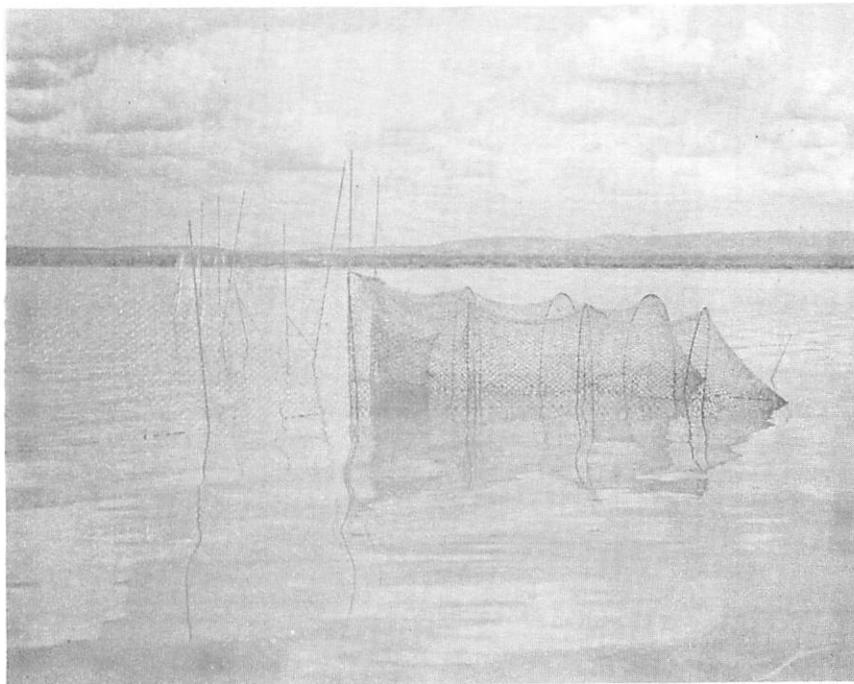


Figure 5. Hawkins Drive Trap Used in Summer Banding.

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BAND NUMBER	RECY. AT		DATE OF RECOVERY			METHOD	SPRINGS	AGE	SEX	DATE OF BANDING			BAND. AT	LARGE	TIPS	MARKS	REMARKS																																																														
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Fig. 6. International Business Machine (IBM) Card Used for Recording and Analyzing Waterfowl Band Recovery Data in Colorado.

At some of the banding stations, various studies other than banding have been conducted in conjunction with banding such as parasite studies, weights, and fluoroscopy. Some experimentation using reward and non-reward bands was conducted by the Fish and Wildlife Service in Colorado. A cooperative study of the effect of injected lead in mallards was conducted at the Rocky Mountain Arsenal near Denver along with fluoroscopic studies of body lead. Some Canada geese were also fluoroscoped at Two Buttes Reservoir. Colored bands have been used primarily to aid in the rapid identification of repeats and ducks from other banding stations. No plastic collars have been applied as yet although some marking with paints, bleaches, and tail clipping was used experimentally with little success.

III. Waterfowl Banded in Colorado.

As previously mentioned, the bulk of the waterfowl banded in Colorado have been mallards (over 65,000). However, over 78,000 waterfowl consisting of fifteen species of ducks and three species of geese in addition to a few coots have been banded in the State since 1944. Table 1 analyzes the banding by species and agencies banding. Waterfowl banded at the various banding stations will be further discussed in the analysis of returns.

For a more detailed breakdown of the bandings by species and banding sites see Appendix A and the discussions in the text listed under the various species headings.

Table 1.--Waterfowl Banded in Colorado - 1944 through March, 1955

Species	Agency Banding			Total
	Colorado Game & Fish Dept.	U. S. Fish & Wildlife Service	Colorado Cooperative Wildlife Research Unit	All Banders
Canada Geese	3,522	---	---	3,522
White-fronted Geese	1	---	---	1
Lesser Snow Goose	3	---	---	3
Mallard	50,544	11,955	3,383	65,882
Black Duck	3	1	---	4
Gadwall	25	2	1	28
Baldpate	807	829	67	1,703
Pintail	6,029	261	416	6,706
Green-winged Teal	538	13	---	551
Blue-winged Teal	93	---	2	95
Cinnamon Teal	1	2	---	3
Shoveller	1	---	---	1
Wood Duck	1	1	---	2
Redhead	49	---	3	52
Canvasback	1	---	---	1
Ring-necked Duck	2	---	---	2
Lesser Scaup Duck	1	---	---	1
Ruddy Duck	3	---	---	3
Mallard X Pintail	1	---	---	1
Coot	34	16	1	51
Total All species	61,659	13,080	3,873	78,612

Table 2.--Out-of-State Banded Waterfowl Recovered in Colorado (459 birds of 11 species) as of February, 1955.

Place	Banded	Mallard	Pintail	Baldpate	G-W Teal	B-W Teal	Redhead	Gadwall	R-N Duck	Lesser Scaup	Canada Goose	Shoveller
Arizona	3	1	--	--	--	--	--	--	--	--	--	--
Arkansas	1	--	--	--	--	--	--	--	--	--	--	--
California	1	8	--	--	--	4	--	--	--	--	--	--
Idaho	22	1	--	--	--	--	--	--	--	--	1	--
Illinois	4	--	--	--	--	--	--	--	--	--	--	--
Indiana	1	1	--	--	--	--	--	--	--	--	--	--
Kansas	2	1	--	--	--	--	--	--	--	--	--	--
Mississippi	1	--	--	--	--	--	--	--	--	--	--	--
Missouri	1	--	--	1	--	--	--	--	--	--	--	--
Montana	52	2	--	--	--	1	--	--	--	--	9	--
Nebraska	39	1	--	--	--	--	1	--	--	--	1	--
Nevada	1	--	--	--	--	--	--	--	--	--	--	--
New Mexico	13	--	--	--	--	--	--	--	--	--	--	--
North Dakota	7	3	--	1	3	--	--	--	--	--	--	--
Ohio	1	--	--	--	--	--	--	--	--	--	--	--
Oklahoma	18	--	--	--	--	--	--	--	--	--	--	--
Oregon	3	--	1	1	--	--	--	--	--	--	--	--
South Carolina	--	--	--	--	--	--	1	--	--	--	--	--
South Dakota	7	--	--	--	--	--	--	--	--	--	--	--
Texas	4	--	--	1	--	--	--	--	--	--	--	--
Utah	1	1	--	--	--	17	--	--	--	--	2	--
Washington	1	--	--	--	--	--	--	--	--	--	--	--
Wyoming	71	1	--	--	--	--	--	--	--	--	7	--
<u>Canada</u>												
Alberta	45	3	1	2	1	--	4	--	2	--	--	--
British Columbia	--	--	--	--	--	2	3	--	--	--	--	--
Manitoba	5	1	--	--	--	--	--	--	--	--	--	--
Saskatchewan	50	6	1	2	--	--	--	--	--	4	1	--
<u>Totals</u>												
Out-of-State	354	30	3	8	4	24	8	1	2	24	1	

IV. Waterfowl Banded Out-of-State, Recovered in Colorado

In addition to recoveries of Colorado banded waterfowl, all known recoveries in Colorado since 1948 of waterfowl banded out-of-state have been summarized in Table 2.

V. Method of Analysis

The analysis of waterfowl recoveries reported herein has been facilitated by transferring information from Fish and Wildlife Service report of recovery forms (Form 3-624) to International Business Machine (IBM) cards and using standard sorting machines to provide the information desired. The IBM cards used (see Fig. 6) were especially designed for Colorado data and should not be confused with the Fish and Wildlife Service return cards (Form 3-137).

Means of recovery have been grouped in four main categories: (1) shot; (2) found dead; (3) trapped, and (4) trapped and released in banding operations. By far most of the recoveries have been by shooting, largely in the regular waterfowl hunting seasons although a limited number were shot in crop depredations control and by treaty Indians and Eskimos permitted to hunt for food anytime of year. The category "found dead" is a rather general classification that includes crippling losses, birds killed by predators, disease, and accidents, such as oil saturation, botulism, gopher poisoning and striking fences. The third category "trapped" is limited to birds caught accidentally in muskrat, beaver, mink, and other mammal trapping. Most of these birds were dead when reported although a few were released alive, sometimes after the band was removed. The fourth classification "trapped and released in banding operations" includes only those birds caught at other trapsites and subsequently released (referred to also as "foreign retraps").

Most emphasis has been placed on recoveries by hunting although where sufficient recoveries by other means are available, they are discussed. Only a small proportion of the recoveries discussed herein are "direct" (see glossary for definitions). Most of the graphs and tables refer to all known recoveries by shooting, both "direct" and indirect". With few exceptions, the data analyzed refer to recovery reports received prior to September 1, 1954, and apply primarily to waterfowl banded since 1944.

Life tables have been constructed where possible using the methods described by Hickey (1952). All IBM cards were coded for the year following banding in which recovered. This "elapse time" was based on using September 1 through August 31 as the recovery year rather than using the calendar year. As in distribution analysis, most emphasis in mortality has been placed on hunting because of its relative importance and the uncertainty of reports from other mortality causes.

Chapter 2--Mallard Recoveries

Introduction. Most of the mallards banded in Colorado were banded in the winter and recovered in subsequent hunting seasons although lesser numbers were banded in the summer on their breeding grounds and others in the fall just prior to hunting seasons or between the halves of split seasons. Very few direct recoveries of winter banded mallards have been received and most of these were caught in muskrat or beaver traps, shot by Indians or died of various miscellaneous causes (botulism, rodent poisoning, striking fences, hit by vehicles, killed on the nest by agricultural machinery, etc.). A small number were trapped and released during banding operations on their breeding grounds. By far, most of the indirect recoveries of winter banded mallards have been by shooting during regulation seasons, although significant numbers have been found dead from miscellaneous causes, primarily crippling losses.

I. Winter Banding

The primary winter banding sites at which most mallards have been banded in Colorado are discussed as follows: (1) South Platte River Valley, from Merino to Julesburg; (2) Valmont Reservoirs, Boulder; (3) Arkansas River Valley, including Two Buttes Reservoir; (4) Denver Area, Rocky Mountain Arsenal and City Park; (5) San Luis Valley; (6) Fort Collins Area, including Windsor; (7) Gunnison and Uncompaghre Rivers; and (8) Bonny Reservoir. A breakdown of recovery numbers by trap site areas is presented in Table 3.

1. South Platte River Valley. Most of the mallards banded in Colorado were trapped during January and February of the years 1945 through 1951 at several sites in the South Platte River Valley in the Northeastern quarter of the State, the more important of which were on the river near Sedgwick, although lesser numbers were banded at Prewitt and Jumbo Reservoirs. Seventy-one mallards were banded by the Fish and Wildlife Service in this area in 1944 to 1945 and some 27,012 by the Colorado Game and Fish Department during the period 1946 to 1951 (over 12,000 in 1950 alone). To date, some 3,419 recoveries have been reported giving an over-all recovery rate of 12.6 percent and a first season following banding recovery rate of 4.3 percent.

The bulk of the 3,204 mallards banded in the South Platte Valley and subsequently recovered by shooting were taken in the Central Flyway of the United States and the Prairie Provinces of Canada (See Figure 7 and Table 5).

Figure 7 graphically presents the distribution of hunting recoveries of mallards banded at the South Platte stations. These recoveries are mainly indirect and should not be interpreted as proof of direct movements from the banding sites to the places of recovery. On the contrary, most recoveries are made one or more hunting seasons after the time of banding during which time the ducks have migrated north and south one or more times, not necessarily wintering in the same areas.

Table 3. --Recoveries of Mallards Banded During the Winter in Colorado-
1944-1954

Where Banded	Number Banded	Total Recoveries	Means of Recovery			
			Shot Dead	Found	Mammal Traps	Retrapped at Other Banding Stations
South Platte River Valley	27,083	3,419	3,204	125	50	40
Valmont Reservoirs	10,301	1,371	1,262	58	14	37
Arkansas River Valley	9,855	1,024	960	27	25	12
Denver Area	5,272	638	551	56	10	21
San Luis Valley ^{1/}	4,613	534	519	10	---	5
Fort Collins Area	1,910	212	198	8	2	4
Bonny Reservoir	556	16	16	---	---	---
Gunnison River	465	41	40	---	---	1
Total	60,055	7,255	6,750	284	101	120

^{1/} Does not include banding at Monte Vista National Wildlife Refuge, nor in Conejos County in 1940.

Table 4. --Wintering Waterfowl Populations in the Vicinity of Trapsite in the South Platte Valley of Colorado and Waterfowl Banded.

Year	Aerial Counts by Months ^{1/}			Number Banded	Percent of High Count
	Jan.	Feb.	Mar.		
1948	24,670	---	3,835	5,353	21.7
1949	104,180	90,470	5,980	6,266	6.0
1950	151,800	70,900	22,100	12,543	8.3
1951	56,100	60,800	30,840	795	1.4

^{1/} Combination of river and Jumbo Reservoir counts, all species but mostly mallards.

Within Colorado (Figure 8 and Table 5) most recoveries were within fifty miles of the trapsites with only a few recoveries being made on the Western Slope.

Breeding season recoveries (Figure 9 and Table 6) seem to indicate that most of the mallards that winter in the South Platte Valley nest in Alberta and Saskatchewan.

Table 5.—Distribution of Recoveries by Shooting of Mallards Banded in the South Platte Valley of Colorado During the Winter.

Place Recovered	No.	Percent	Place Recovered	No.	Percent
<u>Colorado Counties</u>			Kentucky	1	T
Colorado County unknown	1	T	Louisiana	34	1.1
Pueblo	1	T	Minnesota	19	0.6
Weld	77	2.4	Mississippi	7	0.2
El Paso	1	T	Missouri	16	0.5
Las Animas	2	T	Montana	55	1.7
Larimer	21	0.7	Nevada	1	T
Boulder	18	0.6	New Mexico	5	0.2
Otero	5	0.2	North Dakota	164	5.1
Arapahoe	1	T	Ohio	1	T
Jefferson	1	T	Oklahoma	25	0.8
Adams	25	0.8	Oregon	8	0.2
Logan	246	7.7	Pennsylvania	1	T
Morgan	124	3.9	South Dakota	105	3.3
Prowers	12	0.4	Tennessee	4	0.1
Yuma	9	0.3	Texas	74	2.3
Baca	1	T	Utah	1	T
Rio Grande	2	T	Virginia	1	T
Conejos	2	T	Washington	18	0.6
Kit Carson	1	T	Wisconsin	1	T
Washington	16	0.5	Wyoming	54	1.7
Routt	1	T			
Bent	7	0.2	Mexico	1	T
Alamosa	2	T	Alaska	2	T
Chaffee	1	T	Northwest Territories	5	0.2
Lincoln	3	0.1	Northern Alberta	94	2.9
Elbert	1	T	Southern Alberta	309	9.6
Saguache	1	T	Northern British Columbia	2	T
Crowley	6	0.2	Southern British Columbia	4	0.1
Phillips	22	0.7	Northern Manitoba	9	0.3
Sedgwick	272	8.5	Southern Manitoba	31	1.0
Lake	1	T	Northern Saskatchewan	268	8.1
Moffat	1	T	Southern Saskatchewan	1	T
Eagle	1	T	Yukon	1	T
Kiowa	4	0.1			
Douglas	1	T			
South Platte Valley			<u>Summary</u>		
(County unknown)	3	0.1	Central Flyway, U.S.	2,237	69.8
Arkansas Valley (County unknown)	1	T	Mississippi Flyway, U.S.	137	4.3
Colorado Totals	894	27.9	Pacific Flyway, U.S.	55	1.7
Nebraska	808	25.2	Atlantic Flyway, U.S.	4	0.1
Alabama	2	T	Canada	768	24.0
Arkansas	35	1.1	Mexico and Alaska	3	0.1
California	9	0.3			
Idaho	19	0.6			
Illinois	9	0.3			
Indiana	2	T			
Iowa	8	0.2			
Kansas	52	1.6			
			Total	3,204	100.00

Table 6. —Breeding Season Recoveries of Mallards Banded in the South Platte Valley during the winter.

Placed Recovered	No.	Percent
	<u>Direct and Indirect Recoveries (150)</u>	
Ontario	1	0.7
Northern Manitoba	2	1.3
Southern Manitoba	6	4.0
Northern Saskatchewan	20	13.3
Southern Saskatchewan	39	26.0
Northern Alberta	36	24.0
Southern Alberta	28	18.7
Yukon	1	0.7
Northwest Territories	4	2.6
North Dakota	1	0.7
Montana	2	1.3
Idaho	1	0.7
Wyoming	1	0.7
South Dakota	4	2.6
Nebraska	3	2.0
Texas	1	0.7
Totals	150	100.0
	<u>Direct Recoveries (54)</u>	
Northern Ontario	1	1.9
Northern Manitoba	1	1.9
Southern Manitoba	2	3.7
Northern Saskatchewan	10	18.5
Southern Saskatchewan	10	18.5
North Alberta	10	18.5
Southern Alberta	11	20.2
Yukon	1	1.9
Northwest Territories	2	3.7
Montana	2	3.7
Wyoming	1	1.9
South Dakota	1	1.9
Nebraska	2	3.7
	54	100.0

Recapture records (Table 7) in addition to late fall recovery reports indicate that a high proportion of the mallard population wintering in the South Platte Valley of Colorado tends to return winter after winter to the same general area. Comparatively few "foreign" recaptures have been made in the South Platte Valley. Most of these that were winter banded and from Valmont bandings with only a few from the Arkansas Valley.

Table 7.—Mallard Bandings and Recaptures, South Platte Valley, Colorado
(mainly near Sedgwick)

Year	New Bandings	Recaptures	Number of Recaptures Originally Banded Locally	Percent of Recaptures Local Banding
1944-45	71	—	—	—
1946-47	2,781	3	1	33
1947-48	5,128	45	41	91
1948-49	6,263	197	193	98
1949-50	12,118	607	567	93
1950-51	722	238	235	99
Totals	27,083	1,090	1,037	95

The distribution of the kill of mallards banded in the South Platte Valley as indicated by the number reported shot by seasons is presented in Table 8. When this data is tabulated in a mortality table (Table 9) it appears the annual mortality rate ranges from 33% upwards which is lower than any of the mortality rates given by Hickey (1952) for other sections of North America. First-year recovery rates for most mallard banding discussed by Hickey run higher (almost twice) than that realized from the South Platte banding. Much of the banding analyzed by Hickey, however, was for the fall and summer banding, for which first year recovery rates seemingly run higher than for winter banding. Even in Colorado, first-year recovery rates for summer banding ran 9.5% for San Luis Valley banding compared to 4.3% for winter banding in the South Platte Valley.

Table 8.—Seasonal Hunting Pressure as Indicated by Band Recoveries of Mallards Banded in the South Platte Valley of Colorado.

Winter Banded	Number Banded	Number Reported Shot by Seasons 1/										Totals
		44-45	45-46	46-47	47-48	48-49	49-50	50-51	51-52	52-53	53-54	
1944-45	71	1	2	3	2	-	-	-	2	-	-	10
1945-46	No Banding	-	-	-	-	-	-	-	-	-	-	-
1946-47	2,792	-	-	-	44	71	64	61	53	11	11	315
1947-48	5,128	-	-	-	-	170	154	98	104	45	40	611
1948-49	6,263	-	-	-	-	-	324	186	175	90	78	853
1949-50	12,118	-	-	-	-	-	-	490	436	232	188	1,346
1950-51	722	-	-	-	-	-	-	-	31	11	18	60
Totals	27,084	1	2	3	46	241	542	835	801	389	335	3,195

1/ Omits 9 recovery reports for which there was confused data regarding season of recovery.

Table 9.--Hunting Mortality Table for Mallards Banded in the South Platte Valley of Colorado.

Age Interval (Years)	Mortality Total No. Shot	Alive at Start Each Age	Mortality Rate (percent per annum)
x / 0 to x / 1	1	3,195	—
x / 1 to x / 2	1,061	3,194	33
x / 2 to x / 3	861	2,133	40
x / 3 to x / 4	589	1,272	46
x / 4 to x / 5	443	683	65
x / 5 to x / 6	176	240	73
x / 6 to x / 7	51	64	80
x / 7 to x / 8	13	13	100
Totals	3,195	10,794	—
Mean Mortality Rate			30%

2. Valmont Reservoirs, Boulder. Next to the South Platte bandings, the greatest number of recoveries of winter-banded mallards is from the Valmont Reservoirs at Boulder. From 1944 through 1949, personnel from the Denver Wildlife Research Laboratory with the cooperation and assistance of Colorado Game and Fish Department personnel banded 10,020 mallards at Valmont. There was no banding at the reservoir during the winters of 1949-50, nor 1950-51, but 281 mallards were banded there by Game and Fish Department technicians in 1951-52.

Table 10. --Wintering Waterfowl Populations at Valmont Reservoirs, Boulder, Colorado and Waterfowl Banded.

Year	Aerial Counts by Months ^{1/}			Number Banded	Percent of High Count
	Jan.	Feb.	Mar.		
1945				1,473	
1946				3,843	
1947				2,047	
1948	1,500		75	1,439	96.0
1949	7,210	6,200	700	2,267	31.5
1952	29,000	4,500	—	283	1.0

^{1/} 1948 and later based on aerial counts. Earlier counts estimates of banders.

At this writing, 1,371 recoveries are known, 1,262, of which were shot. Recoveries from Valmont are quite similar to those from the South Platte except not so widely dispersed and somewhat more westward in distribution. This is understandable, there being fewer recoveries and Valmont being 140 miles west of the site where most of the South Platte mallards were banded. A greater percentage of the recoveries from Valmont bandings are from Colorado. This probably reflects the fact that local hunting pressure is greater in the Boulder area. Also, Boulder is somewhat more centrally located in the state, whereas the South Platte banding sites are close to Nebraska. There apparently is considerable east and west movement of wintering mallards along the Platte Rivers in western Nebraska and northeastern Colorado.

Within Colorado the distribution of recoveries by hunting of Valmont banded mallards is very similar to that for South Platte bandings — most within 50 miles of the banding site and only a few (0.3%) on the Western Slope. A higher percentage of Valmont (1.2%) than South Platte mallards (0.2%) have been recovered in the San Luis Valley. Hunting recoveries of San Luis Valley summer banded mallards and breeding season recoveries of Valmont banded mallards also seem to indicate that a portion of the mallards wintering in the Boulder area are nesting in the San Luis Valley.

Table 11.—Distribution of Recoveries by Shooting of Mallards Banded at Valmont Reservoirs, Boulder, Colorado, during the Winter.

Place Recovered	No.	Percent	Place Recovered	No.	Percent
<u>Colorado Counties</u>			Iowa	2	0.2
Denver	5	0.4	Kansas	11	0.9
Pueblo	2	0.2	Louisiana	10	0.8
Weld	162	12.9	Minnesota	4	0.3
El Paso	2	0.2	Mississippi	1	0.1
Larimer	63	5.0	Missouri	1	0.1
Boulder	306	24.2	Montana	41	3.2
Mesa	2	0.2	Nebraska	61	4.8
Otero	1	0.2	New Mexico	3	0.2
Arapahoe	4	0.3	North Dakota	27	2.1
Jefferson	6	0.5	Oklahoma	4	0.3
Adams	107	8.5	Oregon	5	0.4
Logan	5	0.4	South Dakota	21	1.7
Fremont	1	0.2	Tennessee	1	0.1
Morgan	22	1.7	Texas	20	1.6
Prowers	2	0.2	Utah	6	0.5
Yuma	1	0.1	Washington	4	0.3
Rio Grande	1	0.1	Wyoming	39	3.1
Garfield	1	0.1			
Conejos	3	0.2	Alaska	1	0.1
Kit Carson	1	0.1	Northwest Territories	5	0.4
Washington	3	0.2	Northern Alberta	25	2.0
Bent	2	0.2	Southern Alberta	131	10.4
Alamosa	5	0.4	Northern British Columbia	2	0.2
Lincoln	1	0.2	Southern British Columbia	1	0.1
Saguache	6	0.5	Northern Manitoba	2	0.2
Crowley	1	0.2	Southern Manitoba	5	0.4
Sedgwick	6	0.5	Northern Saskatchewan	4	0.3
Lake	2	0.2	Southern Saskatchewan	61	4.8
Cheyenne	1	0.1	Yukon	2	0.2
Custer	1	0.2			
Grand	1	0.1			
Jackson	1	0.1			
Colorado Totals	<u>727</u>	<u>57.6</u>			
Arizona	2	0.2	<u>Summary</u>		
Arkansas	6	0.5	Canada	238	18.9
California	4	0.3	Central Flyway U.S.	954	75.6
Idaho	21	1.7	Mississippi Flyway, U.S.	27	2.1
Illinois	1	0.1	Pacific Flyway, U.S.	42	3.3
			Atlantic Flyway, U.S.	—	—
			Alaska	1	0.1
			Totals	<u>1,262</u>	<u>100.0</u>

Most of the breeding season recoveries (only 65 in all) of Valmont mallards are from Canada with a greater percentage in Alberta than in Saskatchewan, especially so when compared to South Platte bandings. Apparently a higher percentage of the Valmont wintering mallards nest in the Rocky Mountain area than seems to be the case with the South Platte birds. Undoubtedly there is some exchange of birds between the two wintering sites.

Table 12.—Breeding Season Recoveries of Mallards Banded at Valmont Reservoirs, Boulder, Colorado, during the Winter.

Place Recovered	No.	Percent
Colorado	8	12.3
Wyoming	6	9.3
South Dakota	1	1.5
Montana	3	4.6
United States Total	18	27.7
Alaska	1	1.5
Alberta	28	43.1
British Columbia	3	4.6
Manitoba	1	1.5
Saskatchewan	10	15.4
Yukon	2	3.1
Northwest Territories	2	3.1
Totals	65	100.0

Table 13.—Season Hunting Pressure as Indicated by Band Recoveries of Mallards Banded at Valmont Reservoirs, Boulder, Colorado

Winter Banded	Number Banded	Number Reported Shot by Season ^{1/}											Totals
		44-45	45-46	46-47	47-48	48-49	49-50	50-51	51-52	52-53	53-54		
1944-45	1,277	10	70	52	22	13	13	1	4	2	1	188	
1945-46	3,507	---	24	229	74	58	44	32	31	6	6	504	
1946-47	1,842	---	---	7	56	30	22	24	24	7	2	172	
1947-48	1,338	---	---	---	2	48	30	25	32	11	5	153	
1948-49	2,056	---	---	---	---	1	69	49	50	29	21	219	
1949-51	No Banding	---	---	---	---	---	---	---	---	---	---	---	
1951-52	281	---	---	---	---	---	---	---	---	9	12	21	
Totals	10,301	10	94	288	154	150	178	131	141	64	47	1,257	

^{1/} Omits five recovery reports for which there was confused data regarding season of recovery.

3. Arkansas River Valley. Winter banding of mallards has been conducted by Game and Fish Department personnel on the Arkansas River near Lamar and on Two Buttes Reservoir near Springfield—all treated herein as Arkansas River Valley bandings. Since 1949, 8,472 mallards have been banded on the river and 1,383 on Two Buttes Reservoir.

Table 14.—Hunting Mortality Table for Mallards Banded at the Valmont Reservoirs, Boulder, Colorado.

Age Interval (Years)	Mortality Total No. Shot	Alive at Start Each Age	Mortality Rate (percent per annum)
x / 0 to x / 1	44	1,257	—
x / 1 to x / 2	481	1,213	40
x / 2 to x / 3	247	732	34
x / 3 to x / 4	177	485	37
x / 4 to x / 5	142	308	46
x / 5 to x / 6	101	166	61
x / 6 to x / 7	44	65	68
x / 7 to x / 8	12	21	57
x / 8 to x / 9	8	9	89
x / 9 to x / 10	1	1	100
Totals	1,257	4,257	—
Mean Mortality Rate			30%

Table 15.—Wintering Waterfowl Populations and Waterfowl Banded in the Arkansas River Valley of Colorado (Ducks Only)

Year	Aerial Counts by Months ^{1/}			Number Banded	Percent of High Count
	Jan.	Feb.	Mar.		
1949	78,430	16,875	675	5,040	6.4
1950	55,700	19,350	38,100	4,457	8.0
1951	61,500	10,390	4,800	2,273	2.7
1952	12,000	5,100	670	594	4.9
1954	1,500	—	—	263	17.5

^{1/} For Arkansas River area only in 1949 and 1950; for river area and Two Buttes Reservoir combined in 1951, and for Two Buttes only in 1952 and 1954. In 1952 and 1954 emphasis was primarily on goose trapping.

To date, 996 recoveries are known from the Arkansas River bandings and 28 from the Two Buttes bandings. A total of 960 recoveries from these two localities were by shooting. The over-all recovery rate for mallards banded in the Arkansas Valley (10.6%) is somewhat lower than that of mallards banded near Boulder (13.2%) or in the South Platte Valley (12.6%) although the first season following banding recovery rate (4.6%) is higher than that for the South Platte Valley.

Recoveries of mallards banded in the Arkansas Valley have been distributed over a wider area than those from either Valmont or South Platte bandings. Fewer recoveries have been made in Colorado indicative of the lower hunting pressure in the Arkansas Valley compared to either the South Platte Valley or the Boulder area. Also, the Arkansas Valley mallards have the highest recovery representation in Canada and the Mississippi Flyway of any of the Colorado banding sites but at the same time a fairly high number were taken in the Pacific Flyway and a few in the Atlantic Flyway.

Table 16. —Distribution of Recoveries by Shooting of Mallards Banded in the Arkansas Valley of Colorado During the Winter.

Place Recovered	No.	Percent	Place Recovered	No.	Percent
<u>Colorado Counties</u>					
Denver	1	0.1	Louisiana	11	1.1
Pueblo	4	0.4	Minnesota	7	0.7
Weld	16	1.8	Mississippi	1	0.1
Larimer	9	1.0	Missouri	8	0.8
Boulder	2	0.2	Montana	26	2.7
Otero	6	0.6	Nebraska	124	12.9
Arapahoe	1	0.1	New Jersey	1	0.1
Adams	8	0.8	New Mexico	5	0.5
Logan	5	0.5	North Carolina	1	0.1
Morgan	19	2.0	North Dakota	55	5.7
Prowers	78	8.1	Oklahoma	19	2.0
Yuma	2	0.2	Oregon	5	0.5
Baca	5	0.5	South Dakota	35	3.6
Rio Grande	1	0.1	Tennessee	2	0.2
Conejos	2	0.2	Texas	42	4.4
Kit Carson	3	0.3	Utah	6	0.6
Washington	2	0.2	Washington	6	0.6
Bent	47	4.9	Wisconsin	2	0.2
Alamosa	4	0.4	Wyoming	18	1.9
Lincoln	2	0.2			
Elbert	2	0.2	Northwest Territories	1	0.1
Saguache	1	0.1	Northern Alberta	31	3.2
Crowley	6	0.6	Southern Alberta	107	11.2
Sedgwick	3	0.3	Southern British Columbia	1	0.1
Gunnison	1	0.1	Northern Manitoba	2	0.2
Kiowa	11	1.2	Southern Manitoba	11	1.1
Cheyenne	3	0.3	Northern Saskatchewan	14	1.5
Grand	1	0.1	Southern Saskatchewan	79	8.2
Jackson	1	0.1	Yukon	1	0.1
Colorado Totals	<u>246</u>	<u>25.6</u>			
Arkansas	14	1.5	<u>Summary</u>		
California	4	0.4	Canada	247	25.8
Idaho	14	1.5	Pacific Flyway, U.S.	35	3.6
Illinois	3	0.3	Central Flyway, U.S.	626	65.2
Iowa	2	0.2	Mississippi Flyway U.S.	50	5.2
Kansas	55	5.7	Atlantic Flyway U.S.	2	0.2
Kentucky	1	0.1			
			Totals	960	100.0

Within Colorado, only two of 246 hunting recoveries of mallards banded in the Arkansas Valley have been recovered on the Western Slope. Most Colorado recoveries have been within 50 miles of the banding sites although to a lesser extent than was the case with either Valmont or South Platte bandings.

Only 54 recoveries (by all means, not just shooting) have been made during the breeding season. These indicate that the mallards that winter in the Arkansas Valley nest primarily in Alberta and Saskatchewan as seems to be the case with mallards that winter on Valmont Reservoir and in the South Platte Valley.

Table 17.—Breeding Season Recoveries of Mallards Banded in the Arkansas Valley of Colorado During the Winter.

Placed Recovered	No.	Percent	Placed Recovered	No.	Percent
Northwest Territories	3	5.8	Yukon	1	1.9
British Columbia	1	1.9	Colorado (Grand Co.)	1	1.9
Northern Alberta	8	15.4	Montana	2	3.9
Southern Alberta	11	21.2	North Dakota	1	1.9
Northern Saskatchewan	9	17.4	Idaho	1	1.9
Southern Saskatchewan	10	19.2	Nebraska	1	1.9
Northern Manitoba	1	1.9	Kansas	1	1.9
Southern Manitoba	1	1.9	Total	52	100.0

The mallard population wintering in the Arkansas Valley seems to be subject to slightly greater hunting pressure than that wintering in the South Platte Valley on the basis of differences in first-year recovery rates and mortality table data (see Tables 18 and 19).

Table 18.—Seasonal Hunting Pressure as Indicated by Band Recoveries of Mallards Banded in the Arkansas Valley of Colorado.

Winter Banded	Number Banded	Number Reported Shot by Seasons 1/						Totals
		1948-49	1949-50	1950-51	1951-52	1952-53	1953-54	
1948-49	4,649	4	202	117	97	58	52	530
1949-50	3,192	—	3	115	79	57	44	298
1950-52	1,085	—	—	1	48	32	23	104
1951-52	566	—	—	—	—	9	17	26
1952-53	No Banding	—	—	—	—	—	—	—
1953-54	363	—	—	—	—	—	—	—
Totals	9,855	4	205	233	244	156	136	958

1/ Omits 2 recovery reports for which there was confused data regarding season of recovery.

Table 19.--Hunting Mortality Table for Mallards Banded in the Arkansas Valley of Colorado.

Age Interval (Years)	Mortality Total No. Shot	Alive at Start Each Age	Mortality Rate (percent per annum)
x / 0 to x / 1	8	958	---
x / 1 to x / 2	374	950	39
x / 2 to x / 3	245	576	43
x / 3 to x / 4	177	331	53
x / 4 to x / 5	102	154	66
x / 5 to x / 6	52	52	100
Totals	958	3,021	---
Mean Mortality Rate			32%

4. Denver Area. Some 5,272 mallards have been banded in the Denver area primarily on the Rocky Mountain Arsenal near Derby but lesser numbers on the South Platte River near Henderson and on the lakes in City Park. To date, 638 recoveries have been reported for these bandings for an overall recovery rate of 12.1% and a first season recovery rate of 5.5%. This is a somewhat lower over-all recovery rate than that for Valmont and South Platte bandings, but higher than that for the Arkansas Valley banding. However, the first-season recovery rate is higher than that for the South Platte and Arkansas Valley bandings, probably reflecting the greater hunting pressure in the Denver area.

Table 20.--Wintering Waterfowl Populations and Waterfowl Banded in the Denver Area of Colorado, 1948-1951.

Year	Aerial Counts by Months ^{1/}			Number Banded <u>2/</u>	Percent of High Count
	Jan.	Feb.	Mar.		
1948	12,300	<u>3/</u>	500	1,885	15.3
1949	900	12,700	3,275	60	0.5
1950	19,750	25,300	4,100	2,991	15.1
1951	11,250	10,000	2,000	1,443	12.8

1/ At Barr Lake, Adams County (All Species).

2/ Primarily at Rocky Mountain Arsenal, nine miles south of Barr Lake.

3/ No count made.

The 551 recoveries by shooting of mallards banded in the Denver area are distributed much as were those from Valmont bandings, i. e. over half in Colorado, three-fourths in the Central Flyway of the United States, a sixth in Canada with lesser fractions in the Mississippi and Pacific Flyways.

Within Colorado, the percentage of recoveries on the Western Slope has been higher for mallards banded in the Denver area than from any of the other Eastern Slope banding sites, however, most of the recoveries are from east of the mountains and within 50 miles of Denver.

Only 26 breeding season recoveries have been reported for mallards banded in the winter in the Denver area. Most of these are from Alberta and Saskatchewan, but three are from Colorado.

Table 21.—Distribution of Recoveries by Shooting of Mallards Banded in Denver area of Colorado During the Winter

Placed Recovered	No.	Percent	Placed Recovered	No.	Percent
<u>Colorado Counties</u>			California	4	0.7
Denver	1	0.2	Idaho	6	1.1
Pueblo	1	0.2	Kansas	5	0.9
Weld	74	13.4	Louisiana	4	0.7
El Paso	2	0.4	Minnesota	2	0.4
Larimer	14	2.5	Missouri	2	0.4
Boulder	24	4.3	Montana	6	1.1
Mesa	1	0.2	Nebraska	39	7.1
Arapahoe	15	2.7	New Mexico	3	0.5
Jefferson	6	1.1	North Dakota	16	2.9
Adams	120	21.7	Oklahoma	1	0.2
Logan	7	1.3	Oregon	5	0.9
Morgan	14	2.5	South Dakota	17	3.1
Prowers	2	0.4	Tennessee	1	0.2
Montrose	1	0.2	Texas	6	1.1
Rio Grande	2	0.4	Utah	3	0.5
Garfield	1	0.2	Washington	3	0.5
Washington	1	0.2	Wyoming	21	3.8
Routt	1	0.2			
Bent	4	0.7	Northwest		
Alamosa	6	1.1	Territories	1	0.2
Lincoln	1	0.2	Northern Alberta	11	2.0
Saguache	1	0.2	Southern Alberta	48	8.7
Crowley	3	0.5	Southern Manitoba	2	0.4
Costilla	1	0.2	Northern		
Sedgwick	2	0.4	Saskatchewan	5	0.9
Eagle	1	0.2	Southern		
Douglas	1	0.2	Saskatchewan	23	4.1
Clear Creek	1	0.2			
			<u>Summary</u>		
Colorado Totals	308	56.0	Canada	90	16.3
Arizona	1	0.2	Central Flyway, U.S.	422	76.6
Arkansas	8	1.4	Pacific Flyway, U.S.	22	4.0
			Mississippi		
			Flyway, U.S	17	3.1
			Totals	551	100.0

Table 22.--Breeding Season Recoveries of Mallards Banded in the Denver Area During the Winter.

Placed Recovered	No.	Percent	Placed Recovered	No.	Percent
Colorado			Canada		
Adams County	1	3.8	Northwest Territories	1	3.8
Grand County	2	7.7	Northern Alberta	4	15.4
Montana	1	3.8	Southern Alberta	7	27.0
Wyoming	1	3.8	Northern Saskatchewan	2	7.7
			Southern Saskatchewan	7	27.0
			Totals	26	100.0

Table 23.--Seasonal Hunting Pressure as Indicated by Band Recoveries of Mallards Banded in the Denver Area of Colorado

Winter Banded	Number Banded	Number Reported Shot by Seasons						Totals	
		1947-48	1948-49	1949-50	1950-51	1951-52	1952-53		1953-54
1946-47	182	3	3	3	1	1	3	-	14
1947-48	1,260	1	44	36	15	27	12	8	143
1948-49	38	-	-	5	1	3	-	-	9
1949-50	3,294	-	-	1	114	83	44	31	273
1950-51	1,906	-	-	-	-	55	29	24	108
Totals	6,680	4	47	45	131	169	88	63	547

1/ Omits 4 recovery reports for which there was confused data regarding season of recovery.

Table 24.--Hunting Mortality Table for Mallards Banded in the Denver Area of Colorado

Age Interval (Years)	Mortality Total No. Shot	Alive at Start Each Age	Mortality Rate (percent per annum)
x / 0 to x / 1	2	547	-
x / 1 to x / 2	221	545	41
x / 2 to x / 3	152	324	47
x / 3 to x / 4	89	172	52
x / 4 to x / 5	59	83	71
x / 5 to x / 6	13	24	54
x / 6 to x / 7	11	11	100
Totals	547	1,706	-
Mean Mortality Rate			32%

On the basis of first-year recovery rates and mortality table data presented in Table 24, it appears that the mallard population wintering in the Denver area is subject to greater hunting pressure than are those populations wintering in either the South Platte or Arkansas Valleys.

5. San Luis Valley. The first mallards banded during the winter in Colorado were banded in the San Luis Valley by the Fish and Wildlife Service during February of 1940. To date 75 recoveries have been reported from 348 mallards banded for an over-all recovery rate of 21.6% and a first season recovery rate of 12.6%. Personnel of the Colorado Game and Fish Department banded 4,613 mallards in the Valley during the winter 1949 to 1952 and 534 recoveries had been reported at the time of this writing. This gives an over-all recovery rate of 11.2% and a first season recovery rate of 6.3% for the later banding. Just why the recovery rates for the 1940 bandings are so much higher (practically double) than the 1949 to 1952 bandings is not known. Certainly the hunting pressure was considerably higher in the latter period although the recovery rates fail to indicate this.

Table 25.—Wintering Waterfowl Populations and Waterfowl Banded in the San Luis Valley of Colorado, 1950-1955

Year	Aerial Counts by Months			Number Banded <u>1/</u>	Percent of High Count
	Jan.	Feb.	Mar.		
1950	17,650	9,180	13,350	1,214	6.8
1951	8,973	5,690	14,950	1,427	9.5
1952	<u>2/</u>	10,347	7,006	3,337	32.2
1954	7,696	<u>2/</u>	<u>2/</u>	159	0.2
1955	7,865	<u>2/</u>	<u>2/</u>	504	0.6

1/ 1950 - 1952 State Game and Fish Department banding primarily in Conejos County.

1954-1955 Monte Vista National Wildlife Refuge banding in Rio Grande County.

2/ No counts made.

Only five recoveries (by any means, not just shooting) have been made during the breeding season, one in Gunnison County, Colorado, two in Wyoming and two in Alberta. In a manner similar to South Platte Valley bandings, recapture records seem to indicate that mallards wintering in the San Luis Valley, tend to return season after season. In the San Luis Valley, a certain portion of the population is apparently resident as evidenced by the winter recaptures of summer-banded mallards. What few "foreign" captures have been made were mainly wanderers from other wintering grounds.

Table 26.—Distribution of Recoveries of Mallards Banded in the San Luis Valley of Colorado During the Winter of 1940 by U.S. Fish and Wildlife Service

Place Recovered	Number	Percent of Recoveries
Colorado		
San Luis Valley	45	60.0
Elsewhere in Colorado	8	10.7
Idaho	1	1.3
Montana	2	2.7
Nebraska	1	1.3
North Dakota	1	1.3
Wyoming	2	2.7
Alberta	4	5.4
Saskatchewan	1	1.3
Arkansas	1	1.3
Louisiana	1	1.3
New Mexico	7	9.4
Texas	1	1.3
Totals	75	100.0

Table 27.--Mallard Bandings and Recaptures, San Luis Valley, Colorado--Winter Bandings, 1949-1952

Year	New Bandings	Recaptures	Number of Recaptures Originally Banded Locally	Percent of Recaptures Local Banding
1949-50	841	3	0	0
1950-51	1,101	39	37	95
1951-52	2,671	108	103	95
Totals	4,613	150	140	93

The 519 recoveries by shooting so far reported for the 1949 to 1952 bandings were largely in Colorado (75.1%) and almost exclusively in the Central Flyway. There is a surprisingly low percentage from New Mexico although the Conejos River banding site is less than 25 miles north of the New Mexico boundary.

Mallards banded in the San Luis Valley during the winters of 1949 to 1952 have been shot in 31 different Colorado Counties, but primarily in the San Luis Valley (Saguache, Rio Grande, Alamosa, Conejos, and Costilla Counties). It is interesting to note that fifteen have been shot in Western Slope Counties.

First-season recovery rates and annual mortality rates for mallards banded in the San Luis Valley during the winters 1949 through 1952 are the highest so far considered in this report with the exception of the rather limited banding done in the Valley in 1940. Kill data from summer banding in the Valley also leads one to believe there is considerable hunting pressure on the mallard population in the San Luis Valley compared to that on mallard populations elsewhere in Colorado.

6. Fort Collins Area. During the winter of 1946-47, 121 mallards were banded by Game and Fish Department personnel at Lindenmeir Reservoir near Ft. Collins and Windsor Reservoir in Weld County. During the winters of 1949 to 1952, personnel of the Colorado Cooperative Wildlife Research Unit at Colorado A & M College banded 1,789 mallards in the Fort Collins area. Additional mallards were banded during the fall, but these are discussed under fall banding.

From this total of 1,910 mallards banded during the winter in the Fort Collins area, 212 recoveries are known, giving an over-all recovery rate of 11.1% and a first-season recovery rate of 7.2%.

The 198 hunting recoveries of mallards winter-banded in the Fort Collins area are distributed very much as were the recoveries of mallards at nearby Valmont Reservoir, i.e. slightly over half in Colorado, about 80% in the Central Flyway States, and 16.9% in Canada.

Table 28.—Distribution of Recoveries by Shooting of Mallards Banded in the San Luis Valley of Colorado During the Winter 1949-1952

Place Recovered	No.	Percent	Place Recovered	No.	Percent
<u>Colorado Counties</u>			Arizona	2	0.4
Pueblo	3	0.5	Arkansas	1	0.2
Weld	13	2.5	Idaho	4	0.8
El Paso	1	0.2	Kansas	3	0.6
Las Animas	1	0.2	Louisiana	1	0.2
Boulder	2	0.4	Montana	4	0.8
Mesa	2	0.4	Nebraska	12	2.3
Otero	1	0.2	Nevada	1	0.2
Jefferson	1	0.2	New Mexico	23	4.4
Adams	4	0.8	North Dakota	3	0.6
Logan	2	0.4	Ohio	1	0.2
Morgan	7	1.3	Oklahoma	1	0.2
Prowers	1	0.2	South Dakota	5	1.0
Delta	2	0.4	Tennessee	2	0.4
Yuma	1	0.2	Texas	8	1.5
Montrose	4	0.8	Utah	12	2.3
Rio Grande	58	11.2	Wyoming	10	1.9
Garfield	1	0.2	Mexico	1	0.2
Conejos	122	23.5	Northern Alberta	2	0.4
Routt	3	0.5	Southern Alberta	21	4.0
Alamosa	123	23.7	Southern Manitoba	1	0.2
Elbert	1	0.2	Southern Saskatchewan	11	2.1
Saguache	22	4.2	<u>Summary</u>		
Crowley	1	0.2	Canada	35	6.7
Costilla	6	1.2	Mexico	1	0.2
Sedgwick	2	0.4	Central Flyway, U.S.	459	88.4
Gunnison	1	0.2	Pacific Flyway, U.S.	19	3.7
Moffat	1	0.2	Mississippi Flyway, U.S.	5	1.0
Douglas	1	0.2	Atlantic Flyway, U.S.	---	---
Custer	1	0.2			
Jackson	1	0.2			
Hinsdale	1	0.2			
Colorado Totals	390	75.2	Totals	519	100.0

Table 29. —Seasonal Hunting Pressure as Indicated by Band Recoveries of Mallards Banded in the San Luis Valley, Colorado.

Winter Banded	Number Banded	Number Reported Shot by Seasons				Totals
		1950-51	1951-52	1952-53	1953-54	
1949-50	841	48	42	27	11	128
1950-51	1,101	---	89	39	22	150
1951-52	2,671	---	---	157	94	251
Totals	4,613	48	131	223	127	529

1/ Includes 10 found dead apparently the result of shooting.

Table 30.--Hunting Mortality Table for Mallards in the San Luis Valley, Colorado

Age Interval (Years)	Mortality Total No. Shot	Alive at Start Each Age	Mortality Rate (Percent per annum)
x / 0 to x / 1	0	529	---
x / 1 to x / 2	294	529	56
x / 2 to x / 3	175	235	74
x / 3 to x / 4	49	60	82
x / 4 to x / 5	11	11	100
Totals	529	1,364	---
Mean Mortality Rate			39%

Table 31.--Wintering Waterfowl Populations and Waterfowl Banded in the Fort Collins Area of Colorado by the Colorado Cooperative Wildlife Research Unit. 1950-1952

Year	High Count During Winter Period 1/	No. Banded 2/	Percent of High Count
1950	11,314	952	7.7
1951	15,763	786	5.0
1952	9,417	301	3.2

1/ In T7N, R68W based on Grieb (1951 b) and Tester (1952 b) - ground counts.
2/ Winter banding only (Dec. 21 - Mar. 21), all species (not just mallards).

Table 32.--Distribution of Recoveries by Shooting of Mallards Banded in the Fort Collins Area of Colorado During the Winter

Place Recovered	No.	Percent	Placed Recovered	No.	Percent
<u>Colorado Counties</u>			Montana	4	2.0
Denver	1	0.5	Nebraska	14	7.2
Pueblo	1	0.5	North Dakota	7	3.6
Weld	26	13.3	South Dakota	2	1.0
Larimer	53	27.2	Texas	5	2.6
Boulder	8	4.1	Washington	2	1.0
Adams	6	3.1	Wyoming	15	7.7
Logan	3	1.5	Northern Alberta	4	2.0
Morgan	7	3.6	Southern Alberta	13	6.7
Garfield	1	0.5	Northern Saskatchewan	2	1.0
Saguache	1	0.5	Southern Saskatchewan	14	7.2
Colorado Totals	107	54.8	<u>Summary</u>		
Arkansas	1	0.5	Canada	33	16.9
California	1	0.5	Central Flyway, U.S.	157	79.0
Idaho	2	1.0	Pacific Flyway, U.S.	5	2.6
Kansas	3	1.5	Mississippi Flyway,		
Louisiana	1	0.5	U.S.	3	1.5
Missouri	1	0.5	Totals	198	100.0

Within Colorado, most of the recoveries were made within 50 miles of the banding area, with only one recovery from the Western Slope and one from the San Luis Valley.

Only two recoveries (by any means) of mallards banded in the winter near Fort Collins have been made during the breeding season, both in Alberta.

7. Gunnison River. The only mallards known to have been banded during the winter on the Western Slope of Colorado were banded on the Gunnison and Uncompaghre Rivers near Delta during February and March of 1952 by personnel of the Colorado Game and Fish Department. A total of 465 mallards were banded from which 41 recoveries have been reported for an over-all recovery rate of 8.8% and a first-season recovery rate of 5.0%. All but one of the 41 recoveries have been by shooting during regular duck seasons. One was trapped and released the following March in Wyoming during banding operations. The 40 hunting season recoveries were distributed as shown in Table 33. As might be expected because of the proximity of the trap site to Utah, three of the recoveries were from that Pacific Flyway state. Most recoveries were from Colorado (82.5%) but 10% were from Pacific Flyway states and 7.5% from Canada.

Table 33.—Distribution of Recoveries by Shooting of Mallards Banded on the Gunnison and Uncompaghre Rivers near Delta, Colorado During February and March, 1952

Place Recovered	Number	Percent of Recoveries
<u>Colorado Counties</u>		
Weld	2	5.0
Mesa	1	2.5
Delta	19	47.5
Montrose	10	25.0
Garfield	1	2.5
Colorado Totals	33	82.5
California	1	2.5
Utah	3	7.5
Southern Alberta	2	5.0
Southern Saskatchewan	1	2.5
<u>Summary</u>		
Central Flyway, U.S.	33	82.5
Pacific Flyway, U.S.	4	10.0
Canada	3	7.5
Totals	40	100.0

The annual winter inventory conducted in January, 1952, revealed that approximately 3,000 ducks were wintering in Delta County and 10,000 in nearby Mesa County, mostly mallards.

8. Bonny Reservoir. As of January 1, 1955, a total of 556 mallards has been banded during the winter at Bonny Reservoir on the South Republican River in eastern Colorado. The majority of these were banded in 1953, but a few were banded in 1951 and 1954. To date, only 16 recoveries have been reported for a recovery rate of 2.9%, all first-season hunting recoveries. These were distributed as follows:

Table 34.—Distribution of Recoveries by Shooting of Mallards Banded in the Winter at Bonny Reservoir, Yuma County, Colorado, 1951 - 1954.

Placed Recovered	Number	Percent of Recoveries
<u>Colorado Counties</u>		
Jefferson	1	6.3
Morgan	4	25.0
Prowers	2	12.4
Colorado Totals	7	43.7
Montana	1	6.3
Nebraska	3	18.7
South Dakota	1	6.3
Texas	1	6.3
<u>Canada</u>		
Northern Alberta	1	6.3
Southern Saskatchewan	2	12.4
<u>Totals</u>	<u>16</u>	<u>100.0</u>

Table 35. Summary of Distribution of Recoveries by Shooting of Mallards Banded in Colorado During the Winter.

	Banding Stations								All Stations
	South Platte Valley	Valmont Res.	Arkansas Valley	Denver Area	San Luis Valley	Fort Collins Area	Gunnison River	Bonny Res.	
Total Banded	27,083	10,301	9,855	5,272	4,613	1,910	465	556	60,555
Total Recoveries	3,204	1,262	960	551	519	198	40	16	6,750
<u>Percentages by Places of Recovery</u>									
Colorado	27.9	57.6	25.6	56.0	75.2	54.8	82.5	43.7	40.2
<u>Flyways, U.S.</u>									
Central	69.8	75.6	65.2	76.6	88.5	79.0	82.5	82.3	72.5
Mississippi	4.3	2.1	5.2	3.1	1.0	1.5	—	—	3.5
Pacific	1.7	3.3	3.6	4.0	3.7	2.6	10.0	—	2.7
Atlantic	0.1	—	0.2	—	—	—	—	—	0.1
Canada	24.0	18.9	25.8	16.3	6.7	16.9	7.5	18.7	21.1
<u>Mexico and Alaska</u>									
Alaska	0.1	0.1	—	—	0.2	—	—	—	0.1

Table 35.—Summary of Distribution of Recoveries by Shooting of Mallards Banded in Colorado During the Winter (Cont'd).

	Banding Stations								All Stations
	South	Valmont	Arkansas	Denver	San Luis	Fort	Gunnison	Bonny	
	Platte Valley	Res.	Valley	Area	Valley	Collins Area	River	Res.	
Alabama	T	—	—	—	—	—	—	—	T
Arizona	—	0.2	—	0.2	0.4	—	—	—	0.1
Arkansas	1.1	0.5	1.5	1.4	0.2	0.5	—	—	1.0
California	0.3	0.3	0.4	0.7	—	0.5	2.5	—	0.3
Idaho	0.6	1.7	1.5	1.1	0.8	1.0	—	—	1.0
Illinois	0.3	0.1	0.3	—	—	—	—	—	0.2
Indiana	T	—	—	—	—	—	—	—	T
Iowa	0.2	0.2	0.2	—	—	—	—	—	0.2
Kansas	1.6	0.9	5.7	0.9	0.6	1.5	—	—	1.9
Kentucky	T	—	0.1	—	—	—	—	—	T
Louisiana	1.1	0.8	1.1	0.7	0.2	0.5	—	—	1.0
Minnesota	0.6	0.3	0.7	0.4	—	—	—	—	0.5
Mississippi	0.2	0.1	0.1	—	—	—	—	—	0.1
Missouri	0.5	0.1	0.8	0.4	—	0.5	—	—	0.4
Montana	1.7	3.2	2.7	1.1	0.8	2.0	—	6.3	2.0
Nebraska	25.2	4.8	12.9	7.1	2.3	7.2	—	18.7	15.8
Nevada	T	—	—	—	0.2	—	—	—	T
New Jersey	—	—	0.1	—	—	—	—	—	T
New Mexico	0.2	0.2	0.5	0.5	4.4	—	—	—	0.6
North									
Carolina	—	—	0.1	—	—	—	—	—	T
North Dakota	5.1	2.1	5.7	2.9	0.6	3.6	—	—	4.0
Ohio	T	—	—	—	0.2	—	—	—	T
Oklahoma	0.8	0.3	2.0	0.2	0.2	—	—	—	0.7
Oregon	0.2	0.4	0.5	0.9	—	—	—	—	0.3
Penn.	T	—	—	—	—	—	—	—	T
South Dakota	3.3	1.7	3.6	3.1	1.0	1.0	—	6.3	2.8
Tennessee	0.1	0.1	0.2	0.2	0.4	—	—	—	0.1
Texas	2.3	1.6	4.4	1.1	1.5	2.6	—	6.3	2.3
Utah	T	0.5	0.6	0.5	2.3	—	2.5	—	0.5
Virginia	T	—	—	—	—	—	—	—	T
Washington	0.6	0.3	0.6	0.5	—	1.0	—	—	0.5
Wisconsin	T	—	0.2	—	—	—	—	—	T
Wyoming	1.7	3.1	1.9	3.8	1.9	7.7	—	—	2.3
Southern									
Ontario	—	—	—	—	—	—	—	—	—
Northwest									
Territories	0.2	0.4	0.1	0.2	—	—	—	—	0.2
Northern									
Alberta	2.9	2.0	3.2	2.0	0.4	2.0	—	6.3	2.5
Southern									
Alberta	9.6	10.4	11.2	8.7	4.0	6.7	5.0	—	9.4
Northern									
British Columbia	T	0.2	—	—	—	—	—	—	0.1

Table 35.--Summary of Distribution of Recoveries by Shooting of Mallards Banded in Colorado During the Winter (cont'd)

	Banding Stations								All Station
	South Platte Valley	Valmont Res.	Arkansas Valley	Denver Area	San Luis Valley	Fort Collins Area	Gunnison River	Bonny Res.	
Southern British Columbia	0.1	0.1	0.1	--	--	--	--	--	0.1
Northern Manitoba	0.3	0.2	0.2	--	--	--	--	--	0.2
Southern Manitoba	1.0	0.4	1.1	0.4	0.2	--	--	--	0.7
Northern Saskatchewan	1.4	0.3	1.5	0.9	--	1.0	--	--	1.0
Southern Saskatchewan	8.1	4.8	8.2	4.1	2.1	7.2	2.5	12.4	6.8
Yukon Territories	T	0.2	0.1	--	--	--	--	--	0.1
Mexico	T	--	--	--	0.2	--	--	--	T
Alaska	T	0.1	--	--	--	--	--	--	T

II. Summer Banding

Comparatively few mallards (1,777) have been banded during the summer in Colorado compared to the relatively large number banded in the winter (over 60,000). Most of the summer banding (1,328) has been on the breeding grounds at the Russell Lakes near Saguache in the San Luis Valley, but others have been banded at Rocky Mountain Arsenal near Denver (110), in North Park (243), and a few on the Yampa River in Routt and Moffat Counties.

1. San Luis Valley. Summer banding of mallards in the San Luis Valley was conducted primarily in the Russell Lakes area of Saguache County although 55 were banded in Alamosa County and one in Rio Grande County. Only the Saguache County bandings are discussed in any detail as the Alamosa banded birds were caught in depredations control work, transported over LaVeta Pass and released near LaVeta in Huerfano County. The mallard banded in Rio Grande County was recovered the following season within a mile of where banded. The 1,328 mallards banded in the Russell Lakes area were caught in bait traps during August of 1949 and July-August of 1950. A total of 293 were classified as immatures, the remainder as adults. All were believed to have hatched or bred in the Valley or surrounding mountains. To date, 224 recoveries have been reported, giving an over-all recovery rate of 16.9% and a first-season recovery rate of 9.5%. These are higher recovery rates than any of the winter banding except that by Kalmbach in the Valley in 1940.

Of the 224 recoveries, 219 have been by shooting, mostly in the San Luis Valley (83.6%), 41.9% in the county of banding.

Another 9.7% of the recoveries were from elsewhere in Colorado, only 6.7% from outside of Colorado.

Table 36.—Distribution of Recoveries by Shooting of Mallards Banded in the San Luis Valley (Saguache County), Colorado, During the Summers of 1949 and 1950

Placed Recovered	No.	Percent	Place Recovered	No.	Percent
<u>Colorado Counties</u>			Arizona	1	0.5
Pueblo	1	0.5	Louisiana	1	0.5
Larimer	2	0.9	Montana	1	0.5
Boulder	4	1.8	Nebraska	2	0.9
Adams	4	1.8	New Mexico	4	1.8
Prowers	1	0.5	Texas	2	0.9
Yuma	1	0.5	Wyoming	1	0.5
LaPlata	1	0.5	Northern Saskatchewan	1	0.5
Montrose	1	0.5	Southern Saskatchewan	2	0.9
Rio Grande	35	16.0			
Conejos	15	6.8	<u>Summary</u>		
Alamosa	38	17.3	Canada	3	1.3
Chaffee	4	1.8	Central Flyway, U.S.	214	97.2
Saguache	94	42.9	Pacific Flyway, U.S.	1	0.5
Costilla	1	0.5	Mississippi Flyway,		
Gunnison	1	0.5	U.S.	1	0.5
Lake	1	0.5	Totals	219	100.0
	<u>204</u>	<u>93.3</u>			

Of only 18 direct recoveries outside of the Valley, ten were definitely north of the Valley. One (an adult female) was shot in October (just 37 days after banding) in Sheridan County, Wyoming, some 500 miles north of the Russell Lakes!

Although most banding studies indicate immature mallards to be more vulnerable to hunting than adult birds, (Hickey, 1951 and 1952 b) no such evidence was found in the San Luis Valley banding. In fact, 76.8% of the mallards banded were classified as adult, 23.2% as immature, and 76.8% of the direct recoveries were adult birds, 23.2% immatures. Males made up a greater percentage of the direct recoveries (40.0%) than they did of the original banding (36.8%) but it is doubtful whether this slight difference can be used as evidence hunters shoot more drakes than hens in the valley.

Of the 55 mallards banded in Alamosa County but released in Huerfano County, 12 have been reported as recovered. Five of these were direct recoveries, 3 returned to the Valley, and 2 were shot near the LaVeta release site. Four of the seven indirect recoveries were made in the San Luis Valley, none near the release site.

2. Denver Area. During August of 1948, 110 mallards were banded on the Rocky Mountain Arsenal north of Denver. Eighteen recoveries (16.4%) have been reported from these bandings giving a first-year recovery rate of 5.5%. Sixteen of these recoveries were by shooting. Two were found dead, one in Adams County (the county in which banded) and one in Wyoming. The 16 hunting recoveries are distributed as follows:

Table 37.—Distribution of Recoveries by Shooting of Mallards Banded in the Denver Area, August, 1948 (110 banded, 16 recoveries by shooting)

Place Recovered	Number	Percent of Recoveries
Weld County	3	18.8
Adams County	6	37.5
Morgan County	1	6.3
Colorado Totals	10	62.5
Nebraska	4	25.0
Southern Alberta	2	12.5

Two of the five direct hunting recoveries were made in Nebraska, the remaining three in Colorado within 50 miles of the banding site. The two recovered in Alberta (drakes) were shot there four and five seasons after banding.

3. Other Summer Banding in Colorado. Mallards have been banded in Brown's Park, the Yampa Valley and in North Park during the summer. During August of 1954, 243 mallards were banded in North Park (Jackson County). Part of these were caught in drive traps (77), part in baited traps (164) and part by hand (2). One drake was caught that had been previously banded in the San Luis Valley in January of 1952.

As of April 15, 1955, fourteen recoveries had been reported for mallards banded in North Park as follows: North Park, 2; North Central Colorado (Weld, Larimer, and Boulder Counties), 5; Salida, 1; San Luis Valley, 1; Arkansas River, 1; Southwestern Colorado (LaPlata County), 1; and Wyoming, 2. It is interesting to note that three of the above recoveries are from the 77 caught in drive traps and 11 from the 164 caught in baited traps. One of the Wyoming recoveries was at Saratoga just north of the Park, but the other was taken near Greybull, some 270 miles north of the banding site. All were direct recoveries.

Four recoveries have been reported from 40 mallards banded during the summer of 1953 in the Yampa Valley in Routt County. Two were from Routt County, one from Weld County and one from New Mexico, all direct recoveries.

III. Fall Banding

Only a limited number of mallards have been in Colorado during the Fall season. They have been banded in the Fort Collins area in September, October, November, and early December, and in the San Luis Valley in October.

1. Fort Collins Area. Fall banding in the Fort Collins area was conducted by the Colorado Cooperative Wildlife Research Unit in 1949 through 1951. In early December, 1949, 210 mallards were banded. Before the first half of the duck season in 1950, 112 mallards were banded and 959 were banded between the two halves. In 1951, 81 mallards were banded before the season and 172 between the seasons. This makes a total of 1,594 mallards banded in the fall in the Fort Collins area. Two hundred and twenty-seven recoveries have been reported, giving an over-all recovery rate of 14.2% and a first-year recovery rate of 3.5%.

Two hundred and fifteen recoveries have been by shooting, 155 (72.1%) of which were in Colorado, the remainder mainly in other Central Flyway states, but a few in Canada, Pacific and Mississippi Flyway States. One was recovered in Mexico. This is only the third recovery out of over 8,000 mallard recoveries from Colorado bandings that was reported from Mexico.

Within Colorado, most recoveries were made in the banding area (Larimer and Weld counties) and all were from the Eastern Slope.

2. San Luis Valley. Twenty-nine mallards were banded in October of 1951 at the Russell Lakes in Saguache County. Five recoveries have so far been reported, three from Conejos County, one from Saguache County, and one from Boulder County.

Thus, 80% were recovered in the San Luis Valley and 20% elsewhere in Colorado. Oddly enough the Boulder County recovery was made the same fall, some 125 miles to the north.

IV. Mallards Banded Outside of Colorado and Recovered in Colorado

Since 1948, 354 mallards have been reported as recovered in Colorado that were banded elsewhere. Most of these were banded to the North of Colorado in the summer or fall but a few in the spring and winter seasons and to the south. Over 69% of these out-of-state banded mallards were recovered in the South Platte Valley, the area where most of the ducks bagged in Colorado are taken. Arkansas Valley recoveries are similar to those in the South Platte Valley, only more southern in place of banding.

Table 38.—Distribution of Recoveries by Shooting of Mallards Banded in the Fort Collins Area of Colorado During the Fall

Place Recovered	No.	Percent	Place Recovered	No.	Percent
<u>Colorado Counties</u>			North Dakota	3	1.4
Pueblo	1	0.5	Oregon	1	0.5
Weld	47	21.8	South Dakota	1	0.5
Larimer	77	35.8	Texas	2	0.9
Boulder	9	4.1	Washington	2	0.9
Adams	12	5.6	Wyoming	8	3.7
Arapahoe	1	0.5	Old Mexico	1	0.5
Morgan	5	2.3	Northern Alberta	4	1.9
Conejos	1	0.5	Southern Alberta	12	5.6
Kit Carson	1	0.5	Northern Saskatchewan	1	0.5
Lincoln	1	0.5	Southern Saskatchewan	3	1.4
Colorado Totals	<u>155</u>	<u>72.1</u>			
			<u>Summary</u>		
Arkansas	1	0.5	Canada	20	9.3
California	1	0.5	Central Flyway, U.S.	187	87.0
Idaho	1	0.5	Pacific Flyway, U.S.	5	2.3
Kansas	5	2.3	Mississippi Flyway, U.S.	2	0.9
Minnesota	1	0.5	Mexico	<u>1</u>	<u>0.5</u>
Montana	2	0.9	Totals	<u>215</u>	<u>100.0</u>
Nebraska	11	5.1			

Recoveries made on the Western Slope (28) have been primarily from Wyoming (52.2%) and Idaho (25.0%), but states to the east such as Illinois and Oklahoma have been represented. Recoveries made in the San Luis Valley were mainly from Idaho, Montana, Wyoming, and New Mexico.

V. Mallard Sex-Ratios Before and After Hunting Season

It has long been noted that there is a preponderance of males in wild mallard populations (Trippensee, 1953). Therefore, it is not surprising that a preponderance of drake mallards was observed in Colorado bandings. A sex ratio of 160 M : 100 F was noted in a sample of 55,971 mallards banded in Colorado. (See Table 40). This is considerably higher than the 127M : 100 F sex ratio one derives from Trippensee's (1953) tables listing data from 50 banding stations elsewhere in the U. S. Most of the mallards banded in Colorado were trapped in the winter. Even within Colorado the sex ratio of mallards varies considerably with the season of banding ranging from 166 M : 100 F for winter banding to only 72 M : 100 F for summer banding. Fall banding in Colorado yields a mallard sex ratio of 120 M : 100 F which is more comparable with Trippensee's nation-wide average, which probably is based largely on fall banding. Within Colorado, considerable range in sex ratios was noted from one banding station to the next. In the South Platte Valley, where most of the mallards have been banded in Colorado, a ratio of 196 M : 100 F was found for 27,012 mallards for which sex was noted. In general, within Colorado, the more northern stations (South Platte and Fort Collins) seem to have run higher to males than did the more southern stations (such as the Arkansas and San Luis Valleys).

Table 39.—Mallards Banded Out-of-State but recovered in Colorado

Place Banded	Totals		Where Recovered in Colorado									
	Recovered In Colorado		South Platte Valley		Arkansas Valley		San Luis Valley		Western Slope		Not Specified	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Arizona	3	0.8	—	—	1	2.2	2	6.1	—	—	—	—
Arkansas	1	0.3	1	0.4	—	—	—	—	—	—	—	—
California	1	0.3	—	—	1	2.2	—	—	—	—	—	—
Idaho	22	6.2	7	2.8	1	2.2	7	21.2	7	25.0	—	—
Illinois	4	1.1	2	0.8	1	2.2	—	—	1	3.6	—	—
Indiana	1	0.3	—	—	—	—	—	—	—	—	1	50.0
Kansas	2	0.6	2	0.8	—	—	—	—	—	—	—	—
Mississippi	1	0.3	1	0.4	—	—	—	—	—	—	—	—
Missouri	1	0.3	1	0.4	—	—	—	—	—	—	—	—
Montana	52	14.7	39	15.9	4	8.7	7	21.2	2	7.1	—	—
Nebraska	39	11.0	30	12.2	8	17.4	—	—	1	3.6	—	—
Nevada	1	0.3	1	0.4	—	—	—	—	—	—	—	—
New Mexico	13	3.7	6	2.4	—	—	7	21.2	—	—	—	—
North Dakota	7	2.0	5	2.2	2	4.3	—	—	—	—	—	—
Ohio	1	0.3	1	0.4	—	—	—	—	—	—	—	—
Oklahoma	18	5.1	12	4.9	3	6.5	1	3.0	1	3.6	1	50.0
Oregon	3	0.8	—	—	2	4.3	1	3.0	—	—	—	—
South Dakota	7	2.0	6	2.4	1	2.2	—	—	—	—	—	—
Texas	4	1.1	3	1.2	1	2.2	—	—	—	—	—	—
Utah	1	0.3	—	—	—	—	1	3.0	—	—	—	—
Washington	1	0.3	1	0.4	—	—	—	—	—	—	—	—
Wyoming	71	20.0	43	17.6	7	15.2	5	15.3	16	57.1	—	—
Northern Alberta	17	4.8	16	6.5	1	2.2	—	—	—	—	—	—
Southern Alberta	28	7.9	21	8.6	6	13.0	1	3.0	—	—	—	—
Southern Manitoba	5	1.4	5	2.2	—	—	—	—	—	—	—	—
Northern Saskatchewan	4	1.1	3	1.2	1	2.2	—	—	—	—	—	—
Southern Saskatchewan	46	13.0	39	15.9	6	13.0	1	3.0	—	—	—	—
Totals	354	100.0	245	100.0	46	100.0	33	100.0	28	100.0	2	100.0
Percents		100		69.2		13.0		9.3		7.9		0.6

Various authors have pointed out the fact that hunters apparently shoot a higher proportion of drakes than hens, higher in fact than one would expect even with the prevailing distorted sex ratios.

In these times of relatively small bags, hunters seemingly try to select drakes. This may be due in part to a desire to spare hens, to a conscious effort to get larger birds for the table, or to an unconscious selection by gunners of the larger, more brilliantly colored birds in a flock. At any rate, the sex ratio of banded mallards reported as recovered runs higher (males to females) than sex ratio data for the original banding. This probably not only reflects the hunter preference for drakes, but also the greater mortality of hens to causes, such as predation while nesting from which bands are not often reported.

Table 40.—Sex-Ratios of Mallards; Banding Data Contrasted with Recovery Data by Banding Sites in Colorado

Banding Sites	Banding Data				Recovery Data			
	M	F	Unid.	Sex Ratio	M.	F	Unid.	Sex Ratio
<u>Winter Banding</u>								
<u>South Platte</u>								
Valley	17,900	9,112	71	196	2,567	834	18	309
Valmont Res.	961	658	8,682	146	626	242	503	259
<u>Arkansas</u>								
Valley	5,369	4,486	—	120	647	377	—	171
Denver Area	3,294	1,978	—	167	443	157	36	282
<u>San Luis</u>								
Valley	2,560	2,053	—	125	365	169	—	216
Ft. Collins Area	1,261	651	—	194	156	62	—	252
Gunnison River	233	232	—	100	26	15	—	173
Bonny Res. ^{1/}	1,294	715	—	181	*	*	*	*
Totals	32,872	19,885	8,753	166	4,830	1,856	557	260
<u>Summer Banding</u>								
San Luis Valley	509	873	—	58	99	125	—	79
Denver Area	56	54	—	104	10	8	—	125
Totals	664	927	—	72	109	133	—	82
<u>Fall Banding</u>								
Ft. Collins Area	872	722	—	121	125	102	—	123
San Luis Valley	12	17	—	71	3	2	—	150
Totals	884	739	—	120	128	104	—	123
<u>Grand Total</u>								
All Seasons	34,420	21,551	8,753	160	5,067	2,093	557	242

^{1/} Bonny Reservoir data as of February 1, 1955. Recovery reports for Bonny too few in numbers to be considered fair sample for sex ratio computations.

In the Fort Collins area, sex ratio data is available for mallards based on three different sources: (1) hunter's bag checks; (2) ground counts of mallard concentrations and (3) banding records. The proportion of drakes in the hunters' bags ran consistently higher than that observed in ground counts or during banding in the same seasons. However, there was no consistent variation between the sex-ratios observed in the ground counts and in the banding operations. (See Table 41)

Table 41.--Sex Ratios in Mallard Populations in the Fort Collins Area of Colorado (expressed in males : 100 females)

Year	1/ Hunters Bags		2/ Field Observations		3/ Banding	
	Sex Ratio	Sample Size	Sex Ratio	Sample Size	Sex Ratio	Sample Size
1949-50	---	---	168	12,827	167	987
1950-51	164	280	145	21,323	130	1,978
1951-52	171	526	135	12,548	166	518

1/ References: 1950-51 (Grieb, 1951 a); 1951-52 (Tester, 1952a)

2/ References: 1949-50 and 1950-51 (Grieb, 1951 b); 1951-52 (Tester, 1952 b)

3/ Based on banding schedules.

VI. Time Distribution of Mallard Kill

Aerial counts and hunter's bag checks conducted in Colorado since 1947 reveal that peak populations and kills of ducks generally occur in December (Grieb and Boeker, 1954). The mallard is by far the most abundant duck in Colorado and usually makes up over 90 percent of the bag, the percentage being greater the later the season. Although the time distribution of the mallard kill was specifically analyzed for only one banding station, (San Luis Valley), it revealed that the peak kill occurred in November and was almost as high in December. Contrasted with studies conducted in other parts of North America (Hickey, 1952 b and Murdy, 1955), the mallard kill runs later for the mallards that winter in the San Luis Valley, which is understandable since a high percentage (over 75%) is killed in the Valley and it is considerably more southern than the areas studied by Hickey and Murdy. The San Luis Valley band recovery analysis also revealed that the proportion of drakes comprising the bag increased as the season progressed and, as was the case at practically all stations, ran considerably higher than the proportion of drakes in the original banding sample (See Tables 40 and 42). In the Fort Collins area separate studies also revealed this increase in the proportion of drakes in hunters' bags and in wild populations of mallards as the season progresses (Grieb, 1951 a; Grieb, 1951 b; Tester, 1952 a and Tester, 1952 b).

Table 42.--Time Distribution of Kill of Mallards Banded in the San Luis Valley of Colorado During the Winters of 1949-1952

Month	Number		Sex Ratio		Sex Ratio
	Shot	Percent	M	F	M:100F
Fall (month unknown)	5	1.0	4	1	400 1/
September	7	1.4	4	3	133 1/
October	129	24.8	83	46	180
November	193	37.2	127	66	193
December	171	32.9	126	45	280
January	14	2.7	9	5	180 1/
Totals	519	100.0	353	166	212 2/

1/ Sample believed too small to yield a reliable sex ratio.

2/ Sex ratio of 4,613 mallards banded was 125.

Mallard Summary

Analysis of Colorado banding data, indicates that mallards are remarkably consistent in their migrations, especially when contrasted with the more erratic wanderers such as pintails and baldpates. Mallards wintering in Colorado remain rather largely in the Central Flyway and apparently come mainly from the prairie provinces of Canada, especially Alberta and Saskatchewan. Generally speaking, conclusions drawn by Hawkins regarding the migration of the mallard (Aldrich et al, 1949) are substantiated by the analysis of Colorado data. Munro (1943) concluded from banding and observational data in British Columbia that "mallard populations in general are definite associations, nesting in the same localities, migrating together, and wintering together in the same areas from year to year." Banding data collected in Colorado tend to support this conclusion somewhat, especially when one observes the comparatively little intermixing of mallards banded in such relatively close areas as the San Luis Valley and the Arkansas Valley. On the other hand, when one considers what relatively few breeding season recoveries are available from winter banding in Colorado, it appears that populations from a fairly widespread area concentrate on a common wintering ground such as the South Platte Valley. As Hickey (1951) has pointed out there is considerable question as to whether adult birds banded by bait trapping represent adequately randomized samples of regional populations. He believes that correction factors can and should be worked out to remove bias introduced by "conditioning", birds being attracted to and remaining in the vicinity of a banding station.

Table 43.—Comparison of the Time Distribution of the Kill of Mallards Banded in the San Luis Valley with the Time Distribution of Other Mallard Populations

Population Area	Canada and Northern U. S.	Mississippi Valley	Lake Andes So. Dakota	Black Hills S. Dakota	San Luis Valley Colo.
Authority	Hickey (1952 b)	Hickey (1952 b)	Murdy (1955)	Murdy (1955)	Ryder (1955)
Month Shot	Percent of Kill				
September	7	6	3	7	1
October	20	31	35	34	25
November	44	36	48	57	37
December	23	22	12	2	33
January	6	5	2	—	3
Fall (Month unknown)	—	—	—	—	1
Month Shot	Accumulative Percent of Kill				
September	7	6	3	7	1
October	27	37	38	41	26
November	71	73	86	98	63
December	94	95	98	100	96
January	100	100	100	100	99
Fall (Month Unknown)	—	—	—	—	100

The shift in emphasis in recent years from bait trapping during migration periods to drive trapping during the summer as a means to capture both young and adult ducks produced in a definite area probably yields data much more representative of a waterfowl population. Bait trapping, however, probably remains the most practical method of studying the migratory movements and mortality of a wintering population. Regional differences in shooting pressure probably also bias the geographic distribution of waterfowl recoveries. Thus, our mallard populations may have a breeding area somewhat farther north than we might tentatively conclude from recovery reports since hunting pressure is considerably less in more northern, less populated areas and those hunters present are perhaps less likely to report their recoveries.

Chapter 3- Canada Goose Recoveries

Introduction. Although the Canada goose is only third among the waterfowl as regards to numbers banded in Colorado, it is second in regard to numbers of recoveries reported. Most of the Canada geese banded in Colorado were trapped in the winter at Two Buttes Reservoir in Baca County, although lesser numbers have been caught in the Denver area and in Brown's Park during the summer.

Table 44. --Canada Goose Bandings and Recoveries in Colorado (As of Sept.1, 1954)

Place Banded	Number Banded	Number of Recoveries	Recovery Rate
Two Buttes ^{1/}	3,441	515	14.9%
Denver Area	77	2	2.6%
Brown's Park	4	---	---
Colorado	3,522	517	14.7%
Out-of-State	---	24	---

^{1/} Includes 41 geese wing-clipped and released at Bonny Reservoir in Yuma County.

The geese banded in the Denver and Brown's Park areas have been relatively large geese, most likely of the Great Basin's Canada goose subspecies (Branta canadensis moffitti). Only two recoveries have been reported from the Denver geese, both from within the Denver area. The geese banded at Two Buttes were mainly in the 5 to 7 pound class and are generally classified as Lesser Canada geese, (Branta canadensis parvipes). About 20% of the Two Buttes geese weighed 7 to 10 pounds and were thought to have been Great Basin's Canada geese. A few weighed less than 5 pounds and some of these approached the Cackling goose (Branta canadensis minima) in size and appearance, while others were probably Richardson's goose (Branta canadensis hutchinsii).

Table 45. --Canada Geese Weights Taken During Banding, Two Buttes Reservoir Colorado ^{1/}

Weight Class	Year Banded			
	1951	1952	1953	1954 ^{2/}
2 pounds	---	---	---	1 (2.6)
3 pounds	---	1 (0.1)	4 (0.3)	3 (7.6)
4 pounds	27 (4.5)	18 (1.4)	93 (6.3)	13 (31.7)
5 pounds	157 (26.3)	268 (21.0)	395 (26.5)	17 (41.5)
6 pounds	269 (45.1)	569 (44.6)	704 (47.7)	6 (14.6)
7 pounds	114 (19.1)	338 (26.5)	240 (16.3)	1 (2.6)
8 pounds	24 (4.0)	57 (4.4)	38 (2.6)	---
9 pounds	3 (0.5)	19 (1.5)	3 (0.2)	---
10 pounds	3 (0.5)	5 (0.4)	1 (0.1)	---
11 pounds	---	1 (0.1)	---	---
Percent Young	49.75%	49%	39%	41.5%
Average Weight in 6 lbs. class		in 6 lbs. class	6.03 lbs	5.1 lbs.
Total weighed	597	1,276	1,478	41

^{1/} Percentages in parentheses.

^{2/} Mostly cripples in poor condition, not representative.

I. Two Buttes Reservoir

Since geese were first banded at Two Buttes Reservoir during the winter of 1950-51, 515 recoveries had been reported as of January 1, 1955, yielding an over-all recovery rate of 15.0% and a first season recovery rate of 10.3%. Of these 515, 504 were shot, 9 found dead, and 2 trapped, and released in banding operations elsewhere (one in Nebraska and one in California). Over half (55%) of the recoveries are from Canada and only 22.9% from Colorado, most of the latter from the Arkansas Valley. These 515 recoveries were made in every month of the year but July and August. Seven geese were recovered during the breeding season giving some idea where these birds probably nest. In Canada, as in the United States, native people, such as Eskimos and Indians, are permitted to shoot game for food anytime, hence the spring recoveries. All breeding season recoveries were of Lesser Canada Geese (six pounders) except one Great Basin's Canada Goose (weight ten pounds) caught in banding operations in California. Apparently most of the Lesser Canada Geese from Two Buttes nest in the MacKenzie River Valley of northern Canada and perhaps a few east to Hudson's Bay. The fact that 55% of all recoveries were from Canada, most of which fall along the route from the MacKenzie southward, seems to support this theory.

Occasionally some of the Two Buttes' geese go further south than the Arkansas Valley to winter as is evidenced by recoveries in Texas and, to a lesser extent, Oklahoma, New Mexico and even Old Mexico.

Table 46.--Distribution of Recoveries of Canada Geese Banded at Two Buttes Reservoir, Colorado
(515 recoveries; 504 shot, 9 found dead, and 2 trapped and released)

Placed Recovered	No.	Percent	Place Recovered	No.	Percent
<u>Colorado Counties</u>			Nevada	2	0.4
Pueblo	1	0.2	New Mexico	4	0.8
Weld	2	0.4	Oklahoma	6	1.2
Jefferson	1	0.2	Oregon	1	0.2
Adams	1	0.2	South Dakota	6	1.2
Morgan	1	0.2	Texas	49	9.5
Prowers	10	1.9	Wyoming	4	0.8
Yuma	1	0.2	Old Mexico	2	0.4
Baca	63	12.2			
Kit Carson	1	0.2	Northwest Territory	15	2.9
Bent	13	2.5	Northern Alberta	24	4.7
Crowley	9	1.7	Southern Alberta	140	27.2
Kiowa	14	2.7	Northern Manitoba	2	0.4
Cheyenne	1	0.2	Northern Saskatchewan	5	1.0
Colorado Totals	<u>118</u>	<u>22.8</u>	Southern Saskatchewan	97	18.8
Arizona	2	0.4	<u>Summary</u>		
California	3	0.6	Canada	283	55.0
Idaho	5	1.0	Pacific Flyway, U.S.	13	2.5
Kansas	2	0.4	Central Flyway, U.S.	217	42.1
Minnesota	1	0.2	Mexico	<u>2</u>	<u>0.4</u>
Montana	4	0.8			
Nebraska	23	4.5	Totals	515	100.0

In 1952 and 1953 fairly high numbers of recaptures were taken from previous seasons bandings. In 1952, 9.5% of the geese banded in 1951 were definitely known to have returned to Two Buttes Reservoir. In 1953, at least 8% of the 1,921 geese previously banded at Two Buttes Reservoir returned. These recaptures and the low number of recoveries from areas south of Two Buttes seem to indicate that the geese wintering in the Two Buttes and Eads areas represent a fairly distinct population that winters in the same general area year after year. Breeding season recoveries, limited as they are, supplemented with early fall recoveries, lead one to believe the Lesser Canada goose population wintering at Two Buttes breeds in the MacKenzie River Valley of Alberta and the Northwest Territories of Canada.

Table 47.—Summary of Canada Geese Bandings and Recaptures, Two Buttes Reservoir, Colorado, 1951-54.

Banded Year	Estimated Population <u>1/</u>	Number Banded	Recaptures in Years		
			1952	1953	1954
1951	14,000	644	61	41	—
1952	15,000	1,278	—	113	1
1953	13,000	1,478	—	—	2
1954	12,000	41	—	—	—

1/ Based on banding reports.

Table 48.—Wintering Populations of Canada Geese and Numbers Banded at Two Buttes Reservoir, 1951 - 1954.

Year	Aerial Counts by Months			Numbers Banded	Percent of High Counts
	Jan.	Feb.	Mar.		
1951	18,100	8,100	725	643	3.6
1952	29,900	3,756	360	1,278	4.3
1953	18,900	5,800	<u>1/</u>	1,478	7.8
1954	8,250	<u>1/</u>	<u>1/</u>	41	0.5

1/ No counts made.

Table 49.—Season Hunting Pressure as Indicated by Band Recoveries of Canada Geese Banded at Two Buttes Reservoir, 1951 - 1954 1/

When Banded	Number Banded	Number Reported Shot by Seasons				Totals
		1951-52	1952-53	1953-54	1954-55	
1951	644	80	43	33	7	163
1952	1,278	—	135	71	28	234
1953	1,478	—	—	133	27	160
1954	41	(all birds retained as a captive flock)				
Totals	3,441	80	178	237	62	557

1/ Computed as of February 16, 1955. 1954-55 season recovery reports not all received.

Varying from year to year, from 0.5 to 7.8% of the Canada geese wintering at Two Buttes Reservoir were believed to have been banded. The wintering population during the banding period has run as high as 29,900 in 1952.

Based on band recovery reports, the population of Canada geese wintering at Two Buttes Reservoir seems to be subject to much greater hunting pressure and mortality than are other species of waterfowl in Colorado. Hunting mortality tables indicate an annual mortality rate of over 60% for the Two Buttes Canada geese compared to only about 30 to 40% for mallards banded in the South Platte and Arkansas Valleys. Although the kill in the Two Buttes area has been estimated to be less than 13% of the wintering population (Nolting, 1952), it should be remembered that only 21.6% of the recovery reports have been from the Arkansas Valley in Colorado. Compared to mallards that winter in Colorado, our goose population is subjected to considerable hunting pressure but apparently not to the detriment of the population if winter aerial counts can be taken as indications of the numerical status of the population. The aerial counts of geese in the Arkansas Valley reached an all-time high of 32,600 in December of 1954. In 1954, Canada goose numbers in the Central Flyway were apparently up compared to the past few years (Crissey, 1954).

Table 50.—Hunting Mortality Table for Canada Geese Banded at Two Buttes Reservoir, Colorado, 1951 - 1954 1/

Age Interval (in years)	Mortality Total No. Shot	Alive at Start Each Age	Mortality Rate (percent per annum)
x / 0 to x / 1	0	557	—
x / 1 to x / 2	348	557	62.5
x / 2 to x / 3	141	209	67.5
x / 3 to x / 4	61	68	89.6
x / 4 to x / 5	7	7	100.0
Totals	557	1,398	
Mean Mortality Rate			40.6%

1/ Computed from recovery reports received as of February 16, 1955.

Limited data is available regarding differential hunting mortality of young and adult geese banded at Two Buttes Reservoir. In 3,394 geese classified as to age at the time of banding, 1,878 were considered adult and 1,516 immatures (124 adults ; 100 immatures). In 379 geese subsequently reported shot and for which age data was available at the time of their banding, 276 were originally recorded as adults, 103 as immature (268 adults ; 100 immatures). Thus, from banding returns it appears that adults are roughly twice as vulnerable to hunting as immatures which is very unlikely and just the reverse of findings found in studies of other Canada goose populations (Hanson and Smith 1950).

II. Canada Geese Banded Out of Colorado

Twenty-four Canada geese banded out-of-state have been recovered in Colorado since the 1951 season. All were apparently of the Great Basin's subspecies except one originally banded in Nebraska that probably was a Lesser Canada goose. Their place of banding and general area in Colorado where recovered is summarized in Table 51.

Table 51. -- Canada Geese Recovered in Colorado but Banded Elsewhere

Place Banded	No.	Percent	Area in Colorado Where Recovered		
			South Platte Valley	Arkansas Valley	Western Slope
Idaho	1	4.2	1	---	---
Montana	9	37.5	9	---	---
Nebraska	1	4.2	---	1	---
Utah	2	8.3	---	1	1
Wyoming	7	29.1	---	---	7
Southern Saskatchewan	4	16.7	4	---	---
Totals	24	100.0	14	2	8

III. Canada Goose Summary

From field observations and an analysis of banding recoveries it appears there are at least three distinct Canada goose populations in Colorado, two wintering on the Eastern Slope and one migrating and breeding in the northwest quarter of the State. The largest and most important population is that which winters in the Arkansas Valley especially around Two Buttes Reservoir and lakes near Eads. This population has recently exceeded 25,000 in number and is composed mainly of Lesser Canada Geese which apparently nest in the tundra of northwestern Canada. A high percentage of the annual harvest of this population is taken in Canada, especially in Southern Alberta. Most of the geese in this population tend to return to their wintering grounds in the Arkansas Valley year after year, but some migrate farther south in Texas, Oklahoma, New Mexico and even Old Mexico.

A smaller population of Canada geese migrates through northcentral Colorado (rarely exceeding 2,500 or any one aerial count) and usually 200 to 600 winter on reservoirs in the Greeley-Denver-Fort Morgan area. Most of these geese are rather large and seem to be of the Great Basin's subspecies. What few band recoveries have been made from this population in recent years, were banded mainly on the Bowdoin National Wildlife Refuge in northern Montana and in southern Saskatchewan. Approximately 100 birds of this population remain during the summer and a few nest in the Denver suburban areas where they are semi-domesticated.

A third, quite distinct population of geese is found in the Green and Yampa Valleys of northwestern Colorado. It is composed of large Great Basin's Canada geese and some 100 pairs or so which nest in the area. During migrations, populations may exceed 500 or even 1,000. Recoveries of banded geese in the area seem to indicate that geese that moult on Pathfinder Reservoir in central Wyoming (east of the Continental Divide) migrate through northwest Colorado. Perhaps geese that breed in the Green and Yampa Valleys move to Pathfinder to undergo their annual molt before migrating southwestward through the Colorado Valley to California and Arizona. Much additional field observations and banding work is needed to better understand this population.

Chapter 4- American Pintail

Introduction. Next to the mallard, more pintails have been banded in Colorado than any other species of waterfowl. From 1945 through 1954, some 6,542 pintails have been banded in Colorado, mostly during the winter, but some in the summer and fall. To date, 409 recoveries have been reported giving an over-all recovery rate of 6.3% and a first year recovery rate of 2.6%. Pintail bandings are summarized in Table 52 as regards to place of banding. Some 366 recoveries have been by hunting. These are summarized in Table 53, and graphically presented in Figure 25.

I. Winter Banding.

As with mallards, most pintails banded in Colorado were trapped in the winter. Unlike mallards, most pintails were trapped in the Arkansas and San Luis Valleys although sizeable numbers were also banded in the South Platte Valley and Denver areas.

Table 52.--Colorado Pintail Bandings and Recoveries as of February 1, 1955

Area	Number Banded	Number Recoveries	Recovery Rate over-all	Recovery Rate 1st season
<u>Winter Banding</u>				
Arkansas Valley	2,192	114	5.2%	2.1%
San Luis Valley	1,287	80	6.2%	2.9%
Denver Area	1,233	79	6.4%	2.4%
South Platte Valley	895	78	8.2%	3.8%
Fort Collins Area	269	18	6.7%	2.2%
Valmont Reservoirs	214	5	2.3%	0.0%
Bonny Reservoir	98	6	6.1%	5.1%
Gunnison	34	1	2.9%	0.0
Totals	<u>6,222</u>	<u>381</u>	<u>6.1%</u>	<u>2.5%</u>
<u>Summer Banding</u>				
North Park	29	1	3.4%	3.4%
San Luis Valley	22	3	13.6%	9.1%
Denver Area	2	1	50.0%	0.0
Totals	<u>53</u>	<u>5</u>	<u>9.4%</u>	<u>5.7%</u>
<u>Fall Banding</u>				
San Luis Valley	83	5	6.0%	3.6%
Fort Collins Area	184	18	9.8%	4.9%
Totals	<u>269</u>	<u>23</u>	<u>8.6%</u>	<u>4.5%</u>
Grand Totals	<u>6,543</u>	<u>409</u>	<u>6.3%</u>	<u>2.6%</u>

1. Arkansas Valley. From 2,192 pintails banded in the Arkansas River Valley (mainly near Lamar and at Two Buttes Reservoir), 114 recoveries have been reported. This represents an over-all recovery rate of 5.2% and a first year recovery rate of only 2.1%. One hundred of these recoveries were by shooting during regular waterfowl seasons. Only 5% of the hunting recoveries were in Colorado, all in the Arkansas Valley. California and Texas accounted for the greatest number of recoveries, (19 and 29%, respectively). Compared to mallards and Canada geese banded in the Arkansas Valley, pintails were recovered in greater percentages in the Pacific and Mississippi Flyway States. Five percent were recovered in Mexico and only nine percent in Canada.

Of the 114 pintail recoveries from the Arkansas Valley bandings, only six were made during the breeding season. These were widely scattered, two in southern Manitoba, one each in California, North Dakota, southern Saskatchewan, and southern Alberta.

2. San Luis Valley. Pintails were banded in Conejos County during the winters of 1949 through 1952. Over one-fourth of the ducks banded in the San Luis Valley during those winters were pintails. Eighty recoveries have been reported from the 1,287 banded yielding an over-all recovery rate of 6.2% and a first season recovery rate of 2.9%. Sixty nine of these recoveries were by hunting. Of these hunting recoveries, 27.6% were from Colorado, mainly from the San Luis Valley, but also from four widely scattered counties outside of the Valley. The greatest number of out-of-state recoveries were made in Mexico (16%), but as with the Arkansas Valley bandings, California, Texas, and Utah were well represented. Only 4.3% were shot in Canada.

Only three recoveries by any means (not shooting alone) were reported, for the breeding season, one each in the Northwest Territories, southern Alberta, and southern Saskatchewan.

3. Denver Area. Pintails were banded at Rocky Mountain Arsenal near Denver during the winters of 1947 through 1951. Seventy-nine recoveries have been reported from the 1,233 banded, giving an over-all recovery rate of 6.4% and a first season recovery rate of 2.4%. Seventy-two of these recoveries were by hunting. Of these hunting recoveries 30.2% were from Colorado, mainly from the north-central area with only one from elsewhere (the Arkansas Valley). As with the Arkansas and San Luis Valleys' bandings, California, Texas and Utah were the main out-of-state places of recovery. Only 6.9% were shot in Canada. Only two pintails banded in the Denver area during the winter have been recovered during the breeding season, one in southern Manitoba and one in southern Saskatchewan, both trapped and released in banding operations.

4. South Platte Valley. Since 1944, 895 pintails have been banded in the South Platte Valley from which 78 recoveries have been reported, giving an over-all recovery rate of 8.2% and a first season recovery rate of 3.8%. Sixty eight of these recoveries have been by hunting. Oddly enough, higher percentages of the hunting recoveries have been from California (26.5%) and Texas (19.9%) than from Colorado (10.3%). Within Colorado most of the recoveries were from the South Platte Valley with only one being made elsewhere (near Pueblo).

Five recoveries were made during the breeding season as follows: southern Saskatchewan, 2; southern Ontario; California, 1; and Montana, 1.

Table 53.— Distribution of Recoveries by Shooting of Pintails Banded in Colorado (371 recoveries)

Placed Recovered	No.	Percent	Placed Recovered	No.	Percent
<u>Colorado Counties</u>			Missouri	4	1.1
Denver	1	0.3	Montana	2	0.5
Pueblo	1	0.3	Nebraska	10	2.7
Weld	6	1.6	New Mexico	2	0.5
Larimer	21	5.6	North Dakota	9	2.4
Boulder	1	0.3	Oklahoma	5	1.3
Mesa	1	0.3	Oregon	6	1.6
Otero	2	0.5	South Dakota	12	3.2
Arapahoe	3	0.8	Texas	68	18.4
Jefferson	2	0.5	Utah	36	9.7
Adams	11	3.0	Washington	4	1.1
Morgan	1	0.3	Wyoming	2	0.5
Huerfano	1	0.3	Mexico	27	7.3
Prowers	1	0.3	Alaska	1	0.3
Rio Grande	3	0.8	Northern Alberta	1	0.3
Conejos	10	2.7	Southern Alberta	8	2.2
Bent	2	0.5	Southern British Columbia	2	0.5
Alamosa	2	0.5	Southern Manitoba	2	0.5
Saguache	4	1.1	Northern Saskatchewan	1	0.3
Crowley	1	0.3	Southern Saskatchewan	10	2.7
Park	1	0.3			
San Juan	1	0.3			
Colorado Totals	<u>76</u>	<u>20.5</u>	<u>Summary</u>		
Arizona	4	1.1	Canada	25	6.7
Arkansas	1	0.3	Central Flyway, U.S.	193	52.0
California	65	17.5	Pacific Flyway, U.S.	115	31.0
Idaho	1	0.3	Mississippi Flyway, U.S.	10	2.7
Iowa	1	0.3	Mexico	27	7.5
Kansas	7	1.9	Alaska	<u>1</u>	<u>0.3</u>
Louisiana	2	0.5	Totals	371	100.0
Minnesota	2	0.5			

Table 54.— Distribution of Recoveries by Shooting of Pintails Banded in the Arkansas Valley of Colorado During the Winter (100 recoveries)

Place Recovered	No.	Percent	Place Recovered	No.	Percent
<u>Colorado Counties</u>			Utah	10	10.0
Otero	2	2.0	Washington	1	1.0
Prowers	1	1.0	Mexico	5	5.0
Bent	2	2.0	Southern Alberta	2	2.0
Colorado Totals	<u>5</u>	<u>5.0</u>	Southern British Columbia	1	1.0
California	19	19.0	Southern Manitoba	1	1.0
Kansas	3	3.0	Northern Saskatchewan	1	1.0
Louisiana	2	2.0	Southern Saskatchewan	4	4.0
Minnesota	1	1.0	<u>Summary</u>		
Missouri	2	2.0	Canada	9	9.0
Nebraska	5	5.0	Central Flyway, U.S.	50	50.0
New Mexico	1	1.0	Pacific Flyway, U.S.	31	31.0
North Dakota	3	3.0	Mississippi Flyway, U.S.	5	5.0
Oklahoma	2	2.0	Mexico	<u>5</u>	<u>5.0</u>
Oregon	1	1.0	Totals	100	100.0
South Dakota	2	2.0			
Texas	29	29.0			

Table 55.— Distribution of Recoveries by Shooting of Pintails Banded in the San Luis Valley, Colorado During the Winter (69 recoveries)

Placed Recovered	No.	Percent	Place Recovered	No.	Percent
<u>Colorado Counties</u>			Oregon	1	1.4
Larimer	2	2.9	South Dakota	5	7.3
Mesa	1	1.4	Texas	7	10.1
Rio Grande	2	2.9	Utah	9	13.0
Conejos	10	14.5	Mexico	11	16.0
Alamosa	2	2.9	Southern Alberta	1	1.4
Park	1	1.4	Southern Saskatchewan	2	2.9
San Juan	<u>1</u>	<u>1.4</u>	<u>Summary</u>		
Colorado Totals	<u>19</u>	<u>27.6</u>	Mexico	11	16.0
Arizona	1	1.4	Canada	3	4.3
California	8	11.6	Central Flyway, U.S.	35	50.7
Kansas	1	1.4	Pacific Flyway, U.S.	19	27.6
Missouri	1	1.4	Mississippi Flyway, U.S.	<u>1</u>	<u>1.4</u>
Nebraska	1	1.4	Totals	69	100.0
North Dakota	1	1.4			
New Mexico	1	1.4			

5. Other Banding Sites. Although pintails have also been banded during the winter at Fort Collins, Boulder, Bonny Reservoir and on the Gunnison River, (see Table 52) comparatively few recoveries have been reported. Such recoveries as have been reported are summarized in the Colorado totals, (Table 53.)

II. Summer Banding

Prior to 1953, only 24 pintails had been banded during the summer in Colorado, 22 in the San Luis Valley and two at the Rocky Mountain Arsenal near Denver. Three recoveries (all by shooting) have been reported from the San Luis Valley bandings. Two were direct recoveries from near the banding site; one was shot in Mexico, 17 months after banding. One of the two pintails banded at the Rocky Mountain Arsenal (a male) was shot three years later in Washington state. One direct recovery has been reported from twenty-nine pintails banded in North Park during the summer of 1954. It was shot near Richmond, Texas.

III. Fall Banding

Fall banding of pintails in Colorado has been limited to the San Luis Valley and the Fort Collins area. Some 83 pintails were banded in Saguache County in October of 1951 from which five recoveries have so far been reported. Three were shot in the San Luis Valley during the 1951 waterfowl season. One was shot in California the following season and another shot in Huerfano County just east of the San Luis Valley in the 1953 season.

During the fall seasons of 1949, 1950, and 1951, some 184 pintails were banded near Fort Collins. To date, 18 recoveries have been reported. Most of these were shot within fifty miles of the banding site, (7 in Larimer County, 2 in Weld County, and 1 in Adams County). Four were shot in Texas, 2 in Old Mexico, 1 in Arizona and 1 in Wyoming.

IV. Pintails Banded out of Colorado and Recovered in Colorado

Since the 1949 waterfowl season, 30 banded pintails have been reported as recovered in Colorado that were banded out of state. Twenty of these were shot in Colorado, two found dead (probably hunting losses) and eight were trapped and released in banding operations.

It is interesting to note that four of the eight California pintails reported were trapped wintering on the Conejos River, but three of those reported shot were from north-central Colorado and one from southwestern Colorado.

Table 56. --Distribution of Recoveries by Shooting of Pintails Banded in the Denver Area During the Winter (72 recoveries)

Place Recovered	No.	Percent	Place Recovered	No.	Percent
<u>Colorado Counties</u>					
Weld County	3	4.1	Texas	11	15.1
Larimer	7	9.6	Utah	5	6.9
Boulder	1	1.4	Mexico	4	5.5
Arapahoe	1	1.4	Alaska	1	1.4
Adams	9	12.3	Northern Alberta	1	1.4
Crowley	1	1.4	Southern Alberta	3	4.1
Colorado Totals	22	30.2	Southern Saskatchewan	1	1.4
Arizona	2	2.7			
Arkansas	1	1.4	<u>Summary</u>		
California	10	13.7	Alaska	1	1.4
Iowa	1	1.4	Canada	5	6.9
Montana	1	1.4	Central Flyway, U.S.	39	54.2
Nebraska	1	1.4	Pacific Flyway, U.S.	21	29.2
North Dakota	2	2.7	Mississippi Flyway, U.S.	2	2.7
Oklahoma	1	1.4	Mexico	4	5.6
Oregon	4	5.5			
South Dakota	1	1.4	Totals	72	100.0

Table 57. --Distribution of Recoveries by Shooting of Pintails Banded in the South Platte Valley of Colorado During the Winter (68 recoveries)

Placed Recovered	No.	Percent	Placed Recovered	No.	Percent
<u>Colorado Counties</u>					
Pueblo	1	1.4	Utah	5	7.4
Larimer	2	2.9	Washington	1	1.4
Arapahoe	2	2.9	Mexico	4	5.9
Adams	1	1.4	Southern Alberta	2	2.9
Morgan	1	1.4	Southern British Columbia	1	1.4
Colorado Totals	7	10.3	Southern Manitoba	1	1.4
California	18	26.5	Southern Saskatchewan	2	2.9
Kansas	2	2.9			
Minnesota	1	1.4	<u>Summary</u>		
Missouri	1	1.4	Canada	6	8.8
Montana	1	1.4	Central Flyway, U.S.	32	47.1
Nebraska	2	2.9	Pacific Flyway, U.S.	24	35.3
North Dakota	3	4.4	Mississippi Flyway, U.S.	2	2.9
Oklahoma	2	2.9	Mexico	4	5.9
South Dakota	2	2.9			
Texas	13	19.1	Totals	68	100.0

Table 58.--Pintails recovered in Colorado but Banded out-of-state.

Place Banded	No.	Percent
<u>Hunting Season Recoveries</u>		
Arizona	1	5.0
California	4	20.0
Idaho	1	5.0
Kansas	1	5.0
Montana	2	10.0
Nebraska	1	5.0
North Dakota	2	10.0
Utah	1	5.0
Wyoming	1	5.0
Northern Alberta	1	5.0
Southern Manitoba	1	5.0
Southern Saskatchewan	<u>4</u>	<u>20.0</u>
Totals	20	100.0
<u>Recoveries by all means (shooting, found dead, etc.)</u>		
Arizona	1	3.3
California	8	26.7
Idaho	1	3.3
Indiana	1	3.3
Kansas	1	3.3
Montana	2	6.8
Nebraska	1	3.3
North Dakota	3	10.0
Utah	1	3.3
Wyoming	1	3.3
Northern Alberta	1	3.3
Southern Alberta	2	6.8
Southern Manitoba	1	3.3
Southern Saskatchewan	<u>6</u>	<u>20.0</u>
Totals	30	100.0

Five of the six pintails banded in Saskatchewan were taken on the Eastern Slope of Colorado (four of which were in the Arkansas Valley) and one in Eagle County on the Western Slope.

V. Pintail Summary

Analysis of recovery data from pintails banded in Colorado tends to substantiate conclusions drawn by Low (Aldrich et al, 1949) and Ballou (1954) that pintails follow a counter-clockwise migration pattern which takes them into the Prairie Provinces of Canada in the spring and back through the Mountain States into California, Mexico, and Gulf Coast States for the winter. California and Texas apparently harvest a substantial percentage of the pintails that migrate through Colorado. The percentage recovered in Mexico is relatively high (7.5%) and may be higher since a language difference probably interferes with the reporting of recoveries from Mexico. From the relatively few breeding season recoveries it appears that pintails wintering in Colorado come from a vast breeding ground extending from the Northwest Territories east to Manitoba and southwestward to California. Limited recoveries of pintails banded in Colorado during the summer and fall indicate them to be as erratic in their movements as those banded during the winter.

Chapter 5 - Baldpate

Introduction. Since 1946, and as of January 1, 1955, 1,682 baldpates have been banded in Colorado, largely during the winter but lesser numbers in the spring and summer.

Table 59.—Colorado Baldpate Bandings and Recoveries, Major Banding Stations 1/

Banding Site	Number Banded	Number Recoveries	Over-all Recovery Rate	1st Season Recovery Rate
<u>Winter Banding</u>				
Valmont	831	70	8.4%	3.7%
Arkansas	469	35	7.6%	3.0%
Fort Collins	75	5	6.7%	4.0%
San Luis Valley	57	4	7.0%	0.0%
South Platte	56	6	10.9%	1.8%
Denver	27	—	—	—
Gunnison River-	1	—	—	—
Totals	1,516	120	7.5%	3.3%
<u>Spring Banding</u>				
Bonny Reservoir	79 2/	—	—	—
North Park	86 2/	3	3.5%	3.5%
Totals	87	3	3.5%	3.5%
Grand Totals	1,682	123	7.4%	3.1%

1/ As of January 1, 1955.

2/ Banded mainly in 1954.

It should be pointed out that most of the spring and summer banded baldpates had not gone through more than one hunting season following banding at this writing, hence the comparative lack of recoveries.

I. Winter Banding

To date, some 120 recoveries have been reported from the 1,516 baldpates banded in Colorado during the winter. Only 92 of these were reported shot, three were found dead, one caught in a mammal trap and 26 recovered in banding operations. Most of the latter (25 or 26) were recaptured within fifty miles of their banding sites one or more years after banding.

Table 60 lists the places of recovery for the 92 baldpates banded during the winter and subsequently reported shot while figure 27 presents these recoveries graphically. The largest percentage of recoveries are for Colorado (39.1%). This is slightly higher than was the case for pintails (21.1%), but lower than winter banded mallards for most stations except in the South Platte and Arkansas Valleys. Similarly to pintail recoveries, a fairly high percentage of the baldpate recoveries was made in Pacific Flyway States (21.7%). New Mexico (18.5%) and California (12.0%) lead in percentages of recoveries made out of Colorado. Unusual places of baldpate recoveries include Maryland and Illinois.

Table 60.—Distribution of Recoveries by Shooting of Baldpates in Colorado During the Winter.

Placed Recovered	No.	Percent	Place Recovered	No.	Percent
<u>Colorado Counties</u>			Nebraska	1	1.1
Pueblo	1	1.1	New Mexico	17	18.5
Weld	4	4.4	North Dakota	3	3.3
Larimer	4	4.4	Oklahoma	1	1.1
Boulder	14	15.2	Texas	3	3.3
Mesa	1	1.1	Utah	5	5.4
Otero	1	1.1	Northwest		
Arapahoe	2	2.2	Territories	1	1.1
Adams	3	3.3	Northern Alberta	1	1.1
Logan	2	2.2	Southern Alberta	2	2.2
Morgan	1	1.1	Southern British		
Bent	1	1.1	Columbia	1	1.1
Alamosa	1	1.1	Southern Saskatchewan	4	4.4
Jackson	1	1.1			
Colorado Totals	36	39.1			
			<u>Summary</u>		
Arizona	2	2.2	Canada	9	9.8
California	11	12.0	Central Flyway, U.S.	61	66.3
Idaho	2	2.2	Pacific Flyway, U.S.	20	21.7
Illinois	1	1.1	Mississippi Flyway,		
Maryland	1	1.1	U.S.	1	1.1
			Atlantic Flyway, U.S.	1	1.1
			Totals	92	100.0

Only four breeding season recoveries have been reported for baldpates banded during the winter in Colorado. Three of these were direct recoveries, one each in the Northwest Territories, Northern Alberta and Southern Manitoba. One indirect breeding season recovery was made in Southern Saskatchewan.

II Summer Banding

Only 88 baldpates have been banded in Colorado during the summer, 87 in North Park and one in the San Luis Valley. As of June 15, 1955, only four recoveries were known, all direct recoveries from the North Park banding. One was recovered near Los Angeles, California, one near Cortez, Colorado, one near Granger, Utah, and another near Mexico City, Mexico.

III. Out-of-State Banded Baldpates

Only three baldpates banded outside Colorado are known to have been reported since 1950 as having been shot in Colorado, one each from Oregon, Southern Alberta and Southern Saskatchewan. The Oregon bird was banded in March, the Canadian birds in July.

IV. Baldpate Summary

Comparatively few recoveries have been reported from baldpates banded in Colorado but from them it appears that baldpates are almost as erratic in their movements as pintails and perhaps have a similar counter-clockwise migration. Apparently baldpates use both the Central and Pacific Flyways. Those wintering in Colorado apparently come from a large breeding area extending from the Northwest Territories to Manitoba, but not as far south as that of the pintail. Limited recoveries of baldpates banded on breeding grounds in Colorado indicate they migrate southwestward into southern California and Mexico.

Chapter 6.—Green-winged Teal Recoveries

Introduction. Since 1946, only 508 green-winged teal had been banded in Colorado as of January 1, 1955, from which 34 recoveries had been reported. The number of bandings and recoveries by banding sites are tabulated in Table 61.

Table 61.—Colorado Green-winged Teal Bandings and Recoveries, as of January 1, 1955

Banding Site	Number Banded	Recoveries Reported	Over-all Recovery Rate	1st Season Recovery Rate
<u>Winter Banding</u>				
Arkansas Valley	208	14	6.7%	1.9%
San Luis Valley	9	—	—	—
South Platte Valley	27	2	7.4%	7.4%
Denver Area	12	1	8.3%	8.3%
Boulder Area	13	4	30.8%	7.7%
Totals	269	21	7.8%	3.0%
<u>Fall Banding</u>				
San Luis Valley	156	6	3.8%	3.8%
<u>Summer Banding</u>				
Denver	1	—	—	—
San Luis Valley	1	1	100.0%	100.0%
North Park	1	—	—	—
Totals	3	1	33.3%	33.3%
<u>Spring Banding</u>				
Bonny Reservoir	80	6	7.5%	7.5%
Grand Totals	508	34	6.7%	3.9%

Of these 34 green-winged teal recoveries, 32 were by shooting. The greatest number of these were shot in Colorado (11) although 3 each were shot in Nebraska and Old Mexico. Table 62 and Figure 28 present the distribution of these recoveries.

Out of the 21 known recoveries of winter banded green-winged teal, only one was made during the breeding season. It was banded in the Arkansas Valley in March of 1951, and recovered in Southern Saskatchewan in May of 1953. The Mexico recoveries were all from birds banded in the San Luis Valley during October of 1951.

The six recoveries from spring banding at Bonny Reservoir were as follows: Nebraska, 3; Texas, 1; Mississippi, 1; and Louisiana, 1, apparently indicating a more eastern population uses Bonny Reservoir than uses the

Arkansas Valley. Only three green-winged teal have been banded in Colorado during the summer. One of these was recovered the following fall in the San Luis Valley where it was banded.

Table 62.—Distribution of Recoveries by Shooting of Green-winged Teal Banded in Colorado

Placed Recovered	No.	Percent	Place Recovered	No.	Percent
<u>Colorado Counties</u>			Texas	2	6.3
Weld	1	3.1	Utah	1	3.1
Boulder	1	3.1	Wyoming	1	3.1
Morgan	1	3.1	Mexico	3	9.3
Prowers	1	3.1	Southern Alberta	2	6.3
Rio Grande	2	6.3	Southern Saskatchewan	2	6.3
Garfield	1	3.1	Yukon	1	3.1
Bent	4	12.5			
Colorado Totals	11	34.3			
			<u>Summary</u>		
Idaho	1	3.1	Canada	5	15.7
Illinois	1	3.1	Central Flyway, U. S.	19	59.3
Kansas	1	3.1	Mississippi Flyway, U.S.	3	9.4
Louisiana	1	3.1	Pacific Flyway, U.S.	2	6.3
Mississippi	1	3.1	Mexico	3	9.3
Nebraska	3	9.4			
Oklahoma	1	3.1	Totals	32	100.0

Chapter 7 - Recoveries of Miscellaneous Species of Waterfowl

Introduction. In addition to the mallard, Canada goose, pintail, baldpate, and green-winged teal, a few recoveries have been reported from the blue-winged teal, redhead, gadwall, canvasback, shoveller, lesser scaup, ringnecked duck, and coot. Although a few have been banded in Colorado, no recoveries have been reported for the white-fronted or snow geese, wood duck, black duck, cinnamon teal, or ruddy duck.

I. Blue-winged Teal

Although 95 blue-winged teal have been banded in Colorado, only one recovery has been reported. It was one of 83 banded in the San Luis Valley in October of 1951. It was shot during the same month near the banding site. Other places of blue-winged teal banding and seasons of banding are North Park, 7 (summer); Fort Collins, 2 (fall); Rocky Mountain Arsenal, 2 (spring); and Moffat County, 1 (summer).

Three recoveries are known to have been reported from Colorado of blue-winged teal banded in North Dakota in August of 1950, one each from the following counties, Crowley, Weld, and Costilla. A blue-winged teal banded in Southern Alberta in September of 1948 was shot in Larimer County in November of the same year.

II. Redhead

Although 52 redheads had been banded in Colorado, only two had been reported as recovered as of January 1, 1955. One immature bird banded in the San Luis Valley in August of 1949 was shot in New Mexico two months later. Another immature banded at the Rocky Mountain Arsenal near Denver in August of 1948 was shot in Southern Ontario in October of 1949. The places and seasons of banding of the 52 redheads banded in Colorado are North Park, 26 (summer); San Luis Valley, 12 (summer); Rocky Mountain Arsenal, 8 (2 in spring, and 6 in summer); South Platte Valley (Prewitt Reservoir), 2 (spring); Arkansas River, 1 (spring); and Fort Collins, 3 (fall).

Redheads banded out-of-state as follows have been reported as recovered in Colorado since 1950: California, 4; Montana, 1; Utah, 17; and Southern British Columbia, 2. All of these ducks were recovered on the Eastern Slope except for one of the California birds and four of the Utah birds.

III. Gadwall

Only one recovery has as yet been reported from 28 gadwall banded in Colorado as follows: Rocky Mountain Arsenal, Denver 12 (spring); San Luis Valley, 8 (2 in winter, 6 in summer); North Park, 5 (summer); Fort Collins, 1 (fall); and Boulder, 2 (winter). The single gadwall recovery was of an immature male banded in North Park in August, 1954, and recovered three months later in Floyd County, Texas.

Eight gadwall are known to have been recovered in Colorado since 1948 that were banded elsewhere, four in Southern Alberta, three in Southern Saskatchewan, and one in Nebraska. The Canadian birds were all banded during July and August, and shot in Eastern Slope counties. The Nebraska bird was banded in April and shot the following November in the San Luis Valley.

IV. Shoveller

Only one shoveller has been banded in Colorado, an immature female in the San Luis Valley in August of 1950. A shoveller banded in Southern Saskatchewan in September and shot in December in Conejos County is the only recovery report for this species received.

V. Lesser Scaup

Only one lesser scaup has been banded in Colorado, that during August of 1954 in North Park. Two recoveries have been received of lesser scaup banded out-of-state and recovered in Colorado. Both were banded during August in Southern Alberta. One was shot in Jefferson County, the other in Pueblo County.

VI. Canvasback

Only one canvasback has been banded in Colorado, that on the South Platte River in January, 1950. Only one banded canvasback is known to have been reported as recovered in Colorado since 1950. It was banded in Oklahoma in April and shot in North Park the following November. The canvasback has been found nesting in North Park.

VII. Ring-Necked Duck.

Only two ring-necked ducks have been banded in Colorado, a pair banded in North Park in August of 1954. To date but one recovery report has been received for this species, that from a ring-necked duck banded in South Carolina in December of 1949 and shot in Weld County in November of 1951.

VIII. Coot

Only two recovery reports have been received from the 51 coots banded in Colorado. One was for a coot banded on the South Platte in March, 1950, and shot in Mexico in December of 1952. The second was for a coot banded in North Park in September, 1954 and found dead in Louisiana that November.

The places and seasons of banding of the 51 coots banded in Colorado are as follows: North Park, 28 (summer); San Luis Valley, 3 (summer); Routt County, 1 (summer); South Platte, 1 (winter); Rocky Mountain Arsenal, 1 (spring); Boulder, 16 (winter) and Fort Collins, 1 (fall).

Chapter 8.- Discussion and Recommendations

I. Proportion of Bands Recovered Which are Reported

The analysis of band recovery data is complicated by the fact that only a proportion of the bands recovered are actually reported. Studies with reward bands and questionnaires seem to indicate that only one-third to one-half of the bands recovered by sportsmen are ever reported (Bellrose, 1955 and Crissey, 1955). To further complicate matters, the rate of reporting often varies season to season and from one part of the country to another, often depending on the publicity given banding.

Although reward band experiments in Colorado conducted by the Fish and Wildlife Service had not been published at this writing, it appears that the difference in reporting rates between reward and non-reward bands has not been near as great in Colorado as that found in Illinois by Bellrose (1945 and 1955).

Some indications of the proportion of bands recovered which are reported can be obtained by an analysis of hunters' bag checks on the Tamarack Public Shooting Ground in Northeastern Colorado. For three years for which records were available for study and during which time band numbers were noted by check station personnel but actual reporting of the recoveries left with the hunters, only from 30 to 50% of the bands were reported. These represent probably higher reporting rates than from areas outside the Management Area as hunters were encouraged to report their recoveries. Even in 1954 when the check station personnel reported all bands they observed, only 89% of the bands known to have been taken on the area were reported because some hunters lost their bands before they got to the check station. It is possible that other bands were missed by check station personnel or removed by hunters and not mentioned when checked.

Table 63.—Proportion of Mallard Bag Banded and Reporting Rates, Tamarack Check Station, Crook, Colorado.

Hunting Season	Mallards Checked	Number Banded	Percent Banded	Number Reported	Percent Reported
1950 <u>1/</u>	1,323	30	2.3	15	50
1951 <u>1/</u>	2,576	54	2.1	16	30
1953 <u>1/</u>	1,583	21	1.3	10	48
1954 <u>2/</u>	1,173	19	1.6	17	89

1/ Band numbers noted at check station but hunters reported recoveries on own.
2/ Check station personnel endeavored to report recovery of all bands.

Various reasons have become apparent in some areas which may partially explain the varying rates of reporting of recovered bands. Hunters checked in the Crook-Sedgwick area recently expressed a lack of interest in reporting bands. A few years previously, literally thousands of ducks were banded in their immediate area. Hunters soon learned to recognize certain band series as being banded locally or, after receiving several band recovery reports all stating the ducks were banded nearby, simply stopped reporting bands. Instances of hunters having over 20 unreported bands were noted. After four winters of intensive banding near the Tamarack Public Shooting Ground during which time over 25,000 mallards were banded, the percentage of recaptures in a banding trap catch became so high (24.8% in 1951) that it became increasingly difficult to catch bandable (i.e. unbanded) ducks. Perhaps a smaller sample of ducks banded in an area will give the same results as a larger sample, but better yet, not risk destroying the incentive of local hunters to report their band recoveries.

II. Recommendations

Based on past banding experience in Colorado and tentative conclusions drawn from this analysis of recovery reports, the following recommendations are made:

1. Banding of approximately 1,000 birds of a particular species of waterfowl in any one locality during a season probably yields an adequate number of recoveries for future analysis. Over banding in one locality apparently reduces the incentive of hunters to report recoveries in that area.
2. Future emphasis in waterfowl banding in Colorado should be placed on summer banding on the various breeding grounds using drive traps. Some attention should also be given to banding important species at other seasons, particularly on areas on which no previous banding has been accomplished.
3. In future bandings, more effort should be made to correlate numbers banded with numbers present in the area during banding. Accuracy and details in record keeping can be over-emphasized.
4. Existing recovery data should be further analyzed to determine if correlation exists between band recoveries and hunters' kill surveys, the significance of age and sex differential mortality and the use of mortality tables in estimating losses in waterfowl populations.
5. IBM analysis of waterfowl band recovery information has proven feasible and should be continued. The waterfowl recovery analysis should be brought up to date at least annually although publication of findings in the future should not be necessary more than every fifth year or so.

6. Experiments should be continued to devise more efficient and economical methods for capturing and banding waterfowl in Colorado but it is not anticipated that techniques as large in scale as those employed in the 1940's will be needed.

7. Game and Fish Department employees, sportsmen and other interested parties should be kept informed of the general mechanics of waterfowl banding, its purposes, how to report recoveries, and what value is gained from banding. Any state-wide program of banding publicity must be handled carefully to insure uniform emphasis to eliminate as much as possible the introduction of bias.

SUMMARY AND CONCLUSIONS

Chapter I. Introduction

I. History of Waterfowl Banding in Colorado.

1. The first known waterfowl banding in Colorado was that done in the San Luis Valley by Triplet in 1938. Most banding has been done since 1946.

2. The Denver Wildlife Research Laboratory (Fish and Wildlife Service) banded at the Valmont Reservoirs near Boulder, 1946-1949. The Colorado Cooperative Wildlife Research Unit banded in the Fort Collins area 1949 - 1952, while the Monte Vista National Wildlife Refuge commenced banding in the San Luis Valley in 1953.

3. Most Waterfowl banding in Colorado has been by personnel of the Colorado Game and Fish Department largely as projects under the Federal Aid in Wildlife Restoration Act. Since 1946, banding has been conducted in ten major areas of the state with some waterfowl having been banded in practically every month, but mostly during the winter. Recently emphasis has been shifted to summer banding.

II. Trapping and Banding Techniques

1. Most of the waterfowl banded in Colorado have been trapped during the winter using various types of grain-baited traps, but especially a particular model designed by Wildlife Conservation Officer, G. I. Crawford, and known as the Colorado Duck Trap.

2. Drive-traps and radio-controlled cannon-net traps have been used.

3. Live decoys, small grain bait, and rallying have all been used in waterfowl trapping in Colorado. Compartmented "catch boxes" and cylindrical tubes of woven wire have been used to remove birds from the traps.

4. Various studies other than banding have been conducted in conjunction with banding such as parasite studies, weights, and fluoroscopy. Some experimentation using reward and non-reward bands was conducted by the U. S. Fish and Wildlife Service in Colorado.

III. Waterfowl Banded in Colorado

1. As of February, 1955, over 78,000 waterfowl consisting of fifteen species of ducks and three species of geese in addition to a few coots had been banded in Colorado since 1944.

2. Mallards have been banded in greatest numbers of any of the species (65,882) with pintails second (6,706) and Canada geese third (3,522).

3. Most waterfowl banded in Colorado since 1944 were banded by the State Game and Fish Department (61,659) and 13,080 being banded by the U. S. Fish and Wildlife Service and 3,873 by the Colorado Cooperative Wildlife Research Unit.

IV. Waterfowl Banded Out-of State, Recovered in Colorado

1. As of February, 1955, 459 recoveries of waterfowl banded out of state but recovered in Colorado were analyzed representing eleven species, mostly mallards.

2. The above recoveries are not believed to be complete, but are based on those information copies received primarily since 1950.

V. Method of Analysis

1. This report is based largely on an IBM analysis of recovery data prepared by transferring information from Fish and Wildlife Service report of recovery forms (Forms 3-624) to IBM cards and using standard sorting machines.

2. Means of recovery were grouped in four categories (1) shot; (2) found dead; (3) trapped, and (4) trapped and released in banding operations. Most emphasis has been placed on hunting recoveries (those birds shot), treating direct and indirect recoveries together in most cases since most recoveries considered in this study are indirect.

3. Life tables and mortality charts have been constructed using an elapse time (in years) based on a recovery year of September 1 through August 31, rather than the Calendar year.

Chapter 2.- Mallard Recoveries

I. Winter Banding

1. Over 60,000 mallards have been banded in Colorado during the winter primarily in eight different localities: (1) South Platte Valley; (2) Valmont Reservoirs, Boulder; (3) Arkansas Valley; (4) Denver area; (5) San Luis Valley; (6) Fort Collins Area; (7) Gunnison and Uncompaghre Rivers in Delta County and (8) Bonny Reservoir.

2. Over 6,700 hunting recoveries had been reported as of September 1, 1955, giving some idea where the mallards that wintered in Colorado have been shot.

3. Slightly greater than 40% of these recoveries are from Colorado, mostly late in the season, within 50 miles of their original places of banding. Station to station, there was considerable variation in the percentages of mallards recovered in Colorado depending mainly on the location of the banding stations within the state. Several locations near

state boundaries, such as the Arkansas Valley with 25.6% quite understandably had lower percentages recovered in Colorado than some stations farther from state line such as Valmont with 57.6%. Oddly enough, however, for San Luis Valley bandings (mostly within 25 miles of the New Mexico line), the percentage of recoveries made in Colorado ran a high 75.2%.

4. Considering all winter banding of mallards in Colorado, 72.5% were recovered in Central Flyway States, 3.5% in Mississippi Flyway States, 2.7% in Pacific Flyway States, and only 0.1% (or 6 recoveries out of 6,750) in Atlantic Flyway States. Canada accounts for 21.1% of the hunting recoveries. Two mallard recoveries were reported from Old Mexico and three from Alaska. Thus, it is rather apparent that mallards wintering in Colorado remain rather much in the Central Flyway.

5. Breeding season recoveries indicate that most mallards wintering in Colorado Prairie Provinces of Canada, (Alberta and Saskatchewan especially).

II. Summery Banding

1. Only 1,777 mallards have been banded in Colorado during the summer primarily in the San Luis Valley and North Park with lesser numbers in the Denver area, and the Northwest portion of the state.

2. San Luis Valley band recoveries (224) indicate most were shot in the Valley (83.6%), 9.7% elsewhere in Colorado, and only 6.7% from outside of Colorado. Retrapping in the Valley during the winter indicate that a sizeable segment of the mallard population in the San Luis Valley is more or less resident.

3. Limited recoveries (16) from summer bandings in the Denver area (110) indicate that most are shot locally, but one-fourth in Nebraska.

4. Direct recoveries (14) from mallards banded in North Park during the breeding season (243) seem to indicate that mallards nesting there are recovered mainly in the South Platte Valley of North Central Colorado with others within the mountain valleys to the south and a few northward in Wyoming.

5. Several direct recovery reports from summer banding (all sites) show evidence of northward movement of young and old mallards during the early fall, some individuals being shot over 500 miles north of their breeding ground.

V. Fall Banding

1. Only a limited number of mallards have been banded during the fall in Colorado, some 1,594 in the Fort Collins area, and 29 in the San Luis Valley.

2. Recoveries, by shooting, from the Fort Collins bandings (215) were mainly in Colorado (72.1%) with remainder largely in other Central Flyway states, but a few in Canada, Pacific and Mississippi Flyway States. One was recovered in Old Mexico (only the third recovery reported from Mexico from over 8,000 mallard recoveries from Colorado Bandings).

3. Recoveries from fall banding in the San Luis Valley seem to verify tentative conclusions from winter and summer banding, that a sizeable portion of the San Luis Valley mallard population is resident.

Chapter 4. - American Pintail Band Recoveries

1. As of September 1, 1954, 6,542 pintails had been banded in Colorado most in the winter (6,222) but a few in the summer (53) and fall (267). Winter banding was at eight different stations in Colorado with greatest numbers being banded in the Arkansas Valley, San Luis Valley, and Denver area. Summer banding was mainly in North Park and the San Luis Valley while fall banding was primarily in the Fort Collins area and the San Luis Valley.

2. Three hundred and eighty-one recoveries have been received from the 6,222 pintails banded in the winter. About one-fifth of the recoveries were made in Colorado, over half in the Central Flyway states, and slightly less than one-third in the Pacific Flyway states. About the same number of recoveries were made in Mexico (25), as in Canada (24). A definite counter-clockwise migration northward in the Central Flyway and southward in the Pacific Flyway seems apparent.

3. Recoveries from summer (10) and fall (23) banding, although few in number, seem to indicate a somewhat similar distribution of recovery locations with greater percentages show near the banding sites than was the case with winter banding.

4. Limited numbers of breeding season recoveries (6) lead one to believe that pintails wintering in Colorado nest mainly in the Southern Prairie Provinces and North Dakota, but there was one breeding season recovery from California.

Chapter 5.- American Baldpate Recoveries

1. Since 1946, and as of January 1, 1955, 1,682 baldpates had been banded in Colorado, largely during winter (1,516) but lesser numbers in spring (79) and summer (87). The winter banding was conducted at seven stations with the greatest number being banded at Valmont (831). Spring banding was primarily at Bonny Dam; summer banding in North Park.

2. Recoveries from winter banding number 120, only 92 of which were shot. Most of these were in Colorado (39.1) with 65.4% in Central Flyway states, 21.7% in Pacific Flyway States. Single baldpates were recovered in the Atlantic and Mississippi Flyways. Four breeding season recoveries indicate that baldpates wintering in Colorado may nest largely in the Prairie Provinces and the Northwest Territories of Canada.

3. Baldpates banded in Colorado during the summer apparently migrate further south rather than winter in Colorado.

Chapter 6.- Green-winged Teal Recoveries

1. Since 1946 and as of January 1, 1955, only 508 green-winged teal had been banded in Colorado (mainly in the Arkansas and San Luis Valleys). From these, 32 recoveries by shooting are known, 11 from Colorado, 8 from other Central Flyway states, 5 from Canada, 3 from Mississippi Flyway states, 2 from Pacific Flyway states, and 3 from Old Mexico.

Chapter 7. - Recoveries of Miscellaneous Species of Waterfowl

1. In addition to the mallard, Canada goose, pintail, baldpate, and green-winged teal, a few recoveries have been reported from the blue-winged teal, redhead, gadwall, canvasback, shoveller, lesser scaup, ring-necked duck, and coot. Most are too few in number from which to draw conclusions.

2. Although a few have been banded in Colorado, no recoveries are known for the white-fronted and snow geese, wood duck, black duck, cinnamon teal, or ruddy duck.

Chapter 8. - Discussion and Recommendations

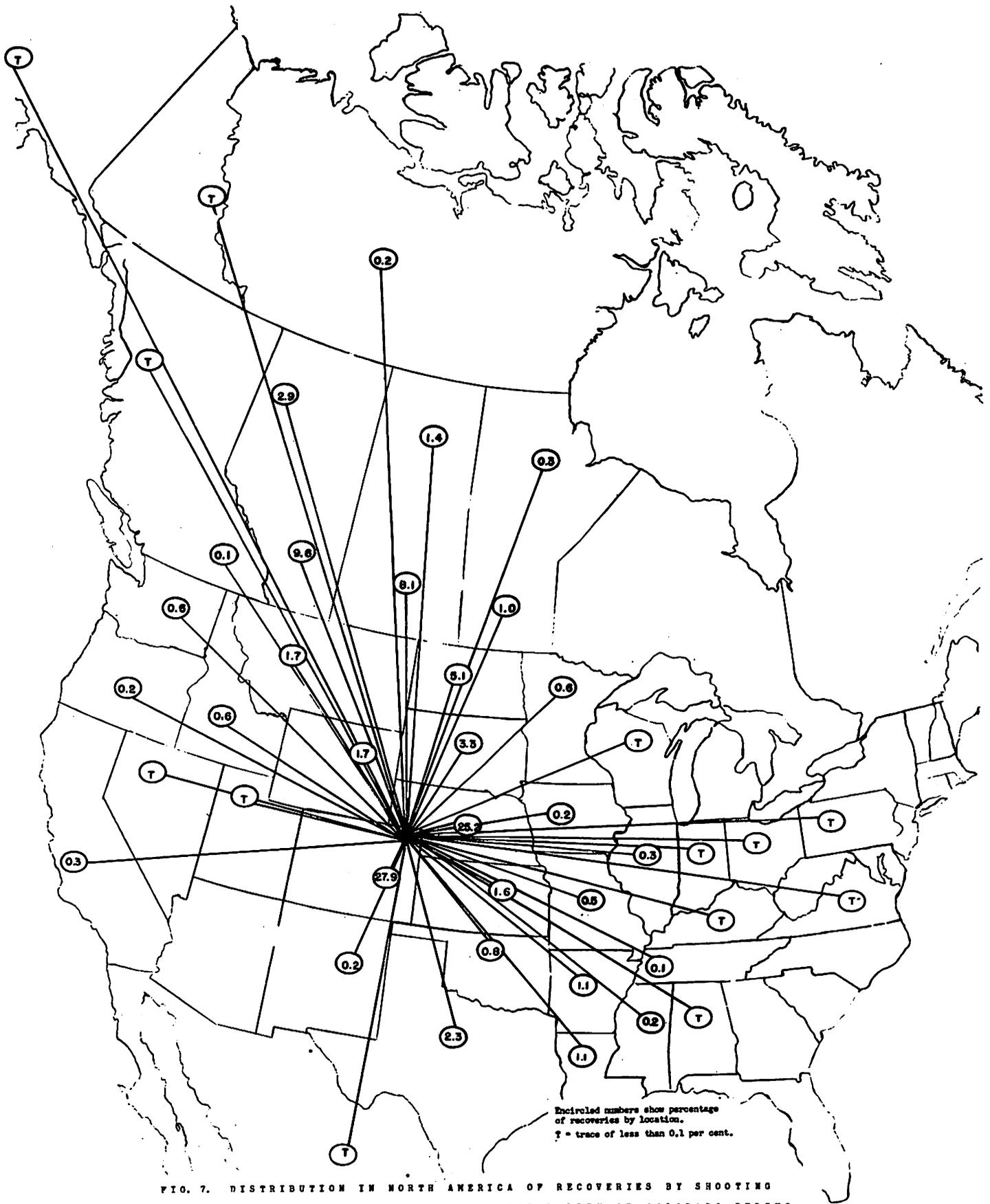


FIG. 7. DISTRIBUTION IN NORTH AMERICA OF RECOVERIES BY SHOOTING OF MALLARDS BANDED IN THE SOUTH PLATTE VALLEY OF COLORADO DURING THE WINTER.

(27,083 BANDED; 3,204 RECOVERIES BY SHOOTING)

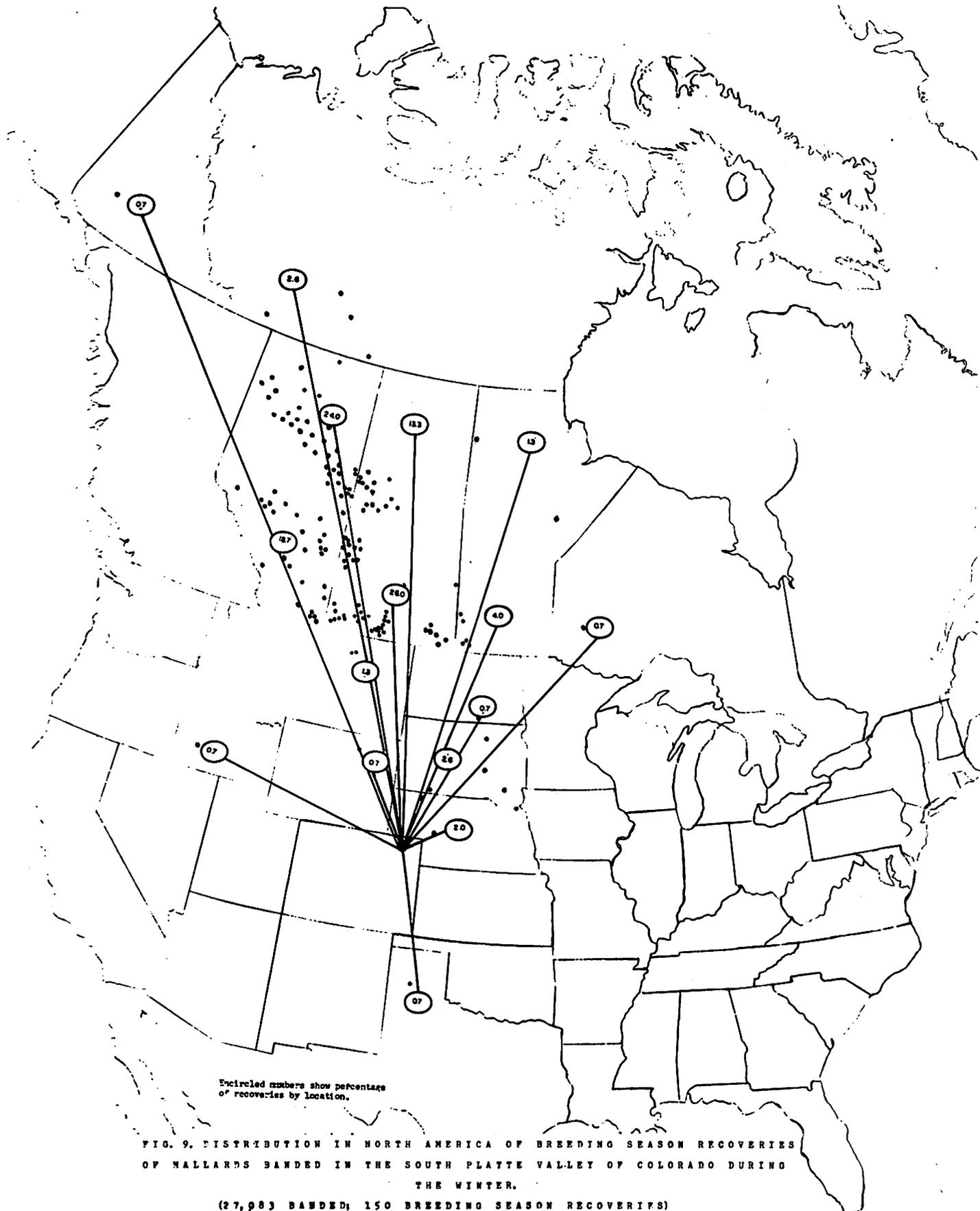


FIG. 9. DISTRIBUTION IN NORTH AMERICA OF BREEDING SEASON RECOVERIES OF MALLARDS BANDED IN THE SOUTH PLATTE VALLEY OF COLORADO DURING THE WINTER.

(27,983 BANDED; 150 BREEDING SEASON RECOVERIES)

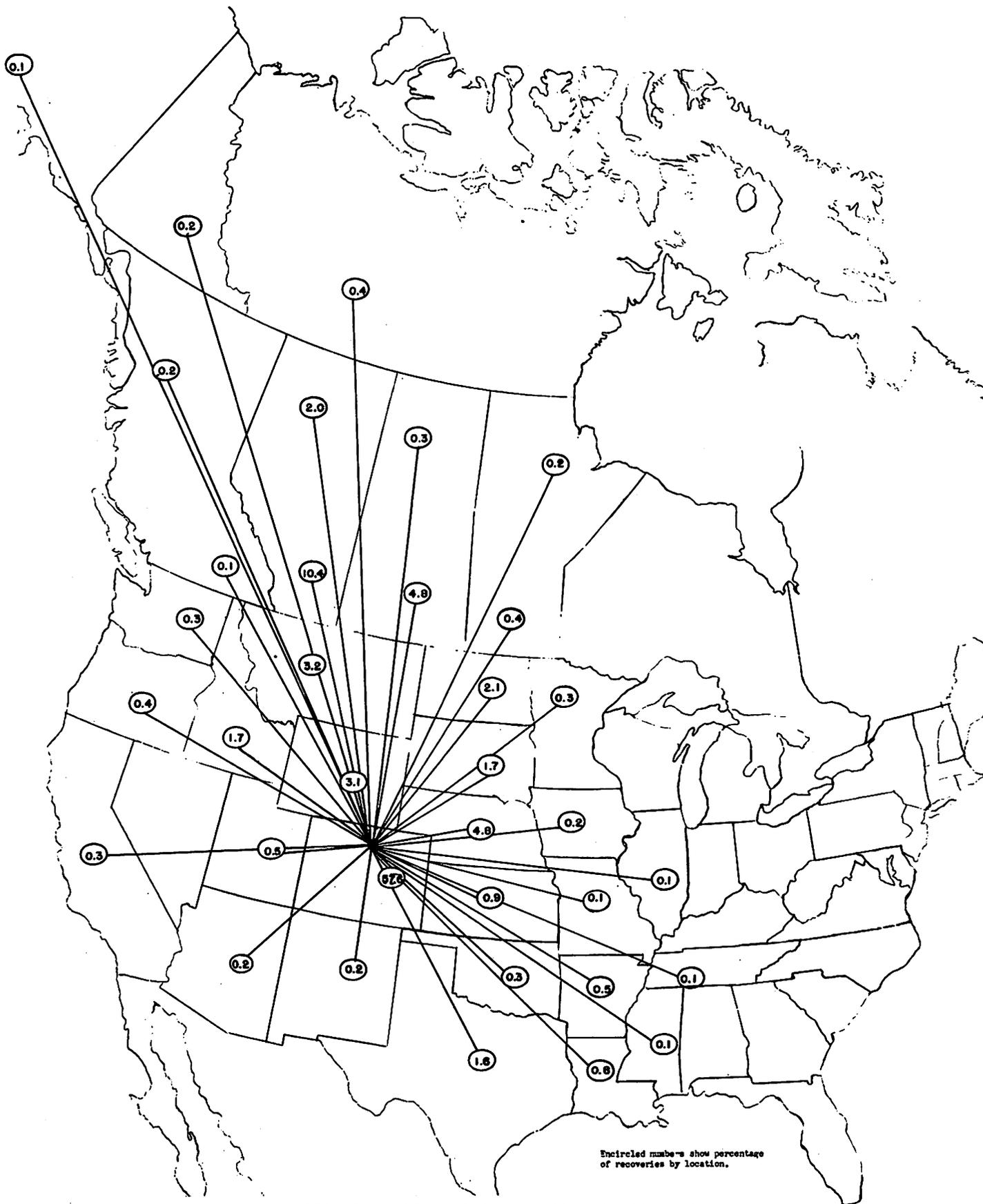


FIG. 10. DISTRIBUTION IN NORTH AMERICA OF RECOVERIES BY SHOOTING OF MALLARDS BANDED AT THE VALMONT RESERVOIRS, BOULDER, COLORADO, DURING THE WINTER.
 (10,301 BANDED; 1,262 RECOVERIES BY SHOOTING)

COLORADO

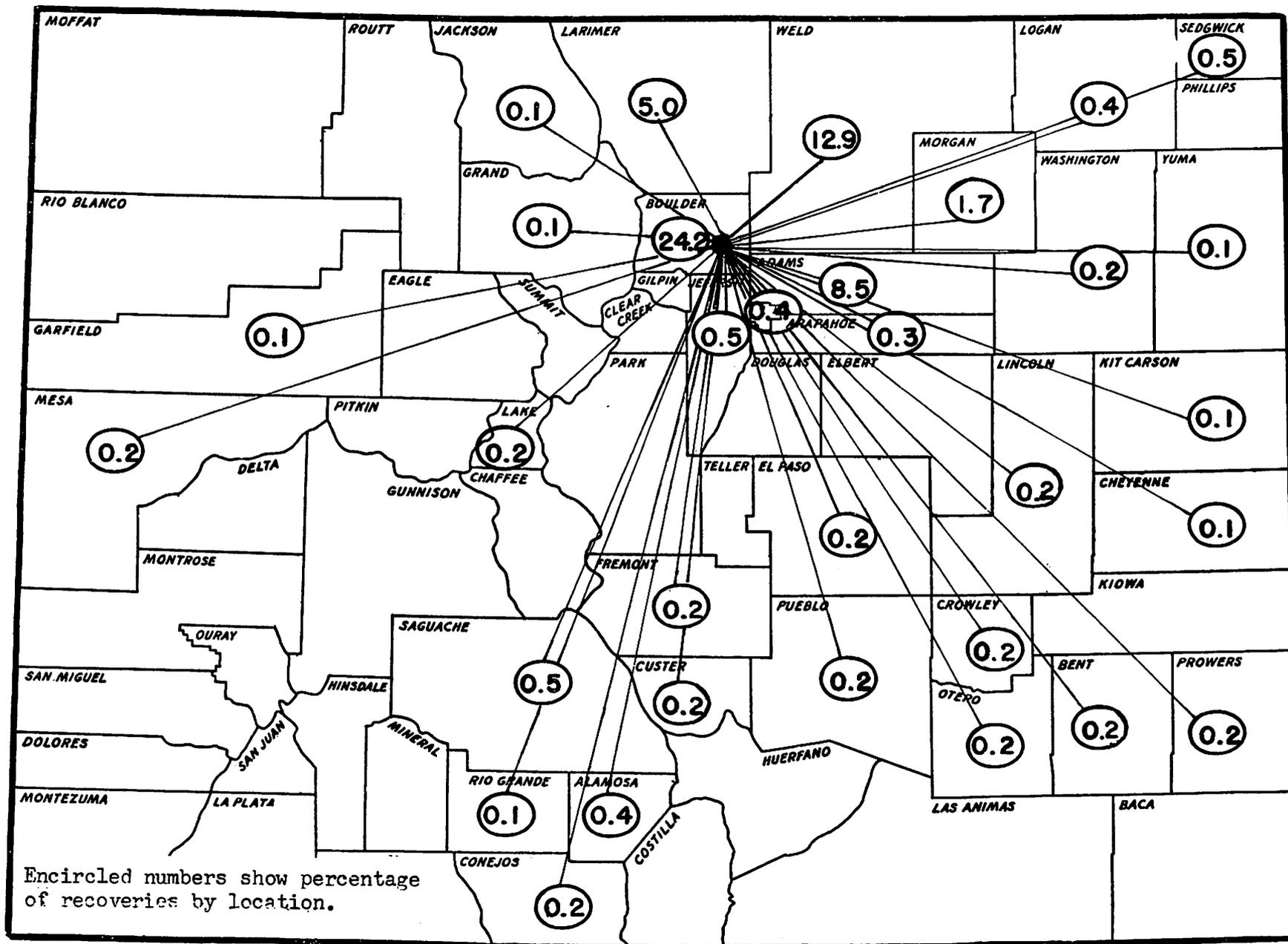


Fig. 11. Distribution in Colorado of Recoveries by Shooting of Mallards Banded at the Valmont Reservoirs, Boulder, Colorado, during the Winter. (10,301 banded; 1,262 recoveries by shooting)

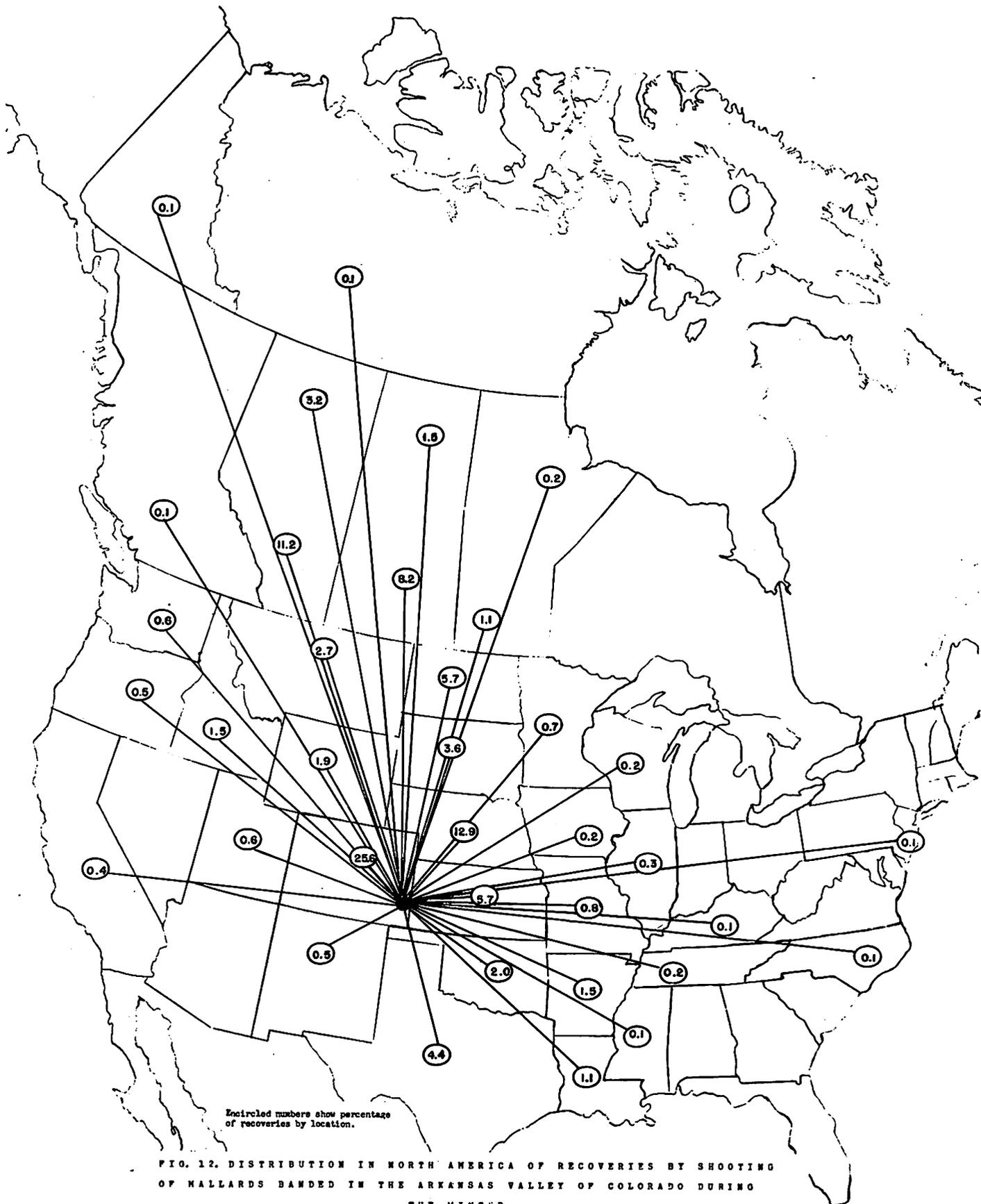


FIG. 12. DISTRIBUTION IN NORTH AMERICA OF RECOVERIES BY SHOOTING OF MALLARDS BANDED IN THE ARKANSAS VALLEY OF COLORADO DURING THE WINTER.

(9,855 BANDED; 960 RECOVERIES BY SHOOTING)

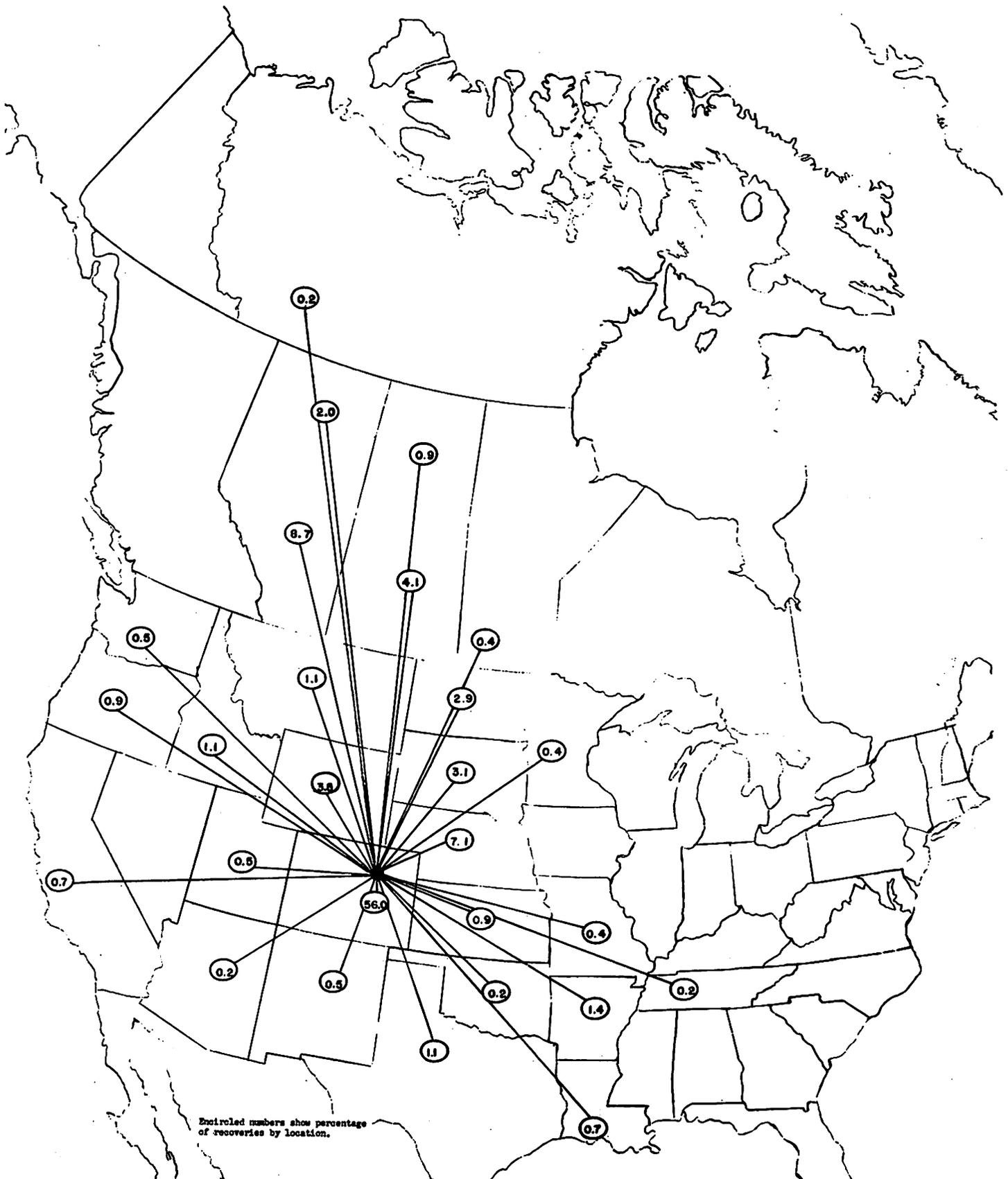


FIG. 14. DISTRIBUTION IN NORTH AMERICA OF RECOVERIES BY SHOOTING OF MALLARDS BANDED IN THE DENVER AREA OF COLORADO DURING THE WINTER.
(5,272 BANDED; 551 RECOVERIES BY SHOOTING)

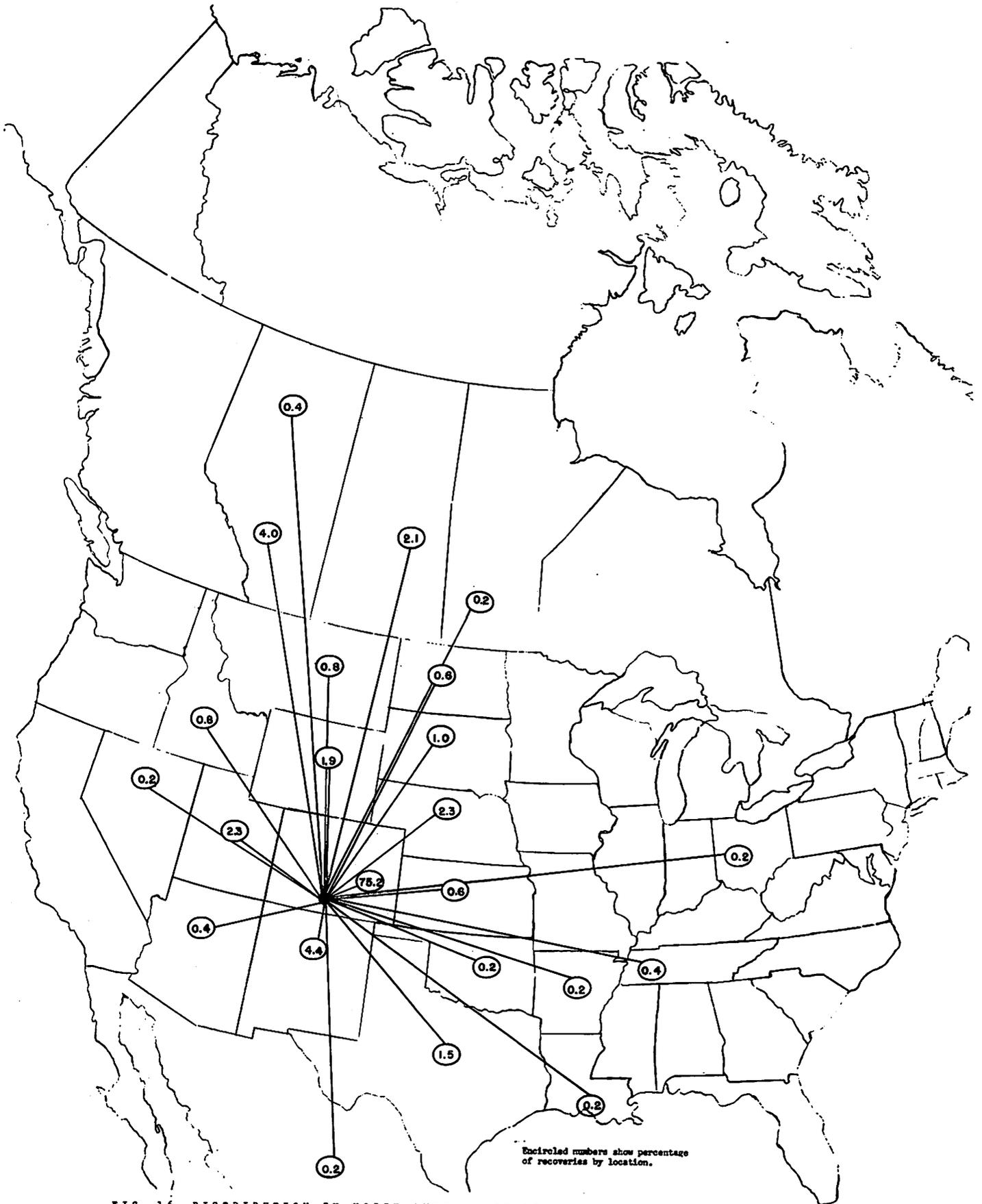
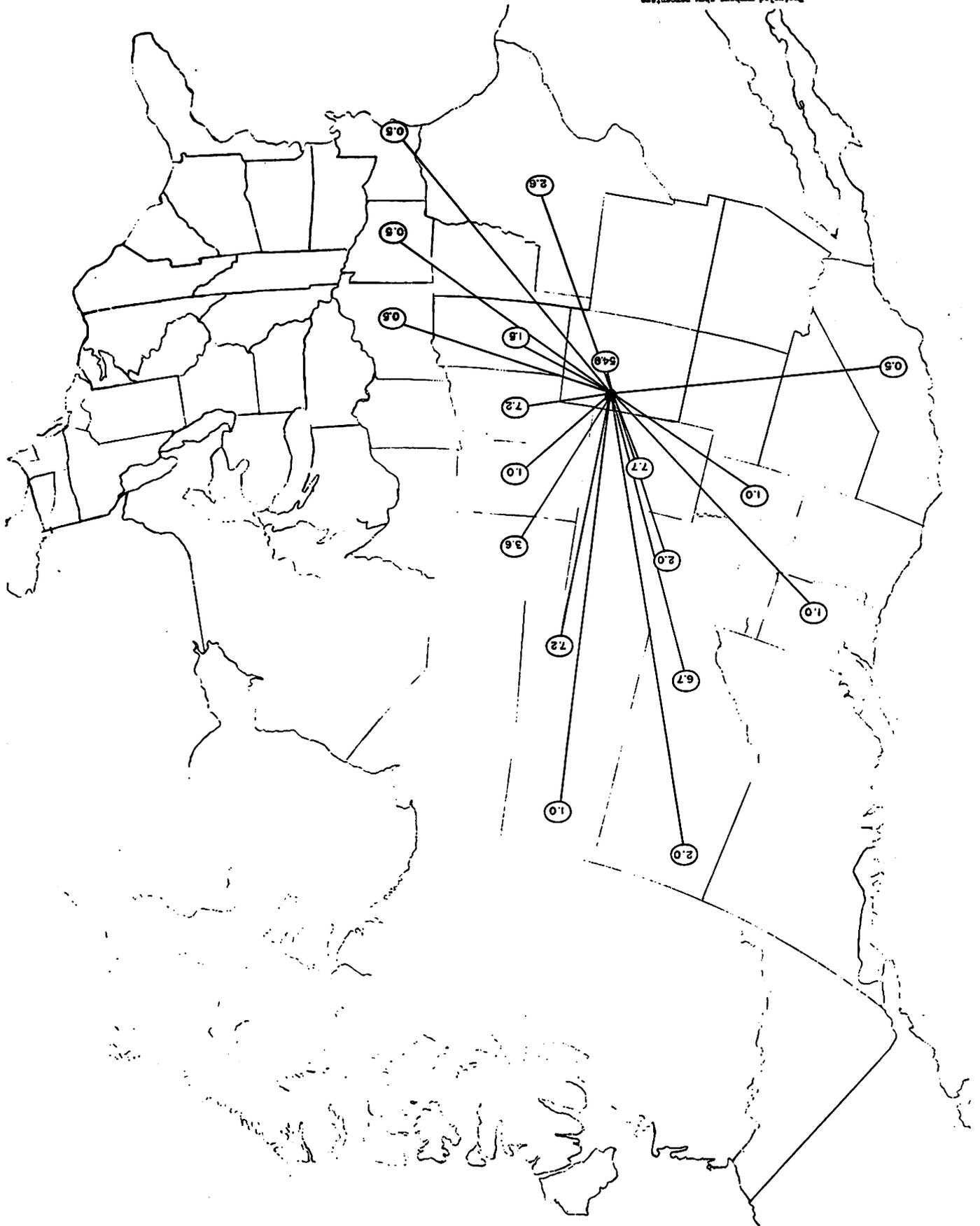


FIG. 16. DISTRIBUTION IN NORTH AMERICA OF RECOVERIES BY SHOOTING OF MALLARDS BANDED IN THE SAN LUIS VALLEY OF COLORADO DURING THE WINTER.

(4,613 BANDED; 519 RECOVERIES BY SHOOTING)

FIG. 18. DISTRIBUTION IN NORTH AMERICA OF RECOVERIES BY SHOOTING OF MALLARDS BANGED IN THE FORT COLLINS AREA OF COLORADO DURING THE WINTER.

Included numbers show percentage of recoveries by location.



COLORADO

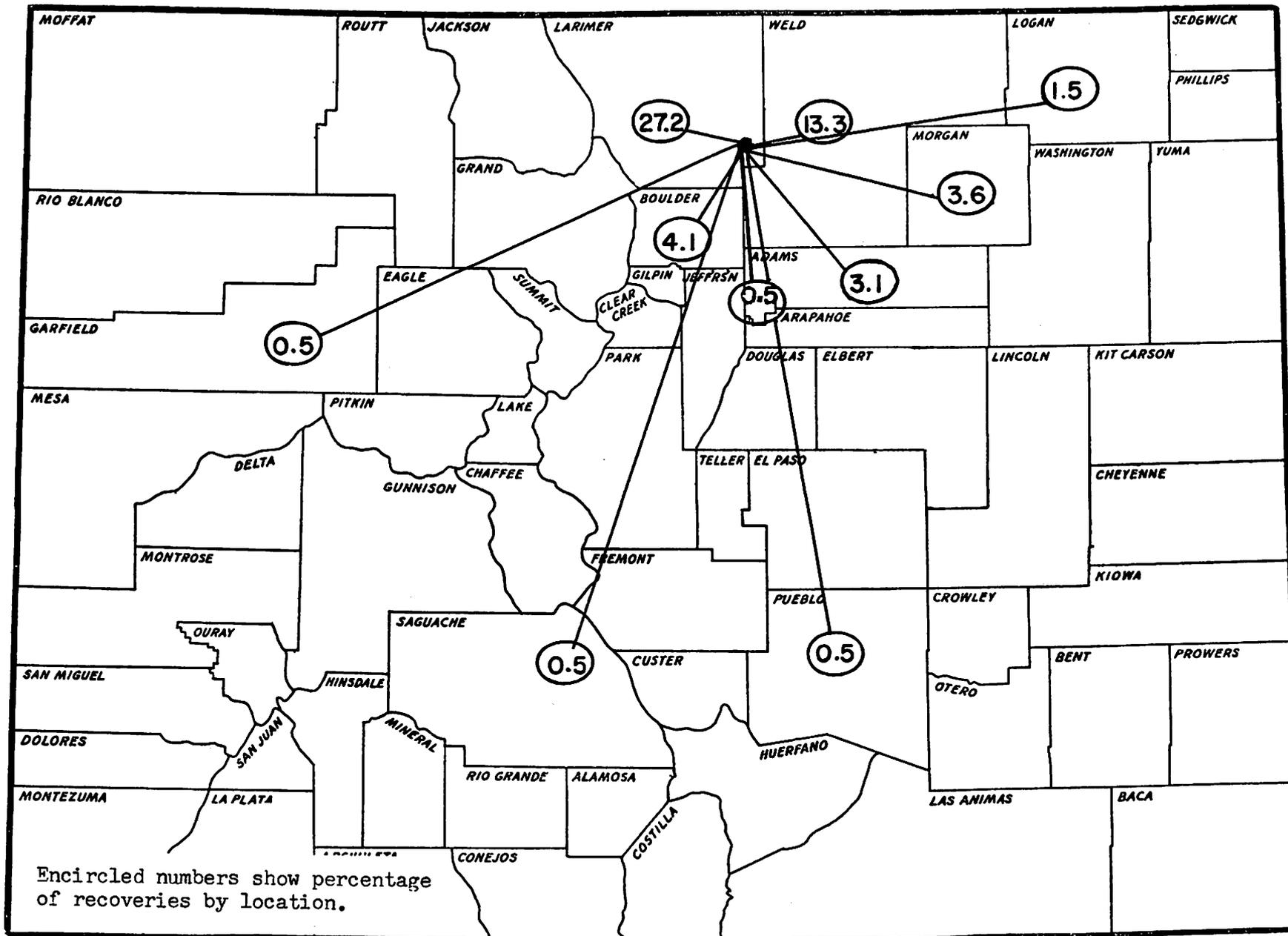
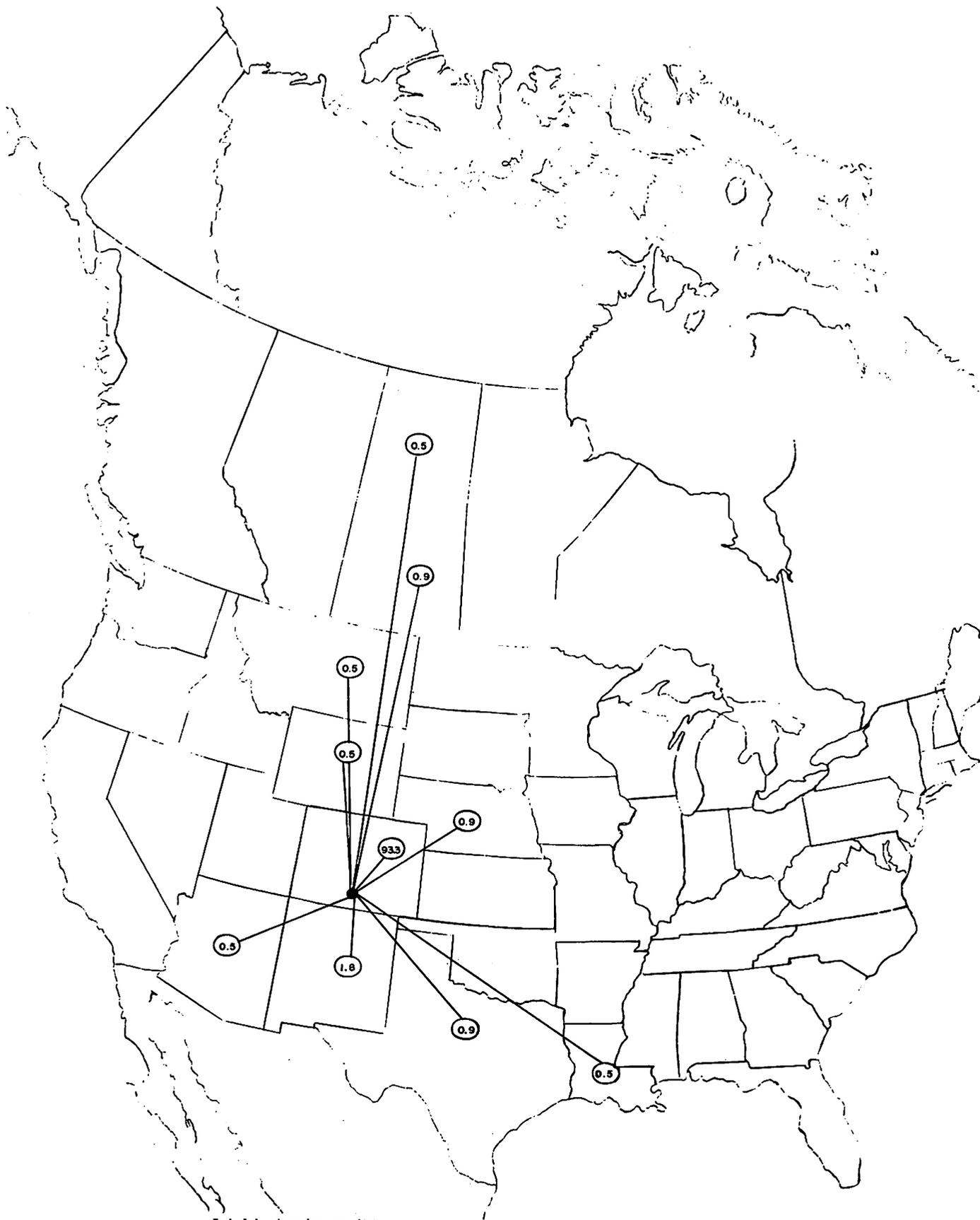


Fig. 19. Distribution in Colorado of Recoveries by Shooting of Mallards Banded in the Fort Collins Area of Colorado during the Winter.
(1,910 banded; 198 recoveries by shooting)



Encircled numbers show percentage of recoveries by location.

FIG. 20. DISTRIBUTION IN NORTH AMERICA OF RECOVERIES BY SHOOTING OF MALLARDS BANDED IN THE SAN LUIS VALLEY OF COLORADO DURING THE SUMMER.

(1,328 BANDED; 219 RECOVERIES BY SHOOTING)

COLORADO

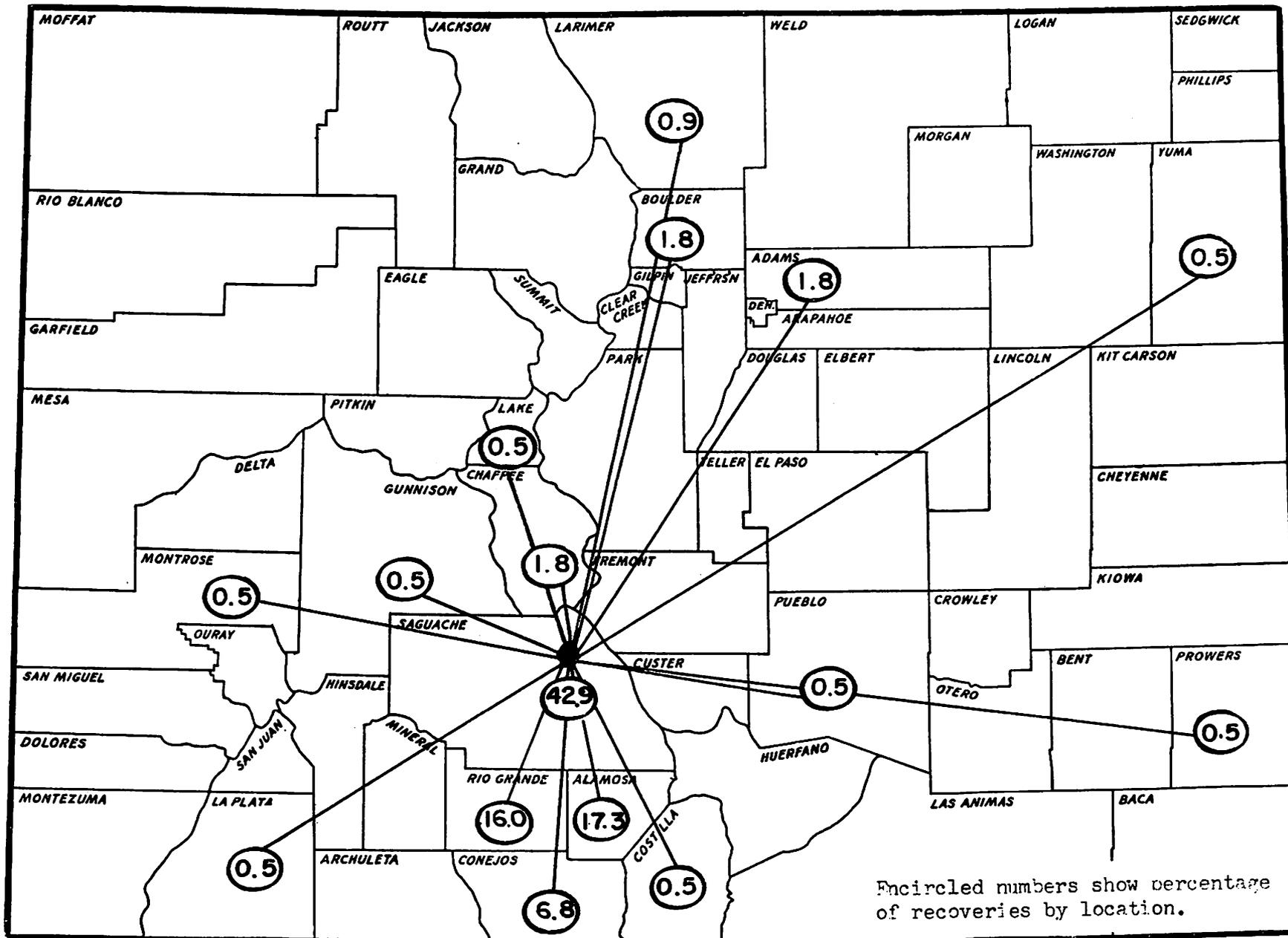
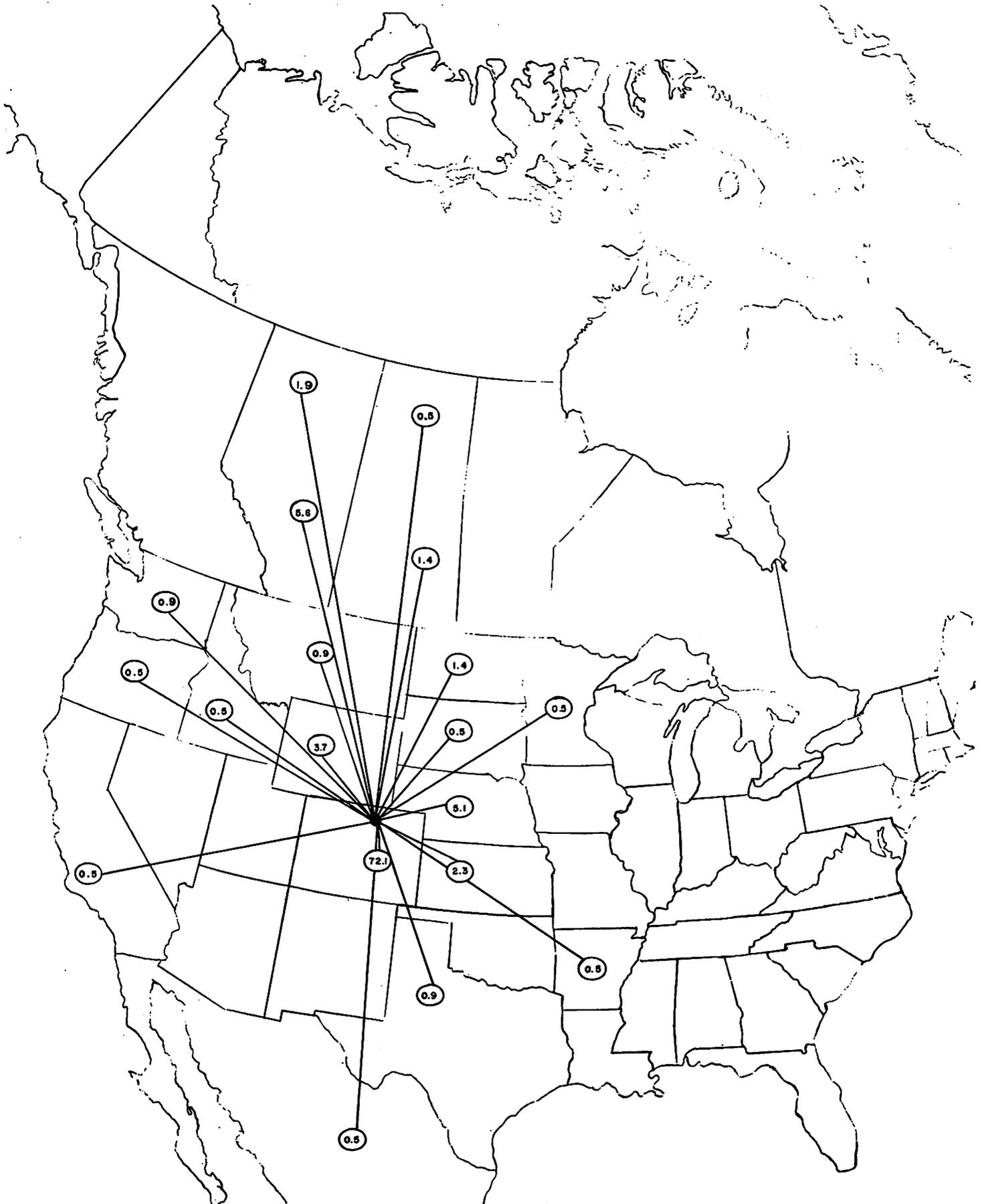


Fig. 21. Distribution in Colorado of Recoveries by Shooting of Mallards Banded in the San Luis Valley of Colorado During the Summer.
 (1,328 banded; 219 recoveries by shooting)



Encircled numbers show percentage of recoveries by location.

FIG. 22. DISTRIBUTION IN NORTH AMERICA OF RECOVERIES BY SHOOTING OF MALLARDS BANDED IN THE FORT COLLINS AREA OF COLORADO DURING THE FALL.

(1,594 BANDED; 215 RECOVERIES BY SHOOTING)

COLORADO

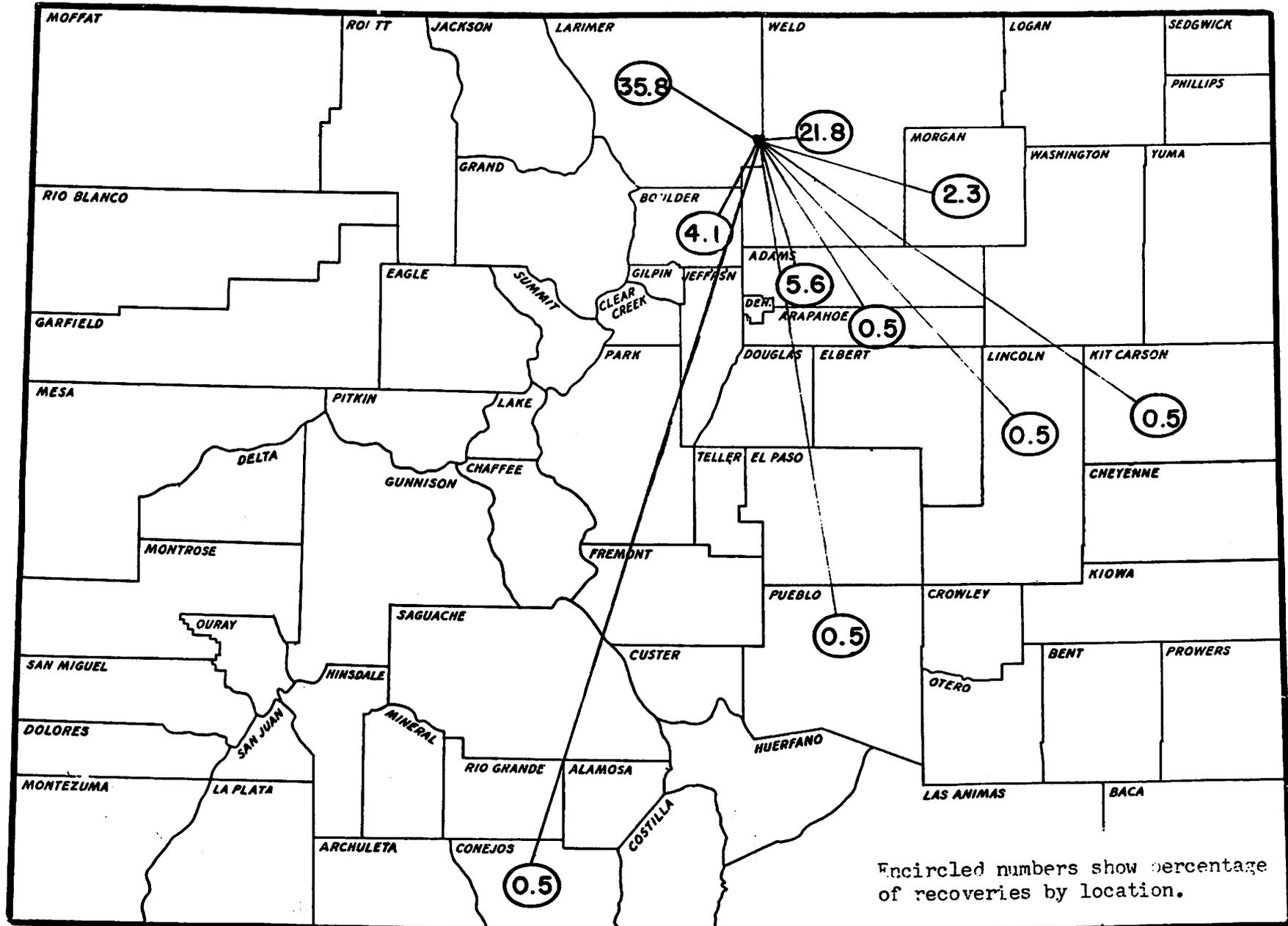


Fig. 23. Distribution in Colorado of Recoveries by Shooting of Mallards Banded in the Fort Collins Area During the Fall.
 (1,594 banded; 215 recoveries by shooting)

COLORADO

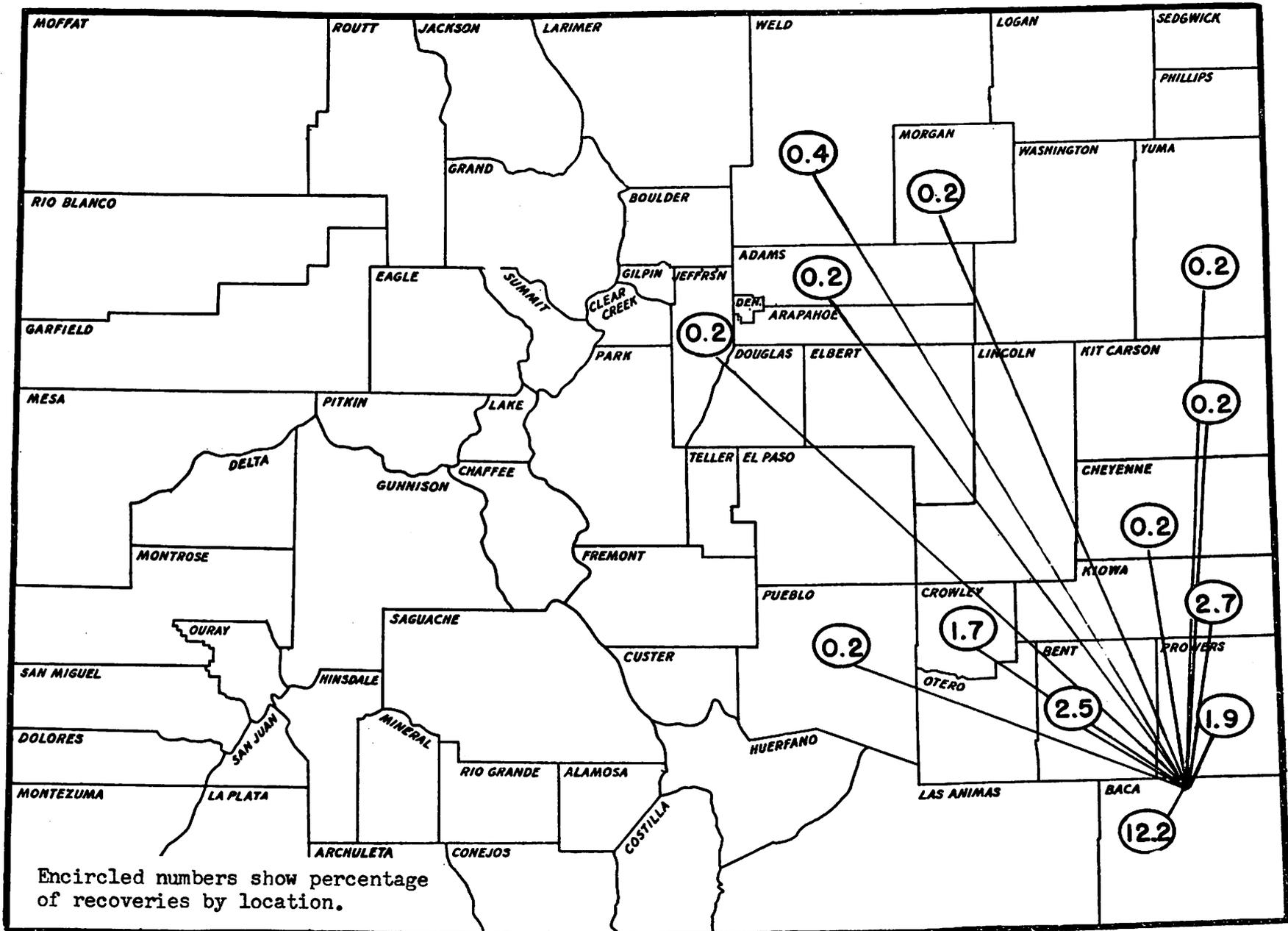


Fig. 25. Distribution in Colorado of Recoveries of Canada Geese Banded at Two Buttes Reservoir, Colorado. (3,441 banded; 515 recoveries - 504 shot; 9 found dead, and 2 trapped and released in banding)

Literature Cited

- Aldrich, John W. et al. 1949 Migration of some North American waterfowl. Special Scientific Report (Wildlife) No. 1, U. S. Fish and Wildlife Service, Wash., D. C. 48 pp
- Anonymous. 1952. Trapped - with no springs attached. Colorado Conservation 1(1):16-17.
- Ballou, Robert M. 1954. Live-trapping and banding of waterfowl. In Federal Aid in Wildlife Restoration, Quarterly Rept. Game Bird Survey W-50-R-3. July. Wyoming Game and Fish Commission. pp. 28-38.
- Bellrose, Frank C. 1945. Ratio of reported to unreported duck band in Illinois. Journal of Wildlife Mgmt. 9(3):254.
- Bellrose, Frank C. 1955. A comparison of recoveries from reward and standard bands. Journal of Wildlife Mgmt. 19(1):71-75.
- Crissey, Walter F. 1954. 1954 status report of waterfowl. Special Scientific Report (Wildlife) No. 26, U. S. Fish and Wildlife Service, Wash., D. C. p. 33.
- Crissey, Walter F. 1955. The use of banding data in determining waterfowl migration and distribution. Journal of Wildlife Mgmt. 19(1):75-84.
- Frary, Ladd G. 1952. Waterfowl banding by the Colorado Cooperative Wildlife Research Units. In News from the Bird Banders. Western Bird-Banding Assoc. 27(1):12.
- Grieb, Jack R. 1951a. Waterfowl hunters' success in the Fort Collins vicinity. Colorado Cooperative Wildlife Research Unit, Quart. Rept. 4(3):72-83.
- Grieb, Jack R. 1951b. Waterfowl migration studies in the vicinity of Fort Collins, Colorado. Colorado Cooperative Wildlife Research Unit, Quart. Rept. 4(3):65-71.
- Grieb, Jack R. and Erwin L. Boeker. 1954. Waterfowl migration studies and their application to management in Colorado. Trans. N. Am. Wildl. Conf. 19:195-210.
- Grieb, Jack R. and Mitchell G. Sheldon. 1955a. Booming success: cannon bird trap. Colorado Conservation 4(1):16-17.
- Grieb, Jack R. and Mitchell G. Sheldon. 1955b. Radio controller firing device for the cannon net traps. Typewritten manuscript submitted to the Journal of Wildlife Mgmt. 3 pp.
- Hanson, Harold C. and Robert H. Smith. 1950. Canada geese of the Mississippi Flyway. Bulletin of the Illinois Nat. History Survey 25(3):67-210.
- Hickey, Joseph J. 1951. Mortality records as indices of migration in the mallard. Condor 53 (6):284-297.

- Hickey, Joseph J. 1952a. Survival studies of banded birds. Special Scientific Report (Wildlife) No. 15, U. S. Fish and Wildlife Service, Wash., D. C. pp. 3-45; 62-82 and 125-164.
- Hickey, Joseph J. 1952b. Monthly distribution of mallard hunting mortality. Journal of Wildlife Mgmt. 16(1):32-38.
- Kalmbach, E. R. and R. H. Imler. 1945. Where do the winter ducks of the San Luis Valley breed. Colorado Conservation Comments 8(4):23-25.
- Kleinschnitz, Ferd and Willard Flinn. 1950. Duck trapping in Colorado. Colorado Conservation Comments. 10(15):17-19, 25.
- Murdy, Ray. 1955. Analysis of first-year recoveries of mallards and Canada geese banded at Lake Andes and in the Black Hills during the winter of 1950-51. Job Completion Rept., Fed. Aid Project W-17-R-9, So. Dakota Department Game, Fish and Parks. 21 pp.
- Munro, J. A. 1943. Studies of waterfowl in British Columbia. Mallard. Canadian Journal of Research 21D(8):223-260.
- Neff, Johnson A. 1948. Colorado's mallards come home. Colorado Conservation Comments 10(8):5-8, 27-28.
- Neff, Johnson A. 1948. Waterfowl banding in Colorado. In News from the Bird Banders. Western Bird-Banding Assoc. 25(1):9.
- Nolting, Donald H. 1952. Hunting season checks on migratory waterfowl. Federal Aid, Quart. Rept., Colo. Game and Fish Dept. April pp. 32-33.
- Ryder, Ronald A. 1951. The San Luis Valley - a Colorado waterfowl factory. Colorado Conservation. March pp. 22-25.
- Ryder, Ronald A. 1955. Long gone goslings. Colorado Conservation. 4(2):12-14.
- Tester, John R. 1952a. Analysis of waterfowl harvest, Fort Collins area, Colorado, 1951. Colorado Cooperative Wildlife Research Unit, Quart. Rept. 5(3):87-97.
- Tester, John R. 1952b. Waterfowl winter populations, Fort Collins area, 1951-52. Colorado Cooperative Wildlife Research Unit, Quart. Rept. 5(3):78-86.
- Trippensee, Reuben E. 1953. Wildlife Management. Vol. 2 Furbearers, waterfowl and fish. McGraw-Hill Book Co, Inc. N.Y. pp. 195-199.

Appendix A - Waterfowl Banded in Colorado, by Species and Banding Sites 1/
1944 to June, 1955 (Cont'd)

Seasons	Mallard			Pintail			Baldpate			Green-winged Teal		
	M	F	Unid 2//	M	F	Unid	M	F	Unid 2//	M	F	Unid 2//
<u>San Luis Valley (Conejos County)</u>												
1949-50	389	452	---	172	194	---	4	2	---	---	---	---
50-51	656	445	---	163	107	---	23	16	---	2	4	---
51-52	1,515	1,156	---	382	269	---	10	2	---	2	1	---
Totals	2,560	2,053	---	717	570	---	37	20	---	4	5	---
<u>San Luis Valley (Saguache County)</u>												
Summer '49	334	206	---	1	2	---	---	---	---	---	---	---
" '50	148	640	---	10	9	---	---	1	---	1	---	---
Fall '51	12	17	---	24	59	---	---	---	---	70	86	---
Totals	494	863	---	35	70	---	---	1	---	71	86	---
<u>San Luis Valley (Alamosa and Rio Grande Counties)</u>												
Summer 1950	27	27	---	---	---	---	---	---	---	---	---	---
<u>Fort Collins - Windsor</u>												
Winter 1946-'47	75	48	---	23	14	---	6	2	---	---	---	---
Fall '49	119	91	---	1	---	---	17	16	---	---	---	---
Winter 1949-50	498	279	---	94	72	---	6	3	---	---	---	---
Fall '50	610	521	---	42	64	---	8	7	---	---	---	---
Winter 1950-51	508	239	---	18	13	---	7	1	---	---	---	---
Fall 1951	143	110	---	13	64	---	---	---	---	---	---	---
Winter 1951-52	180	85	---	15	20	---	---	1	---	---	---	---
Totals	2,133	1,373	---	206	247	---	45	30	---	---	---	---
<u>San Luis Valley - Monte Vista Refuge</u>												
Summer 1953-54	---	---	9	---	---	3	---	---	---	---	---	---
Winter 1953-54	106	49	---	1	3	---	---	---	---	---	---	---
Summer 1953-55	---	---	17	---	---	---	---	---	---	---	---	---
Winter 1954-55	397	102	---	2	3	---	---	---	---	---	---	---
Totals	503	151	26	3	6	3	---	---	---	---	---	---

Appendix A -- Waterfowl Banded in Colorado, by Species and Banding Sites 1/
1944 to June, 1955 (cont'd)

Season	Mallard			Pintail			Baldpate			Green-winged Teal		
	M	F	Unid ^{2/}	M	F	Unid	M	F	Unid ^{2/}	M	F	Unid ^{2/}
<u>Delta County</u>												
Winter 1952	233	232	---	20	14	---	1	---	---	---	---	---
<u>Bonny Reservoir</u>												
Winter 1951	2	7	---	7	8	---	1	1	---	26	7	---
Winter 1953	340	194	---	60	22	---	1	1	---	37	10	---
Winter 1954	8	5	---	1	---	---	53	22	---	---	---	---
Winter 1955	1,117	616	---	112	42	---	52	17	---	40	3	---
Totals	1,467	822	---	180	72	---	107	41	---	103	20	---
<u>Yampa Valley</u>												
Summer 1953	16	27	---	---	---	---	1	---	---	---	---	---
<u>North Park</u>												
Summer 1954	90	153	---	8	21	---	40	36	---	1	---	---
All Stations	35,103	21,989	8,779	3,485	2,597	624	632	330	741	350	190	11

1/ Major species only. See text for other species.

2/ Sex not recorded when banded.

Appendix B - Glossary of Banding Terms

Elapse Time - time (in this study expressed in years) that elapsed between time bird was banded and time it was later recovered.

Foreign Retrap - (or Recapture) - the retaking in a trap of a bird previously banded at another banding station at least five miles distant.

IBM - abbreviation for International Business Machine.

Live Table - tabulation of populations according to age groups generally containing four or more columns such as: (1) age; (2) number living; (3) number dying and (4) rate of mortality.

Master Permittee - any banding permit holder who has had a sub-permit issued to one or more banding assistants.

Mortality Rate - in life table studies, the number of individuals in a population dying in a given age interval divided by the number alive at the start of that age interval. (In this study expressed as a percentage figure).

Recovery - the retaking of a banded bird by any means at anytime following banding; generally implies that the bird is dead; may be local or distant.

Local Recovery - taken within fifty miles of banding site.

Distant Recovery - taken at a distance greater than fifty miles of banding site.

Direct Recovery - a banded bird taken during the same migration period in which it was banded. Thus direct recoveries for the fall migration period would be from birds banded during the breeding season (June 1 to Aug. 31) or the fall migration (Sept. 1 to Dec. 31) and recovered before the next spring migration has started (Feb. 1). Direct recoveries for the spring migration period would involve birds banded on their wintering grounds (Jan. 1 to Jan. 31) or during the spring migration (Feb. 1 to May 31) and recovered before June 15.

Indirect Recovery - a banded bird taken in subsequent seasons following banding after the bird has had a chance to go through at least one intervening season of movement from the time of banding.

Repeat - the recapture of a bird previously banded less than 90 days since the last prior capture in the same area (5 mile radius).

Return - the recapture of a bird previously banded at the same location after an interval of 90 days since the last previous capture or recapture.

Schedule - a U.S. Fish and Wildlife Service form (3-860) used by banders to report new bandings.

Sex Ratio - proportion of males to females, in this study expressed as the number of males per 100 females.