



Elk migration patterns, and some of the factors affecting movements in the Gallatin River drainage,
Montana
by Arthur R Brazda

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Abstract:

The marking of elk calves with plastic ear markers, initiated in 1949 and 1950, was continued in 1951 in the Gallatin River Drainage, Montana. Ninety-three were marked in 1951, making a total of 225 for the 3 years. Sight and kill records of marked individuals provided the basis for a study of elk migration patterns. Observations of marked calves on the calving grounds (upper winter range), showed no movement away from this area until the close of the calving season. Observations of marked calves from June 27 to July 31 indicated movements to generally higher elevations as the season progressed. Sight records of marked calves during August showed no movement beyond that for July. Observations of marked calves indicated summer range on both sides of the river: head of the Gallatin River and the Bacon Rind Creek-Migration Creek areas. The pattern of sight records suggested 5 possible migration routes during the upward movement of the elk. Fall movements, represented by hunter kills, suggested 3 possible routes in their downward movements. Thirty-four winter records suggested that the elk reached the limits of their downward movement by December. Data further suggested that the lower limits of the winter range were the Buffalohorn Creek-Porcupine Creek area and the Taylor Fork-Meadow Creek area. The upper limit may have extended to the mouth of Bacon Rind Creek, but was probably centered near the Gallatin Ranger Station. Thirty-one sight records indicated considerable intermingling of east and west side (Gallatin River) animals during the winter. Movements of individual elk substantiated the migration routes implied by the pattern of sight records. Observations of 4 marked calves suggested restricted movement on the winter range. Observations and kill records indicated that some elk return to the same winter and summer range year after year. Sight records of Yellowstone and Gallatin marked animals on the same summer range showed considerable intermingling during the summer. Positive evidence was indicated by 3 marked animals on winter range. Plastic marker returns pointed out that best results were obtained when heavy, durable material was used. Some markers were retained in perfect condition for 18 months. A study of tabanid populations, for certain localities on the summer range, suggested an inverse relationship between tabanid numbers and elk numbers. A study of the development of the vegetation indicated that the large numbers of elk did not arrive on the summer ranges until the majority of the vegetation was well developed. Parturition may have been an important factor governing the upward movement of the cows. Snowcover was apparently not a factor in retarding the upward movement during the spring of 1951.

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ELK MIGRATION PATTERNS, AND SOME OF THE FACTORS AFFECTING
MOVEMENTS IN THE GALLATIN RIVER DRAINAGE, MONTANA

by

ARTHUR R. BRAZDA

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ABSTRACT

The marking of elk calves with plastic ear markers, initiated in 1949 and 1950, was continued in 1951 in the Gallatin River Drainage, Montana. Ninety-three were marked in 1951, making a total of 225 for the 3 years. Sight and kill records of marked individuals provided the basis for a study of elk migration patterns. Observations of marked calves on the calving grounds (upper winter range), showed no movement away from this area until the close of the calving season. Observations of marked calves from June 27 to July 31, indicated movements to generally higher elevations as the season progressed. Sight records of marked calves during August showed no movement beyond that for July. Observations of marked calves indicated summer range on both sides of the river: head of the Gallatin River and the Bacon Rind Creek-Migration Creek areas. The pattern of sight records suggested 5 possible migration routes during the upward movement of the elk. Fall movements, represented by hunter kills, suggested 3 possible routes in their downward movements. Thirty-four winter records suggested that the elk reached the limits of their downward movement by December. Data further suggested that the lower limits of the winter range were the Buffalohorn Creek-Porcupine Creek area and the Taylor Fork-Meadow Creek area. The upper limit may have extended to the mouth of Bacon Rind Creek, but was probably centered near the Gallatin Ranger Station. Thirty-one sight records indicated considerable intermingling of east and west side (Gallatin River) animals during the winter. Movements of individual elk substantiated the migration routes implied by the pattern of sight records. Observations of 4 marked calves suggested restricted movement on the winter range. Observations and kill records indicated that some elk return to the same winter and summer range year after year. Sight records of Yellowstone and Gallatin marked animals on the same summer range showed considerable intermingling during the summer. Positive evidence was indicated by 3 marked animals on winter range. Plastic marker returns pointed out that best results were obtained when heavy, durable material was used. Some markers were retained in perfect condition for 18 months. A study of tabanid populations, for certain localities on the summer range, suggested an inverse relationship between tabanid numbers and elk numbers. A study of the development of the vegetation indicated that the large numbers of elk did not arrive on the summer ranges until the majority of the vegetation was well developed. Parturition may have been an important factor governing the upward movement of the cows. Snowcover was apparently not a factor in retarding the upward movement during the spring of 1951.

INTRODUCTION

A system for tagging elk calves with plastic markers was initiated in the Gallatin Drainage, Montana in 1949 and continued in 1950 and 1951. Johnson (1951) reported the use of these markers for 1949 and 1950 in his paper on the elk calf. The writer worked with Johnson in 1950 and continued the project in 1951, when 93 calves were marked. The same shaped symbols were used. The color combination designating 1951 was red and yellow. Thus 225 calves were marked in the 3 years. Johnson (op. cit.) has pointed out the value of these markers for migration studies, so far as durability and visibility are concerned, but his data were too few to indicate the migration routes although he did suggest the general pattern of elk migrations. Since then, many more sight and kill records of elk marked as calves have accumulated. The present paper is an attempt to evaluate these records on the basis of movement, and to show the migration routes of the Gallatin River drainage elk herd. In addition, the writer gathered information on some factors which possibly affect elk movements. Methods are described in the text. For a description of the study area see Johnson (op. cit.).

Authorization of the project and provision of the financial support and equipment, by the Montana Fish and Game Department was appreciated. Thanks are extended to J. E. Gaab, Montana Fish and Game Department, for permission to use checking station records and the sight records of Norman Wortman made during the winter of 1950-51; to D. E. Johnson for the use of his 1949 and 1950 records; to Norman Wortman and J. W. Lentfer for aid in the field. Further acknowledgements are made to Dr. C. B.

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PATTERNS OF ELK MIGRATIONS

Movement During The Calving Period

According to Johnson (1951), the extremes of the calving periods for 1949 and 1950 were May 21 and June 12. Observations during 1951 indicated extremes of May 17 and June 15.

Observations of marked calves during the calving seasons for these years indicated no movement away from the calving grounds during this period (Table I). Only 3, of 31 positively identified, had moved from the drainage where they were marked. In all instances, the movements were less than a mile and to an interlocking drainage on the calving ground. Two moved into the head of Daly Creek; 1 from the north side of the head of Black Butte Creek, the other from the south side of upper Tepee Creek. One moved from Daly Creek to Sawmill Gulch (Figure 1). Nineteen marked on Daly Creek, 7 marked on Fan Creek, and 2 marked on Sawmill Gulch were observed in the drainage where marked. The identity of 20 marked calves seen in Daly Creek drainage was not established. In light of the behavior of the identified calves, it is probable that a high proportion of these were Daly marked.

These data suggest that the calves remain on the calving grounds

until the close of the calving season and in most instances movement is restricted to a single drainage.

TABLE I

Observations of marked calves during the calving periods of 1949, 1950, and 1951. Localities:-DC, Daly Creek; FC, Fan Creek; SG, Sawmill Gulch; BBC, Black Butte Creek; TC, Tepee Creek.

No.	Dates Marked	Locality	Dates Observed	Locality	Movements .5 Airline Miles
1949					
3	5/29-6/3	DC	6/2-6/7	DC	1 (.125 - 2)
2	6/1-6/8	FC	6/8-6/12	FC	1 (.5 - 1.75)
1950					
2	6/3-6/10	SG	6/10-6/16	SG	.5 (.5 - .75)
2	5/27-6/9	DC	5/31-6/11	DC	1.5 (.25 - 2.5)
1951					
10	5/23-6/9	DC	6/4-6/20	DC	1 (0 - 2.5)
5	6/7-6/15	FC	6/14-6/18	FC	.5 (0 - 2)
1	6/3	BBC	6/4	DC	1
1	6/8	TC	6/9	DC	1
1	6/3	DC	6/14	SG	1
20	5/23-6/9	DC	5/31-6/20	DC	1.25 (0 - 2.5)

Summer Movements

Observations of marked calves during the period June 27 to July 31 are shown in Table II. Only 1 of 19 was seen in the drainage where marked, and it was seen on June 28. Four others seen during June, after calving season, had moved away from the drainage where tagged, but only for short distances (2.5 to 3.5 miles). From July 1 to July 15 observations of 5 marked calves showed an average movement of about 11.4 airline miles (8-18). Seven observations, July 16-31, showed an average movement of about 14.8 airline miles (6.5-18). Movements were generally to higher elevations as the season progressed.

Observations of marked calves during August indicated no movement

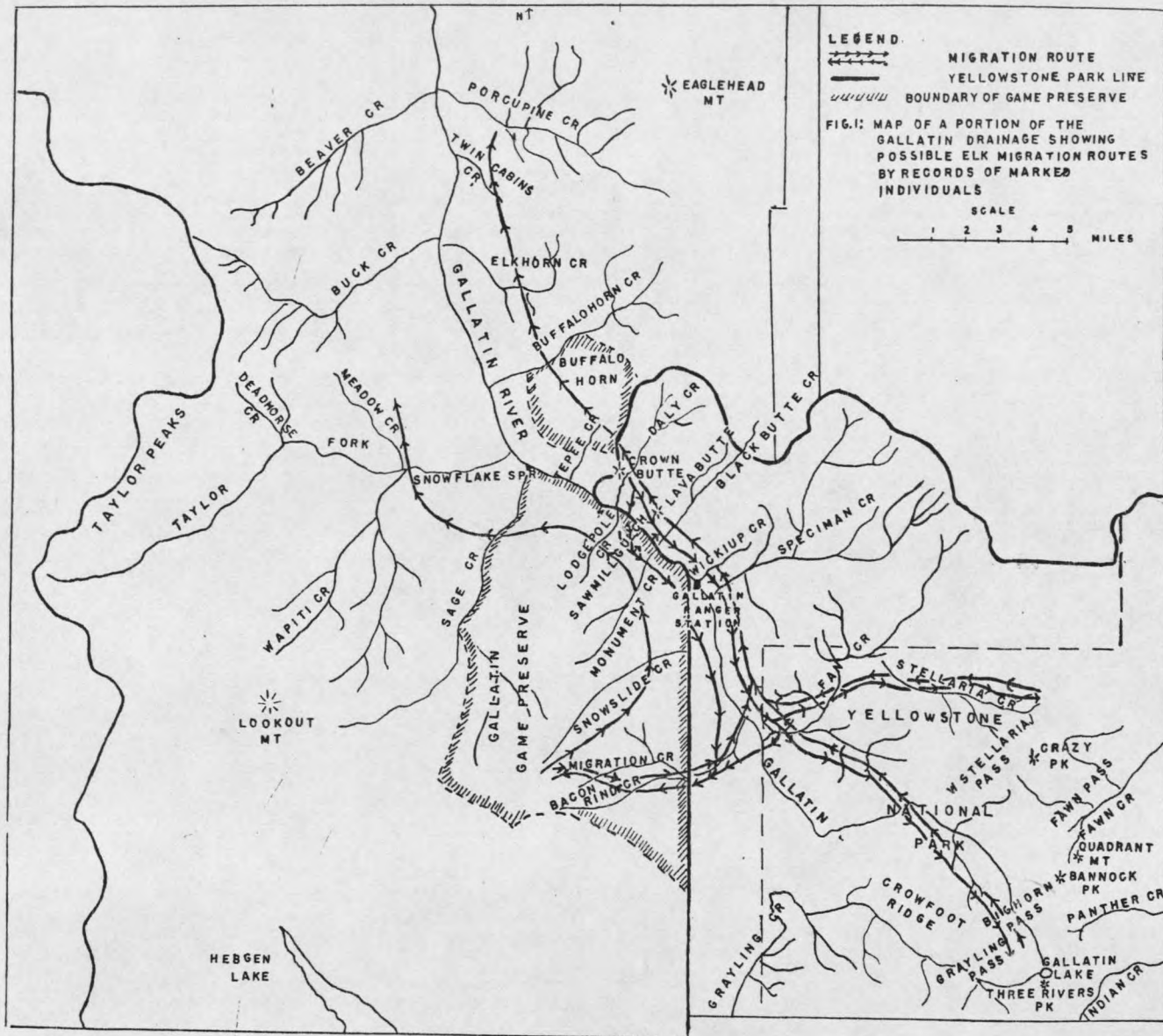


TABLE II

Observations of marked calves from June 27 through July for 1949, 1950, and 1951: Localities:- FC, Fan Creek; UGR, Upper Gallatin River; DC, Daly Creek; SG, Sawmill Gulch; GD, Gallatin Drainage; FP, Fawn Pass; BRC, Bacon Rind Creek; HGR, Head of Gallatin River; WSP, West Stellaria Pass; MC, Migration Creek; GP, Grayling Pass.

No.	Dates Marked	Locality	Dates Observed	Locality	Movement .5 Airline Miles
1949					
2	6/12	FC	6/28	UGR	2.5 (2 - 3)
1	6/12	FC	6/28	FP	2.5
1	6/4	UGR	7/26	BRC	8
1950					
1	6/2	DC	6/28	DC	2.5
2	6/9-6/11	DC	7/11	FC	11 (10 - 12)
1	6/1	DC	7/15	BRC	9
1	6/3	SG	7/15	BRC	8
1	5/21-6/11	DC	7/26	HGR	17
1951					
1	6/10	FC	6/27	WSP	3.5
1	5/22-6/20	GD	6/28	UGR	----
1	6/7	FC	7/18	MC	6.5
1*	6/2/50	DC	7/26	HGR	18
1	6/3	DC	7/13	HGR	18
3	6/3-6/9	DC	7/26	HGR	18 (18)
1	5/22-6/20	GD	7/31	GP	----

* observed as yearling

beyond that for July (Table III), suggesting that the animals reached the limit of their migration during the latter month. Eight of 10 were seen in drainages where marked calves had been seen in July. Two, seen at the head of Stellaria Creek, represent first observations, but observations were made in the same general area at the head of the Gallatin River and on West Stellaria Pass during June and July.

Sight records of marked calves indicate summer range on both sides of the Gallatin River (vicinity of the head of the Gallatin River, Bacon Rind Creek-Migration Creek areas). Records show that calves marked on the east side of the Gallatin River may or may not summer on the same side. Of 21 seen on summer range, or enroute from the calving grounds to summer range, 15 had not crossed over and 6 had gone into the Bacon Rind Creek-Migration Creek area.

Only two sight records of calves marked on the west side of the river were obtained. Both remained on the west side, moving from Sawmill Gulch to the Bacon Rind Creek-Migration Creek area.

The pattern of the sight records provides some basis for speculating on migration routes:

Twelve Daly Creek marked calves were seen as follows: 1, Daly Creek, June 28; 2, Fan Creek, July 11; 6, head of Gallatin River, July 13-26; 1, head of Stellaria Creek, August 2; 1, Migration Creek, August 8; 1, Bacon Rind Creek, July 15. The first 10 listed possibly suggest a migration route as follows: Daly Creek through Fan Creek to the head of the Gallatin River and vicinity. The other two do not fit into this pattern since they were seen across the Gallatin River in the Bacon Rind Creek-

TABLE III

Observations of marked calves during August for 1949, 1950, 1951.

Localities:- UGR, Upper Gallatin River; DC, Daly Creek, SG, Sawmill Gulch; LC, Lodgepole Creek; U, unknown; GD, Gallatin Drainage; FC, Fan Creek; BBC, Black Butte Creek; HGR, Head of Gallatin River; MC, Migration Creek; HSC, Head of Stellaria Creek.

No.	Dates Marked	Locality	Dates Observed	Locality	Movement .5 Airline Miles
1949					
1	6/4	UGR	8/5	HGR	5.5
1950					
1	5/21-6/12	DC	8/8	MC	8
1	5/21-6/12	SG or LC	8/8	MC	7.5
1	5/21-6/12	U	8/8	MC	12 approx.
1951					
1	6/8	DC	8/2	HSC	13.5
1	5/22-6/20	GD	8/2	HSC	-----
1*	6/15/50	FC	8/16	MC	5.5
1	5/22-6/12	GD	8/16	MC	-----
1	6/4	BBC	8/16	MC	6.5
1	5/22-6/20	GD	8/16	MC	-----

* Observed as yearling

Migration Creek area.

Six Fan Creek marked calves were seen as follows: 2, upper Gallatin River, June 28; 1, Fawn Pass, June 28; 1, West Stellaria Pass, June 27; 2, Migration Creek, July 18-August 16. The two upper Gallatin River observations strengthen the possibility of a migration route through Fan Creek drainage to the head of the Gallatin River, as suggested by observations of 10 Daly Creek marked calves. The Fawn Pass and West Stellaria Pass observations could very logically be interpreted as adding further evidence in support of this possible migration route because of their proximity to the head of the Gallatin River (Figure 1). The other 2 Fan

Creek calves, like 2 of the Daly Creek calves, were seen across the Gallatin River in the Bacon Rind Creek-Migration Creek area. This gives a clue as to the route followed by the Daly Creek calves in reaching the Bacon Rind Creek-Migration Creek areas. The suggested route is Daly Creek through Fan Creek to the Bacon Rind Creek-Migration Creek area.

Two upper Gallatin River marked calves were seen as follows: 1, Bacon Rind Creek, July 26; 1, head of Gallatin River, August 5. The first strengthens the possibility of movement across the Gallatin River to the Bacon Rind Creek-Migration Creek area from upper Fan Creek and vicinity. The second falls into the Daly Creek-Fan Creek-head of the Gallatin River pattern.

Two Sawmill Gulch marked calves were seen as follows: 1, Bacon Rind Creek, July 15; 1, Migration Creek, August 8. These calves could most directly reach the Bacon Rind Creek-Migration Creek area by remaining on the west side of the Gallatin River. However, there was nothing to prevent them from crossing the river into Daly Creek and moving into this area by way of Fan Creek. It follows that Daly Creek calves could cross to Sawmill Gulch and take the direct route to the Bacon Rind Creek-Migration Creek area. One example is available to substantiate this: a calf marked June 3 on Daly Creek was seen in Sawmill Gulch on June 14.

One Black Butte Creek marked calf was seen on Migration Creek August 16. This calf could presumably take one or the other routes intimated for Daly Creek calves.

Six calves, whose marking locality is unknown, were seen as follows: 1, upper Gallatin River, June 28; 1, Grayling Pass, July 31; 3, Migration

Creek, August 8-16; 1, head of Stellaria Creek, August 2.

The suggested migration routes are shown on Figure 1.

Fall Movements

No effort was made to obtain sight records in September, 1949 and 1950. Attempts in September, 1951 were unsuccessful. The location of marked animals when killed by hunters during October and November for 1950 and 1951 are shown in Table IV.

Marked calves were killed as follows: 21, Buffalohorn Creek-Porcupine Creek area; 6, Taylor Fork-Meadow Creek area; 4, Tepee Creek; 1, Sage Creek; 1, Daly Creek; 1, Indian Creek (Madison drainage); 1, Buck Creek; and 1 unknown.

These elk were killed in the same general areas or below the areas where they were marked as calves. The appearance of marked calves in these lower-areas further indicates a considerable down country fall movement of Gallatin elk, as evidenced by sight records of marked calves in the head of the Gallatin River and Bacon Rind Creek-Migration Creek areas during July and August.

Of 29 calves marked on the east side of the Gallatin River, 24 were killed on the east side and 5 on the west side. Of 6 marked on the west side, 4 were killed on the west side and 2 on the east side. The drainage where tagged and the area of kill for the 35 animals are given below. Seventeen Daly Creek marked calves were killed as follows: 12 Buffalohorn Creek-Porcupine Creek area, 2 Tepee Creek, 1 Sage Creek, 1 Taylor Fork-Meadow Creek area, and 1 unknown; 6 Fan Creek calves: 4 Buffalohorn Creek-Porcupine Creek area, 1 Taylor Fork-Meadow Creek area, 1 Buck

TABLE IV.

Locality of hunter kills of marked calves from October 15 to November 30 for 1950, 1951. Localities:-FC, Fan Creek; LC, Lodgepole Creek; DC, Daly Creek; MC, Meadow Creek; BC, Buffalohorn Creek, BBC, Black Butte Creek; TC, Tepee Creek; UGR, Upper Gallatin River; DHC, Dead Horse Creek; SG, Sawmill Gulch; BuC, Buck Creek; SC, Sage Creek; U, Unknown; TFC, Taylor Fork Creek; EC, Elkorn Creek; ICM, Indian Creek, Madison; PC, Porcupine Creek, TCC, Twin Cabin Creek.

No.	Dates Marked	Locality	Dates Observed	Locality	Movement .5 Airline Miles
1950					
1*	6/12/49	FC	11/13	BuC	18
1	6/10/50	LC	11/15	TC	1
1*	6/6/49	DC	11/17	TC	1.5
1	5/30/50	MC	11/21	MC	0
1	6/11/50	DC	11/23	SC	4
3	6/11/50	DC	11/24	BC	3.5 (3-4)
1	6/3/50	BC	11/24	BC	0
1	6/2/50	BBC	11/24	BC	6
1951					
1*	6/2/50	DC	10/15-11/9	U	----
1*	6/1/50	TC	10/27	TFC	6.5
1**	6/4/49	UGR	10/27	DC	7.5
1*	6/6/50	DC	10/28	EC	6.5
1**	5/28/49	DHC	10/29	TC	9
1*	5/30/50	MC	10/31	TFC	2.5
1*	6/7/50	FC	11/9	TFC	13.5
1*	6/4/50	MC	11/12	ICM	10
1**	6/1/49	FC	11/7	BC	13.5
1**	6/12/49	FC	11/7	PC	21
2*	6/1/50	TC	11/2-11/8	PC	8.5 (8-9)
1*	6/6/50	DC	11/6	BC	5
2	6/10/51	FC	11/1-11/9	PC	19.5 (19-20)
1	6/8/51	DC	11/5	EC	6
1	6/8/51	DC	11/7	TCC	9.5
1*	6/1/50	DC	11/5	TCC	8.5
1**	6/13/49	DC	11/8	PC	11.5
1	6/3/51	DC	11/7	PC	10.5
1*	6/1/50	DC	11/7	PC	8.5
1*	6/1/50	TC	11/1	PC	9.5
1*	6/3/50	SG	11/1	TFC	7.5
1*	5/31/50	DC	11/3	TC	2
1**	5/29/49	DC	11/6	TFC	7.5
1	6/4/51	DC	11/4	BC	5

* Yearling ** Two Years Old

Creek; 1 upper Gallatin River calf: Daly Creek; 4 Tepee Creek calves: 3 Buffalohorn Creek-Porcupine Creek area, 1 Taylor Fork-Meadow Creek area; 1 Black Butte Creek calf: Buffalohorn Creek-Porcupine Creek area; 1 Buffalohorn Creek calf: Buffalohorn Creek-Porcupine Creek area; 4 Taylor Fork-Meadow Creek calves: 2 Taylor Fork-Meadow Creek area, 1 Indian Creek (Madison drainage), 1 Tepee Creek; 1 Sawmill Gulch calf: Taylor Fork-Meadow Creek area; 1 Lodgepole Creek calf: Tepee Creek. The first 14 Daly Creek calves, the first 4 Fan Creek calves, the upper Gallatin River calf, the first 3 Tepee Creek calves, the Black Butte Creek calf, and the Buffalohorn Creek calf possibly indicate the reversal of the Daly Creek-Fan Creek-head of the Gallatin River migration pattern and/or the Daly Creek-Fan Creek-Bacon Rind Creek pattern noted during the upward movement.

The last 2 Daly Creek calves, the last 2 Fan Creek calves, 1 Tepee Creek calf, 3 Taylor Fork-Meadow Creek calves, and 1 Sawmill Gulch calf were killed on the west side of the Gallatin River. It is probable that these elk moved from the Bacon Rind Creek-Migration Creek area. Both sight records of calves marked on the west side of the river were in that area. Furthermore, there are sight records of Daly Creek and Fan Creek calves in the Bacon Rind Creek-Migration Creek areas.

One Taylor Fork-Meadow Creek calf and 1 Lodgepole Creek calf killed on Tepee Creek suggest the possibility that the elk intermingle somewhat after they reach the winter range. This possibility is substantiated in a later section. It is highly probable, however, that most of the elk were killed soon after leaving the sanctuary of the Gallatin Game Preserve or

Yellowstone Park because of intensive hunting pressure. This suggests that the majority was killed on or near their downward migration route. The possibility of elk ranging on both sides of the Gallatin River during the winter is far greater and of much less significance than in summer. In summer most elk move to higher elevations adjacent to the river, while in winter they are generally concentrated in areas much closer to the river.

Winter Movements .

Thirty three sight records and one hunter kill for December, January, February, and March of 1949, 1950, and 1951 are shown in Table V. No observations were made at lower elevations than those for October and November, suggesting that the elk reached the limits of their downward movement by December. Thirteen were recorded in areas where others had been recorded in October and November: 9, Taylor Fork-Meadow Creek area (ave. 8.3 airline miles from place marked); 4, Tepee Creek (4.8). Eighteen seen at elevations above those recorded for October and November are: 3, Gallatin Ranger Station (2); 1, Upper Gallatin River (7); 1, Wickiup Creek (1.5); 3, Black Butte Creek (1); 1, Lava Butte (1); 1, Crown Butte (2); 1, Snowslide Creek (5); 2, Monument Creek (3); Sawmill Gulch (5); 2, Snowflake Springs (7.5).

These records, plus the observations recorded in the previous section, suggest that the lower limit of the winter range, on the east side of the Gallatin River, is the Buffalohorn Creek-Porcupine Creek area; on the west side, the Taylor Fork-Meadow Creek area. It is further indicated that the upper limit may extend to the mouth of Bacon River Creek, but is probably centered near the Gallatin Ranger Station.

TABLE V.

Observations of marked elk calves during December, January, February, and March of, 1949, 1950, and 1951. Localities:- LC, Lodgepole Creek, DC, Daly Creek; FC, Fan Creek; YD, Yellowstone Drainage, U, Unknown; BBC, Black Butte Creek; DHC, Dead Horse Creek; MC, Meadow Creek; SG, Sawmill Gulch, MoC, Monument Creek; MHS, Mammoth Hot Springs; SS, Snowflake Springs; TC, Tepee Creek; MBRC, Mouth of Bacon Rind Creek; WC, Wickiup Creek; GRS, Gallatin Ranger Station; TFC, Taylor Fork Creek, SC; Snowslide Creek; LB, Lava Butte; CB, Crown Butte.

No.	Dates Marked	Locality	Dates Observed	Locality	Movement - .5 Airline Miles
1*	6/6/49	LC	12/21/49	TFC	3.5
1950					
1	6/3/49	DC	1/12	MoC	4.5
1**	6/12/49	FC	1/19	MHS	18
1	6/6/50	DC	12/9	TC	2
1	6/16/50	LC	12/12	BBC	2
1**	/50	YD	12/12	DC	---
1	6/14/50	FC	12/14	SS	11
1	5/30/50	MC	12/14	SS	4.5
1	5/24/50	FC	12/14	SG	8.5
1	6/14/50	FC	12/27	DHC	19
1	- /50	U	12/14	SG	---
1	5/24/50	BBC	12/14	BBC	0
1	6/4/50	DHC	12/22	TC	9.5
1	5/25/50	MC	12/22	TC	6.5
1	6/9/50	DC	12/29	MBRC	7
1951					
1	5/24/50	BBC	1/4	WC	1.5
2	5/24/50	BBC	1/26-3/15	GRS	1.5 (1.5)
1	6/4/50	MC	1/3	TFC	2
1	6/2/50	DC	1/3	TFC	7.5
1	6/6/50	DC	1/16	SG	1.5
1	6/10/50	SG	1/26	SC	5
1	6/9/50	DC	1/29	LB	1
2	6/14/50	FC	2/20-3/6	TFC	13 (12-14)
1	5/24/50	BBC	2/6	LB	1
1	5/24/50	BBC	2/22	CB	2
1	6/10/50	SG	2/6	BBC	1.5
1	6/10/50	SG	2/9	MoC	1.5
1	6/9/50	DC	2/9	GRS	3
1	6/9/50	DC	2/6	TFC	3.5
1	6/11/50	DC	2/14	TC	1.5
1	6/1/50	DC	2/26	MC	7.5
1	6/3/50	SG	2/26	TFC	6.5

* Hunter Kill. ** Changed Drainage

Of 21 sight records, representing 12 calves marked on the east side of the Gallatin River, 10 were recorded on the east side and 11 on the west side. Of 10 records, representing 8 calves marked on the west side, 6 were observed on the west side and 4 on the east side. These data suggest that there is more intermingling of east and west side (Gallatin River) marked calves during the winter than at any other season. The probable reason for this is intimated earlier in the paper. It further suggests that east or west side marked calves are not restricted to one side of the river on their winter range.

Three sight records have no bearing on this section; the marking locality of one was unknown, two involved animals that changed drainages (discussed in a later section).

Movements of Individual Elk

Elk seen more than once after marking, supply some basis for evaluating the migration routes indicated by the pattern of sight records (Table VI).

Calf 24, marked 6/12/49 on Fan Creek, was observed 6/28/49 on Fawn Pass (Gallatin River side) and was killed 11/7/51 on Porcupine Creek. Calf 74, marked 6/8/51 on Daly Creek, was seen 8/2/51 at the head of Stellaria Creek and was killed 11/5/51 on Elkhorn Creek. These calves fit into the migration route: Daly Creek through Fan Creek to the vicinity of the head of the Gallatin River and return.

Calf 83, marked 6/1/50 on Daly Creek, was seen 7/15/50 on Bacon Rind Creek and 2/26/51 at Meadow Lake on Taylor Fork. This seemingly verifies the possibility that some of the Daly Creek elk, summering in the Bacon

TABLE VI

Marked individuals recorded more than once during 1949, 1950, and 1951.

Localities:- FC, Fan Creek; DC, Daly Creek; BBC, Black Butte Creek; SG, Sawmill Gulch; MC, Meadow Creek; FP, Fawn Pass, PC, Porcupine Creek; BRC, Bacon Rind Creek; TFC, Taylor Fork Creek; SS, Snowflake Springs; DHC, Dead Horse Creek; WC, Wickiup Creek, GRS, Gallatin Ranger Station; LB, Lava Butte; CB, Crown Butte; BC, Buffalohorn Creek; SC, Snowslide Creek; MoC, Monument Creek; HGR, Head of Gallatin River; SSC, Head of Stellaria Creek; TC, Tepee Creek.

No.	Date Marked	Locality	Date Observed	Locality	Movement - .5 Airline Miles
1949					
24*	6/12/49	FC	6/28/49	FP	2.5
			11/7/51 -	PC	21
1950					
83	6/1/50	DC	7/15/50	BRC	9
			2/26/51	TFC	7.5
171*	6/6/50	DC	12/9/50	TC	2
			10/28/51 -	EC	7.5
154*	5/30/50	MC	12/22/50	SS	4.5
			10/31/51 -	TFC	1.5
118	6/14/50	FC	12/14/50	SS	11
			12/27/50	DHS	19
			2/20/51	TFC	13.5
			3/6/51	TFC	12
82	5/24/50	BBC	12/14/50	BBC	0
			1/4/51	WC	1.5
			1/26/51	GRS	1.5
			2/6/51	LB	1
			2/22/51	CB	2
			3/15/51	GRS	1.5
1951					
169*	6/6/50	DC	1/16/51	SG	1.5
			11/6/51	BC	5
135	6/10/50	SG	1/26/51	SC	5
			2/6/51	BBC	1.5
			2/9/51	MoC	1.5
131	6/9/50	DC	1/29/51	LB	1
			2/9/51	GRS	3
32	6/3/51	DC	7/13/51	HGR	18
			7/26/51	HGR	18
74*	6/8/51	DC	8/2/51	HSC	13.5
			11/5/51 -	EC	6
141*	6/3/50	SG	2/26/51	TFC	6.5
			11/1/51	TFC	5.5

* Hunter Kill

Rind Creek-Migration Creek area, stay on the west side of the Gallatin River in their downward movement as suggested earlier. The possibility of these elk moving to the latter locality after reaching the winter range cannot be overlooked. Winter movements of calves subsequently discussed, however, seem to somewhat discredit the possibility of such a movement.

Four calves were seen as follows: calf 82, marked 5/24/50 on Black Butte Creek was seen 12/14/50 on Black Butte Creek (0 ave. airline miles from drainage marked), 1/4/51 Wickiup Creek (1.5), 1/26/51 Gallatin Ranger Station (1.5), 2/6/51 Lava Butte (1), 2/22/51 Crown Butte (2), 3/15/51 Gallatin Ranger Station (1.5); calf 118, marked 6/14/50 on Fan Creek - 12/14/50 Snowflake Springs (11), 12/27/50 head of Deadhorse Creek (19), 2/20/51 Taylor Fork (13.5), 3/6/51 Taylor Fork; calf 131, marked 6/9/50 on Daly Creek - 1/29/51 Lava Butte (1), 2/9/51 Gallatin Ranger Station (3); calf 135, marked 6/10/50 on Sawmill Gulch - 1/26/51 Snowslide Creek (5), 2/6/51 Black Butte Creek, 2/9/51 Mouth of Monument Creek. The greatest radius of movement in airline miles for each was: calf 82 (2); 118 (4.25); 131 (1.12); 135 (1.75). These data seem to indicate that movement of elk on their winter range is restricted, although they may or may not cross the Gallatin River.

The possibility that elk return to the same winter range year after year is suggested by animals 24, 169, 171, 141, and 154. The first was killed as a two year old, the other 4 as yearlings. Data are as follows: calf 24, marked 6/12/49 on Fan Creek was observed 6/28/49 on Fawn Pass, 11/7/51 Porcupine Creek; calf 169, marked 6/6/50 on Daly Creek - 1/16/51

