

5K
367
FS45
1959

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Arnie J. Suomela, Commissioner

1958 FIELD INVESTIGATIONS
DENALI AND VEE CANYON DAM SITES AND RESERVOIR AREAS
SUSITNA RIVER BASIN

STATE OF ALASKA

Juneau, Alaska
June 1959
For Administrative Use Only

TABLE OF CONTENTS

	Page
BACKGROUND	1
OPERATIONS AND METHODS	6
FINDINGS, DENALI AREA	
Description and Range	8
Big Game	10
Small Game	16
Fur Bearers	16
Waterfowl	17
Stream Surveys and Fisheries	19
FINDINGS, VEE CANYON AREA	
Description and Range	24
Big Game	26
Small Game	27
Fur Bearers	27
Waterfowl	28
Stream Surveys and Fisheries	29
CONCLUSION	34
LITERATURE CITED	37

BACKGROUND

1. The coming era is regarded by many as one of population expansion and industrial growth for Alaska with an attendant demand for increased and cheaper electrical power. Development of the hydroelectric potential of the Susitna Basin, located between the population centers of Anchorage and Fairbanks, appears to be one of the most feasible means of meeting the anticipated power demands in this area (Fig. 1). The Susitna River, glacial in origin, and 275 miles long, drains a relatively uninhabited area of about 19,300 square miles. This river flows generally to the southwest between the Alaska Range lying to the north and west, and the Talkeetna Mountains lying to the southeast. The Alaska Railroad, running north and south through the middle of the Basin, and the Denali Highway cutting the northern fringe, are the main facilities developed for ground travel.

2. The Bureau of Reclamation (1952) has described 19 potential dam sites for ultimate power development of the Susitna River Basin. Three preliminary Fish and Wildlife Service reports dealing with basin-wide aspects of the fish and game resources were issued in response to this Bureau of Reclamation report. The first dam to be constructed would be at Devil Canyon at river mile 134. Results of Fish and Wildlife Service investigations to determine effects of a dam at Devil Canyon on fish and wildlife were presented in progress reports issued in 1957 and 1959. Investigations are being



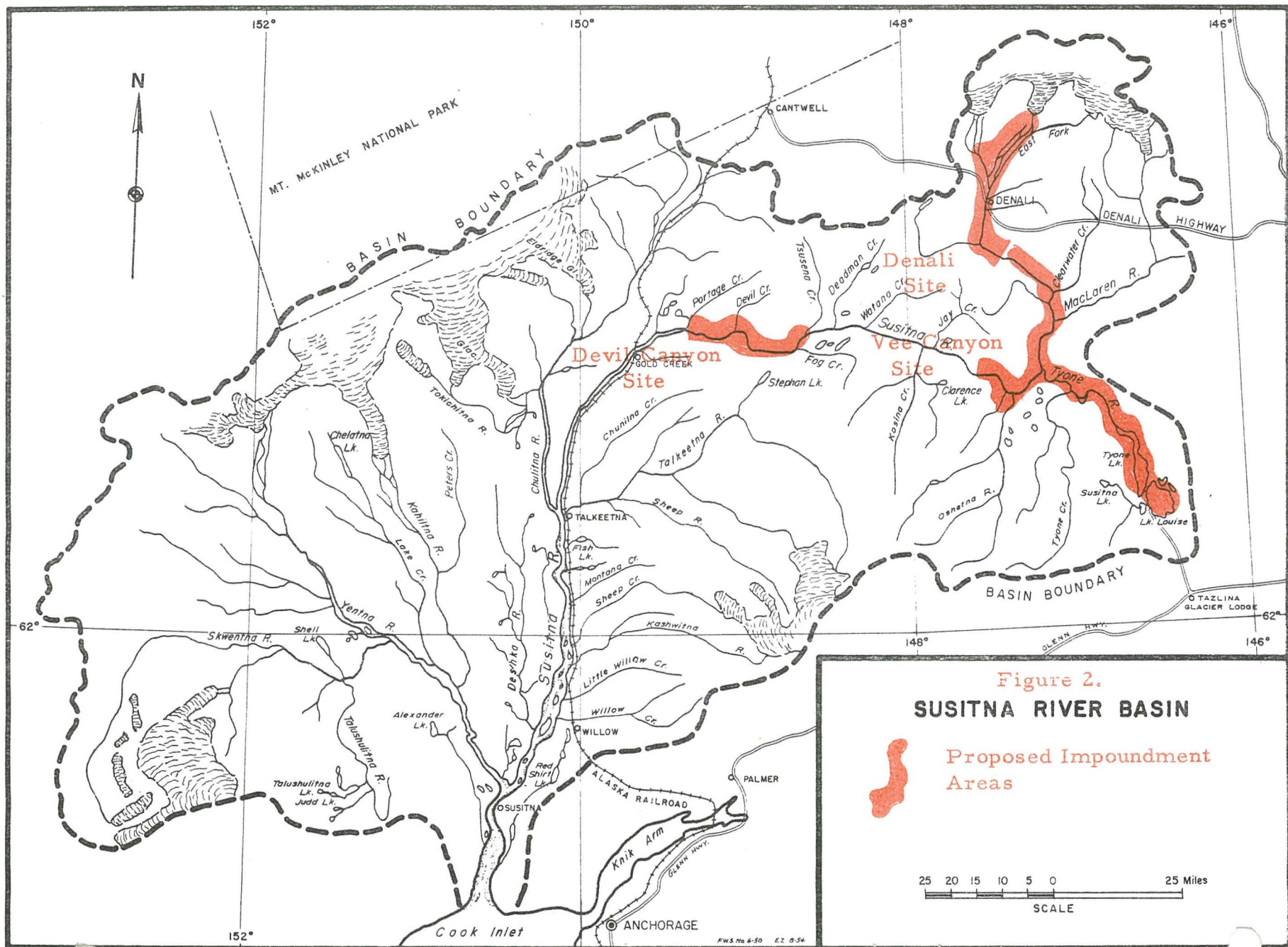
continued to determine downstream effects on fish and game of an impoundment at Devil Canyon.

3. A second dam in the Bureau of Reclamation's plan of ultimate development for the Basin would be located at the Denali site on the upper section of the river at mile 245 (Figs. 2 and 3). This unit would function as a storage reservoir to provide regulated water releases for power generation at Devil Canyon.

4. The earth dam planned for Denali would be 205 feet high and would have a crest length of 1,900 feet. The reservoir would be 2 to 6 miles wide, 29 miles long, and would extend almost to the headwater glaciers if the maximum reservoir capacity of 6,700,000 acre-feet were developed. This would inundate approximately 120 square miles. Inasmuch as the reservoir would be intended primarily for storage, it is probable that no power plant would be installed.

5. A third dam, Vee Canyon, at river mile 200 would be a concrete, arch-gravity structure with a height of 425 feet and crest-length of 1,400 feet. The most recent figures obtained from the Bureau of Reclamation list 2,400 feet as the probable maximum reservoir elevation. This would inundate between 95 and 100 square miles, backing water up the main stem of the Susitna River a distance of 50 miles to the headwaters of the Tyone system at Lake Louise. With ultimate development of the Susitna Basin, a power plant with a productive capacity of 260,000 kilowatts would be installed at Vee Canyon.

6. Studies to determine feasibility of the Denali site were started by the Bureau of Reclamation in 1958. Concurrently, the Branch of River Basin Studies began field investigations to determine what effects the



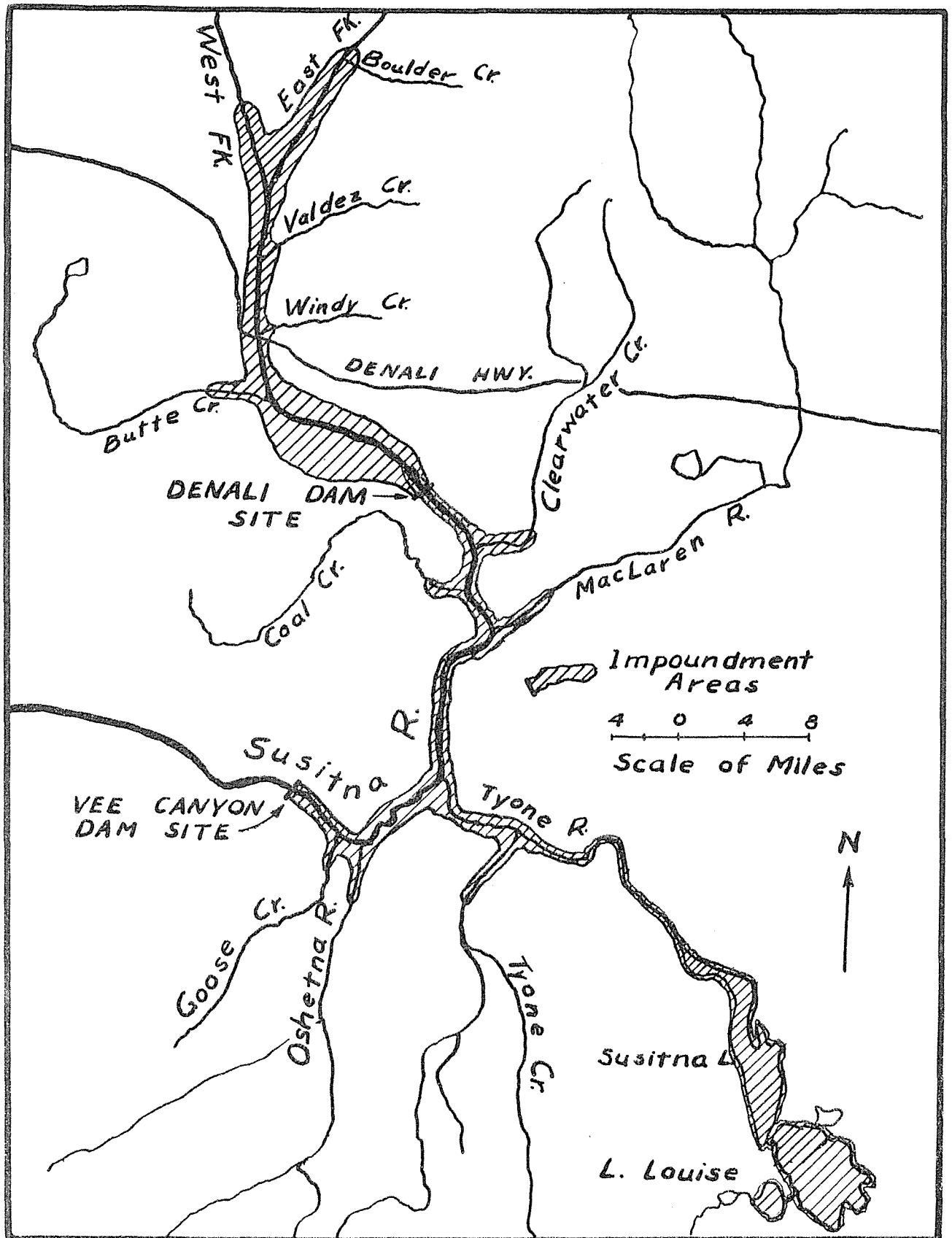


Figure 3. Susitna River, showing Denali and Vee Canyon dam sites.

proposed development would have upon the fish and wildlife resources.

Because of the proximity of the Denali and Vee Canyon sites, the Fish and Wildlife Service program was expanded to include similar determinations for the Vee Canyon impoundment.

OPERATIONS AND METHODS

7. Semi-permanent camps were established for summer field investigations at the Denali Highway crossing of the Susitna River and at the mouth of the Tyone River. River travel was accomplished with a 30-foot river boat powered with a 35-horsepower outboard motor. Areas inaccessible by boat were covered on foot by the two or three crew members who separated, sometimes for several days. The routes followed on foot were laid out so that impoundment areas could be adequately cover-typed and the larger water bodies surveyed for the presence of fish, fur bearers, and waterfowl.

8. Interviews with residents of the area gave information on trapping pressure and winter harvest of game.

9. In cooperation with the Bureau of Sport Fisheries and Wildlife, an intensive effort was made to contact hunters in and adjacent to the Denali impoundment area during the first few days of the hunting season which opened August 20. Hunters were then interviewed periodically until the end of the first moose season, September 20. Information recorded was hunter name, type of transportation, residence, camp location, kind and number of game animals desired, kind and number of game animals killed, location hunted, and location in which game was killed. In addition, each hunting party was asked for a total cost estimate of direct expenses for the trip, not including non-expendable items. A total of 282 hunters (273 resident,

9 non-resident) were interviewed. Total trip-cost estimates were obtained from 262 hunters. Additional information relative to expenditures for transportation, food, ammunition and miscellaneous items was obtained from 81 of these 262. Twenty individuals were unable to determine costs associated with their hunting.

10. Stream surveys and fish collections were made on the lower sections of most streams which would be affected by impoundment. Stream flows were computed by the floating chip method. Fish were collected by means of a $\frac{1}{4}$ -inch seine, minnow traps, and hook and line.

11. Counts of game present in the impoundment areas were obtained during aerial transects. Nine counts were made in the Denali area; three in the Vee Canyon area. Original plans were to obtain 50 percent coverage by flying transects one mile apart and recording animals in a $\frac{1}{2}$ -mile wide strip, $\frac{1}{4}$ mile on each side of the plane. Plans were changed on 2 flights to give 25 percent coverage by flying at 2-mile intervals and counting a $\frac{1}{4}$ -mile strip on each side of the plane. Spacing between transects was maintained quite consistently by flying at right angles between transects for the length of time required to travel the desired distance at the plane's particular speed. However, in open areas it was noted that animals were being recorded in locations nearly adjacent to the previous transect. Therefore, $\frac{1}{8}$ mile was added to the width of the counting strip on each side of the plane. This provided 75 percent coverage when a 1-mile interval was

maintained between transects and 37.5 percent coverage when a 2-mile interval was maintained. These percentage figures have been expanded to obtain an estimate of total numbers of animals in the impoundment areas.

FINDINGS DENALI AREA

Description and Range

12. The upper portion of the proposed Denali reservoir area extends nearly to the headwaters of the East and West Forks of the Susitna River and is confined largely to an old flood-plain. Both forks are spread out and braided. The outermost channels of the East Fork are from $1\frac{1}{2}$ to $2\frac{1}{2}$ miles apart; those of the West Fork range from a single channel to channels $1\frac{1}{2}$ miles apart. Nearly pure stands of sedge or willow, and stands of sedge and willow together are the dominant vegetative types in this upper 15-mile long section. Game animals in the past have browsed this willow lightly to moderately. Current usage appeared light.

13. About 2 miles below the junction of the East and West Forks the river and impoundment area narrow. Sedge and willow are the dominant vegetation in the river bottom. Glandular scrub birch, scattered spruce, and a heath formation composed of blueberry, low-bush cranberry, Labrador tea, and crowberry occur on the side hills. Willow showed light to moderate use (Fig. 4).



Figure 4. Upper section of Denali impoundment area looking north from Denali Highway bridge crossing of Susitna River to headwater glaciers.

14. The Susitna River is confined to a $\frac{1}{2}$ -mile wide channel for 4 miles below the Denali Highway crossing. The impoundment area is $1\frac{1}{2}$ to 2 miles wide in this section. Glandular scrub birch and heath plants are the dominant vegetation. Spruce is scattered through the area with willow and sedge prominent along water bodies.

15. Topography changes below the mouth of Butte Creek; in this area, hills do not encroach on the river as closely as in upper sections. The impoundment area reaches its greatest width, $1\frac{1}{2}$ to $4\frac{1}{2}$ miles, in this locale and contains numerous lakes, potholes, and marsh areas, separated by higher well-drained land. Sedge and willow form pure stands in

the wet, low areas and also occur together and with spruce. Spruce and scrub birch are the dominant plants. Heath plants and lichens occur as an understory throughout the better-drained sections.

16. In the lower three miles of the Denali area, the impoundment would be confined by hills to a strip $\frac{1}{4}$ to $\frac{1}{2}$ mile wide. This is an area of scrub birch with scattered spruce and willow and a heath plant understory.

Big Game

17. Indication of the numbers of big game animals utilizing the impoundment areas was obtained by means of aerial surveys. Counts of moose in the Denali impoundment area and the expanded population estimates are presented in Table 1. The northern half of the Denali impoundment area is part of the Denali Reserve, a section 80 miles long north of the Denali Highway which is closed to big game hunting.

Table 1. Moose counted in the Denali impoundment area on nine flights and expanded population estimates.

Date	Coverage	Area	Moose Counted	Expanded Population Estimate
11-20-57	75%	Reserve	55	73
		Open	2	3
		Total	57	76
1-8-58	75%	Reserve	21	28
		Open	4	5
		Total	25	33
2-12-58	75%	Reserve	44	59
		Open	7	9
		Total	51	68
3-11-58	75%	Reserve	31	41
		Open	13	17
		Total	44	59

7
91621
70

Table 1. (continued)

Date	Coverage	Area	Moose Counted	Expanded Population Estimate
4-28-58	75%	Reserve	7	9
		Open	3	4
		Total	10	13
5-2-58	75%	Reserve	26	35
		Open	17	23
		Total	43	57
7-28-58	37.5%	Reserve	17	45
		Open	22	59
		Total	39	104
10-23-58	37.5%	Reserve	16	43
		Open	15	40
		Total	31	83
12-1-58	75%	Reserve	88	117
		Open	8	11
		Total	96	128

18. Factors which might contribute to the variation in numbers of animals recorded in the period from November through April, when snow and sighting conditions were considered good, are 1) animals movement in and out of the impoundment area and 2) inconsistencies of pilot and observer in sighting moose. Snow cover was poor on the May flight. Moose were relatively easy to sight in July although there was no snow on the ground. Sighting and snow conditions were good on the October and December 1958 flights.

19. Sexual differentiation, exclusive of calves, was possible during three of the counts when visible antlers were present on the bulls. These counts and sex and calf ratios are presented in Table 2.

Table 2. Sex and age composition of moose counted in the Denali impoundment area.

Date	Section	Bulls	Cows	Calves	Bulls/ 100 cows	Calves/ 100 cows
11-20-57	Reserve	23	24	8	96	33
	Open		1	1	0	100
	Total	23	25	9	92	36
7-28-58	Reserve	7	7	3	100	43
	Open	6	9	7	67	78
	Total	13	16	10	81	63
10-23-58	Reserve	7	7	2	100	29
	Open	3	6	6	50	100
	Total	10	13	8	76	61

Ratio of bulls to cows, which is higher in the reserve than in the open area, probably reflects bull removal under a "bulls only" hunting restriction.

Number of animals observed are too few to permit comparison of calf:cow ratios in the reserve and open areas. However, from fall count ratios of the entire impoundment area, calf productivity, as defined by Rausch (1958), may be considered good in 1957 and excellent in 1958.

20. Table 3 lists counts and estimates of numbers of caribou in the Denali impoundment area based on aerial transecting. Most of the variation in caribou counts is probably due to the nomadic nature of these animals.

Table 3. Caribou counted in Denali impoundment area on nine flights and expanded population estimates.

Date	Percent Coverage	Caribou Counted	Total Estimate
November 20	75	702	936
January 8	75	3,680	4,907
February 12	75	753	1,004
March 11	75	258	344
April 4	75	175	233
May 21	75	193	257
July 28	37.5	13	35
October 23	37.5	270	720
December 1	75	195	260

21. Hunting season began August 20 for moose, caribou, and black bear and September 1 for grizzly bear. The most intensive hunting pressure occurred along the Denali Highway, the only portion of the proposed impoundment area which could be reached by automobile. Of the 282 hunters interviewed in or adjacent to the Denali impoundment area, 243 (86%) were hunting moose and 266 (95%) of the same 282 hunters desired caribou.

Table 4 presents the interview data according to number of caribou desired.

Table 4. Number of caribou desired and obtained by 282 hunters in and adjacent to the Denali impoundment area. In general, hunting trips of those interviewed were roughly one-half completed.
(Bag limit: 3)

No. of Caribou desired	No. of hunters	Caribou killed		
		one	two	three
1	83 (30%)	24		
2	65 (24%)	24	8	
3	105 (39%)	19	14	17
Uncertain	7 (3%)			

22. At the time of the interviews, 16 moose had been killed, resulting in a success ratio of 3.7 percent. A total of 110 hunters had killed at least 1 caribou at the time of the interview; these figures yield a success ratio of 41 percent. Data for both moose and caribou, including success ratios presented here, were obtained in field interviews after approximately one-half the hunting effort of those interviewed had been expended. Total harvest figures and success ratios would have been higher had hunters been contacted at the conclusion rather than the middle of their hunt.

23. Less than 1 percent of those persons interviewed were specifically hunting bear but 27 percent said they would take a black bear and 9 percent said they would take a grizzly bear should they have the chance while hunting moose and caribou.

24. Days spent hunting, excluding figures from the few who did not know how long they would hunt, ranged from 1 to 30. Average length of hunting trip was 5 days. The length of hunting trips most frequent in the interview data (22 percent) was 2 days.

25. A cost estimate for the particular trip to the Susitna area was obtained from 262 of the 273 resident hunters interviewed. Average cost per hunter for food, transportation, ammunition, film, and miscellaneous expendable items was \$53 per trip. A breakdown of expenditures obtained from 81 hunters gave a total cost-per-hunter figure of about \$37. This smaller sample figure is less than the \$53 figure obtained for 262 hunters.

Table 5 presents this breakdown.

Table 5. Trip expenditures of hunters on foot in and adjacent to the Denali impoundment area in 1958.

	(81 hunters) Average time spent hunting--43 days.		
	Expend. / Trip	Expend. / Day	%
Transportation	\$19.78	\$4.60	53.5
Food	12.23	2.84	33.1
Lodging			
Ammunition, misc.	4.96	1.15	13.4

26. Expenditures of 8 non-resident hunters averaged \$500 apiece. Of the resident hunters interviewed, 60 percent resided in the Anchorage area, 20 percent in the Fairbanks area, and 20 percent in other localities in south-central Alaska.

27. Figures quoted thus far are for hunters who did not utilize services of weasel and swamp buggy operators along the Denali Highway either for the initial hunt or for hauling game which had been killed while hunting on foot. According to the three operators who worked fairly intensively in the Denali area, approximately 75 percent of their hunters took caribou. Cost for an unsuccessful trip was \$10 to \$25. Average price for hauling a moose was \$50; a first caribou, \$25; and additional caribou, \$10 to \$25 each.

Small Game

28. Snowshoe hare, whose numbers fluctuate periodically, are reported to inhabit the impoundment area although none were observed during the period of investigation. None of the hunters interviewed were hunting this species.

29. Likewise, game bird populations were at a low level of abundance. One spruce grouse and approximately ten broods of ptarmigan were the total numbers seen during the field season. Less than 1 percent of hunters interviewed were hunting only small game but 30 percent were interested in hunting game birds in addition to big game. Six ptarmigan taken by two hunters constituted the total harvest among hunters interviewed. No hunting pressure was observed for Wilson's snipe, present throughout the area.

Fur Bearers

30. Wolf, red fox, wolverine, beaver, muskrat, and river otter were seen in the Denali impoundment area. Wolf numbers have been reduced in recent years by bounty hunters and by the Predator Control Division of the Fish and Wildlife Service. The proposed impoundment location is in a study area where wolves are protected to obtain information on their life history and ecology. Beaver, distributed through most of the impoundment area, appear to have the greatest potential value of the fur bearing species. One or two year-round residents, who trap

occasionally for beaver near the Denali Highway crossing of the Susitna River, now exert the only known trapping pressure in the Denali impoundment area. These people estimated that their average annual take does not exceed 20 beaver.

Waterfowl

31. The first waterfowl observations in the Denali area were made on a flight May 21 in conjunction with moose and caribou counting. At this time, about one-third of the total water area was ice-free. Approximately 450 ducks--mostly scaup--in groups of from 20 to 75 were counted. Other ducks, mostly paired, including mallards and pintails, were noted in vegetation along edges of water bodies but a complete count was not obtained.

32. Ground observations of waterfowl were recorded from June 15 through August 16 in the Denali area from the dam site to the mouth of Valdez Creek. An aerial survey on August 28 sampled the area above the junction of the East and West Forks which was not covered from the ground. Tables 6 and 7 summarize these data, which are not total numbers but are considered representative of waterfowl composition of the area. Most of the ducks observed early in the season were groups of molting males. Broods were more readily observed as the season progressed. Since pintails are among the first to migrate and those observed in the aerial survey of August 28 were in large flocks, they may not have nested in the impoundment area.

Table 6. Waterfowl recorded from the ground in the Denali impoundment area from June 15 through August 16, 1958.

Species	Adults without young	Broods		
		Adults	Young	Avg. young/brood
Swan		4	several	
Canada goose	2			
Scaup	111	22	180	8.2
Widgeon	75	4	22	5.5
Mixed scaup & widgeon	423			
Green-winged teal	28	2	4	2
Mallard	20			
Pintail	11	1	5	5
Bufflehead	7	1	6	6
Shoveller	6			
Canvasback	3			
American goldeneye	2			
White-winged scoter	31	3	19	6.3
Old squaw		1	3	3
American merganser	28			
Unidentified	225			

Table 7. Waterfowl counted from the air on the East and West Forks of the Susitna River in Denali impoundment area, August 28, 1958.

Swan	11	Shoveller	5
Pintail	263	Green-winged teal	15
Mallard	81	White-winged scoter	14
Scaup	67	American merganser	33
Widgeon	48	Unidentified	579

33. The areas of greatest waterfowl concentration were in the upper 10-mile section of the impoundment area, and on and adjacent to Goose Island, a marshy area with many lakes and potholes about 12 miles below the Denali Highway crossing of the Susitna River. Lack of food apparently

limited waterfowl use in other areas. Star duckweed and pondweed were the principal waterfowl food species in the Goose Island area.

34. Swans nesting in this area are believed to be trumpeters, inasmuch as all nesting swans and eggs which have been identified by personnel of the Fish and Wildlife Service waterfowl division south of the Alaska Range have been trumpeters. Measurements made June 12, 1958 of an egg from a clutch near the mouth of the Oshetna River and of 2 eggs from a clutch near Crosswind Lake, 13 miles east of Lake Louise definitely established these clutches as trumpeter rather than whistling swans (Hansen, 1958).

35. Residents report that sizeable numbers of a small species of Canada goose rest and feed in the impoundment area on their way south in the fall.

36. The waterfowl hunting season opened September 1; hunting pressure was negligible.

Stream Surveys and Fisheries

37. The Susitna River is glacial in origin and flows generally through flat bottom land. In the Denali impoundment area, it is characterized by many shifting channels and a silt-mud bottom. Water levels were measured daily at the Denali Highway bridge. Day to day fluctuations ranged from 0 to 8 inches, and the total range observed was 16 inches. No overall upward or downward trend was evident during the period from June 18 through August 15. Sun, which melted the glaciers, or rain,

caused the river to rise; cooler weather without rain caused the river to drop. Cold weather after August 15 caused a steady drop to the September 11 level, which was 28.5 inches lower than the highest recorded in July.

38. A continual record of air and water temperatures was obtained for the Susitna River at the Denali Highway bridge. Mean daily high and low water temperatures and range in daily fluctuations by two-week periods are tabulated in Table 8.

Table 8. Susitna River temperatures in degrees Fahrenheit at Denali Highway bridge.

Period	Mean Daily High	Mean Daily Low	Range in Daily Fluctuations
June 18 - 30	47.1	42.5	1 - 8
July 1 - 15	46.9	42.1	2 - 8
July 16 - 31	45.4	41.6	2 - 7
August 1 - 15	44.1	40.9	2 - 6
August 16 - 31	42.5	39.2	2 - 5
September 1 - 14	41.5	38.7	2 - 4

39. Few, if any, anadromous fish occur in the Susitna River system above Devil Canyon. None were found above Vee Canyon during the period of investigation. Sport fish are not sought in the silty main stem of the Susitna River. Burbot were the only fish collected in the main stem of the Susitna River in the Denali area.

40. Tributaries, portions of which would be flooded by a dam at Denali site, are described beginning with the furthest upstream and working downstream. Flows have been computed using a factor of 0.8 for these streams which all have rough bottoms.

41. Boulder Creek, flowing into the East Fork of the Susitna River, is about 13 miles long. It is glacial in origin, has clear water tributaries, and receives no fishing pressure. The lower 1/2 mile would be inundated by dam construction at Denali site. Due to the inaccessibility of Boulder Creek, the stream was surveyed from the air and no discharge measurements were made.

42. Valdez Creek, 14 miles long, enters the Susitna River from the east about 5 miles below the junction of the East and West Forks. Placer operations at the gold mining site of Denali, about 3 miles above the mouth of Valdez Creek, have silted the gravels in the lower section. The stream above is clear with many riffle areas, few pools, and a steep gradient. Bottom types are gravel and rubble. Water temperature at 3:30 p.m. on August 16 was 58°F.; corresponding air temperature was 49°F. Average velocity of a cross section in the lower 2 miles subject to inundation was 6.3 feet per second, average depth was 1 foot, and average width was 20 feet to give a flow of 101 c.f.s.

43. Mayflies, the dominant aquatic insect, were fairly numerous. One whitefish (Coregonus cylindraceus (Pallas)) was seined at the mouth

of Valdez Creek. Fishing pressure is negligible since the stream is 5 miles from the Denali Highway and may be reached only by persons on foot or using track or four-wheel drive vehicles.

44. Windy Creek, a clear stream about 14 miles long, flows into the Susitna River from the east about 1 mile above the Denali bridge. The lower 2-mile section, which would be inundated, has pool and riffle areas interspersed and a gravel-rubble bottom. Water and air temperatures at 10:30 a.m. on August 16 were 46°F. and 51°F., respectively. Based on an average depth of 0.8 feet, a cross section averaging 50 feet in width with an average velocity of 3.5 f.p.s., the stream flow in the lower section was computed to be 112 c.f.s.

45. Mayflies, caddis flies, and stone flies were the dominant aquatic insects present. Accessible from the Denali Highway by a short walk, Windy Creek probably received more fishing pressure than any other stream in the impoundment area. All of this angling was for grayling, which were readily taken and which ranged up to 16 inches in length. Fishing effort and success were noted from late June through mid-September.

46. Butte Creek, a clear-water stream about 28 miles long, drains an area of rolling hills to the west of the Susitna River. Much of Butte Creek drainage can be traversed with swamp buggies and track vehicles. A dam at Denali site would inundate the lower 7 miles of Butte Creek. Pools about 4 feet deep and 10 feet long occur about every 50 feet in this

section and are interspersed with riffle areas. Stream bottom types are gravel and rubble. A cross section taken in the proposed impoundment yielded an average velocity of 2.5 f.p.s., average depth 2.5 feet, and average width 30 feet for a calculated flow of 150 c.f.s. Water and air temperatures on August 27 at 2:00 p.m. were 47°F. and 59°F., respectively.

47. Caddis flies were abundant; stone flies, mayflies, and black flies were also present. Grayling, whitefish, and cottids were seined and grayling were observed in pools. Fishing pressure, most of which was incidental to other activities such as hunting or prospecting, was light. Access was by swamp buggy or track vehicles.

48. Raft Creek, which drains a wet, lowland area to the east of the Susitna River would have its lower 2 miles inundated by the proposed Denali dam. This stream is clear with an almost imperceptible current. Bottom material is largely organic. No fish were observed in the section which would be inundated.

49. Shallow, bog, brown-water lakes scattered throughout the Denali impoundment area apparently support fish only if connected to a stream system. Suckers and grayling were observed in several of these lakes.

50. A clear-water lake of about 200 surface acres and having a sand and rubble bottom is located about two miles south of the Denali

Highway on the west side of the Susitna River. Designated locally as Sand Lake, it supports lake trout and receives a moderate amount of fishing pressure. Anglers reach the lake by means of tundra vehicles or walking, and fish for grayling and whitefish in the outlet stream.

51. Another clear-water lake approximately the same size as Sand Lake is located in the impoundment area about ten miles south of the Denali Highway. It is nearly inaccessible except by plane.

FINDINGS VEE CANYON AREA

Description and Range

52. The Bureau of Reclamation has indicated that the Vee Canyon impoundment probably would have a maximum elevation of 2,400 feet. At this level, the reservoir would extend about $1\frac{1}{2}$ miles above the Denali site and be essentially confined to the present river bed in this uppermost area (Figs. 5 and 6).

53. Most of the Vee Canyon reservoir would be confined by side-hills to a strip $1/4$ to 2 miles wide on each side of the Susitna River and tributaries. Here the Susitna is $1/8$ to $1/4$ mile wide and flows in a narrower, deeper channel than in the Denali area. The impoundment area bordering the river has spruce and glandular scrub birch interspersed as dominants with occasional stands of aspen on the better-drained sites. Heath plants form the understory. Willow and sedge are present on wetter



Figure 5. Vee Canyon dam site looking upstream.

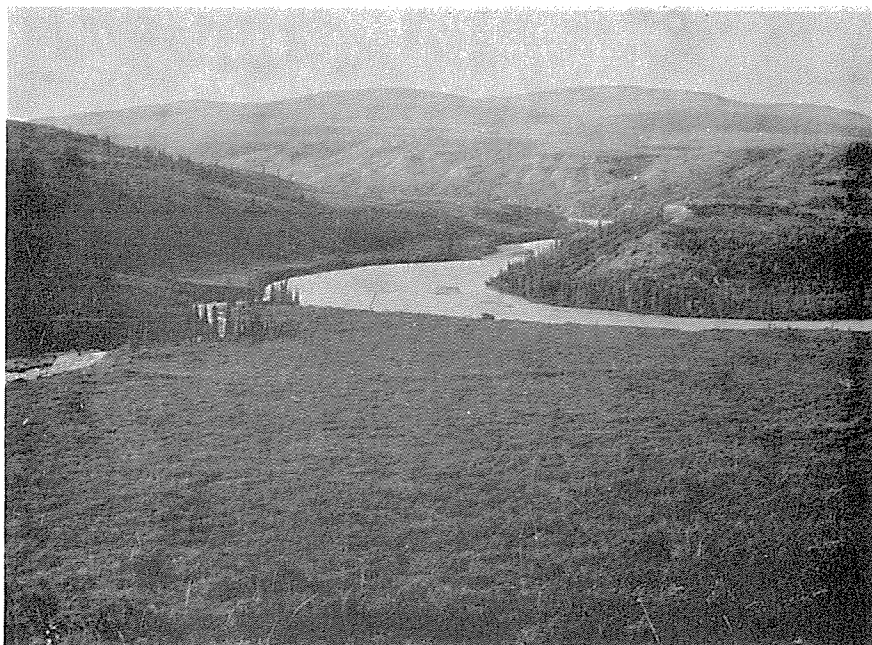


Figure 6. Vee Canyon dam site looking downstream with Goose Creek flowing in from left.

sites and bog cotton grass is an occasional dominant. Lichens present throughout the area are most numerous in the Coal Creek and MacLaren River areas but are only moderately abundant in those locales.

54. Willow in that portion of Clearwater Creek which would be impounded has been utilized in past years to the extent that some plants are dying and resprouting. Moderate use was noted on current growth at the time of survey. Scrub birch had been utilized slightly.

55. The portion of the impoundment area which extends into the Coal Creek drainage is a wet, lowland type characterized by intermingled willow, spruce, sedge, and Sphagnum bogs. Scrub birch is dense on slopes and ridges. Lichens are fairly abundant along ridges which run further back from the creek. Willow shows moderate to heavy use on past growth. Light use was noted on current growth.

56. A dam at Vee Canyon would inundate lowlands having willow, aspen, spruce, and sedge cover in the MacLaren River drainage. Willow and aspen show moderate to heavy past use with some willow having been killed out and resprouting. Current browse use was moderate. Slopes have heavy growths of scrub birch and a few spruce. Scrub birch in some areas shows moderate use on past growth. Lichens are fairly abundant.

57. The proposed impoundment will back water up the Tyone River system but it will be generally confined to present shorelines in Lake Louise, Susitna Lake, Tyone Lake and the upper Tyone River. Land

bordering the lower Tyone River and Tyone Creek which would be flooded has extensive areas of bog cotton grass and some sedge in addition to the widespread willow, spruce, scrub birch, and heath cover. Spruce are small due to a relatively recent burn. Willow shows moderate to heavy use on past growth. Light use was noted on recent growth.

58. Alders are intermingled with willow, scrub birch, heath plants, and spruce in the portion of the Oshetna drainage which would be inundated. Browsing in the past has been heavy on willow; current use had been light to moderate at the time of survey.

59. Willow and scrub birch are the dominant species in that portion of Goose Creek which would be flooded. In this area, willow showed heavy past use.

Big Game

60. Table 9 summarizes moose and caribou counts in the Vee Canyon impoundment area. The limited data suggest that moose calf production is excellent. Black and grizzly bear were present throughout the area.

Table 9. Aerial counts of moose and caribou in Vee Canyon impoundment area and expanded population estimates.

Date	Coverage	Counted	Estim. Total	Bulls	Cows	Calves	Bulls/ 100 cows	Calves/ 100 cows
<u>MOOSE:</u>								
7-29	37.5%	7	19	2	2	3	100	150
10-23	37.5%	34	91	2	20	12	10	60
12-1	75%	73	97					
<u>CARIBOU:</u>								
7-29	37.5%	1	3					
10-23	37.5%	129	344					
12-1	75%	22	29					

61. The most intensive hunting in the Vee Canyon area was centered in the upper Tyone River section. Lake Louise can be reached by road and Lake Louise and the connecting Susitna and Tyone Lakes are popular for hunting from boats. Due to inaccessibility, hunting throughout the rest of the Vee Canyon area is limited to boat and float plane operations and is not intensive. Boat hunting, confined largely to the Tyone system, is not intensive below Tyone Lake due to difficulties imposed by shallow water sections of the Tyone River. Planes are able to land and take off from several areas of the Susitna River; however, lakes adjacent to the impoundment area are utilized to a greater extent than the river. As in the Denali area, moose and caribou are the species most sought.

Small Game

62. Snowshoe hare and spruce grouse, populations of which fluctuate periodically, are reportedly present in the area. None were observed during the period of investigation. Ptarmigan, another cyclic species, were not abundant. One adult and eight young were the total seen in the impoundment area. Wilson's snipe were distributed throughout the area.

Fur Bearers

63. Evidence of wolf, fox, lynx, wolverine, river otter, beaver, and muskrat was seen in the Vee Canyon area. A moderate amount of trapping in the Lake Louise area constitutes the major pressure currently exerted to harvest these species. Beaver, perhaps, have the highest potential

value of the fur bearing species. Wolves have been reduced in numbers in recent years but are presently protected as part of a study to learn more of their life history and ecology.

Waterfowl

64. Waterfowl recorded in the Vee Canyon area, exclusive of Lake Louise, Susitna Lake, and the Tyone River above the mouth of Tyone Creek, are presented in Table 10.

Table 10. Waterfowl recorded from the ground in Vee Canyon impoundment area from July 11 through August 2, 1958.

Species	Adults without young	Broods		
		Adults	Young	Average Young/Brood
Canada goose	2			
American merganser	33	1	9	9
White-winged scoter	12	2	19	9.5
Scaup	8	1	5	5
Bufflehead	8	1	6	6
American goldeneye	4	1	7	7
Pintail	3	4	13	3.3
Mallard	3	1	8	8
Widgeon		4	26	6.5
Green-winged teal	1	3	12	4
Surf scoter		1	4	4
Old squaw	1			
Unidentified	7	1	1	1

These data, obtained while covering the impoundment area by boat and on foot, are not total numbers of waterfowl utilizing the reservoir site, but are considered representative of the composition of waterfowl present in

the locale. Water suitable for nesting is limited in the Vee Canyon area, much of which is confined to the Susitna River bottom and immediate side hills. Many of the lakes or potholes which would otherwise be suitable lacked food for waterfowl. Nearly all lakes with food produced at least one brood; however, broods generally were small. Pondweed, water milfoil, and bur reed were the most abundant duck food. Water lily was also abundant in the shallow, bog lakes.

65. Hansen (1958) reports a clutch of trumpeter swan eggs in the impoundment area at the mouth of the Oshetna River and another near Crosswind Lake 13 miles east of Lake Louise.

Stream Surveys and Fisheries

66. The Susitna River in the Vee Canyon impoundment area is confined by hills with moderate to steep slopes and has formed one or two deep, permanent channels in most sections. Bottom materials include rocks, boulders, mud, and silt. Flow data obtained for a cross section of the Susitna River just above the mouth of Tyone Creek July 27 are: average velocity, 5 f.p.s.; average depth, 6 feet; average width, 225 feet; discharge, 5400 c.f.s. A constant of 0.8 for a rough bottom is used in calculating the discharge. Grayling, fine-scaled sucker, cottid, and burbot were seined in shallow-water areas of the Susitna River 4 miles above the mouth of Tyone River.

67. Clearwater Creek, about 34 miles long would have its lower 5 miles inundated by a dam at Vee Canyon. This lower section, which drains an area of low hills and ridges, has many deep, long pools interspersed with riffle areas. Willow and Equisetum are the predominant shore vegetation; spruce and glandular scrub birch are the dominant surrounding country vegetation. Water flow data were obtained July 21 from a cross section of stream. Average velocity was 5 feet per second, average depth was 2 feet, and average width was 90 feet, while discharge of 720 c.f. s. was calculated. Grayling, burbot, and cottids were taken by seine and minnow trap. The lower section, inaccessible except by boat or float plane, receives little or no fishing pressure.

68. Coal Creek, about 28 miles long, drains a relatively low area west of the Susitna River. The lower 5-mile section of Coal Creek which would be inundated, possesses a wet, lowland type terrain containing willow, spruce, and sedge bogs. This clear stream has a gravel-rubble bottom and many pools from 5 to 30 feet long and 1 to 5 feet deep interspersed with riffle areas. A cross section measurement indicated an average stream velocity in the area which would be inundated of 2.2 f.p. s. ; average depth, 1 foot; and average width, 25 feet, resulting in a calculated discharge of 44 c.f. s. Caddis flies and May flies were the dominant aquatic insects. Grayling and cottids were taken by seining; a run of adult suckers was observed moving upstream on July 20. Fishing pressure is nearly nonexistent due to inaccessibility.

69. The MacLaren River, a major tributary of the Susitna River, enters from the east and originates at MacLaren Glacier 50 miles above its junction with the Susitna. The lowlands in the 5-mile section which would be flooded by a dam at Vee Canyon are interspersed with willow, aspen, spruce, and sedge. The turbid river has many long, deep pools interspersed with riffle areas; glacial mud and gravel are the stream bottom types present. Average depth of a cross section near the mouth was 3 feet; average width, 150 feet; velocity, 5 f.p.s.; and the discharge was computed to be 1800 c.f.s. Burbot and cottids taken with minnow trap and seine were the only fish species noted. No fishing pressure is known to occur on the MacLaren.

70. The Tyone system would lose more clear water through inundation than any other stream in either impoundment area. Tentative Bureau of Reclamation figures list 2,400 feet as the probable maximum Vee Canyon reservoir water level. If this is attained, the water levels of Tyone Lake (elevation 2,361 feet m.s.l. from 1:63,360 USGS maps issued in 1952), Susitna Lake (2,361 feet m.s.l.), Lake Louise (2,362 feet m.s.l.) and Little Lake Louise (2,375 feet m.s.l.), all at the upper end of the Tyone River, would be raised.

71. Lake Louise, accessible by 18 miles of gravel road from the Glenn Highway, provides boat access to Susitna Lake and Tyone Lake. This area is becoming increasingly popular; private cabins are appearing along

much of the available lake frontage and Army and Air Force recreation camps have been established here. The lake trout fishery is a major reason for this popularity. Allin (1956) states that, from records supplied by the military, it is computed that 211 man-days of pressure took about 459 lake trout in 1955. Military personnel exerted about 75% of the fishing pressure at that time. Other species present are grayling, whitefish, fine-scaled sucker, and burbot. Allin (1956, 1957) more fully describes the Lake Louise fishery.

72. The lower ten miles of the Tyone River were surveyed. Willow, spruce, and Equisetum are the dominant shore species with glandular scrub birch and spruce dominant on surrounding hills. The river is clear and flows over gravel and rubble with pools from 1 to 8 feet long about every 100 yards. Riffle areas are abundant. The water level fluctuates greatly depending on rainfall. Flow data obtained from a cross section in this area are: average velocity, 1.4 f.p.s.; average depth, 2 feet; average width, 30 feet; and discharge, 67 c.f.s. Caddis flies were the dominant aquatic insect. Water temperature on June 22 at 10:00 a.m. was 58°F.; air temperature was 59°F. Grayling, fine-scaled sucker, burbot, and cottids were taken with seine and minnow trap at the mouth of the Tyone River. Although the lower Tyone River is accessible by boat from Lake Louise, little fishing pressure was exerted here.

73. The Oshetna River, which flows north for 50 miles before emptying into the Susitna River, would have its lower 6 miles flooded by a dam at Vee Canyon. Willow, alder, and glandular scrub birch are the dominant vegetative types in this section. Pools are infrequent in this fast, clear stream which flows over gravel, rubble, and boulders. Stream flow data obtained when the river was high due to rains are: average velocity, 6 f.p.s.; average depth, 4 feet; average width, 100 feet; and discharge, 1920 c.f.s. Water temperature on July 31 at 7:30 a.m. was 48°F. Caddis flies were abundant in the stream and grayling were present. Little or no fishing occurs in this drainage due to inaccessibility.

74. Goose Creek, a clear stream flowing north to the Susitna River, would have 3 miles of its total length of 15 miles flooded by a dam at Vee Canyon. This lower section, bordered by willows and alders, has a stream bed of mixed gravel, rubble, and boulders and contains many pool and riffle areas. Water temperature at 1:00 p.m. July 31 was 52°F. Average velocity of a cross section measured when the stream was high due to rain was 5 feet per second, average depth was 2 feet, average width was 25 feet, and flow was 200 c.f.s. Fishing pressure is non-existent due to inaccessibility.

75. Shallow potholes and brown-water bog lakes, present throughout the Vee Canyon area but less numerous than in the Denali area, apparently contain fish only if accessible from a stream system. Temperature of most of these lakes was about 60°F.

CONCLUSION

76. Investigations were conducted in the Denali and Vee Canyon project areas of the Susitna River Basin to ascertain the species of fish and wildlife present. The species identified are summarized by area in Tables 11 and 12.

77. The information contained herein, along with the findings of subsequent studies, will eventually be used in the preparation of reports for the Bureau of Reclamation dealing with the effects of the proposed projects on the fish and wildlife resources.

Table 11. Fish and Wildlife species observed in the Denali and Vee Canyon impoundment. areas.

Area	Water Turbidity	Fish						Big Game	Small Game	Furbearers					Waterfowl																							
		Burbot	Cottids (Cottus cognatus)	Grayling	Lake trout	Fine-scaled sucker	Whitefish (Coregonus cylindraceus (Pallas))	Black bear	Caribou	Grizzly bear	Moose	Ptarmigan	Snowshoe hare	Spruce grouse	Wilson's snipe	Beaver	Fox	Lynx	Muskrat	River otter	Wolf	Wolverine	Swan	Canada goose	American goldeneye	American merganser	Bufflehead	Canvasback	Green-winged teal	Mallard	Old squaw	Pintail	Scaup	Shoveller	Surf scoter	White-winged scoter	Widgeon	
<u>DENALI</u>								x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Main Stem Susitna	glacial	x																																				
Boulder Creek	glacial																																					
Valdez Creek	clear						x																															
Windy Creek	clear			x																																		
Butte Creek	clear		x	x			x																															
Raft Creek	clear																																					
Sand Lake	clear			x	x		x																															
<u>VEE CANYON</u>								x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x		x	x	x	
Main Stem Susitna	glacial	x	x	x		x																																
Clearwater Creek	clear	x	x	x																																		
Coal Creek	clear		x	x		x																																
MacLaren River	glacial	x	x																																			
Tyone System (Lakes Louise, Susitna, and Tyone)	clear	x	x	x	x	x	x																															
Oshetna River	clear			x																																		
Goose Creek	clear																																					

Table 12. Non-game birds recorded in Denali and Vee Canyon areas.

Species	Denali area	Vee Canyon area
Common loon	x	
Pacific loon	x	
Horned grebe	x	
Swainson's hawk	x	
Redtailed hawk	x	x
Golden eagle		x
Bald eagle	x	x
Marsh hawk		x
Osprey		x
Golden plover	x	
Semi-palmated plover	x	
Hudsonian curlew	x	
Spotted sandpiper	x	x
Lesser yellowlegs	x	x
Northern phalarope	x	
Shortbilled gull	x	x
Franklin gull	x	x
Arctic tern	x	x
Horned owl		x
Hawk owl		x
Snowy owl	x	
Flicker		x
Hairy Woodpecker		x
Kingfisher	x	x
Cliff swallow	x	x
Robin	x	x
Hermit thrush		x
Russet-backed thrush		x
Ruby-crowned kinglet	x	
Bohemian waxwing	x	x
Myrtle warbler	x	x
Purple finch	x	
Whitewinged crossbill		x
Tree sparrow	x	x
White crowned sparrow	x	x
Song sparrow		x
Slate colored junco	x	x

LITERATURE CITED

Anonymous

- 1952. A report on potential development of water resources in the Susitna River Basin of Alaska. U. S. Bureau of Reclamation report.
- 1952. A preliminary report on fish and wildlife resources in relation to the Susitna River Basin Plan, Alaska. U. S. Fish and Wildlife Service report.
- 1954. A special report on economic aspects of the Nelchina Caribou Herd. U. S. Fish and Wildlife Service report.
- 1954. A progress report on wildlife of the Susitna River Basin. U. S. Fish and Wildlife Service report.
- 1957. 1956 field investigations, Devil Canyon dam site, Susitna River Basin. U. S. Fish and Wildlife Service progress report.
- 1959. 1957 field investigations, Devil Canyon dam site and reservoir area, Susitna River Basin. U. S. Fish and Wildlife Service progress report.

Allin, R. W.

- 1956. Catch distribution, composition, and size structure, sport fishing Anchorage area. Federal Aid in Fish Restoration quarterly progress report.
- 1957. Preliminary lake survey of Lake Louise and Little Lake Louise. Federal Aid in Fish Restoration quarterly progress report.

Hansen, H. A.

- 1958. Annual waterfowl report, Alaska. U. S. Fish and Wildlife Service report.

Rausch, R. A.

- 1958. Herd composition surveys--Susitna and Copper River valleys, moose management studies. Federal Aid in Wildlife Restoration job completion report.