

RECENT HISTORY OF PEREGRINE FALCONS IN THE TANANA VALLEY, ALASKA¹

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Abstract. A study was conducted from 1970 to 1974 on a population of peregrine falcons (Falco peregrinus) along a 300 mi (483 km) stretch of the Tanana River in Interior Alaska. Observations on the pattern of abandonment of former nesting sites and changes in the birds' reproductive success were made in an attempt to gain insight into factors causing the decline of this population. Seven pairs were found in 1970, and by 1974 only a single pair remained. During this period the number of young produced declined from 20 in 1970 to 1 in 1974. The last nesting sites to be abandoned by the adults were those on high cliffs and sites isolated from human activity. This pattern of cliff abandonment suggests man has had a direct influence in hastening the disappearance of the birds from the more accessible eyries, but other factors may have also influenced the population.

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INTRODUCTION

This paper reports the results of a 5 year study on changes in the population of peregrine falcons along the Tanana River in Interior Alaska. Data were collected on the physical features of nest sites, site occupancy and reproductive success, adult behavior, and the effects of man in an attempt to determine the factors influencing the population dynamics of the falcons.

The crash of peregrine falcon populations over widespread areas of North America and Europe during the last 3 decades has aroused the concern of environmental biologists on both continents (Hickey 1969). For a while, it appeared that populations of birds in Alaska, and perhaps regions of northern Canada, were not being affected as were the more southerly populations (Cade et al. 1968). By 1970, however, evidence was accumulating that some northern populations had declined or were failing to reproduce successfully (Cade and Fyfe 1970, White and Cade 1971), and the possibility that these populations might soon suffer the fate of the southerly populations was recognized.

In 1970 an organized effort was made to census as many breeding populations as possible to determine the status of the peregrine in North America (Cade and Fyfe 1970). As part of this effort, I conducted a survey on the Tanana River, the first concerted study of the population in that area (Haugh 1970). From 1971 to 1974 I continued to study population changes of the falcons along the Tanana

and to make observations on their reproductive success.

The major focus of my investigation was to determine if the population decline observed elsewhere in North America was occurring in this area of Alaska and, if so, to see if abandonment of known nesting sites and decline in the birds' reproductive success were following the same pattern observed among other populations of this species in North America.

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THE STUDY AREA

The Tanana River is one of the largest Alaskan rivers. From its origin at the confluence of the Nabesna and Chisana rivers in eastern Alaska, it flows over 400 mi (644 km) before emptying into the Yukon River near the village of Tanana in central Alaska. Throughout its length the river flows through the forests of the Alaskan taiga.

Along its course, the river passes through a wide U-shaped valley. In many areas it is braided into numerous small channels and flows around extensive groups of islands and gravel bars. This

has resulted in the right and left extremes of the river being separated from each other by distances of a mile or more in some sections. Cliffs are found only where the river encounters hills, and there are extensive intermediate areas where suitable nesting habitat for cliff-nesting birds, such as the peregrine, is lacking. The cliffs on the Tanana River are small to medium in size, generally ranging from 10 to 300 ft in height (3 to 91 m), although occasional rock outcrops on the sides of hills are somewhat higher above the water. The majority of the cliffs front on the river, but in some areas rocky outcrops are somewhat back from the river on the sides of hills.

Somewhat unique among Alaskan rivers, the Tanana flows parallel to the Alaska Highway, and at points where it approaches the highway, access for launching boats is available. Nevertheless, except between Fairbanks and Nenana and within a few miles upriver from Big Delta, where considerable river traffic is at times encountered, the river maintains its wilderness quality and is largely devoid of man's influence. During the 5 years of my study, I never encountered another person on the river between Tanacross and Healy Lake, a distance of approximately 90 mi (145 km), where numerous rapid areas and braided sections make boating dangerous. Many other areas along the river were similarly impressive for their lack of human activity. Thus, the Tanana exhibits along its length the characteristics of both a wilderness river, where man may not appear for weeks or months at a time, and a recreational stream, where man's influence is felt almost daily. Until recently, peregrine

falcons nested along the river in both of these contrasting situations. (See Figure 1)

METHODS

In each of the 5 years of the investigation, a boat trip was made over the course of the study area from Tetlin Junction to Nenana, a distance of approximately 300 river mi (483 km) as measured on U.S.G.S. maps with a scale of 1:63360. The trips were made during the month of July at a time when viable eggs had hatched and young falcons were in the nests. Because of other research commitments, it was not always possible to conduct the survey at exactly the same time each year. The observations in 1970 and 1973 were made during the first half of July when downy young were in the eyries. In 1971, 1972 and 1974, studies were conducted during the last 2 weeks of July when the young birds were within a few days of fledging. Except for some previously abandoned eyrie sites between Fairbanks and Nenana, I did not make observations during June when the adult falcons were incubating eggs, a time at which disturbances might increase the possibility of nesting failure.

A total of 13 sites were examined in each year of the study. Six of these sites (8 through 13) were reported to have been active in the 1960s (Gerald Swartz, personal communication). The seven other sites (1 through 7) were examined as part of my original survey (Haugh 1970) and were found active at that time. When

possible, all actual nesting sites (eyries) of the falcons were climbed to and examined at close hand. A climbing rope and standard mountaineering techniques were used to reach nesting ledges. Occasionally, when it proved impossible to actually reach an eyrie, the site was observed from another point on the cliff with the aid of 9x35 Nikon binoculars. Using one of these two methods, I was successful in observing the nesting sites of all pairs of falcons located during the course of the study.

RESULTS

Occupancy and reproductive success. Eyrie sites 8 through 13 were found to be unoccupied during the initial survey in 1970, and no evidence of reoccupancy was found in subsequent years. At the seven occupied eyries (sites 1 through 7) adult falcons fledged 20 young in 1970. In 1971 eyries 4, 6 and 7 were unoccupied, and no evidence was found to indicate falcons returned to the cliffs or attempted to nest in any year after 1970. From 1971 to 1973 seven to nine young were produced at the four remaining active cliffs, but in 1974 only cliff 1 was occupied in July by adult falcons, and only a single young was fledged at this site. A detailed search of nesting ledges and prominent points on cliffs 2 and 5 where falcons might pluck prey or leave prey remains, failed to reveal any evidence that birds had returned in 1974. Peregrines were observed in early June at cliff 3 by an Alaska Department of

Fish and Game research biologist (Tony Smith, personal communication), but this pair either failed to lay or had an early nesting failure, for they were not present in July. Table 1 summarizes the reproductive data from the Tanana River from 1970 to 1974.

Physical characteristics of nesting sites. Eyries 1, 2 and 3 were located on three of the highest and most inaccessible cliffs on the river. At sites 1 and 3 the rock faces were highly dissected, and in order to locate the eyries, several hours of climbing and searching was necessary. Site 2 was a sheer rock wall, rising approximately 300 ft (91 m) directly from the river and with a number of ledges situated at locations difficult or impossible for me to reach with the climbing equipment I had available. All three eyries were located along stretches of the Tanana where rapids and log jams were common and served to make river travel dangerous to inexperienced boaters. During five boat trips past these eyries, I never observed other river travelers or signs of human activity.

Eyries 4, 5 and 7 were located on relatively small, low cliffs with but one or two suitable nesting ledges. These three sites were easy to reach, and sophisticated climbing techniques were not necessary if caution was used. They were, however, isolated from the general flow of human activity on the river by the location of the cliffs off the main channels of the river. The cliffs at sites 5 and 7 were located on a slow moving stretch of the river with heavy boat traffic, but were set back on small sloughs where boat traffic was not possible. To reach these cliffs it was necessary

to walk several hundred feet through trees which tended to screen the cliff from the main river. Over the screen birds at these eyries did have a partial view of the river, especially farther up and down the valley. The immediate foreground, however, was hidden from view by the trees.

Eyrie 4 was readily visible from the main channels of the river but was somewhat isolated on a small side channel by several gravel bars and log jams which discouraged boats from entering this channel and approaching the cliff. The river was swift flowing in this region, but because of easy access from the highway some boat traffic was evident. Local people travelling the river used the channel on the side of the river opposite the cliff, and others would also be naturally directed away from the eyrie cliff by the wider channels and safer water on the opposite side. Thus, by being far enough removed from the main traffic so not to be observed or disturbed by travellers on the river, the falcons at eyrie 4 were as isolated as those at eyries 5 and 7.

Eyrie 6 was unique during my study in being a relatively small cliff with few nesting ledges and located on a well-travelled portion of the river less than a mile from a boat-docking area and access site. The nesting site was located less than 100 ft (30 m) above the water. This site, therefore, did not possess the features which served to isolate the other eyries from disturbance.

Nine nesting attempts at sites 1, 2, and 3 on the Tanana gave the following measurements: height of nesting site above the river,

180 ft or 55 m (range 150-280 ft or 46-85 m); distance below brink of cliff, 85 ft or 26 m (range 15-100 ft or 6-30 m). Sites 4 through 7 were located on smaller cliffs and average measurements for the four nesting sites were: height of nesting site above the river, 100 ft or 30 m (range 50-175 ft or 13-53 m); distance below brink of cliff, 20 ft or 6 m (range 10-30 ft or 3-9 m). All eyrie sites along the Tanana faced in a westerly or southerly direction.

Behavior of adult peregrines. A considerable difference in behavioral response to intrusion was observed among adult birds during the course of the study. Pairs at eyries 1, 2, and 3 rarely experienced river travelers and readily responded to my presence by calling and flying from the cliff, even when I was a considerable distance from the nesting site (0.25 mi or 0.4 km). Falcons at eyries 4, 5, and 7 did not call or leave the cliff unless a close approach was made by someone walking through the woods in the case of eyries 5 and 7, or entering the small side channel in the case of eyrie 4. The adults at eyrie 6 did not respond to travelers passing less than 100 ft (30 m) below the eyrie on the river. Only when I climbed the cliff and approached close to the actual nesting ledge did the falcons call or fly from the cliff. When I was in the nest with the young, the adult birds flew to the opposite end of the cliff and remained silent.

DISCUSSION

The results of the present study (see Table 1) show a pattern of rapid decline in the number of adults and fledged young. The pattern has three main characteristics: (1) the failure of non-breeding adults to return to previously occupied cliffs, (2) the failure of peregrines from other populations to recolonize cliffs, and (3) the early abandonment of low cliffs that are poorly isolated from human activity.

The first two characteristics are at odds with other reported studies where (1) in declining populations, non-breeding birds frequently were observed to return and occupy cliffs (see Hickey, 1969), and (2) peregrines from other localities recolonized empty eyries, especially if the eyries were in desirable locations (Hickey 1942, Ratcliffe 1963 and 1972). The failure of birds to recolonize the Tanana Valley area may be related to the failure of other populations of Alaskan peregrines to reproduce successfully. For example, the peregrine population in northern Alaska along the Colville River appears to have suffered a severe decline in the early 1970s (Haugh, unpublished data).

The third characteristic mentioned above is similar to previously reported studies which show that eyries isolated from human activity are occupied longer than other eyries (Rice 1969), and that eyries located on the largest cliffs are preferentially occupied (Hickey 1942, Ratcliffe 1972). Eyries 1, 2, and 3 in the present study

(the last to be abandoned) were located on the largest cliffs on the river and were the most isolated. Eyries 4, 5, 6, and 7, as well as eyries 8 through 13 (abandoned rather early) were located either on accessible cliffs or poorly isolated from disturbing activities. This pattern of abandonment suggests that man has played a role in the decline of the peregrines along the Tanana, perhaps by shooting the adults or otherwise disturbing the nesting birds. Although I have no direct evidence that falcons were shot during my study, spent shotgun shells were found on the tops of eyrie cliffs on four different occasions, and these shells may have been fired at the falcons. Some direct human interference was observed, however. During the 1970 survey, I saw a group of falconers on the river. Rechecking two eyries, I found that four young falcons were missing. I was later informed by the Alaska Department of Fish and Game that these same falconers were known to have removed six young peregrines from the Tanana eyries.

The success of the peregrines at site 6 until 1970, despite significant disturbance below the eyrie (see above) and after sites at other similarly exposed cliffs were abandoned, is of interest. The nearly complete lack of defense exhibited by this pair is probably a reflection of their adaptation to man and the regular activity below the eyrie. The failure of this pair to respond to activity may have prevented their detection and allowed for their survival after pairs on other low and exposed cliffs along the river had disappeared. Similar examples of the ability of the peregrine to

adapt to man, in the absence of other negative factors, can be found in the observations of Hall (1955) and Herbert and Herbert (1965) and the continued success of Spanish peregrines (T. J. Cade, personal communication).

In light of the ability of healthy peregrine populations to adapt to man's presence and recover from heavy predation (see Ratcliffe 1963), the pattern of abandonment and decline observed in the Tanana Valley suggests that the activity of man has hastened (rather than caused) the decline of a population already weakened by other detrimental factors. This view is reinforced by the decline of other more isolated populations, such as the birds along the Colville River. The possibility exists that organochlorine pesticides, apparently a primary factor in the drastic decline of the British peregrines (Ratcliffe 1963 and 1972), may have influenced the birds along the Tanana.

Cade et al. (1968:177) found in 1966 that Interior Alaskan falcons along the upper Yukon were "perilously balanced near the threshold level of organochlorine residues that initiates dysgenic reproductive behavior and eventual population decline." It appears that most residues in Alaskan peregrines are from organochlorines accumulated by the birds in their wintering areas in Central and South America (Peakall et al. 1975). Since the Tanana peregrines are part of the Interior Alaskan population with similar ecology, it is possible that residue levels in these birds would be similar to those of the Yukon falcons in 1966. Since the late 1960s the

species has been considered too rare for specimens to be collected solely for analysis, but three addled eggs were obtained in 1969 and three more were obtained in 1973 from eyries along the Tanana River. The analysis of these eggs (and eggs obtained from the Colville River as well) has provided evidence that eggshell thinning and organochlorine levels are similar to those normally expected to prevent adequate reproduction for population maintenance (Peakall et al., 1975) and suggests that organochlorine contamination may have also influenced the decline of the Tanana River falcons.

The decline of peregrine populations in North America and Europe has generally been associated with peculiar reproductive failures, followed after a time by the disappearance of adults from their nesting cliffs (Hickey 1969). The decline in the number of fledged young from 20 in 1970 to 1 in 1974, and the reduction of adult pairs, suggests that the Tanana falcons may be exhibiting a similar pattern. Without observations at the eyries in June, it is impossible to state with certainty, however, that only one or perhaps two pairs of falcons attempted to nest in 1974. Nevertheless, the failure to locate any sign of birds (i.e., prey remains, excretion, non-breeding adults) at previously occupied sites does strongly suggest this. Moreover, the failure of any eyrie site along the Tanana to be reoccupied once abandoned lends support to the idea that what is involved is not a temporary nesting failure but a permanent loss of breeding pairs. Whether this is the result of reproductive failure and failure of fledglings to survive to enter

the breeding population, increased adult mortality, or a combination of these factors is unclear. It is clear, however, that without a dramatic reversal in the present population trend, the extinction of the Tanana River peregrines is likely in the near future.

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Table 1. Falcon reproductivity and eyrie characteristics on the Tanana River, 1970 to 1974

Eyre No.	Cliff Accessibility* and Description**	Number of Live Young				
		1970	1971	1972	1973	1974
1	AA	3	7	2	1	1
2	AA	3	3	2	1	X
3	AA	3	3	0	3	X
4	AC	1	X	X	X	X
5	AC	4	3	3	3	X
6	CB	2	X	X	X	X
7	BB	4	X	X	X	X
8	BB	X	X	X	X	X
9	BB	X	X	X	X	X
10	CA	X	X	X	X	X
11	CB	X	X	X	X	X
12	CC	X	X	X	X	X

Table 1 (continued)

13	BB	X	X	X	X	X	X
Total Young		20	9+	7	8	1	

(X) = No adults present at time of survey. (0) = Adults present, no young produced.

(?) = Adults present, young fledged at time of observation and could not be located.

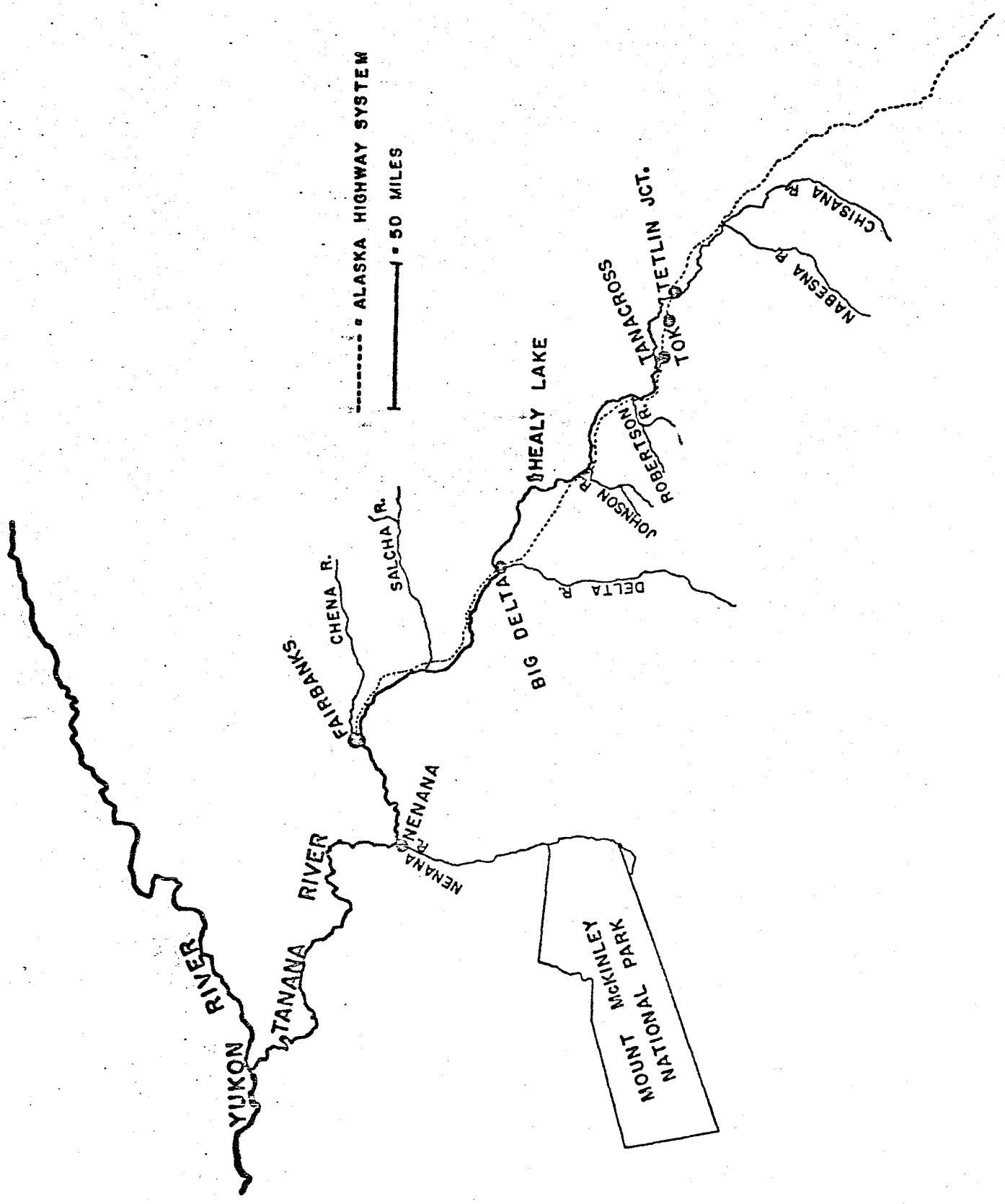
*Cliff Accessibility. The first letter in each pair indicates the accessibility of the cliff to human activity or disturbance. (A) = Low accessibility, cliff off main river channel and located where boats are unlikely to pass or on a section of river where fast water or rapids discourages river travel; cliff not readily accessible from land. (B) = Moderate accessibility, cliff on main channel but along a section of river with little river travel, or cliff off main river channel but moderately accessible by land. (C) = High accessibility, cliff on main channel and in area of regular river travel, or cliff readily accessible by land.

**Cliff Description. The second letter of each pair indicates the degree of protection provided by the structure of the cliff for nesting falcons (with respect to climbers or other potential human disturbance). (A) = Cliffs providing maximum protection, over 200 ft (61 m) with sheer faces having several ledges inaccessible except with the aid of ropes and sophisticated climbing techniques.

(B) = Cliffs providing moderate protection, under 200 ft (61 m) with most ledges accessible with ropes and minimal climbing ability. (C) = Cliffs providing little protection, under 200 ft (61 m) with ledges accessible without ropes or climbing aids.

FIGURE LEGEND

Fig. 1. Map illustrating study area and major topographical features along the Tanana River.



----- ALASKA HIGHWAY SYSTEM
|-----| = 50 MILES

YUKON RIVER

TANANA RIVER

FAIRBANKS

CHENA R.

SALCHA R.

NENANA R.

BIG DELTA

SHEALY LAKE

MOUNT MCKINLEY
NATIONAL PARK

JOHNSON R.

ROBERTSON R.

TANACROSS

OKOTETTILIN JCT.

NABESNA R.

CHISANA R.