REGIONAL CHRONOLOGIES IN SPRUCE OF THE KUSKOKWIM RIVER, ALASKA

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The problem of dating driftwood samples recovered from ruins on the shores of the Bering Sea coast and Arctic Ocean has led to the pressing need for establishment of living tree chronologies in all areas where such driftwood specimens could have originated. After determining the local regions of consistent ring sequence in living trees, it is not only possible to date a larger percentage of the archaeological wood but also to relate the derived chronologies to climate, driftwood origin, and other studies. Living tree chronologies have been defined for much of interior Alaska and the Yukon River proper (Giddings, 1941, pp. 12-28; Oswalt, 1950, pp. 26-30), the forested areas of Seward Peninsula (Giddings, 1941, p. 32; 1951, pp. 2-6), the Kobuk River region (Giddings, 1942, pp. 2-8), and the Copper River region (Oswalt, 1952, pp. 5-10); however, the previous absence of an over-all Kuskokwim River ring sequence was a major gap in Alaskan tree-ring data.

The Kuskokwim River rises in the west central section of interior Alaska and derives much of its initial volume from the glacial streams flowing northwest from the Alaska Range. Below Medfra, where the Kuskokwim River as such may be said to originate, the river flows in a general southwestern direction among well-rounded hills with occasional cut banks along one side. Beyond Kalskag the hills disappear, and a low, relatively flat alluvial plain is the characteristic geographical feature all the way to the Bering Sea, into which the Kuskokwim empties. The waters of the lower Kuskokwim River, unlike those of the Yukon, are not dissipated into many small channels at the mouth; consequently, relatively large ocean-going ships may enter the river proper and small river steamers may go upstream seven hundred miles.

The only class of Alaskan tree known to have all the requirements for successful and consistent cross-dating is the conifer; on the Kuskokwim the white spruce *(Picea glauca)* is the only species of conifer recorded (Hustich, 1953, pp. 144-62), and it is in general the most valuable for Alaskan tree-tree studies. Sampled stands were located primarily along river banks and in potential flood areas from which the trees could be dislodged and set adrift, most often to reach the sea and become coastal driftwood.

Aided by a grant from the University of Alaska Department of Anthropology the writer was able, during the summer of 1953, to collect living tree samples from below McGrath on the Kuskokwim River to the limit of the species in the vicinity of Bethel, a distance of approximately four hundred miles. During the course of the trip 20 stands were tested with a Swedish increment borer and approximately 250 cores were obtained. Of this number 41 with sufficient ring variability and tree longevity were selected as the primary basis of

[1]The writer wishes to acknowledge the many helpful comments on this study by Dr. J. L. Giddings, Jr. and Mr. T. Smiley.

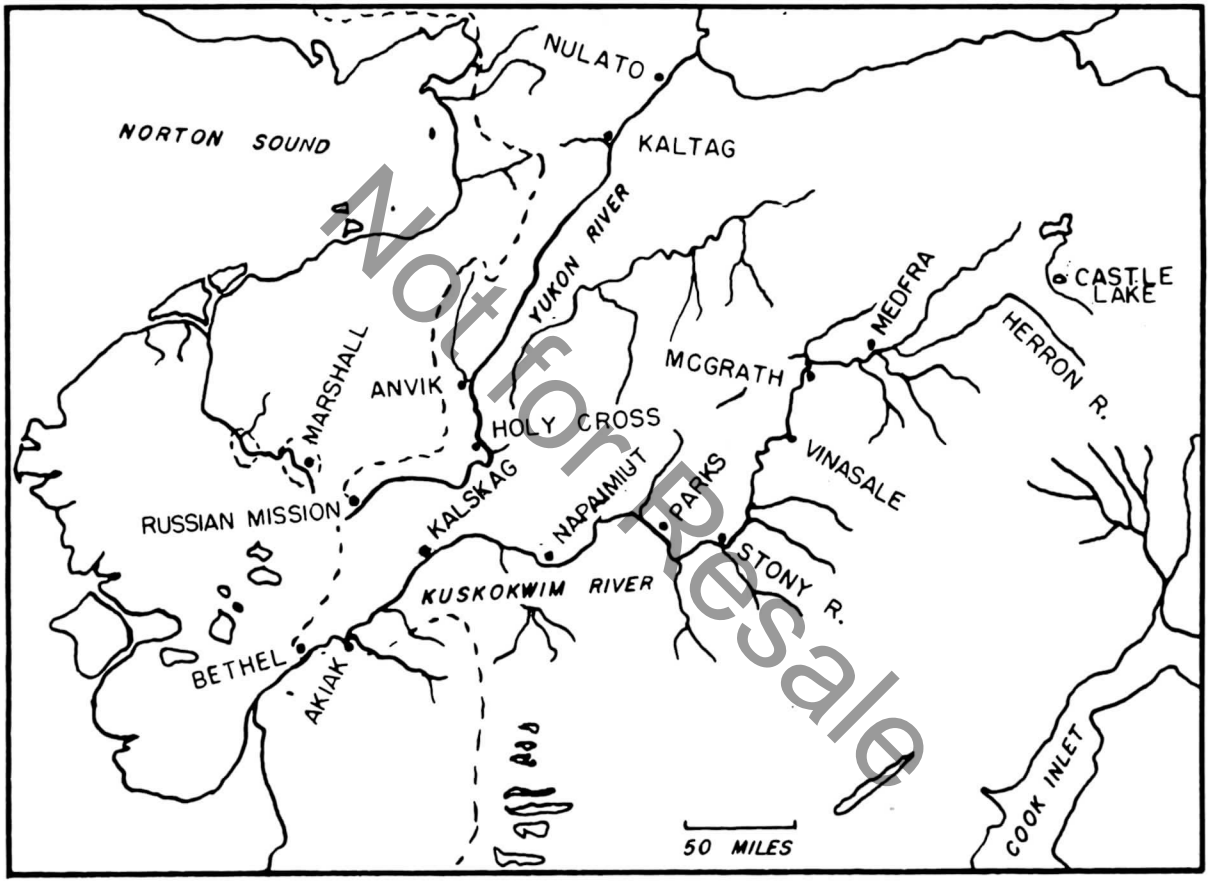

Figure 1. Map of the Kuskokwim River region, Alaska. The dotted line indicates the approximate limit of spruce in the area.

this report. Supplementing this series was an additional 40 cores, of which 6 were utilized, from the headwater regions of the Kuskokwim not visited by the writer.[2] The 47 selected cores were prepared and measured in hundredths of a millimeter, the results plotted on metric paper, and then visually compared. In each case the cross-dating was of definitive but not optimum quality in relation to most previous Alaskan groups. The measurements of the individual trees were combined with others in the same stand or an adjacent stand and averaged to form group means. The means of unmanipulated data were plotted and compared among themselves as well as with similar groups from other Alaskan localities. A synopsis of the empirical similarities in regional sequences is outlined in the summary, while the individual year by year group averages are recorded in Table 1 and the individual groups plotted in Figure 2. The latter demonstrates the changing character of the ring record in this area but is not intended to show regional cross-dating.

The number, name, area of collection, and number of measured samples, along with any other pertinent data, of each group are listed below. The seven cores constituting Group I (Herron-Castle) were derived from trees in two localities separated by approximately twenty miles (all distances are approximate). This group is presented only to indicate in a general way the ring sequence for the headwater region. Since the Herron River stand is on a relatively small stream, it could not contribute any appreciable amount of driftwood to the coast, and the Castle Lake stand is over a low divide in the Yukon River drainage. The Herron River sampling station, from which three cores were utilized, is a river bank stand in a floodable area of silty soil. The four Castle Lake cores are from black spruce *(P. mariana)* on a well-drained lake shore. The river bank sampling stations that follow are below McGrath on the Kuskokwim River and spaced at roughly 20 mile intervals; adjacent stations are often combined to form a regional group. Group II (McGrath), with four samples, is from a single scattered stand, five miles below the town of McGrath. Group III (Vinasale), with four samples, is also from a single scattered stand, two miles below the abandoned village of Vinasale. Group IV (Swift), with three samples, is from a stand eighteen miles up the Kuskokwim from the mouth of Stony River. Group V (Stony) was derived from two separate stands. One, represented by three trees, is on the island including the Stony River Trading Post at the mouth of the Stony River, while the second group of three trees is sixteen miles down river from the Trading Post. Group VI (Parks) includes five samples from eight miles below Parks. Group VII (Napaimiut) consists of three samples from thirty miles above Napaimiut and one sample from four miles below the same village. From twenty miles above Napaimiut to the limit of the species, the spruce become quite scattered. Group VIII (Kalskag) derived one sample seventeen miles above Kalskag and two samples eight miles below the same village. Group IX (Akiak) includes two samples from

[2]The cores from Herron River and Castle Lake were collected through the kindness of Mr. C. J. Lensink.

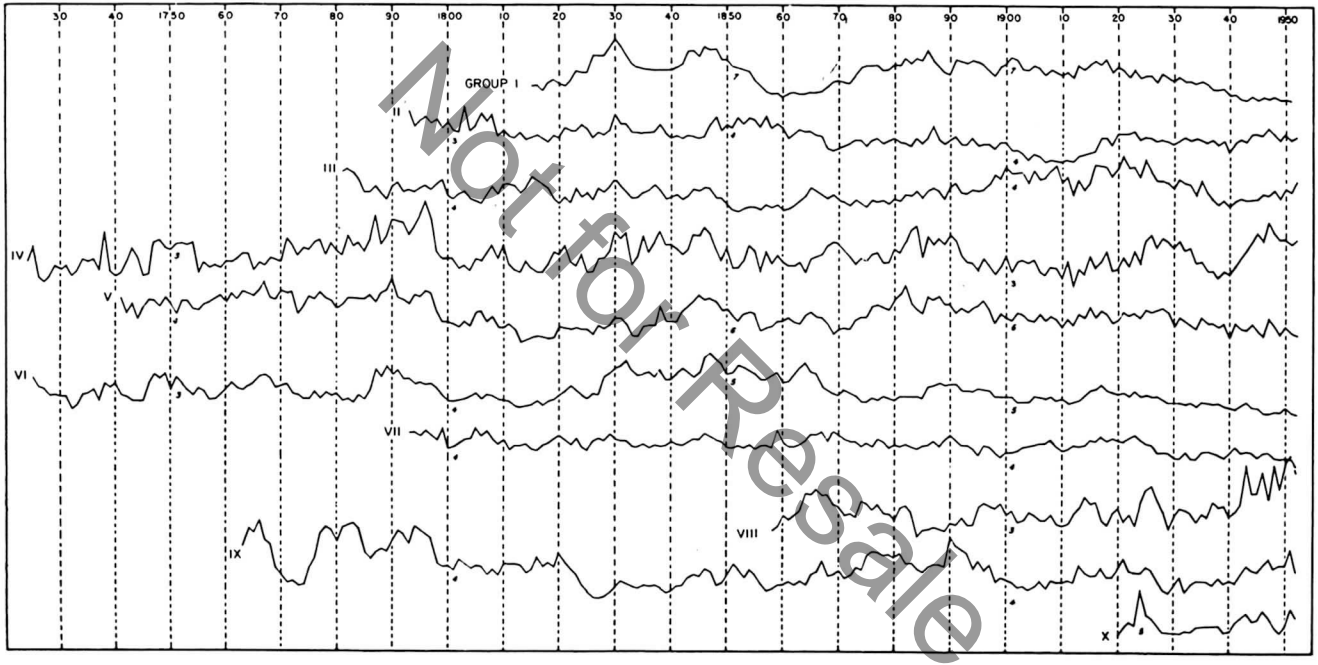

Figure 2. Regional ring patterns for spruce of the Kuskokwim River, Alaska. The graphically represented measurements are in one hundreths of a millimeter. The small numbers throughout the body of the graph represent the number of individual trees forming the means at fifty year intervals.

two miles below Akiak and two others from six miles below Akiak. The final group, number X, includes five short samples from one-half mile above the village of Bethel. The Bethel region is the last outpost of spruce along the Kuskokwim River. Eight miles above the village one 193 year old tree and a 160 year old one were sampled; at the village proper the oldest sampled tree had 64 rings, while the younger trees had 37, 40, 42, 44 and 52 rings, seeming to indicate an eight mile advance in the limit of the species in less than 129 years. That some of the trees around the village have been cut for Christmas trees is possible but unlikely, since most of them are quite small and contorted. Many of the sampled spruce growing near (within forty miles of) the limit of the species contained very complacent ring records, which in part accounts for the inferior quality of Group VIII.

Because of the general varience of Groups VI, VII, and VIII from each other and from the ring patterns characteristic of trees farther up the Kuskokwim, it is difficult to list those rings which are diagnostic of the entire river series; however, in general, the consistently small rings are A.D. 1793, 1801, 1809, 1826, 1885, 1910, 1912, and 1949. The 1783 faintlate ring (Giddings, 1941, p. 72) is usually indistinguishable in the Kuskokwim River spruce.

SUMMARY AND CONCLUSIONS

The Kuskokwim River series of spruce samples has the general ring qualities characteristic of "Series A Dating" (Giddings, 1943, pp. 26-32), which is found in spruce growing at or near the limit of the species on interior Alaskan mountain sides or toward the coastal tundra zone. In the McGrath and Vinasale groups there are also faint traces of "Series B Dating" (Giddings, 1943, pp. 26-32), best known from the Stevens Village-Fort Yukon region along the Yukon River, indicating a transitional type of ring pattern. A visual analysis of the regional groups indicates that the Herron-Castle group compares most favorably with the Alaska Range Series A of Giddings (Giddings, 1941, Table 4) even though the former represents a complacent valley bottom sampling. The McGrath, Vinasale, and Swift groups are most similar in detail to the Yukon River samples from Nulato to Anvik (Oswalt, 1950, pp. 26-30), while the Stony group closely parallels the entire lower Yukon series. The Parks, Napaimiut, Kalskag, and Akiak groups diverge considerably from each other and from the lower Yukon and middle Kuskokwim groups. Although the reason for this divergence is not clear, it should be noted that these middle Kuskokwim groups are from an east-west transection, and east-west disconformity in dating regions has been recognized previously from other Alaskan localities (Giddings, 1943, pp. 26-32; Oswalt, 1950, pp. 26-30). This may be due to the fact that while summer temperatures seem to have an influence on marginal tree growth (Giddings, 1941, p. 75; 1943, pp. 26-32), the summer isotherms in the Bering Sea region are in a north-south direction (United States Weather Bureau Summaries), thus seemingly subjecting the middle Kuskokwim trees to a more variable climatic influence than those from north-south transections. However, if temperature is the single dominant factor in the growth of marginal spruce toward coastal Alaska, then a

greater degree of ring uniformity should be expected than is actually present in the trees of the lower Kuskokwim River region. This poses an unsolvable problem since the historic temperature records necessary for comparison with Kuskokwim tree growth are for only a relatively few years.

The interpretation of driftwood tree-ring dates from archaeological sites along the Bering Sea coast, toward which this paper is oriented (for various statements on arctic driftwood see Kindle, 1921, pp. 50-53; Holtedahl, 1922, pp. 521-531; Transche, 1925, pp. 367-398; Giddings, 1952, pp. 129-142), necessitates a constant awareness of a number of crucial variable factors. Among these is the lag between the time a tree died and the time it was actually used in the construction of a dwelling. The Hooper Bay driftwood collected by the writer (Oswalt, 1951, pp. 6-8) during the summer of 1950 may be considered as a pilot study in this regard. In the Hooper Bay Village region driftwood is plentiful enough to supply cabin logs as well as wood for heating houses and the sweatbath structure. The thirty selected log samples from along the beach already had been axe-marked by individual Eskimos who would return later with a boat or dog sled and haul the logs to the nearby village (one mile) where they would be used during the winter. Of these thirty samples twenty-one were satisfactory for dating purposes and fourteen actually dated; of this number, eleven end dates fell within the 1939-1949 decade, while the other three end dates were 1901, 1933, and 1938. Assuming that these logs were used the following winter in house construction, there would be a cluster of dates reflecting a period of construction very soon after the trees were deposited on the beach. It is possible that this situation might have differed somewhat under conditions before European contact but it does not seem likely. The end date for a single isolated piece of wood in a midden may, as in the above example, be several decades behind the actual date of use. This seems to indicate that the time lag, while present, is not so great that the derived dates would be outside their associated context. There are of course factors which could distort the driftwood dates; for example, if for a number of successive years the interior river valleys contributing the bulk of the coastal driftwood did not flood during the spring breakup of the ice or during the fall, then the likelihood of a large quantity of standing timber being dislodged and drifting to the sea during that year would be small.

Other problems are the origin of the driftwood and the possibility of dating any selected sample. As noted above nearly one-half of the specimens in the Hooper Bay collection were actually dated, but only two cores, one from Nulato and the other from Stevens Village, could be traced to the region of their origin with any degree of accuracy. Both of these factors will be better controlled when we have more living tree samples from the various small western Alaskan rivers contributing driftwood to the Bering Sea coast. As seen in the case of the lower Kuskokwim River groups the ring sequence may change greatly within a very few miles. It is likely that some ring records in spruce approaching the western Alaskan limit of the species have ring

sequences far removed from the typical Series A Dating, which may well be one reason that much of the Bering Sea driftwood recovered to date cannot be fitted into the existing regional chronologies.

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TABLE 1 GROUP I—HERRON-CASTLE

	0	1	2	3	4	5	6	7	8	9
1810	—	—	—	—	—	28	28	24	31	33
1820	30	28	33	41	40	40	55	55	55	61
1830	70	63	55	49	45	44	43	43	43	43
1840	43	45	48	60	60	55	64	61	61	52
1850	52	46	45	43	41	34	29	24	22	21
1860	19	21	23	22	22	23	23	24	27	32
1870	33	32	31	38	45	46	46	46	43	44
1880	48	47	53	49	53	51	60	51	46	41
1890	39	52	50	49	51	50	48	42	38	46
1900	49	54	51	44	43	46	45	39	43	41
1910	39	41	36	47	44	49	51	49	53	41
1920	47	44	37	44	36	38	39	33	40	37
1930	34	37	33	34	32	34	31	26	26	27
1940	21	22	18	17	20	19	20	19	20	18
1950	18	17	—	—	—	—	—	—	—	—

TABLE 1 GROUP II—McGRATH

	0	1	2	3	4	5	6	7	8	9
1790	—	—	—	55	41	47	50	45	48	40
1800	45	39	37	61	38	43	53	46	53	34
1810	38	33	32	37	30	31	33	31	28	33
1820	32	41	38	38	43	40	31	36	34	38
1830	53	44	44	36	36	36	36	37	44	36
1840	32	33	31	34	33	32	33	44	50	39
1850	44	42	51	45	50	49	42	52	41	45
1860	41	32	35	40	38	38	35	34	24	21
1870	23	25	27	30	30	25	30	32	28	30
1880	32	29	28	25	32	27	32	43	31	28
1890	30	33	27	26	32	26	27	27	24	29
1900	29	22	22	19	14	19	16	11	13	12
1910	11	14	12	16	18	20	21	33	33	26
1920	37	37	37	39	31	34	33	30	31	30
1930	28	30	34	31	32	31	29	31	27	30
1940	25	29	32	30	36	36	35	42	37	31
1950	36	31	34	—	—	—	—	—	—	—

TABLE 1 GROUP III—VINASALE

	0	1	2	3	4	5	6	7	8	9
1780	—	51	54	50	44	33	33	39	32	26
1790	38	41	33	35	34	36	38	35	40	44
1800	30	27	31	34	27	25	23	31	38	31
1810	40	40	39	32	37	47	44	40	36	28
1820	23	29	24	37	29	33	26	37	33	39
1830	45	39	34	28	29	33	35	40	35	28
1840	29	31	27	30	36	35	38	37	29	29
1850	24	18	16	19	20	20	18	23	20	22
1860	18	19	21	26	30	37	35	32	29	31
1870	26	25	22	27	24	20	27	25	26	24
1880	28	26	32	31	35	29	35	38	35	28
1890	39	42	34	33	36	35	36	41	50	46
1900	56	51	51	51	42	54	46	47	54	58
1910	42	48	32	45	36	43	58	58	57	49
1920	55	66	56	57	48	64	53	45	45	44
1930	39	46	43	41	32	45	35	29	24	27
1940	23	26	29	27	28	28	33	32	36	29
1950	38	35	44	—	—	—	—	—	—	—

TABLE 1 GROUP IV—SWIFT

	0	1	2	3	4	5	6	7	8	9
1720	—	—	—	—	46	60	32	28	34	42
1730	39	42	34	38	48	46	48	39	71	38
1740	34	36	46	58	50	34	35	63	65	58
1750	57	62	63	61	63	36	45	40	44	41
1760	46	46	48	53	53	39	45	43	49	49
1770	46	66	61	52	59	57	64	66	53	63
1780	56	52	70	60	64	55	65	87	62	69
1790	83	82	81	70	78	87	100	84	55	49
1800	50	49	40	44	39	49	47	54	61	48
1810	62	43	39	36	47	40	37	36	44	55
1820	53	61	47	43	53	37	38	49	50	57
1830	73	68	73	44	50	68	55	64	74	62
1840	62	59	53	58	70	70	77	71	59	48
1850	59	41	41	48	62	56	38	56	45	53
1860	47	44	44	46	37	49	51	53	61	65
1870	64	57	51	45	50	48	53	55	46	47
1880	59	55	64	75	79	51	70	62	68	63
1890	71	66	53	47	46	40	50	44	36	43
1900	53	39	47	49	47	49	39	35	43	42
1910	33	48	25	41	37	53	42	48	57	40
1920	41	51	44	57	46	65	72	60	69	66
1930	60	66	58	60	47	48	40	40	34	40
1940	37	44	51	58	65	74	66	83	74	68
1950	68	64	67	—	—	—	—	—	—	—

TABLE 1 GROUP V—STONY

	0	1	2	3	4	5	6	7	8	9
1740	—	64	50	59	45	55	61	61	56	63
1750	58	50	61	61	54	54	58	60	63	66
1760	60	68	63	70	68	66	72	79	65	63
1770	70	69	69	50	56	65	63	69	64	61
1780	54	58	64	64	64	63	66	60	68	71
1790	81	65	63	59	67	65	70	68	51	43
1800	43	42	39	44	39	52	53	43	48	39
1810	38	41	36	25	26	29	30	29	28	29
1820	39	37	36	38	36	36	32	40	37	40
1830	46	46	41	30	30	38	40	40	57	44
1840	44	44	52	56	61	67	63	64	62	54
1850	55	49	44	50	52	50	35	37	39	43
1860	44	46	43	41	49	51	48	47	42	32
1870	37	38	37	45	48	48	58	59	57	55
1880	63	69	77	60	55	51	67	64	67	60
1890	60	52	56	53	56	58	63	55	43	51
1900	48	45	52	50	46	45	52	46	50	47
1910	40	46	41	51	49	58	49	55	51	44
1920	46	54	50	52	48	55	54	55	56	53
1930	39	48	45	42	39	49	44	44	40	42
1940	30	43	39	38	42	36	32	48	40	34
1950	40	35	33	—	—	—	—	—	—	—

TABLE 1 GROUP VI—PARKS

	0	1	2	3	4	5	6	7	8	9
1720	—	—	—	—	—	41	34	32	26	27
1730	25	25	14	18	27	28	31	21	36	33
1740	36	26	25	22	21	21	36	45	42	46
1750	31	43	36	31	26	33	30	23	24	27
1760	32	38	33	32	35	38	43	45	42	34
1770	35	36	29	27	24	24	30	24	30	26
1780	29	22	24	20	26	23	31	50	43	53
1790	45	50	41	41	37	39	36	36	34	27
1800	22	21	22	23	26	29	24	28	26	24
1810	23	21	17	16	17	18	21	18	21	23
1820	26	30	35	31	27	24	28	27	43	47
1830	51	54	59	50	45	46	48	44	50	41
1840	41	47	52	48	44	47	62	65	60	55
1850	46	47	54	53	50	46	42	42	45	48
1860	39	40	45	52	56	49	46	35	31	29
1870	27	31	30	28	22	22	25	25	26	25
1880	24	26	26	26	26	25	35	36	39	37
1890	38	38	33	32	31	34	33	32	26	26
1900	26	26	22	22	22	27	26	25	26	24
1910	25	22	22	24	28	31	34	38	33	31
1920	30	30	28	32	28	29	27	27	25	22
1930	22	22	21	22	19	22	22	21	21	19
1940	17	16	20	22	18	17	13	13	14	14
1950	19	14	12	—	—	—	—	—	—	—

TABLE 1 GROUP VII—NAPAIMIUT

	0	1	2	3	4	5	6	7	8	9
1790	—	—	—	44	44	40	45	41	36	48
1800	29	30	34	37	38	48	40	45	38	33
1810	37	27	31	31	33	29	27	31	34	38
1820	41	37	33	38	30	28	35	38	36	42
1830	38	37	37	31	30	33	30	32	31	32
1840	35	33	32	35	38	37	43	40	37	36
1850	30	30	31	30	33	29	31	32	30	46
1860	35	31	31	34	36	42	43	45	37	45
1870	43	39	36	36	33	35	32	39	36	31
1880	33	31	34	31	30	32	33	36	33	37
1890	42	38	34	33	30	25	33	31	27	23
1900	26	26	28	32	32	34	35	35	38	32
1910	29	30	33	33	34	39	37	41	38	40
1920	38	37	40	42	39	35	34	26	27	26
1930	23	21	27	22	21	27	29	27	25	23
1940	26	32	27	28	27	24	26	26	22	21
1950	22	21	15	—	—	—	—	—	—	—

TABLE 1 GROUP VIII—KALSKAG

	0	1	2	3	4	5	6	7	8	9
1850	—	—	—	—	—	—	—	—	32	36
1860	45	42	45	49	65	64	68	63	63	55
1870	54	45	47	44	58	56	50	55	48	47
1880	41	52	54	48	27	32	33	35	34	32
1890	39	37	44	37	37	52	57	54	52	56
1900	46	50	40	41	49	47	42	42	47	39
1910	37	39	47	53	63	57	59	43	37	49
1920	53	41	47	38	58	69	73	60	50	35
1930	46	53	51	48	41	49	45	58	54	55
1940	46	50	56	91	66	66	85	61	91	70
1950	91	99	85	—	—	—	—	—	—	—

TABLE 1 GROUP IX—AKIAK

	0	1	2	3	4	5	6	7	8	9
1760	—	—	—	68	83	80	90	73	70	48
1770	41	35	37	33	34	49	58	79	85	81
1780	71	85	86	88	84	61	56	62	65	63
1790	73	81	78	70	85	82	79	75	53	50
1800	50	46	56	51	49	50	50	43	47	42
1810	52	53	52	51	45	48	59	50	54	50
1820	63	54	48	43	34	28	23	22	24	26
1830	32	37	35	33	31	34	33	34	31	27
1840	29	32	33	40	43	41	48	45	33	35
1850	42	51	48	40	47	42	35	29	30	33
1860	34	36	34	37	34	43	45	55	42	44
1870	46	40	43	50	48	60	64	64	60	61
1880	59	61	53	54	48	45	50	51	51	50
1890	77	69	65	61	49	55	48	52	37	40
1900	39	37	31	32	30	32	38	31	39	36
1910	36	38	36	52	45	43	43	50	42	42
1920	49	58	46	45	45	50	48	38	30	27
1930	34	41	29	35	39	39	38	35	41	36
1940	39	37	45	52	49	46	53	59	50	52
1950	53	67	47	—	—	—	—	—	—	—

TABLE 1 GROUP X—BETHEL

	0	1	2	3	4	5	6	7	8	9
1920	14	21	26	23	56	34	30	24	18	17
1930	16	16	19	18	22	23	23	24	24	18
1940	19	26	30	35	28	29	37	32	22	17
1950	21	39	31	—	—	—	—	—	—	—