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U. S. COAST AND GEODETIC SURVEY.	
<i>Henry S. Pritchett</i> , Superintendent.	
State: <i>Alaska</i>	U. S. COAST AND GEODETIC SURVEY. LIBRARY AND ARCHIVES JUL 1 1899 No. 51655
DESCRIPTIVE REPORT.	
<i>Topographic</i> Sheet No. <i>2440-44</i> <i>2433</i>	
LOCALITY:	
<i>Coast of Yukon Delta</i>	
1899.	
CHIEF OF PARTY:	
<i>G. R. Putnam</i>	

JUN. - 1. 1900. 09300

Coast of Yukon Delta
Alaska

51655

Descriptive report to accompany the following topographic sheets:

<u>Titles</u>	<u>Number of topographic sheet</u>
Coast of Yukon Delta; South of Kwiklowak Mouth	2433
" " " " ; Kwiklowak Pass to Kweguk Pass	2440
" " " " ; Kweguk Pass to Kawanak Pass	2441
" " " " ; Kwikpak Pass to Glangozhewik	2442
" " " " ; Gowik to Okshokwehik	2443
" " " " ; West from Apoon Mouth	2444

These sheets cover the coast line of the Delta with the exception of some portions near the Kawanak and Kwikpak Mouths (see work of Varis 1899) and near the Apoon Mouth (see work of party of Assistant Pratt 1898). As far as known no white man had previously traversed this shore, and its position on previous charts was out from 10 to 35 miles (it was further to seaward than had been shown).

This coast is low and marshy the entire distance, with no vegetation near the shore but grass and moss, ^{except a few bushes near the Apoon} and with extensive mud flats bare at low tide. There are in general firm banks only near the mouths of some of the outlets. There were found to be 26 outlets of the river more than 200 metres wide at the coast. The following descriptive notes are taken from a report prepared by Br. H. D. W. Edmonds (who executed the work) and transmitted by me to the Superintendent Dec. 14, 1899.

This report describes more fully both the region and the work.

There are quite distinct characteristics that divide the Yukon Delta coast into three portions. The first extends from the Kwiklowak to the Kawanak and Kwikpak Mouths; the second extends 25 miles from the Kwikpak to the Okshokwehik, and is characterized as very swampy; the third portion

is distinguished by jutting points of land, occasional bushes and patches of deep moss. In the southern section most of the shore line is a low bank from 2 to 3 feet above the outlying mud, with firm hard mud and sand extending at low tide from 1 to 2 miles out to sea. At high water one can keep generally within a quarter of a mile of shore in light draught boats, such as Peterborough canoes. Loaded boats at any time must keep out so far that scarcely an indication of land exists. With light draught boats there is no difficulty, at medium high tide, in finding suitable camping spots. Large streams enter the sea every few miles, and smaller streams and sloughs at every half mile or so. These all furnish favorable camping places and some drift wood for fires. The small streams cannot usually be entered at any time except in small canoes. The largest ones can be entered at any time in light draught boats; namely the Kawoohawik, 5 miles north of the Avogon; the Bugomowik, 17 miles from the Avogon, and the Kawanak system, 25 miles from the Avogon, which can be entered by small boats at any time. The Kawoohawik is hard to locate from the sea except at high tide. On the Bugomowik there is a conical stack of wood a mile up the river and the entrance lies up the coast from abreast of the stack. All the other streams but these mentioned shallow out at varying distances from the shore and as the sea bottom is hard they can be easily waded around. The widest streams are sometimes the easiest to pass around as for instance the Kweguk which is shoal almost at the coast line but is over half a mile wide, while the channels of the Kawanak preserve their depth some distance to sea.

The first ten miles of coast are marshy with slightly raised banks. There are innumerable sloughs, and poor camping places, and the drift wood line is situated on slightly higher ground too far from the coast to be utilized. From here for another 8 miles the ground becomes even more marshy and scarcely a vestige of wood exists except on the banks of the Bugomowik. From here on however the banks become better and wood appears in quantity. Land may be

approached nearer and favorable spots for camping found almost anywhere. Loaded boats must however be anchored far from shore and outfits hauled or carried in to shore.

Between the Avogon (Kwiklawak mouth) and the Kawanak mouth the distance is about 28 miles. Natives may often be seen in their kayaks traveling over this stretch, making the distance in a short day. Only in one place do they take advantage of inland passages, namely to avoid the shoals off the mouth of the Kweguk. They make use here of the branch channels of the Kweguk, avoiding thus about five miles of coast. No grass islands exist on this stretch except a semi-circle of small islands about the Kweguk entrance. The Kweguk and the Bugomowik rivers are used by the natives to go into the interior, even up towards the head of the delta, and are navigable for good sized boats except at the entrance.

The general appearance of this coast is of course desolate. No trees or bushes can be seen, except some bushes near the Kawanak. There are no habitations except one a mile up the Bugomowik. In all this area except in the neighborhood of the Kwiklawak and the Kawanak, there are less than a dozen habitations. Four of these are on the Kweguk, two or three on the Bugomowik, and the rest at the junction of the most important sloughs. They consist usually of but a single hut and are uninhabited the greater part of the year.

The first 5 or 6 miles on either side of the Kawanak and Kwiklawak are characterized by good banks and deep and well defined streams; with scattered drift wood. Light draught boats can keep well in shore. Lines of brush extend along the main rivers a short distance from the coast. The better streams are all marked by stacks of wood at varying distances from the shore. Eskimo life is again manifest, the villages and single houses of this locality being the only ones along the whole face of the delta from beginning to end. From here to the Kwiklawak mouth is one days journey in a kayak, and to the Apoon or to Kotlik it is a two days' trip. From here to St. Michael it takes two days in a good sailboat with favorable wind.

After leaving the Kivikpak there are 5 or 6 miles of good land. Then one enters upon the ~~low~~ or swamp lands proper. Here the grass lands slope gradually down to the sea, and merge into the mud and slime of the ocean. During high tides Bering Sea covers a half mile or more of grass lands, and at low tide a still greater area of mud is often exposed. No dwellings whatever are to be found here. For five weeks Dr. Edmonds saw not a sign of human beings ^{not} even in the distance in kayaks. The country is a paradise of water foot and mosquitoes. One almost stumbles over the geese, and on the streams they scarcely get out of the way of the boat. To add to the utter desolation and dispiriting influences the loon is present in force.

Travel along the coast is only possible at high water in small boats. At low water, even an unloaded Teterborough may be aground entirely out of sight of land. To enter even the largest streams in empty boats one must drag the boat some distance over the flats until the river channel is entered. At high tide there is however no trouble.

The redeeming features of this whole district are the high conical woodstacks that mark the streams affording safe stopping places. These stacks may be observed from some distance off shore even when out of sight of land, and are situated a mile or two up the rivers at the first proper camping spot. Usually there is enough old drift wood near by for camping purposes. As the rivers approach the coast at varying angles it is not often easy even after sighting a woodstack to find the river mouth. The water is so shallow that one cannot approach near enough to land to distinguish its features well. One may possibly be compelled to wade ashore and tramp the mud a mile or so each way to find the river entrance. The streams themselves shoal so rapidly in the sea that at the distance one travels from shore, except at high tide, no river channel is run across. On finding the entrance, the first indication of elevated banks is at least a half mile up the river. Only one side of a river at any place has high banks, the channel side. It is not safe to camp lower down a river than at the first

woodstacks, and even there it is sometimes safer to sleep on staging, as at any time after southerly winds the sea seems to come inland a full mile or more, and this occurs with an alarming rush and noise. At low tide, standing at the grass edge, the sea is often invisible. For hours sea gulls may be seen wading around in an inch or so of water a mile from shore. Mirage distorts objects so that birds and men, and boats and logs are not distinguishable at times.

The mud itself is exasperating. At very low tide far out there is slightly firmer mud. Closer in, the mud usually uncovered is very sticky and wretched to walk on. Closer in shore often the mud was covered with a thin layer of slime or mud-moss. The shore is grassy and wet and swampy and cut up by ditches. A few lonesome stumps half hidden in the marsh, mark the course of some of the larger streams. Travel on foot is impossible except along the outside mud flats, wading out around the river mouths.

From the Kwilepak to the good lands near the Okshokwe-whik there are but few rivers affording good stopping places. Three miles from the Kwilepak there is a branch of the same; at 14 miles the Inalitqueengak; at 18 miles the Blongozhewik and at 22 miles the Borik. These streams are all marked by the woodstacks, the Blongozhewik having two.

Along this stretch only distant views of willows may be obtained on fair days. All else is grass and water. From the time of leaving the Bugomouwik where the last view of the Kusilvak Int. is obtained, no elevations are visible until near the Blongozhewik, a distant view of the tips of the mountains back of "Hogback", and later on those behind Pt. Romanof is obtained.

The last stretch of coast of about 25 miles is the most pleasant. The Apoon Pass approaches the coast somewhat and many rivers connect the sea and the Apoon. These are all well defined and have raised banks and are heavily lined with willow and other bushes to within a short distance of the coast. The wild cries of the loon and the geese close to disturb one, and the ptarmigan make their appearance

along with the moss and berries and bushes. A large portion of the coast has raised banks close to which one can go in small boats at high water, and often even at low water. The mountains near Kottlik and Romanof become more and more distinct, and finally the noise of the river steamers may be heard, and at last the steamers themselves appear, gliding behind the lines of bushes. The coast is a succession of points dividing the river channels, and in many places sloughs or wider channels cut up the points into islands and afford local inland passages. Spots of brush often appear almost at the sea shore and patches of thick moss in places. Usually a grass margin occupies the shore line, indicating by its strewn appearance the sweeping of the high tides. Even here one must select his camping places away from the coast. The sea is still shallow but the river channels are better and extend further out to sea. They are no longer marked by woodstacks.

The lower parts of the rivers are bare, perhaps for a half mile or more from the coast. Then scattering brush and deep moss make their appearance. Later the brush becomes so thick one can scarcely penetrate it, while drift wood is piled up in the eddies.

Methods of survey. The traverse line included on sheets 2440 to 2444 inclusive is 83 statute miles long. This difficult work was accomplished by G. H. M. W. Edmonds, accompanied by three men (rodman, boatman and cook). The line closely followed the coast. There were 271 traverse stations at an average distance of somewhat less than 500 metres. The party with its camp outfit and supplies was carried in a Peterborough canoe and a small dory. Camps were made at convenient intervals and the coast worked in both directions from each. Great difficulties were encountered in establishing camps, because of the shallow water and low marshy coast. The loaded boats sometimes could not be brought within a mile of the shore, and the outfit had to be carried through the mud. It was difficult to find land not subject to overflow during exceptionally high tides.

The instrument used was a 7 inch engineer's transit, with a stadia rod similar to that employed on the Mexican Boundary Survey. Only one rodman could be used, because of the difficulties of transportation. The back sights were taken on stakes left to mark each station. The half distance was read as a check. It was necessary for a man to follow with the empty canoe to ferry across the deeper outlets. Some of the wider channels were triangulated across.

This traverse line is controlled by joining the Delta triangulation at its ends, the Kwiklowak and Apoon mouths, and at an intermediate point, the Kawanak and Kwikpak mouths. These connections divide it into two sections, respectively 23.6 and 59.3 statute miles in length, and each section was computed separately. The following method was employed in computing the traverse. The azimuth of the first line, derived from the triangulation, was carried through to the end, disregarding convergence of meridians, and the latitudes and departures computed for each measured length, as though the whole were on a plane surface. The sum of the latitudes and the sum of the departures were then taken as the two sides of a right

angle triangle, the solution of which gave the distance between the initial and end points, and the azimuth of the latter from the former. With this distance and azimuth the latitude, longitude and back azimuth at the end point were then computed by the usual geodetic position computation. To obtain the positions of a number of intermediate points for convenience in plotting the work, the line was divided into a number of shorter sections, each of which was computed by the same process as above, the azimuth for each section being derived from the back azimuth of the preceding. The same latitude and longitude for the final point was obtained by the two computations, thus proving the numerical accuracy, as well as the correctness of this method of computing the traverse. A rigid computation of such a traverse would be to use the geodetic position computation for each traverse station, but this would be laborious, and as proved above, unnecessary.

The traverse line was run between Aug. 5 and Sept. 8, in 21 actual working days. No great precision was expected in work, done along this very marshy coast under the conditions experienced, and in the time possible, but it is thought the work is sufficiently accurate for all practical purposes, in view of the fact that most of this coast is not easily approachable by white men. The closing errors were as follows: 1st section, latitude 12.09 , longitude 12.89 ; 2nd section, latitude 24.31 , longitude 38.10 ; these represent the differences between the positions carried through by the traverse and by the triangulation. The traverse was adjusted to fit the triangulation by distributing the discrepancy proportionately throughout the distance. The coast located by this traverse line is from 11 to 35 miles to seaward from the coast line published in 1898.

Additional notes in regard to the running of the traverse line and the difficulties encountered, will be found in Dr. Edmonds' interesting report, transmitted Dec. 14, 1899.

On sheet No. 2440 the greater part of the topography (as far as "Ed" Sta.) was put in by a plane table survey by Assistant L. L. Flower, and is controlled by the triangulation extended by him from start of 1898.

On sheet No. 2433 the topography along the coast south of "Meadow" 4th sta. was by traverse and theodolite and stadia survey by G. F. Putnam. This was carried to connect with the work of the previous year carried up from the Kipnigut River to "End" 4th sta. There is low marsh land along most of this shore with a slightly higher bank a little back; this bank is lined with drift wood and there is fairly good walking along its outer edge; back of it the country is marsh and lakes and ponds as far as one can see. ^{South of Kogonik this bank runs back away from the coast.} At Kogonik there is an Eskimo settlement of 8 huts, all unoccupied at this season of the year; they are probably occupied at the seal hunting season. Two of these huts had been built since 1878.

Sheet No. 2433 also has a little topography near the junction of Kwiklokelum with the Kwemeluk, to fill in part of a gap left on the sheet of 1898; also a sketch of the shore line for $7\frac{1}{2}$ miles up the Kwemeluk, with one line of soundings. The Kwiklokelum work was done by G. F. P. with sextant, and that up the Kwemeluk by G. L. Flower with steam launch, and is controlled by compass and log readings beyond the triangulation. Mr. Flower started to ascend the Kwemeluk and Akularak to the Kwiklowak, but was unable to go further with the launch on account of shoal water.

On sheet No. 2441 the connections of Bugomonik and some other sloughs are sketched from information from the natives. See sheet No. 2432 for further joining of these with the Kwiklowak.

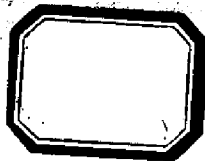
On sheet No. 2444 four of the sloughs are sketched through to the Apoon, having been traversed by Dr. Edmunds in the canoe. The balance of the Okwega is shown on one of Assistant Farris' sheets.

The projections are based on the St. Michael astronomical position carried through Assistant Farris' triangulation. The field results were used in the projections; to make them accord with the final office values, all latitudes must be increased 0.18 (or parallels moved south 5.5 metres) and all longitudes must be diminished 0.56 (or meridians moved west 8.0 metres). This is

a uniform correction to be applied to the projections of all the
Gykon River and Delta work of 1899. The projections of work of
party of Assistant Pratt in 1898, were made on different data,
and a correction must be applied to join these to 1899 sheets.

G. R. Putnam
Assistant

May 25, 1900.



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*Photographs illustrating
Coast of Yukon River Delta*

*(See complete descriptive list
on file in Library and Archives)*

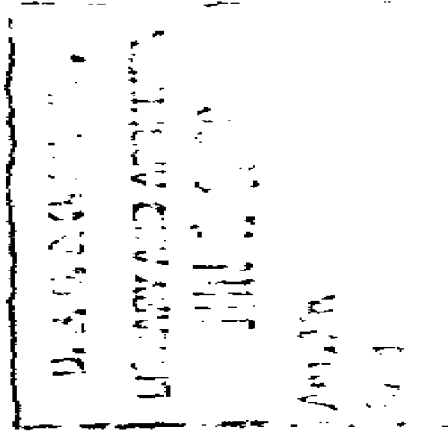
*Names are written on backs of prints
(many additional negatives in Archives)*

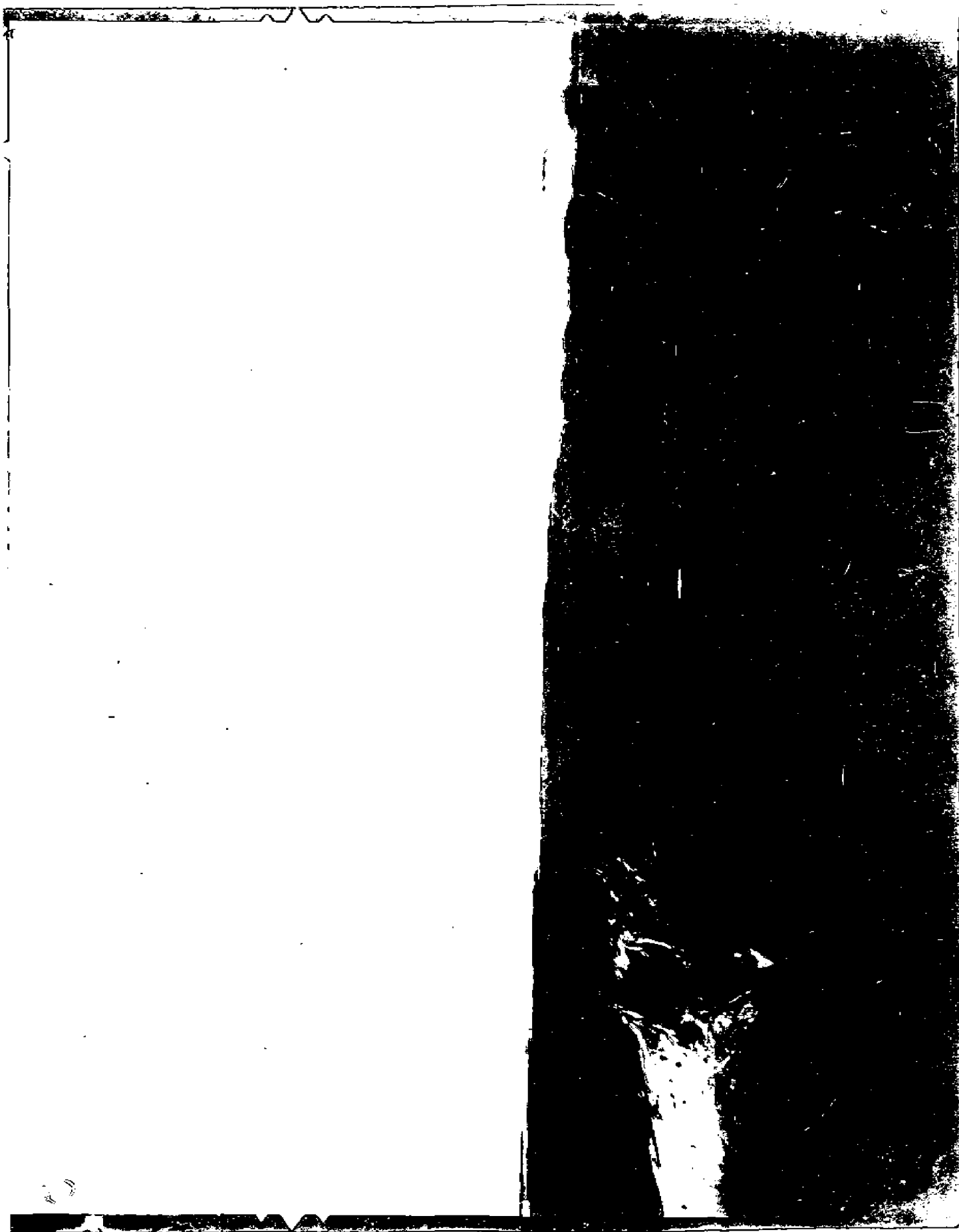


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hauling boats in to Camp Wade

Dr. Edmunds' traverse party





near "Grand" 5th sta. (mouth of Kipmuyut River)
view of marsh & mud flat.

