# SURVEY OF THE ADELAIDE RIVER

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The resources of the Northern Territory of Australia are widely dispersed over a vast area, and distance and lack of adequate means of transport makes uneconomic much of the primary production of which it is capable. Railways and all-weather roads are few and, because of their high capital cost, can be developed only slowly. Possibly more than any other medium, air transport has opened up the Territory though this, of course, has serious limitations. To what extent can the transport situation be overcome by the use of river transport ? The northern part of the Territory is well provided with great rivers. Products of a prodigious monsoon rainfall, they meander through hundreds of miles of country which, for many months of the year, receives no rain at all. Many of these, like the Alligator River, the Daly, Fitzmaurice and Victoria, are mighty rivers. The Roper is 170 miles from its source to its deep broad mouth. Imagine the use barge-minded people would make of this great river system ! There are few places where a barge cannot sail, including to sea behind a tug. These rivers, therefore, are ready-made and self-maintained highways.

One of these rivers, the Adelaide, will probably be the first to be exploited as a highway. Navigable probably for over 70 miles, it winds its nonchalant way through the great rich blacksoil plains. Fed by seemingly inexhaustible springs away above the township of Adelaide River, it carries millions of tons of fresh water to the sea some 50 miles east of Darwin.

The rich black soil on the Adelaide's banks and an endless water supply invited the bold experiment of growing rice at Humpty Doo.

During the development of the Humpty Doo rice growing projects, the Northern Territory Administration thought of the river as a means of transporting economically to Darwin the products of the area — and, as a first step, asked the Navy for a hydrographic survey.

The Hydrographic Service of the Australian Navy was at the time fully committed. Consequently, as a trained hydrographer serving in a general duties appointment I was given the job. The task was to carry out the survey with the minimum of equipment and personnel.

I was given one Leading Seaman Survey Recorder and all the essential equipment and instruments were supplied. We buffed up the 40-foot workboat, especially the ancient echo-sounder, and prepared the 90-foot general purpose vessel H.M.A.S. *Banks* to come along as headquarters.

In the meantime, an approach to the Australian Army Survey Corps, whose men were fortuitously working in the coastal area near the Adelaide River, met with full co-operation. They established two new triangulation stations at points selected by me and co-ordinated them with other stations in the area. Thus we had a firm start.

*Banks* was free from other duties by October, and we sailed one Sunday at midnight, *Banks* leading the way, the workboat following, to arrive in Adam Bay at daylight. We crept cautiously in, guided by an Admiralty chart of 1864, and anchored without difficulty in Port Daly, just inside the mouth of the Adelaide River. Up river we could see the Narrows, gateway to the river proper, enticing, its close shores of dense mangroves hiding the fine stream beyond. Behind the river edging of mangroves the surrounding country was flat — saltpans, clay, mud and desolation. Absolute quiet reigned save the running water straining at our anchor cable; at night, blackness, save our own brave lights.

Our first task was to raise a tide pole to enable soundings to be reduced to datum. This proved something of a task because the shores of Port Daly are mud flats covering with a 17-foot tide. At the outer edge the mud drops sharply to deep water scoured by strong tidal streams. We had to place the pole just over this edge so that it would not dry out at low water, which made it very difficult to secure. It was hot in the sun so we enjoyed wallowing in the muddy water laying out anchors to take guy ropes, struggling, pushing, and relying on our laughter and noise to scare away sharks and crocodiles whose prevalence we had not had time to gauge.

Following some minor triangulation, during which a crocodile watched us from about 20 feet, with interest but without evident malice for half an hour, we were able to start sounding Adam Bay. A smart lesson in tides was learnt when we allowed our boat to ground whilst observing with a theodolite. Too late by moments, we pushed and shoved, sinking to our knees in black, gluey mud. In no time we were high and dry and surrounded by hundreds of yards of soft oozy mud. Six hours to wait — no water, no food, no shade, and no one could reach us ! My wounded pride soon gave way to physical discomfort abetted by myriads of insects. It didn't happen again.

My instructions were to check the soundings of the old chart and assess the possibility of a 20-foot draught ship, 300 feet long, reaching Humpty Doo, 40 miles upstream. Soundings only in and around the channel, Adam Bay and Port Daly were soon finished. The channels had moved a little, but depths were much the same except at the outer end where considerable silting was recorded without, however, closing the channel. So far, so good, up to the Narrows — but this had all been done 100 years ago by Commander HUTCHINSON, R.N. Duties in Darwin recalled me and the onset of the "wet" season "stopped play" until April the next year.

Encouraged by the appearance of dragon flies, a sure sign of the coming of the "dry", we set out once again, *Banks* with the workboat following. Investigation of the river proper was before us, the exciting uncharted part. A few scattered soundings on the chart hinted at trouble

in the first big stretch, Broad Sound. Beatrice Rock was charted, but not found by us.

First, we must know something of the tides in and above the Narrows. Fortunately, our old friends of the Northern Territory Administration Water Resources Branch were, at this moment, erecting an automatic tide gauge just above the Narrows. A comparison of tide levels revealed a rise of one foot through the Narrows. Here the great river is forced through a narrow channel between low rocky cliffs. Transversely across here runs the only high ground, only some 15 feet high, but different in nature from the black soil plains above. The cliffs are not a true rock, but a soggy, soft rock resembling rather a firm clay. Gum trees grow hereabouts and we saw a brilliant green snake as thin as a pencil and three to four feet long. In the middle of the Narrows rises a rock which just peeps out at low water springs, downstream from which is a hole 92 feet deep, whilst above it is another scoured hole 60 feet deep. At full spring ebb and flood the water boils through the Narrows at six knots, tormented by the rock so that it roars and throws up fine spray. It is a truly fine and awe-inspiring sight. We had to sound the Narrows at slack water in order to retain control of the boat and because the echo-sounder transmissions would not penetrate the bubbling waters.

We found good clear passage either side of the Rock and began work on Broad Reach. Here was the contrast; with the river nearly a mile wide, the slower moving stream had deposited its silt and built sand bars. In one place there were only two feet of water but we found a passage of a least depth of nine or ten feet and crossed the Reach with lines of soundings, fixing our position at the end of each line upon aerial photographs taken by the Royal Australian Air Force. These splendid photographs, greatly enlarged, showed almost every mangrove and clearly the numerous small creeks which enter the main stream.

Our method was to steam up each bank identifying features on the aerial photographs. These we marked with coloured strips of calico, which in turn we used as marks for positioning the boat. It was sufficient for our purpose to establish whether deep water existed and relate it to its immediate surroundings. Orientation and even scale were not important, because ships later using the river would navigate by eye keeping to the channel which would be marked with beacons. Sufficient "control" of the photographs could subsequently be obtained from general maps of the area. This apparently rather loose form of control proved remarkably accurate and avoided the enormous task of a full triangulation or traverse in extremely difficult terrain.

Two days' work found us at the head of Broad Sound and at the beginning of the river proper. About 200 yards wide and with two fairly straight reaches to begin with, it steadily narrows down to 175 yards at Humpty Doo, 37 miles above. Soon it begins to meander and turn, in one place completing a circle of three miles circumference at a narrow neck only 200 yards across.

Expecting the river proper to be clear and deep, I decided that one run up the centre and one either side would be sufficient — in any case

it was not possible to write clearly more than three lines of soundings on the chart with the river being less than half an inch wide on paper.

Leaving *Banks* in Port Daly, we set off up the river on the first run, which was to be exploratory. We had covered each aerial photograph with tracing paper and as we went we noted the identifiable features on either bank. We left the ship at 3.30 a.m. and reached the beginning of the river proper at daylight. It was beautiful. Silent and shining smooth, clearly reflecting the stars, the river lay between the black mangroves on the banks. As dawn came it was turned to pink, and then the hot sun beat down and we were hot and sweaty. Endless cups of tea were consumed. We were at Bird Island at sun-up and, as our boat's engine broke the peace, the very trees seemed to lift as a dense cloud of birds rose, to land again after we passed. Black birds, white birds and grey ones, ducks, geese, cormorants and cranes — none of us had seen such a sight. Further on we saw mobs of domestic cattle on the west bank and, on the east, herds of grey buffalo.

About three and a half miles below Humpty Doo we found our first shallow patch, a sort of bar across the river where again slightly higher ground showed on either side, with taller trees. Hitherto, we had been calling soundings from 35 to 60 feet. Finally we rounded our last bend and the pumping station at Humpty Doo came into sight.

Here was another tide gauge belonging to the Water Resources Branch, but further experience was to show that we badly needed more gauges in between. These, however, were beyond us, for we would have no means of comparing levels as there had been no survey work done on the banks of the Adelaide. Some day, levels must be run through this area, but it will be a monumental task crossing the black soil plains where the heat can be overwhelming, insects are in dense clouds and the way blocked by deep boggy creeks requiring tens of miles of deviation to round. The water level is of no value for it is not level. High tide at Humpty Doo occurs some three and a half hours after high water at the Narrows. The tide travels up and down like a long wave pushing the water before it at four knots.

We ran our three lines of sounding once down the middle and once up and down the sides. For the main part the cross section is like a square letter U, steep sided on the outside of the curves, less so on the inside.

With the scant tidal information available the accurate reduction of soundings was impossible. I assumed three arbitrary datum points; the lower reaches based on the Narrows tide gauge, the top one-third based on the Humpty Doo gauge and the middle section a mean of the two. This, the best I could do, was far from satisfactory. On one sounding run we moved down with low tide all the way from Humpty Doo. As we approached the lower reaches the banks were still well exposed. This was interesting, for soon we would reach the Narrows where it was due to be high tide. Suddenly the answer came. In a distance of one mile, in ten minutes, the banks had disappeared and the tide was high. We had climbed a 13-foot high tidal wave.

We inked in our soundings and the river looked good. There was one way to prove our work; *Banks,* 90 feet long and drawing 10 ft 6 in, must go up. One morning at slack water she passed through the Narrows and anchored in Broad Reach. Then with the first rise of the tide we set off up the Adelaide River.

Ahead went the sounding boat with a red flag to wave if she found less than 12 feet. On the bridge, *Banks'* Captain faced a four-hour trial. The ship handled well but unusually. Because of the push of the flood tide she was so eager to turn the corners that opposite wheel was needed. It takes getting used to, using port wheel for a starboard turn.

Only at the bar three and a half miles below Humpty Doo did the red flag go up, but almost at once the boat found a deep passage and soon we were anchored at Humpty Doo. It had been a wonderful trip. The buffalo had been terrified of this huge white "thing" which had invaded their world; rising quickly from their wallows they raised their heads and thundered off, sometimes a hundred in a herd, their slate grey backs shining, their great horns tossing.

As darkness fell we lit our anchor riding lights so that any passing ships should not run into us and " spliced the main brace " with a keg of cold beer brought down by road from Darwin. Thus the first ship for 56 years reached Hmpty Doo.

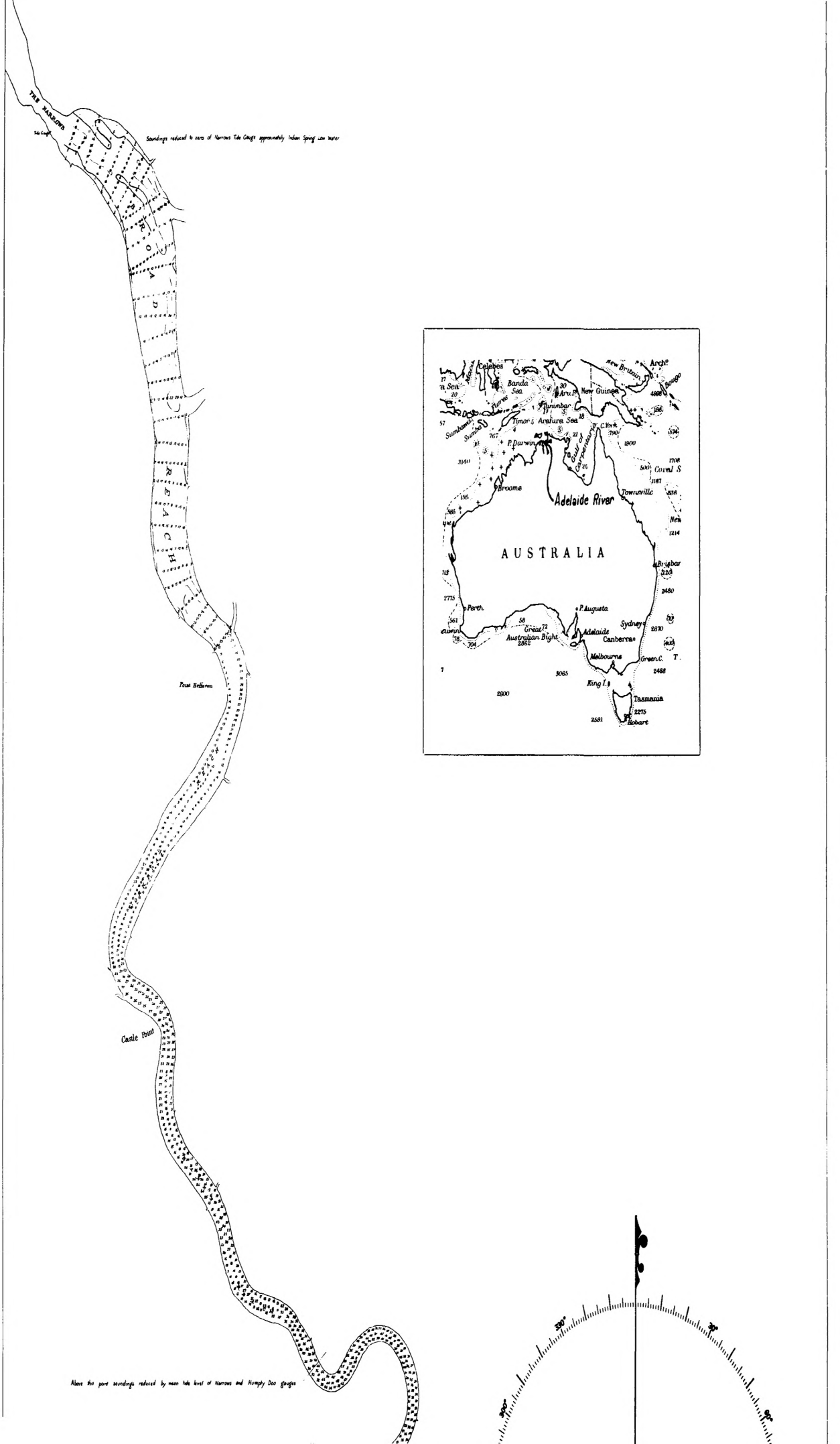
In the evening we fell to talking of former ships' visits. In 1884 s.s. *Palmerston* came around from Darwin, entered the river and reached Beatrice Hill. She drew 12 ft 6 in and was 175 feet long. The fearless captain sailed up the river at 12 knots with no sounding boat ahead, no echo sounder, and primitive engines and steering. In 1908 s.s. *Federal* repeated the feat three times— once with the Governor-General aboard. She drew 10 feet. One can imagine them racing up the river belching black smoke, dressed to the " nines " with high collars and beards — fearless ? foolhardy ? lucky ! We had the knowledge, a chart of a sort, electronics — yes, but our Captain would not be allowed to make a mistake.

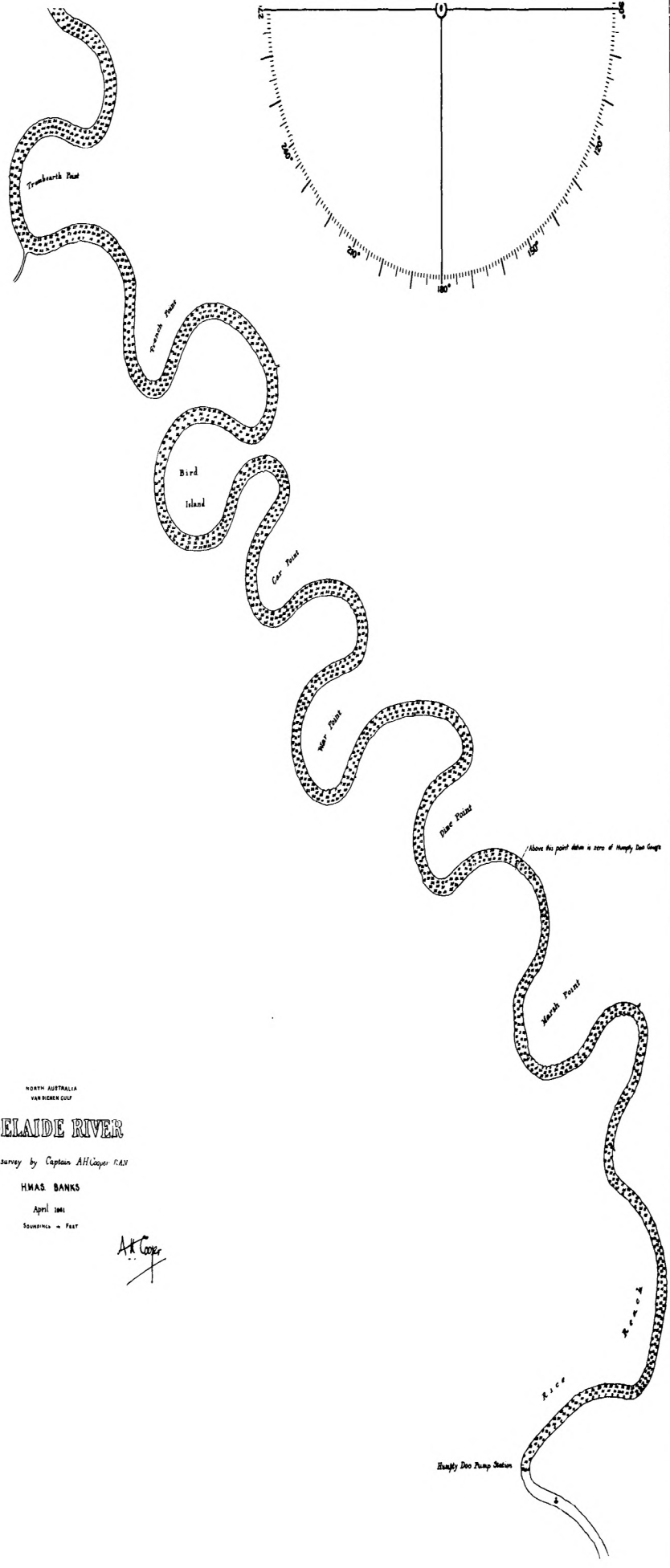
I believe that this method of surveying a river is practical and as accurate as the tedious business of endless quadrilaterals observed by sextant. The dense fringes of mangroves preclude theodolite observations and traverses. The control could, if required, be strengthened by a Tellurometer traverse using towers on high ground, if any.

The real weakness of the survey was the tidal reductions. The only simple solution which presents itself would be the erection of tide poles at, say, 3-mile intervals. These could be connected by reading maximum and minimum heights over a seven-day period. The poles would then be read as the sounding boat passed in the course of soundings. In the Adelaide River the tidal picture was complicated by the up-river tides being almost exactly out of phase with those at the entrance. Furthermore, tide gauge readings showed that whereas there was considerable spring and neaps variation at the entrance there was no discernible variation at Humpty Doo, 40 miles up-river.

Ship handling presented no serious problem provided the ship proceeded with the stream. I am very doubtful whether turns could have

been made against the stream, due to pressure on the bow and the need to keep on the outside of curves to hold deep water. Where the ship was stopped she showed no tendency to leave the centre of the river. Windage on the hull was almost negligible due to the high walls of mangroves.


THE NARROWS
Soundings reduced to zero at Narrows Tide Gauge approximately Indian Spring Low Water
R O A D
R E A C H
Point Rotherham
Castle Point
Above this point soundings reduced by mean tide level at Narrows and Humpty Doo gauges
Celebes
Banda Sea
Aru Is.
New Guinea
New Britain
Arafura Sea
Timor S.
Gulf of Carpentaria
C.York
P.Darwin
Broome
Adelaide River
Townsville
AUSTRALIA
Brisbane
Perth
P.Augusta
Great Australian Bight
Adelaide
Canberra
Sydney
Melbourne
King I.
Tasmania
Hobart
Coral S.




NORTH AUSTRALIA
VAN DIEMEN GULF

# ADELAIDE RIVER

Sketch survey by Captain AH Cooper RAN

H.M.A.S. BANKS

April 1861

SOUNDINGS in FEET

A H Cooper