THE OCEAN CURRENTS AROUND AUSTRALIA.

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With Plate XI.

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Previous to the year 1770 when Cook explored and took possession of the east coast of Australia, practically nothing had been recorded of the currents around our coast, but since that time each of the following explorers has added to our knowledge:—Vancouver who entered and named King George's Sound in 1791, Flinders and Bass who extended the discoveries of Cook on the east coast in 1798, followed by Murray in 1802. During 1802-3 Capt. Matthew Flinders in H.M.S. "Investigator," explored the coast between Sydney and the Gulf of Carpentaria, and completed his remarkable voyage by sailing completely round Australia. About the same date the French explorers Baudin and Freycinet in the "Geographe" and "Naturaliste" examined the north-west and west coasts. The northern and north-western coasts were charted by Capt. King in 1820-4, followed by Captains Wickham and Stokes in 1837 to 1843, and Capt. Denham in 1858. Since 1872 the Admiralty has carried out detached surveys, mostly on the north and north-west coasts, but by far the larger portion of the shores of Australia are still very imperfectly examined and charted, both as regards the outline of the land, and the trend of the currents and tidal streams. Beside the names above mentioned a great number of isolated observations on the direction and velocity of some of the surface currents have been made by chance visitors or exploring expeditions at odd times, such as Capt. Sir James
Ocean Currents Australasia

Cold Currents are shown by black arrows.
Warm do do red do.

Cocos Is
Christmas Is
Borneo
Java
Batavia
New Guinea
Ellice Is
Union Is
Samoa Is

darwin
Morrisby
Torres Strait
Cooktown
New Hebrides
Fiji Is
Friendly Is

Inner N. Australia
Broome
Darwin
New Caledonia
Annooerba

New Zealand
Auckland
Wellington
Chatham Is
Dunedin
Bounty Is

Lord Howe Is
Norfolk Is
Kermadec Is

Sydney
Tasman Sea

Macquarie Is

Perth
Fremantle
Adelaide
Sydney
Brisbane
Townsville
New South Wales
Melbourne

It is necessary to remember that the observations were confined in most cases, to one season of the year, so that the results must be regarded as applying to that particular time and place only. It will thus be evident that from the paucity of the observations available, any conclusions arrived at concerning the ocean currents around Australia, must be regarded as more or less tentative.

The South Australian Current.—The whole of the southern shore of Australia, from Cape Leuwin to Tasmania, is swept by that largest and grandest of all streams, which is impelled on its majestic way by the anti-trades, or roaring forties, or the “brave west winds,” so called by the illustrious Maury.

The unobstructed path of this wind, completely round the earth, between south latitudes 40° and 50° approximately, creates an easterly drift of the surface water known as the Southern Ocean Current. There is an indraft of water from the Antarctic Ocean, in a north-easterly direction, and so vast a quantity of cold water in the immediate vicinity of our southern shores has a very pronounced effect on the climate of a large portion of the continent.

There is also an indraft of warm water from the Indian Ocean which, having no outlet to the north, as in the case of the Atlantic and Pacific Oceans, must discharge the whole of its warm and comparatively light waters to the southward.

We are unfortunately destitute of information as to the width or depth or velocity or location of this discharge, but we know of a warm southerly and easterly surface drift from the vicinity of Cape Leuwin, at the south-west corner of Australia, and the “Challenger” observations.
show that a warm sub-surface current, about 400 miles wide, and about 250 fathoms deep, flows in an easterly direction off Cape Northumberland on the Victorian coast. At Cape Leuwin it is a surface current, but at Cape Northumberland it is about 150 fathoms below, and has cooled to the extent of about 16° Fah.

As the great Southern Ocean current of less temperature than 62° approaches the south-west coast of Australia it meets this warm southerly drift from the Indian Ocean, and its water being the heavier, it dips below the warmer stream, and flows as a sub-surface current until it meets the shore line. It bifurcates probably from 400 miles to 500 miles south-west of Cape Leuwin, one part flowing northwards along the western coast of West Australia, as far north as Sharks Bay, and the other flows easterly along the South Coast as far as Bass' Strait. The branch which flows northward dips under the warm southerly drift from the Indian Ocean before referred to, but upwells in the immediate vicinity of the shore line, forming a cold belt, which varies in width according to the strength and duration of the off shore winds.

There is not sufficient information available to enable us to say how far it extends as a sub-surface current to the west. The oceanic isotherm of 62° approaches the west coast approximately in an east and west direction, on about the latitude of Perth, until within from 50 to 200 miles from the shore line, according to the season, and then bends sharply to the south. Towards the end of June it is at its greatest distance (about 200 miles) south of Cape Leuwin, and it approaches to within a few miles of the shore line at the end of September. The waters adjacent to the shore between Eucla and North West Cape of West Australia, are reported to be about 5° colder than the water in the offing, and this is probably due to an upwelling of the water of the Southern Ocean current.¹

¹ Report by J. J. East to the West Aust. Govt., August, 1912.
The southern branch continues as an easterly surface current across the Bight, with a rate varying from 3 to 4 knot as far as Spencer Gulf. The warm current from the Indian Ocean, which appears to be confined to the Bight, to that point, here dips below and becomes partly merged in the main stream until it strikes the Tasmanian Plateau. This obstruction, by deflecting the current to the south-east, causes a further mixing of the warm and cold waters, which accounts for the water in Bass' Strait being generally from 2° to 4° colder than the water off Cape Northumberland.

The Tasmanian plateau obstruction also causes a local retardation of the current velocity in Bass' Strait, to such an extent that the tidal currents become the more important, while both are, to a large extent, dominated by the wind.

The main body of the Southern Ocean current sweeps along the western side of the plateau, turning sharply and with increased velocity to the left, at the southern coast of Tasmania, and continues its majestic course north-easterly and easterly around the world.

Eastern Australian Current.—The Eastern Australian current, unlike that of the Southern Ocean, is a stream current, being a branch of the South Pacific Equatorial current, which after passing to the southward of the Fiji Islands and New Caledonia, is deflected towards the Australian coast. It first strikes the eastern Australian shore line near Great Sandy Island, where it is again deflected, this time to the southward, and flows, under the name of the Eastern Australian current close along the shores of southern Queensland and New South Wales as far as Jervis Bay. The coast line here bends slightly to the westward while the current continues its course southwards until it impinges upon the Southern Ocean current flowing eastwards, at about Latitude 43° South. It is here
split into three portions, the first being bent round and
flows eastward as a warm surface current; the second is
also carried eastwards, and mixing with the colder stream,
helps to account for the rise of temperature—from 41° Fah.
to 50° Fah., according to season—which is observed between
latitudes 50° and 60° south; the third is that part which,
having become cooler and therefore heavier, sinks below
the cold surface water, and taking a south-easterly course,
flows as a comparatively warm under current, into the
Antarctic Ocean.

This warm water, in conjunction with that of the
Brazilian current in the South Atlantic, and the Aghulhas
or Cape Current of the Indian Ocean may cause the under-
mining of the enormous ice-masses which form the "Ice
barrier," detaching from them the numerous floating ice-
bergs which strew the face of the Southern Ocean down to
50° and 40° South latitudes.

The melting of these ice masses produces a quantity of
water, which, being fresher, is of less specific gravity than
the salt water of the surrounding sea, and therefore floats
upon it, but as the fresher water from the icebergs mixes
with this salt water, the mixture being of lower tempera-
ture is rendered heavier and sinks, and hence the supply of
cold water which, to a depth of several thousand fathoms,
fills the basins of the Atlantic, Pacific, and Indian Oceans.¹

The portion which is bent round and flows eastward con-
tinues its journey thus till it strikes the west coast of New
Zealand, when it is again deflected to the northward along
that coast as far north as Cape Maria Van Diemen, where
it turns to the west and is lost in the waters of the Tasman
Sea.

Between Great Sandy Cape and Jervis Bay, the Eastern
Australian Current, for which the name Tasman Current is

now proposed, has a width of about 350 or 400 miles, at Latitude 34° South, and a depth of about 100 fathoms. Its velocity on the New South Wales coast is about 1½ knots at the littoral and about 2 knots in the offing, at all times and seasons, and at all the salient points from Point Danger to Jervis Bay, its speed and direction have been measured or observed. On the littoral, the speed is, of course, diminished and the direction even reversed, on account of the current meeting headlands of varying form, but these return currents extend but a few miles, and are of local importance only.

On the west coast of New Zealand the temperature of the stream is from 8° to 10° Fah. warmer than on the east coast, but the information available is not sufficient to enable us to state its dimensions.

Between Jervis Bay and Bass Strait the direction and velocity of this current are variable, as it is very liable to interference by an extension northerly of that part of the Southern Ocean current flowing easterly through Bass' Strait. The area between the shore line and the western edge of the Tasman current, is alternately occupied by branches of the warm or the cold water, according as the wind blows from the south-west or from the south-east quadrant.

The western equatorial drift in the eastern South Pacific caused by the south-east Trades, will be found to extend to about latitude 20° or 22° South, and as before described,

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1 The title Notonectian Current has been proposed for this stream by Mr. Charles Hedley, F.L.S., but the name does not appeal to the writer either as descriptive or distinctive. There are several southerly flowing currents in the ocean, so that the term Notonectian is not distinctive, and as this one has first a westerly course, then southerly, then easterly and finally northerly and north-westerly to its termination or extinction, it cannot be said to be distinctive.


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a portion of its waters is deflected towards the Australian coast at about New Caledonia. The remaining portion flows in a north-westerly direction towards Cape York and into the Arafura Sea.

Within the triangle formed by New Caledonia, Cape York and the Chesterfield Reefs, the currents are uncertain both as regards direction and velocity, being influenced largely by the prevailing winds, and, when close to the shore line, by the tidal currents which are very complicated, being partly produced by local conditions existing throughout the numerous islands.

Inside the Barrier Reefs the currents are mainly tidal, and the set is largely influenced by the wind, and by local land configuration.

Generally speaking the flood tide sets north, and the ebb tide south, but during the prevalence of the north-west winds, from December to March, these directions may be reversed.

_Arafura Sea Currents._—In the Arafura Sea the current generally sets with the wind, its course, in the south-east monsoon season, from the beginning of April to the beginning of October, being to the westward. The velocity depends much upon the force of the wind, but seldom exceeds 1 to 1½ knots. Along the northern side of Sirwatti Islands between Timor and the Tenimber group, the current sets to the eastward, or to windward, during the south-east monsoon season. During the north-west monsoon the currents generally set also to the eastward. Practically nothing has been done in investigating the currents of the Arafura Sea, or towards the solution of the many complicated problems appertaining to this area.

_The North-west and West Coasts._—On the north-west and west coasts of Australia the current, though generally setting with the wind, is sometimes uncertain both in
velocity and direction, being complicated with the strong tidal currents which prevail at those parts of the coast. The range of the tides between Van Diemen’s Gulf, in Longitude 132° East, and Dampier Archipelago in Longitude 116° 30' East is abnormally great, ranging from 19 feet to 38 feet at springs, the average of twenty-two stations being 26 feet. The greatest rise and fall on this coast is 38 feet at Hanover Bay, in Longitude 124° 45' East, but at neaps, the range is reported to be only 2 feet at times.

Such large masses of water entering and leaving the gulfs and bays, necessarily cause serious indrafts and extensive outdrafts which being further complicated by great diurnal inequality, are a menace to safe navigation.

Owing to the predominance of offshore winds on the north-west and west coasts, the tendency is to keep the heated water away from the shore; the outward surface drift being replaced by a counter flow or upwelling of cold water from below. On this account the temperature, in the immediate vicinity of the shore, is made more bearable, while the increased warmth of the water in the offing, conduces to the growth of fish, and thus adds to the commercial prosperity of the country.

It will be noticed that the words ‘probably’ and ‘about’ are used in this paper more often than they should be in dealing with a subject of such vast importance to the community. They are rendered necessary on account of the very meagre information at our disposal, and in the author’s opinion, this unfortunate and undesirable state of affairs should be remedied as soon as possible, quite apart from the commercial value of a complete knowledge of our ocean currents as affecting our fish supply and our climatic conditions upon which our farming industries so much depend.

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