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THE SEASONAL CIRCULATION OF THE SURFACE  
WATER MASSES OF THE TASMAN AND  
CORAL SEAS

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FOREWORD

This report has been prepared to provide information for biologists and others interested in the Coral and Tasman Seas. It gives a simplified summary of the two scientific papers mentioned in the introduction.

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# THE SEASONAL CIRCULATION OF THE SURFACE WATER

## MASSES OF THE TASMAN AND CORAL SEAS

By D. J. Rochford

### I. INTRODUCTION

Two papers have been prepared on the regional and external water masses of the Tasman and Coral Seas. The earlier (Rochford 1957\*) used data prior to 1955 for the identification and nomenclature of the regional water masses of the Tasman Sea. The more recent (Rochford in preparation) used 1955-56 data to examine the properties and probable circulation of the external water masses which determine surface characteristics of the Tasman and Coral Seas as a whole. This report summarizes the conclusions of these two papers in the form of figures showing the relationships and seasonal circulation of the surface water masses of the region. These figures are based upon evidence given in these two papers and reference must be made to them for details.

### II. RELATIONSHIPS OF THE SURFACE WATER MASSES

Figure 1 shows the relationship between the regional water masses of the Tasman Sea (Rochford 1957) and the external water masses of the whole region (Rochford in preparation). As indicated, the regional Sub-Antarctic, the South-west Tasman, and the Central Tasman are formed by mixing between the external Sub-Antarctic and the West Central South Pacific water masses. It is suspected that some of the low temperatures of the Central and South-west Tasman water masses are due on occasions to the introduction of some of the "Tui" water mass into this relationship.

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\*Rochford, D.J. (1957).-- The identification and nomenclature of the surface water masses in the Tasman Sea (Data to the end of 1954). Aust. J. Mar. Freshw. Res. 8 (4): 369-413.

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The regional South Equatorial and Coral Sea waters are considered to be mixtures of the external South Equatorial and the West Central South Pacific modified during the passage south by mixing with deeper waters containing Sub-Antarctic waters.

### III. SEASONAL CIRCULATION OF SURFACE WATER MASSES

#### (a) August - October (Fig. 2)

In this quarter the Tasman Sea is dominated by the Central Tasman moving north and east, and the South-west Tasman circulating clockwise off east Tasmania and Bass Strait. The Sub-Antarctic water appears to intrude northwards as a wedge along longitude 155°E.

Extensive vertical mixing occurs east of about 160°E and Sub-Antarctic waters occur near the surface. In the Coral Sea the West Central South Pacific water mass is the dominant, moving as a broad drift into the region between New Caledonia and Norfolk Island. The South Equatorial water flows into the northern Coral Sea but does not move south in any quantity.

#### (b) November - January (Fig. 3)

In this quarter meridional flow commences and the Coral Sea water mass appears off the New South Wales coast as part of the East Australian current. Central Tasman waters are found to the east and south of this current. Warmed Sub-Antarctic waters drift north of the sub-tropical convergence into the southern Tasman Sea, whilst the East Central New Zealand water mass appears off the west coast of North Island, New Zealand. A general easterly escape-ment of waters from Bass Strait occurs during the quarter. In the eastern Coral Sea the South Equatorial waters flow south over the West Central South Pacific waters. In the western region of this sea, the Arafura water mass drifts eastwards and also overlies the West Central South Pacific waters. There appears to be little direct flow of this latter water mass into the region in this quarter.

#### (c) February - April (Fig. 4)

In this quarter South Equatorial waters and their immediate derivatives are the dominant feature of the East Australian current extending south of Sydney to Eden, with an occasional flow into east Tasmania and Bass Strait. The Coral Sea water mass occupies the central region of the

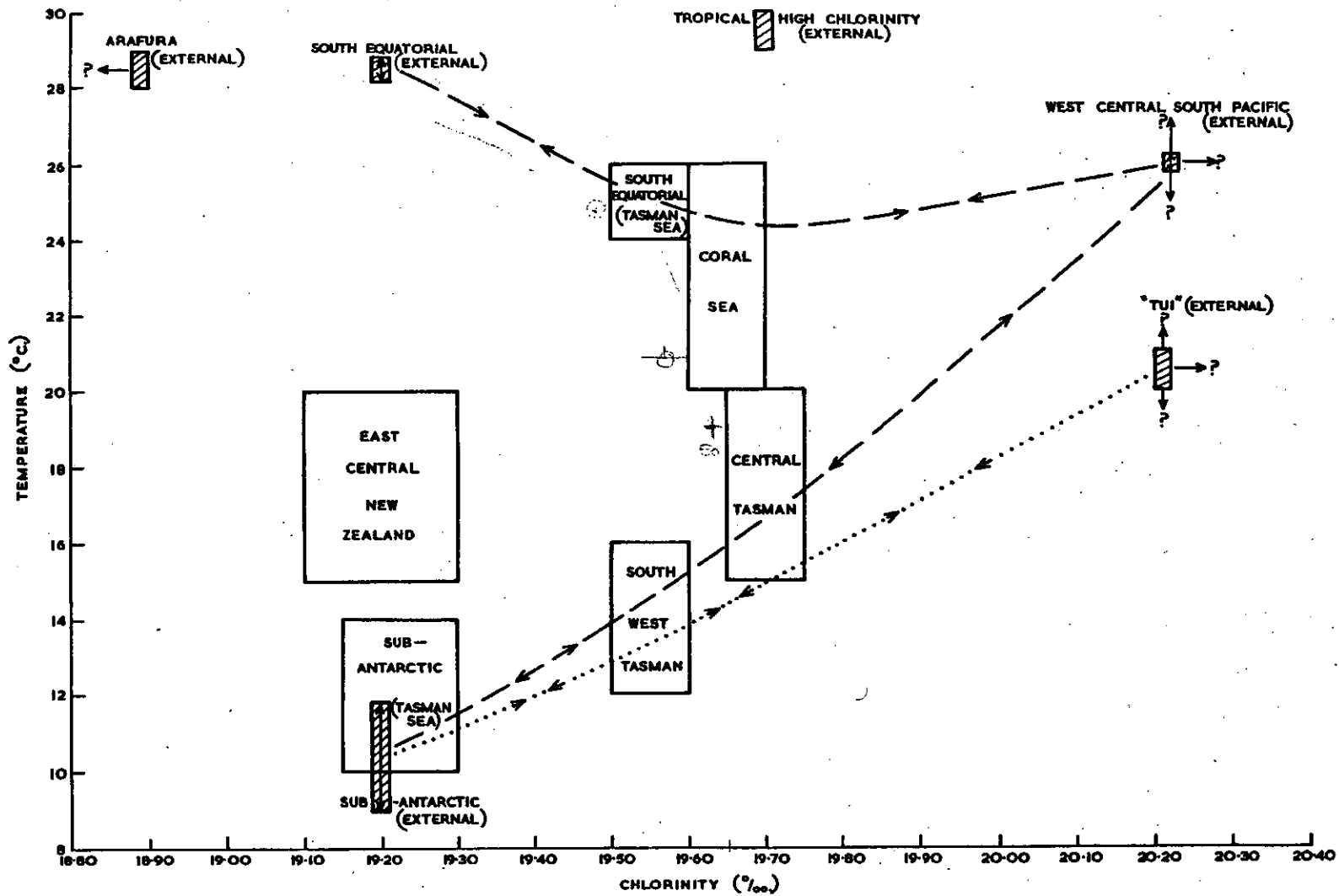


Fig. 1. The properties and probable relationships (full dashed lines) of the regional and external water masses of the Tasman and Coral Seas. Secondary relationships are indicated by the dotted lines.

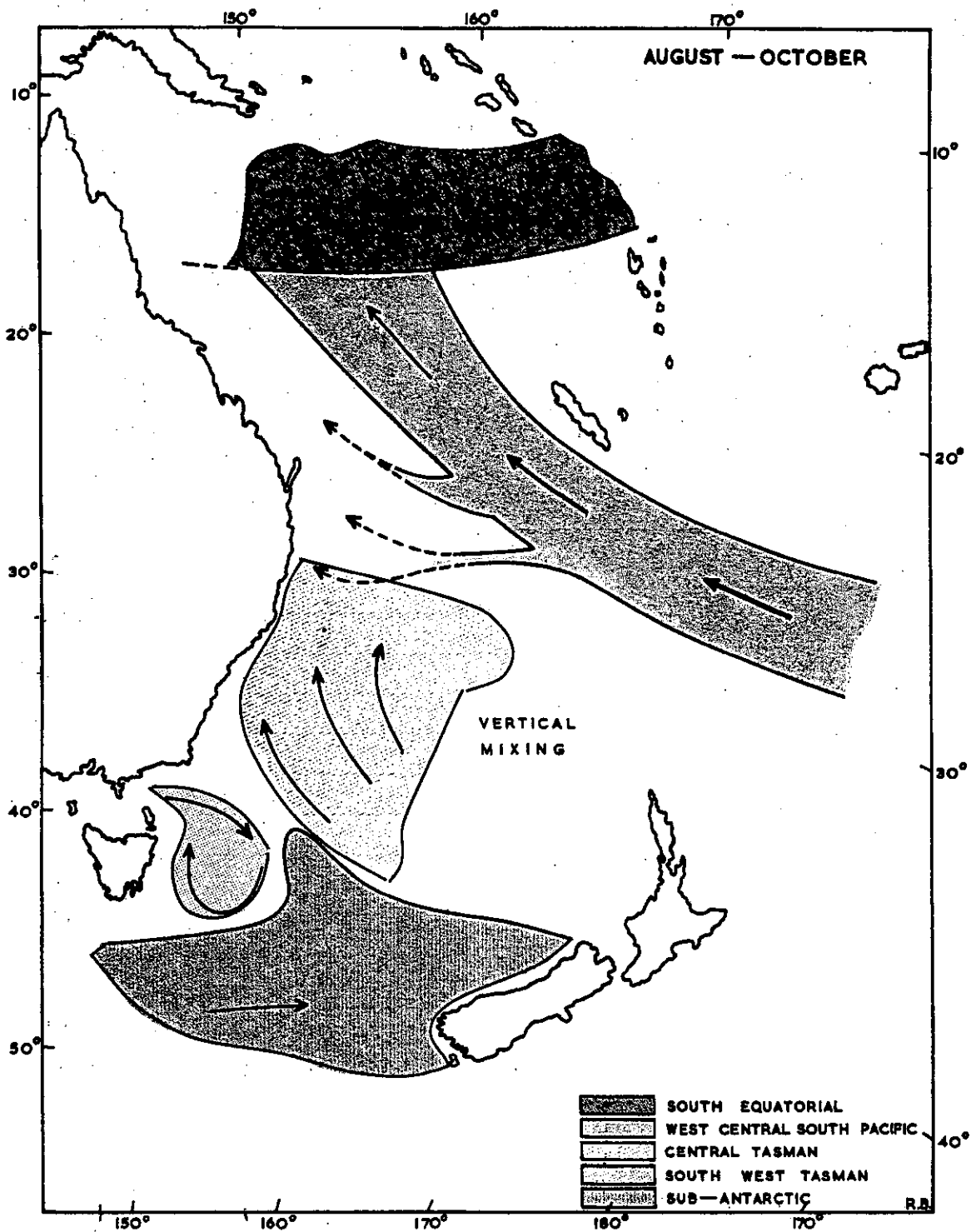


Fig. 2. The distribution and principal circulation paths of the surface water masses of the Tasman and Coral Seas, August - October.

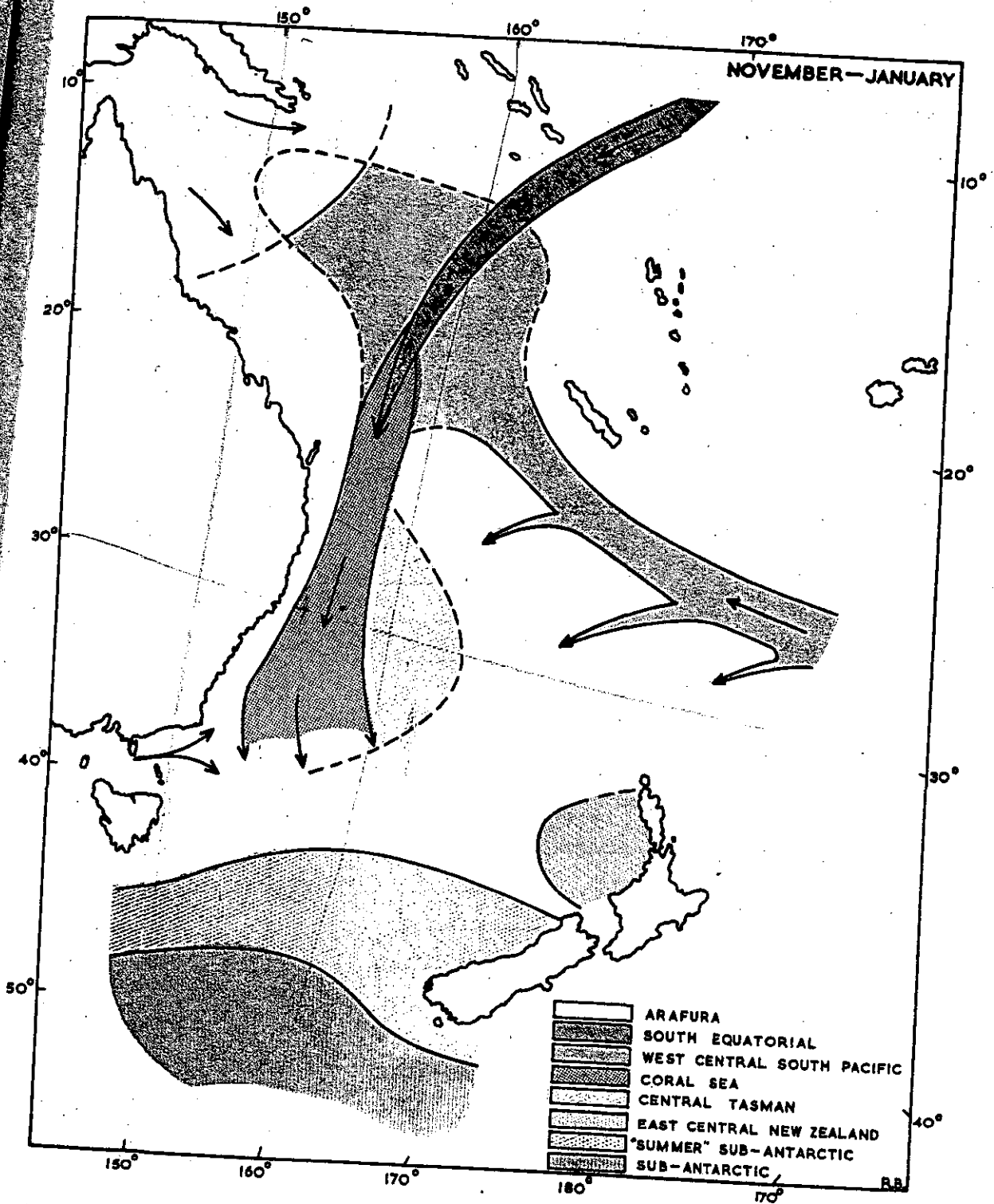


Fig. 3. The distribution and principal circulation paths of the surface water masses of the Tasman and Coral Seas, November - January.

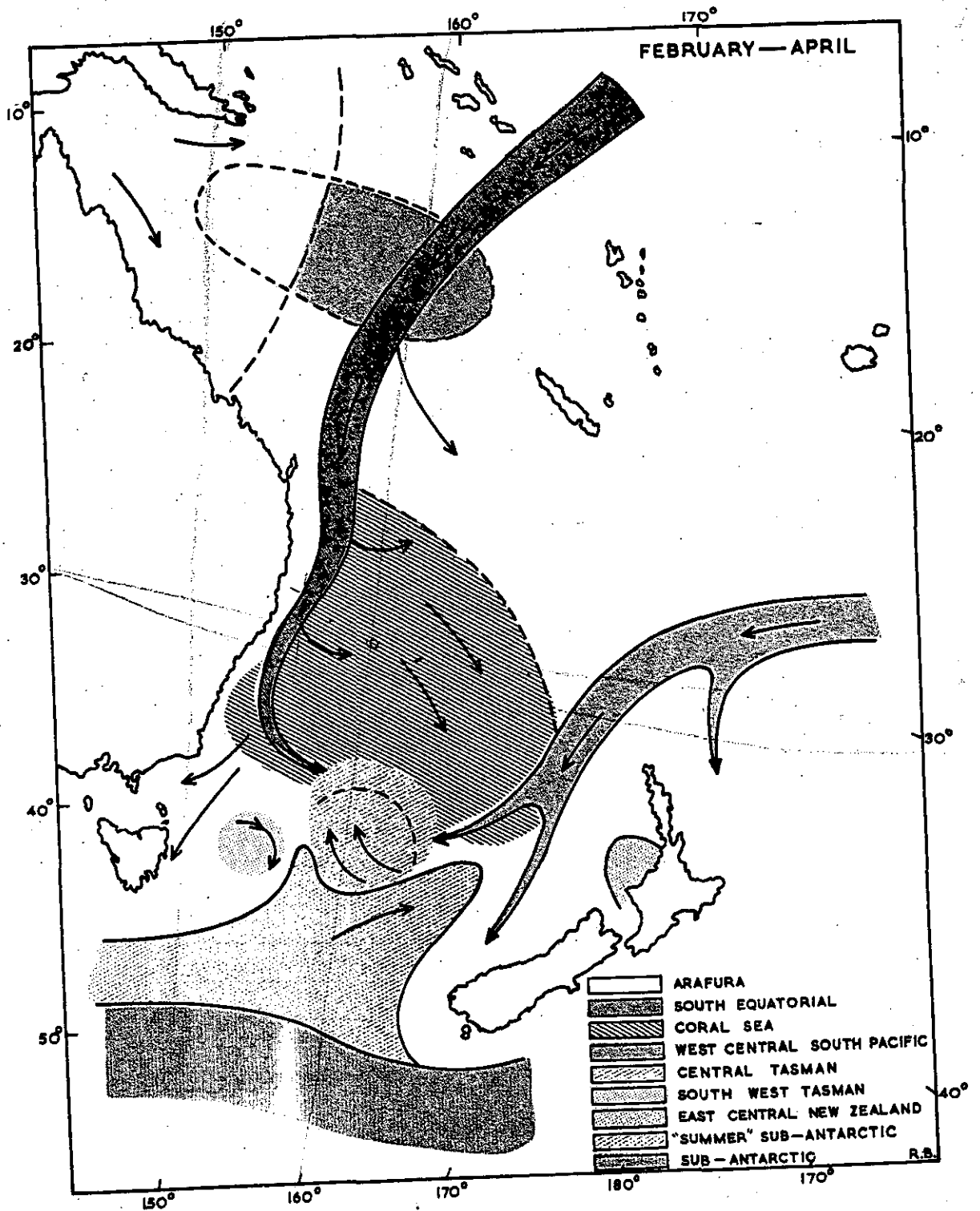


Fig. 4. The distribution and principal circulation paths of the surface water masses of the Tasman and Coral Seas, February - April.



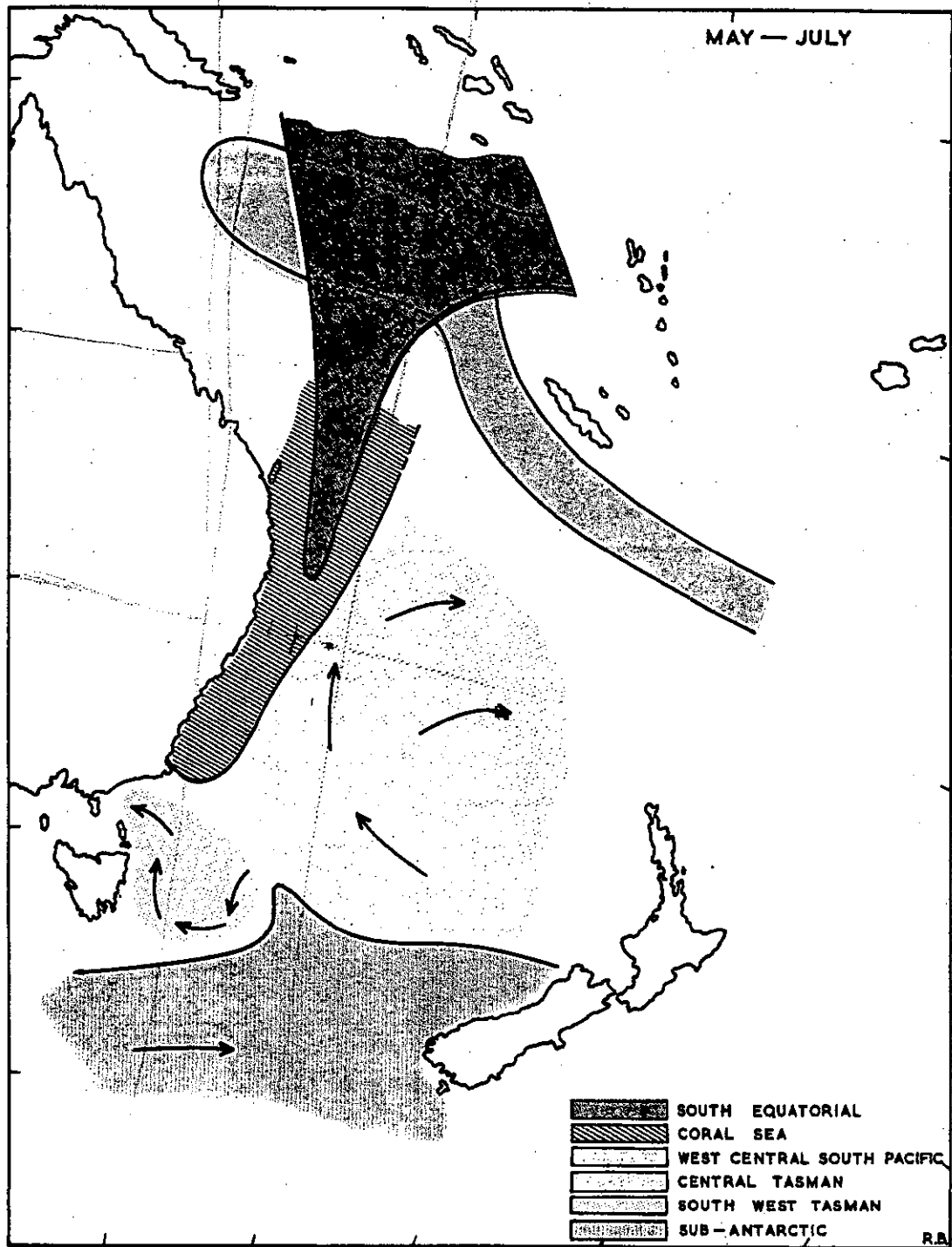


Fig. 5. The distribution and principal circulation paths of the surface water masses of the Tasman and Coral Seas, May - July.

Tasman Sea, and a near surface stream of West Central South Pacific occupies the eastern. Mixing between this latter water mass and Sub-Antarctic waters has occurred and formed the Central Tasman and South-west Tasman waters of the following winter. East Central New Zealand waters are found in reduced extent around Cook Strait, New Zealand.

In the eastern Coral Sea the Arafura water mass is still extensively distributed. The West Central South Pacific can be found as a subsurface layer only, in the central Coral Sea.

(d) May - July (Fig. 5)

In the Coral Sea the southward flow of South Equatorial waters has been much reduced and some flow occurs of the West Central South Pacific waters into this region. Off the New South Wales coast the Coral Sea water mass dominates, with the Central Tasman distributed to the east. Towards the end of this quarter this latter water mass moves into New South Wales offshore waters as far north as Sydney.

The South West Tasman occupies the region east of Tasmania to about 155°E and flows generally in a clockwise gyral. Some of this water enters eastern Bass Strait, but the magnitude of this flow is unknown.

*[Faint, illegible text, possibly bleed-through or very light print]*

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