



MARINE BIOLOGICAL STUDIES IN RELATION TO THE
OPERATION OF THE TORRENS ISLAND POWER STATION.

a thesis by

WILLIAM MUIR HOST, B. SC. (HONS.)

prepared in association with the Department of Zoology,
Faculty of Science and submitted to

THE UNIVERSITY OF ADELAIDE

in fulfilment of the requirements for the degree of
MASTER OF SCIENCE

SUBMITTED :

DECEMBER, 1977

TABLE OF CONTENTS

| | Page |
|---|--------|
| List of tables | v. |
| List of diagrams | ix. |
| Prologue | xvii. |
| Summary | xviii. |
| Declaration | xx. |
| Acknowledgements | xxi. |
| SECTION A. The control of fouling in the cooling water system | |
| 1. Introduction | 1. |
| 1.1 The cooling water system | 1. |
| 1.2 The fouling fauna | 2. |
| 1.3 Control of the fouling fauna | 3. |
| 2. Materials and methods | 6. |
| 3. Results | 9. |
| 3.1 Weights of growth on the plates | 9. |
| 3.2 Settlements on the plates | 13. |
| 3.3 Settlement and growth of the serpulid <i>Hydroides norvegica</i> Gunnerus | 15. |
| 3.4 Presence of less common species | 17. |
| 3.5 The serpulid <i>Eulaeospira convexis</i> (Wisely) | 18. |
| 3.6 Growth on the walls of the troughs | 21. |
| 3.7 Supplementary results | 22. |
| 4. Discussion | 24. |
| SECTION B. Thermal effluent and epifauna | |
| 1. Introduction | 35. |
| 1.1 The situation at Torrens Island - present and future | 40. |
| 2. Materials and methods | 42. |

Table of contents (cont.)

| | Page |
|--|------|
| 3. The distribution of temperatures and the dispersal of the warmed water | 45. |
| 4. Results | 50. |
| 4.1 Weights of growth | 50. |
| (a) Two-week plates | 50. |
| (b) Four-week plates | 55. |
| (c) Eight-week plates | 63. |
| 4.2 Species present on the plates | 73. |
| (a) The compound ascidian <i>Leptoclinum (Leptoclinum) rayneri</i> (MacDonald) | 73. |
| (b) The bryozoan <i>Zoobotryon verticillatum</i> (Della Chiaji) | 78. |
| (c) The hydroid <i>Tubularia</i> sp. | 81. |
| (d) An endoproct (which is probably) <i>Loxosomella kefersteini</i> | 85. |
| (e) The bryozoan <i>Watersipora subovoidea</i> (d'Orbigny) | 87. |
| (f) The bryozoan <i>Bugula avicularia</i> (L) | 90. |
| (g) The bryozoan <i>Bugula neritina</i> (L) | 94. |
| (h) The simple ascidian <i>Ciona intestinalis</i> L. | 96. |
| (i) The compound ascidian <i>Botryllus schlosseri</i> (Pallas) | 100. |
| (j) The compound ascidian <i>Botrylloides nigrum</i> Herdman | 103. |
| (k) The serpulid <i>Eulaeospira convexis</i> (Wisely) | 105. |
| (l) The simple ascidian <i>Microcosmus squamiger</i> Michaelson | 109. |
| (m) An unidentified polychaete (family Sabellidae) | 110. |
| (n) The serpulid <i>Hydroides norvegica</i> Gunnerus | 112. |
| (o) The barnacle <i>Balanus amphitrite</i> Darwin | 117. |
| (p) The oyster <i>Ostrea angasi</i> Sowerby | 119. |
| (q) A tube-dwelling amphipod <i>Corophium</i> sp. | 119. |

Table of contents (cont.)

| | Page |
|--|------|
| (r) An unidentified tube-dwelling amphipod (family Corophiidae) | 122. |
| (s) A tanaid crustacean (Tanaidacea : Tanaidae), possibly <i>Paratanais ignotus</i> | 125. |
| 5. Discussion | 126. |
| Notes on identification | 132. |
| References | 133. |
| Appendices | |

LIST OF TABLES

| SECTION A | | Page |
|-----------|--|------|
| Table 3.1 | Summary of the analysis of variance conducted on the data on the weights of growth on two-week plates from the chlorinated troughs. | 10. |
| Table 3.2 | Summary of the analysis of variance conducted on the data on the weights of growth on four-week plates from the chlorinated troughs. | 12. |
| Table 3.3 | Summary of analyses of variance on total numbers of five species of sessile animals present on glass and concrete-asbestos plates. | 13. |
| SECTION B | | |
| Table 4.1 | Summary of the analyses of variance conducted on the data on weights of growth on two-week plates from CW(OS), Outfall and Jetty stations over the period 30/8/72 - 4/7/73. | 51. |
| Table 4.2 | Summary of the analyses of variance conducted on the data on weights of growth on two-week plates from all stations, except CW(NS), over the period 18/7/73 - 24/4/74. | 53. |
| Table 4.3 | Summary of the analyses of variance on the data on weights of growth on two-week plates from the CW(OS) and CW(NS) stations over the period from 31/1/73 - 16/1/74. | 54. |
| Table 4.4 | Summary of the analyses of variance conducted on the data on weights of growth on 2-week plates from the CW(OS) and CW(NS) stations over the period from 8/5/74 - 19/12/74. | 56. |
| Table 4.5 | Summary of the analyses of variance conducted on the data on weights of growth on two-week plates from the CW(OS) and Jetty stations over the period from 21/11/74 - 13/2/75. | 57. |
| Table 4.6 | Summary of the analyses of variance conducted on the data on weights of growth on four-week plates from the CW(OS), Outfall and Jetty stations over the period 13/9/72 - 3/1/73. | 58. |
| Table 4.7 | Summary of the analyses of variance conducted on the data on weights of growth on four-week plates from the CW(OS), Outfall, Jetty and 30R station over the period from 26/4/73 - 26/9/73. | 59. |

List of tables (cont.)

| | Page | |
|------------|---|-----|
| Table. 4.8 | Summary of the analyses of variance conducted on the data on weights on four-week plates from all stations, except CW(NS), over the period 10/10/73 - 24/4/74. | 61. |
| Table. 4.9 | Results of the <i>a posteriori</i> tests extending the results shown in table 4.8. | 62. |
| Table 4.10 | Summary of the analyses of variance conducted on the data on weights of growth on four-week plates from the CW(OS) and CW(NS) stations over the period from 5/7/74 - 19/12/74. | 64. |
| Table 4.11 | Summary of the analyses of variance conducted on the data on weights of growth on four-week plates from the CW(OS) and Jetty stations over the period from 4/12/74 - 13/2/75. | 65. |
| Table 4.12 | Summary of the analysis of variance conducted on data on the organic weights of growth on eight-week plates from the CW(OS), Outfall and Jetty stations over the period from 11/10/72 - 3/1/73. | 67. |
| Table 4.13 | Summary of the analyses of variance conducted on the data on weights of growth on eight-week plates from the CW(OS), Outfall, Jetty and 30R stations over the period 28/3/73 - 10/10/73. | 68. |
| Table 4.14 | Summary of the analyses of variance conducted on the data on the growth on eight-week plates from all stations, except CW(NS), over the period 7/11/73 - 24/4/74. | 69. |
| Table 4.15 | Summary of the analyses of variance conducted on the data on weights of growth on eight-week plates from the CW(OS) and CW(NS) stations over the period 23/5/73 - 16/1/74. | 71. |
| Table 4.16 | Summary of the analyses of variance conducted on the data on weights of growth on eight-week plates from the CW(OS) and CW(NS) stations over the period 2/8/74 - 19/12/74. | 72. |
| Table 4.17 | Results of a series of one-sample runs tests conducted on the data on the presence of <i>Leptoclinum rayneri</i> on plates from all stations, except CW(NS), obtained over the period from 1/8/73 to 22/5/74. | 74. |
| Table 4.18 | The occurrence of <i>Zoobotryon verticillatum</i> on the sets of frames and plates. | 79. |
| Table 4.19 | Results of a series of one-sample runs tests conducted on the data on the presence of <i>Watersipora subovoidea</i> on plates from all stations, except CW(NS), obtained over the period from 10/10/73 - 22/5/74. | 88. |

List of tables (cont.)

| | Page |
|------------|---|
| Table 4.20 | Results of a series of one-sample runs tests conducted on the data on the presence of <i>Bugula avicularia</i> on plates from the CW(OS), Jetty and 30R stations obtained during the second year. 92. |
| Table 4.21 | Results of a series of Wilcoxon matched pairs signed-rank tests conducted on the data on the presence of <i>Bugula avicularia</i> on plates from the CW(OS), Outfall, Jetty and 30R stations obtained during the second year. 93. |
| Table 4.22 | Results of a series of one-sample runs tests conducted on the data on the presence of <i>Bugula neritina</i> on plates from the CW(OS), Jetty and Outfall stations obtained over the period 26/4/73 - 22/5/74. 95. |
| Table 4.23 | Results of a series of Wilcoxon matched-pairs signed-rank tests conducted on the data on the presence of <i>Bugula neritina</i> on plates from the CW(OS), Outfall, Jetty and 30R stations obtained over the period 26/4/73 - 22/5/74. 97. |
| Table 4.24 | Results of one-sample runs tests conducted on the data on the presence of <i>Ciona intestinalis</i> on four-week and eight-week plates from the CW(OS), Jetty and 30R stations over the period 1/8/73 - 22/5/74. 99. |
| Table 4.25 | Results of a series of Wilcoxon matched-pairs signed-rank tests conducted on the data on the presence of <i>Ciona intestinalis</i> on plates from the CW(OS), Outfall, Jetty and 30R stations obtained over the period 1/8/73 - 22/5/74. 101. |
| Table 4.26 | Results of a number of one-sample runs tests conducted on the data on the presence of <i>Botrylloides nigrum</i> on plates from the CW(OS), Jetty and 30R stations obtained over the period 29/8/73 - 22/5/74. 104. |
| Table 4.27 | Summary of the results of a series of Wilcoxon matched-pairs signed-rank tests conducted on the data on the presence of the compound ascidian <i>Botrylloides nigrum</i> on four-week and eight-week plates from the CW(OS), Outfall, Jetty and 30R stations over the period from 29/8/73 - 22/5/74. 106. |
| Table 4.28 | Summary of the analyses of variance conducted on the data on rates of settlement of the serpulid <i>Eulaeospira convexis</i> on two-week plates from the Outfall, Jetty and 30R stations. 107. |
| Table 4.29 | Summary of the results of a series of Wilcoxon matched-pairs signed-rank tests conducted on the data on the presence of <i>Microcosmus squamiger</i> on plates from the CW(OS), Outfall, Jetty and 30R stations obtained over the period 23/5/73 - 22/5/74. 111. |

List of tables (cont.)

| | Page |
|------------|---|
| Table 4.30 | Summary of the results of a series of Wilcoxon matched-pairs signed-rank tests conducted on the data on the presence of an unidentified sabellid on plates from the CW(OS), Outfall, Jetty and 30R stations obtained over the period 12/9/73 - 8/5/74. 113. |
| Table 4.31 | Summary of the analyses of variance conducted on the data on rates of settlement of the serpulid <i>Hydroides norvegica</i> on 2-week plates from all stations, except CW(NS) station, over the period from 1/8/73 - 24/4/74. 115. |
| Table 4.32 | Summary of the analyses of variance conducted on the data on rates of settlement of the barnacle <i>Balanus amphitrite</i> on two-week plates at locations in Angas Inlet and North Arm. 118. |
| Table 4.33 | Summary of the analyses of variance conducted on the data on rates of settlement of the oyster <i>Ostrea angasi</i> on two-week plates from the CW(OS), Outfall and Jetty stations obtained over the period 25/10/72 - 14/2/73. 120. |
| Table 4.34 | Results of a series of Wilcoxon matched-pairs signed-rank tests conducted on the data on rates of settlement of the oyster <i>Ostrea angasi</i> on two-week plates from all stations, except CW(NS) station, obtained over the period 7/11/73 - 10/4/74. 121. |
| Table 4.35 | Summary of the analysis of variance conducted on the data on the presence of the amphipod <i>Corophium</i> on two-week plates from the CW(OS), Outfall and Jetty stations obtained over the period 30/8/72 - 3/1/73. 123. |
| Table 4.36 | Results of a series of Wilcoxon matched-pairs signed-rank tests conducted on the data on the occurrence of an unidentified amphipod on two-week plates from all stations, except CW(NS) station, obtained over the period 29/8/73 - 22/5/74. 125. |

LIST OF DIAGRAMS

| | Following page |
|-----------|---|
| SECTION A | |
| Fig. 1.1 | The location of patches in the vicinity of a bend in a duct. 3. |
| Fig. 2.1 | Diagram of an experimental trough, viewed from above. 6. |
| Fig. 3.1 | Dry weights of growth on glass plates exposed for two weeks in troughs containing running seawater : the effect of dosing the seawater with chlorine. 9. |
| Fig. 3.2 | Dry weights of growth on glass plates exposed for four weeks in troughs containing running seawater : the effect of dosing the seawater with chlorine. 11. |
| Fig. 3.3 | Total numbers of five species of sessile organisms present on glass plates exposed for four weeks in troughs containing running seawater : a comparison of the relative effects of different doses of chlorine. 13. |
| Fig. 3.4 | Total numbers of five species of sessile animals present on concrete-asbestos plates exposed for eight weeks in troughs containing running seawater : a comparison of the effects of different doses of chlorine. 13. |
| Fig. 3.5 | Numbers of the serpulid <i>Hydroides norvegica</i> present on glass plates exposed for four weeks in troughs containing running seawater : a comparison of the effects of two different doses of chlorine. 16. |
| Fig. 3.6 | Numbers of the serpulid <i>Hydroides norvegica</i> present on concrete-asbestos plates exposed for eight weeks in troughs containing running seawater : a comparison of the effects of two different doses of chlorine. 16. |
| Fig. 3.7 | Numbers of the serpulid <i>Eulaeospira convexis</i> present on glass plates exposed for two weeks in troughs containing running seawater : settlements in the two control troughs. 18. |
| Fig. 3.8 | Numbers of the serpulid <i>Eulaeospira convexis</i> present on glass plates exposed for four weeks in troughs containing running seawater : settlements in the two control troughs and in two of the chlorinated troughs. 18. |
| SECTION B | |
| Fig. 1.1 | Map showing the location of the Torrens Island Power Station in relation to the surrounding areas. 40. |

List of diagrams, Section B (cont.)

| | Following page | |
|----------|--|-----|
| Fig. 3.1 | Average weekly inlet and outlet temperatures of cooling water over the period from June, 1972 to May, 1974. | 45. |
| Fig. 3.2 | Temperature profiles observed in Angas Inlet during early spring, 1972. | 46. |
| Fig. 3.3 | Temperature profiles observed in Angas Inlet on 3/4/73. | 47. |
| Fig. 3.4 | Temperature profiles observed in Angas Inlet during later winter, 1973. | 48. |
| Fig. 3.5 | Temperature profiles observed in Angas Inlet during early spring, 1973. | 48. |
| Fig. 4.1 | Total weights of growth on 2-week plates from the CW(OS) and Jetty stations over the period from June, 1972 to May, 1973. | 52. |
| Fig. 4.2 | Organic weights of growth on 2-week plates from the CW(OS) and Jetty stations over the period from September, 1972 to May, 1973. | 52. |
| Fig. 4.3 | Total weights of growth on 2-week plates from the CW(OS) station over the period from June, 1973 to April, 1974 and from the CW(NS) station over the period June, 1973 to mid-January, 1974. | 54. |
| Fig. 4.4 | Organic weights of growth on 2-week plates from the CW(OS) station over the period from June, 1973 to April 1974 and from the CW(NS) station over the period June, 1973 to mid-January, 1974. | 54. |
| Fig. 4.5 | Total weights of growth on 2-week plates from the CW(OS) station during May, 1974 to February, 1975, the CW(NS) station during May-December, 1974 and the Jetty station during November, 1974 to February, 1975. | 56. |
| Fig. 4.6 | Organic weights of growth on 2-week plates from the CW(OS) station during May, 1974 to February, 1975, the CW(NS) station during May-December, 1974 and the Jetty station during November, 1974 to February, 1975. | 56. |
| Fig. 4.7 | Total weights of growth on 4-week plates from the CW(OS) and Jetty stations over the period from June, 1972 to May, 1973. | 58. |
| Fig. 4.8 | Organic weights of growth on 4-week plates from the CW(OS) and Jetty stations over the period from late August, 1972 to May, 1973. | 58. |

List of diagrams, Section B (cont.)

| | Following page |
|-----------|---|
| Fig. 4.9 | Total weights of growth on 4-week plates from the CW(OS) station during the period from June, 1973 to April, 1974 and from the CW(NS) station during June, 1973 to January, 1974. 63. |
| Fig. 4.10 | Organic weights of growth on 4-week plates from the CW(OS) station during the period from June, 1973 to April 1974 and from the CW(NS) station during June, 1973 to January, 1974. 63. |
| Fig. 4.11 | Total weights of growth on 4-week plates from the CW(OS) station during the period from May, 1974 to February, 1975 and from the CW(NS) station over July to December 1974. 64. |
| Fig. 4.12 | Organic weights of growth on 4-week plates from the CW(OS) station during the period from May, 1974 to February, 1975 and from the CW(NS) station over July-December, 1974. 64. |
| Fig. 4.13 | Total weights of growth on 8-week plates from the CW(OS) station during the period from June, 1973 to April, 1974 and from the CW(NS) station over August, 1973 to January, 1974. 72. |
| Fig. 4.14 | Organic weights of growth on 8-week plates from the CW(OS) station during the period from June, 1973 to April, 1974 and from the CW(NS) station over August, 1973 to January, 1974. 72. |
| Fig. 4.15 | Total weights of growth on 8-week plates from the CW(OS) station during the period from May, 1974 to February 1975 and from the CW(NS) station over August to December, 1974. 72. |
| Fig. 4.16 | Organic weights of growth on 8-week plates from the CW(OS) station during the period from May, 1974 to February, 1975 and from the CW(NS) station over August to December, 1974. 72. |
| Fig. 4.17 | Presence of the compound ascidian <i>Leptoclinum rayneri</i> on 2-week plates over the period from June, 1973 to May, 1974. 73. |
| Fig. 4.18 | Presence of the compound ascidian <i>Leptoclinum rayneri</i> on 4-week plates over the period from June, 1973 to May, 1974. 73. |
| Fig. 4.19 | Presence of the compound ascidian <i>Leptoclinum rayneri</i> on 8-week plates over the period from June, 1973 to May, 1974. 73. |
| Fig. 4.20 | Presence of the compound ascidian <i>Leptoclinum rayneri</i> on 2-week plates over the period from June, 1972 to May, 1973. 73. |

List of diagrams, Section B (cont.)

| | | Following page |
|-----------|---|-------------------|
| Fig. 4.21 | Presence of the compound ascidian <i>Leptoclinum rayneri</i> on 4-week plates over the period from June, 1972 to May, 1973. | 73. |
| Fig. 4.22 | Presence of the compound ascidian <i>Leptoclinum rayneri</i> on 8-week plates over the period from September, 1972 to May, 1973. | 73. |
| Fig. 4.23 | Presence of the hydroid <i>Tubularia</i> sp. on 2-week plates over the period from June, 1972 to May, 1973. | 81. |
| Fig. 4.24 | Presence of the hydroid <i>Tubularia</i> sp. on 2-week plates over the period from June, 1973 to May, 1974. | 81. |
| Fig. 4.25 | Presence of the hydroid <i>Tubularia</i> sp. on 2-week plates from the CW(OS) and CW(NS) stations during the period from May to December, 1974. | 81. |
| Fig. 4.26 | Presence of the endoproct probably <i>Loxosomella kefersteini</i> on 2-week plates over the period from June, 1972 to May, 1973. | 85. |
| Fig. 4.27 | Settlement of the bryozoan <i>Watersipora subovoidea</i> on 2-week plates over the period from June, 1973 to May, 1974. | 87. |
| Fig. 4.28 | Presence of the bryozoan <i>Watersipora subovoidea</i> on 4-week plates over the period from June, 1973 to May, 1974. | 87. |
| Fig. 4.29 | Presence of the bryozoan <i>Bugula avicularia</i> on 4-week plates from the CW(OS), 30R and Jetty stations over the period from June, 1973 to May, 1974. | 90. |
| Fig. 4.30 | Presence of the bryozoan <i>Bugula avicularia</i> on 8-week plates from the CW(OS), 30R and Jetty stations over the period from June, 1973 to May, 1974. | 90. |
| Fig. 4.31 | Presence of the bryozoan <i>Bugula avicularia</i> on 2-week plates from the CW(OS), Outfall and Jetty stations over the period from June, 1972 to May, 1973. | 93. |
| Fig. 4.32 | Presence of the bryozoan <i>Bugula avicularia</i> on 4-week plates from the CW(OS), Outfall and Jetty stations over the period from June, 1972 to May, 1973. | 93. |
| Fig. 4.33 | Presence of the bryozoan <i>Bugula avicularia</i> on 8-week plates from the CW(OS), Outfall and Jetty stations over the period from September, 1972 to May, 1973. | 93. |

List of diagrams, Section B (cont.)

| | Following page |
|-----------|--|
| Fig. 4.34 | Presence of the bryozoan <i>Bugula neritina</i> on 4-week plates from the CW(OS), 30R and Jetty stations over the period from May, 1973 to May, 1974. 94. |
| Fig. 4.35 | Presence of the bryozoan <i>Bugula neritina</i> on 8-week plates from the CW(OS), 30R and Jetty stations over the period from May, 1973 to May, 1974. 94. |
| Fig. 4.36 | Presence of the simple ascidian <i>Ciona intestinalis</i> on 2-week plates over the period from June, 1972 to May, 1973. 97. |
| Fig. 4.37 | Presence of the simple ascidian <i>Ciona intestinalis</i> on 4-week plates from the CW(OS) and Jetty stations over the period from June, 1972 to May, 1973. 97. |
| Fig. 4.38 | Presence of the simple ascidian <i>Ciona intestinalis</i> on 8-week plates from the CW(OS) and Jetty stations over the period from September, 1972 to May, 1973. 97. |
| Fig. 4.39 | Presence of the simple ascidian <i>Ciona intestinalis</i> on 4-week plates from the CW(OS), 30R and Jetty stations over the period from June, 1973 to May, 1974. 98. |
| Fig. 4.40 | Presence of the simple ascidian <i>Ciona intestinalis</i> on 8-week plates from the CW(OS), 30R and Jetty stations during the period from June, 1973 to May, 1974. 98. |
| Fig. 4.41 | Settlement of the compound ascidian <i>Botryllus schlosseri</i> on 2-week plates over the period from June, 1972 to May, 1973. 101. |
| Fig. 4.42 | Presence of the compound ascidian <i>Botryllus schlosseri</i> on 4-week plates from the CW(OS), Outfall and Jetty stations over the period from June, 1972 to May, 1973. 101. |
| Fig. 4.43 | Presence of the compound ascidian <i>Botryllus schlosseri</i> on 8-week plates from the CW(OS), Outfall and Jetty stations over the period from September, 1972 to May, 1973. 101. |
| Fig. 4.44 | Presence of the compound ascidian <i>Botrylloides nigrum</i> on 4-week plates from the CW(OS), Outfall and Jetty stations over the period from June, 1972 to May, 1973. 103. |
| Fig. 4.45 | Presence of the compound ascidian <i>Botrylloides nigrum</i> on 4-week plates from the CW(OS), 30R and Jetty stations over the period from June, 1973 to May, 1974. 103. |
| Fig. 4.46 | Presence of the compound ascidian <i>Botrylloides nigrum</i> on 8-week plates from the CW(OS), 30R and Jetty stations over the period from June, 1973 to May, 1974. 103. |

List of diagrams, Section B (cont.)

| | Following page |
|--|-------------------|
| Fig. 4.47 Settlement of the serpulid <i>Eulaeospira convexis</i> on 2-week plates over the period from June, 1972 to May, 1973. | 106. |
| Fig. 4.48 Presence of the serpulid <i>Eulaeospira convexis</i> on 4-week plates over the period from June, 1972 to May, 1973. | 106. |
| Fig. 4.49 Presence of the serpulid <i>Eulaeospira convexis</i> on 8-week plates over the period from September, 1972 to May, 1973. | 106. |
| Fig. 4.50 Settlement of the serpulid <i>Eulaeospira convexis</i> on 2-week plates over the period from June, 1973 to May, 1974. | 106. |
| Fig. 4.51 Presence of the serpulid <i>Eulaeospira convexis</i> on 4-week plates over the period from June, 1973 to May, 1974. | 106. |
| Fig. 4.52 Presence of the serpulid <i>Eulaeospira convexis</i> on 8-week plates over the period from June, 1973 to May, 1974. | 106. |
| Fig. 4.53 Presence of the simple ascidian <i>Microcosmus squamiger</i> on 4-week plates from the CW(OS), Outfall, Jetty and 30R stations over the period from June, 1973 to May, 1974. | 109. |
| Fig. 4.54 Presence of the simple ascidian <i>Microcosmus squamiger</i> on 8-week plates from the CW(OS), Outfall, Jetty and 30R stations over the period from June, 1973 to May, 1974. | 109. |
| Fig. 4.55 Presence of an unidentified polychaete (family Sabellidae) on 4-week plates from the CW(OS), Outfall, Jetty and 30R stations over the period from June, 1973 to May, 1974. | 111. |
| Fig. 4.56 Presence of an unidentified polychaete (family Sabellidae) on 8-week plates from the CW(OS), Outfall, Jetty and 30R stations over the period from June, 1973 to May, 1974. | 111. |
| Fig. 4.57 Settlement of the serpulid <i>Hydroides norvegica</i> on 2-week plates over the period from June, 1972 to May, 1973. | 113. |
| Fig. 4.58 Settlement of the serpulid <i>Hydroides norvegica</i> on 2-week plates over the period from June, 1973 to May, 1974. | 113. |

List of diagrams, Section B (cont.)

| | Following page |
|-----------|---|
| Fig. 4.59 | Presence of the serpulid <i>Hydroides norvegica</i> on 4-week plates over the period from June, 1973 to May, 1974. 113. |
| Fig. 4.60 | Presence of the serpulid <i>Hydroides norvegica</i> on 8-week plates over the period from June, 1973 to May, 1974. 113. |
| Fig. 4.61 | Settlement of the barnacle <i>Balanus amphitrite</i> on 2-week plates over the period from June, 1972 to May, 1973. 117. |
| Fig. 4.62 | Settlement of the barnacle <i>Balanus amphitrite</i> on 2-week plates over the period from June, 1973 to May, 1974. 117. |
| Fig. 4.63 | Presence of the barnacle <i>Balanus amphitrite</i> on 4-week plates over the period from June, 1973 to May, 1974. 118. |
| Fig. 4.64 | Presence of the barnacle <i>Balanus amphitrite</i> on 8-week plates over the period from June, 1973 to May, 1974. 118. |
| Fig. 4.65 | Presence of the barnacle <i>Balanus amphitrite</i> on 2-week and 4-week plates from the CW(OS) and Jetty stations over the period from June, 1974 to February, 1975. 118. |
| Fig. 4.66 | Settlement of the oyster <i>Ostrea angasi</i> on 2-week plates over the period from June, 1972 to May, 1973. 119. |
| Fig. 4.67 | Settlement of the oyster <i>Ostrea angasi</i> on 2-week plates over the period from June, 1973 to May, 1974. 119. |
| Fig. 4.68 | Presence of the oyster <i>Ostrea angasi</i> on 4-week plates over the period from June, 1973 to May, 1974. 121. |
| Fig. 4.69 | Presence of the oyster <i>Ostrea angasi</i> on 8-week plates over the period from June, 1973 to May, 1974. 121. |
| Fig. 4.70 | Presence of the tube-dwelling amphipod <i>Corophium</i> sp. on 2-week plates over the period from June, 1972 to May, 1973. 122. |
| Fig. 4.71 | Presence of the tube-dwelling amphipod <i>Corophium</i> sp. on 2-week plates over the period from June, 1973 to May, 1974. 122. |
| Fig. 4.72 | Presence of an unidentified tube-dwelling amphipod (family Corophiidae) on 2-week plates over the period from June, 1972 to May, 1973. 123. |

List of diagrams, Section B (cont.)

| | Following page |
|---|-------------------|
| Fig. 4.73 Presence of an unidentified tube-dwelling amphipod (family Corophiidae) on 2-week plates over the period from June, 1972 to May, 1973. | 123. |
| Fig. 4.74 Presence of a tube-dwelling crustacean (Tanaidacea : Tanaidae) on 2-week plates over the period from June, 1972 to May, 1973. | 125. |

PROLOGUE

During the period from April, 1972 to April, 1975, I was employed in a temporary position as a marine biologist by the Electricity Trust of South Australia. I conducted research on two matters of concern to the Electricity Trust : the control of fouling by sessile animals in the cooling water ducts of the Torrens Island Power Station and the ecological effects of thermal effluent from the power station on the surrounding areas. The Electricity Trust agreed to the proposal that the results obtained during these studies may be used in the preparation of a thesis for the degree of Master of Science. This thesis is the result.

SUMMARY

Experiments were conducted to determine the effect of dosing seawater with chlorine on rates of settlement of sessile animals, with the aim of finding the optimum dose to prevent fouling in the cooling water ducts of the Torrens Island Power Station. Frosted glass plates were exposed in troughs containing running seawater. Six troughs were dosed with chlorine, five continuously and one intermittently, while two troughs were controls. Rates of settlement of fouling organisms on the plates were examined. The results showed that chlorine was effective in reducing rates of settlement. Of particular interest from the practical viewpoint was the fact that a low continuous dose of chlorine (0.2 ppm) was more effective in minimizing fouling than a higher dose (6 ppm) applied intermittently (10 minutes every 4 hours). Not only were rates of settlement lower but in addition, those animals which did settle in the troughs receiving the continuous dose were stunted in growth while those that settled in the trough receiving the intermittent dose grew normally.

The effect of the thermal effluent on epifauna of the Torrens Island area was examined by placing glass plates, held in specially constructed brass frames, at six different locations. A regular series of observations on plates exposed for two, four and eight weeks were made. Animals present on the plates were counted and the weights of growth measured. From the data on weights of growth, it was concluded that the thermal effluent had little effect on the total production of the epifauna. However, considerable differences in weights of growth were observed at two adjacent locations in the cooler water, one in turbulent water and the other in still water. Much greater weights of growth were found on plates from the turbulent water where three species were very abundant, apparently favoured by the greater current speeds.

Amongst the other species present, a variety of effects of the warmed water on distribution and abundance were noted. Several species showed seasonal differences in occurrence, settlement being found in spring in areas influenced by the warmer water and during summer in other areas. Some species were favoured by the warmed water, some were little affected in abundance, while others were adversely affected. When the positive effects of the thermal effluent were balanced against the negative effects, there was little evidence of any damage to the epifauna caused by the thermal effluent.

DECLARATION

I, William Muir Host, declare that this thesis contains no material which has been accepted for the award of any other degree or diploma in any university and that, to the best of my knowledge and belief, the thesis contains no material previously published or written by another person, except when due reference is made in the text of the thesis.

Signed ..

...
W. M. Host

ACKNOWLEDGEMENTS

I wish to thank my supervisors, firstly Mr. I. M. Thomas and following his retirement Dr. A. J. Butler, for their helpful advice and encouragement throughout. I am also indebted to Mr. M. Bosio, Chemical Engineer, the Electricity Trust of S.A. for his influence in the creation of the temporary position of marine biologist and for his continued interest throughout the study. My thanks are also extended to Mr. C. M. Beer, Senior Chemist, Torrens Island Power Station, and his staff for their help during my stay at Torrens Island. In particular, Messrs. A. J. Arthur, C. J. Steer and J. Vingelis helped in collection of plates from Angas Inlet by small boat and maintained the chlorinating apparatus used in the experiments. Mechanical Design Section of the Electricity Trust and Messrs. B. Gepp and P. Zed conducted several temperature surveys and their results have been included. Several persons helped with identification of the species found in this study and this help was much appreciated : Miss L. M. Angel, Dr. S. J. Edmonds, Mr. B. J. Brock and Mr. W. Zeidler (see also p. 132).