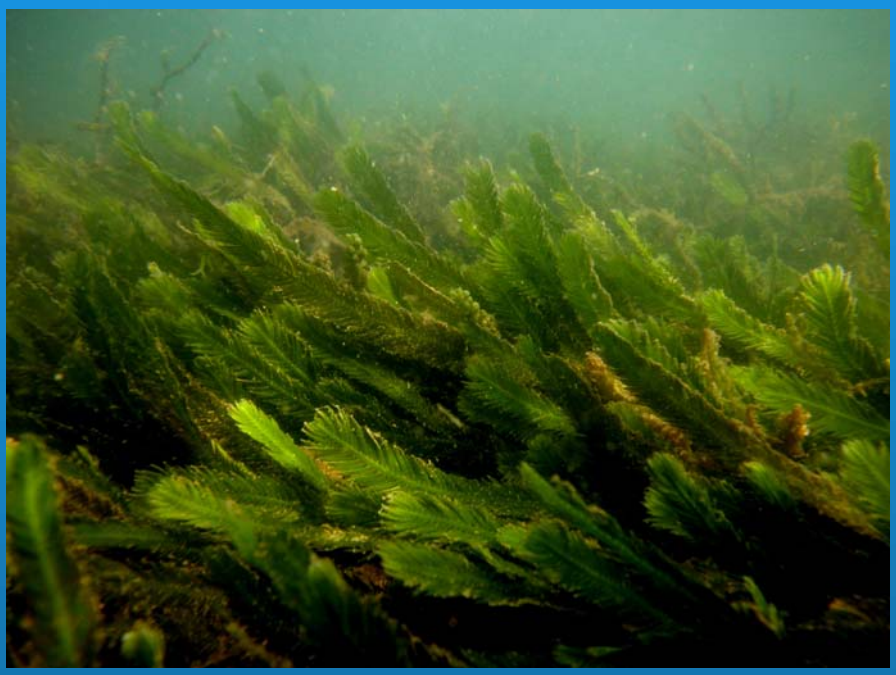
Marine Environment & Ecology
Marine Pests Subprogram

SARDI
SOUTH AUSTRALIAN RESEARCH AND DEVELOPMENT INSTITUTE

# *CAULERPA TAXIFOLIA* - 2008 SURVEY OF THE UPPER PORT RIVER



Prepared for PIRSA Marine Biosecurity

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January 2009

SARDI AQUATIC SCIENCES PUBLICATION NO F2009/000049-1
SARDI RESEARCH REPORT SERIES NO 331

Government of South Australia

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**This publication may be cited as:**
Rowling, K (2009). *Caulerpa taxifolia* – 2008 survey of the upper Port River. Prepared for PIRSA Marine Biosecurity. SARDI Aquatic Sciences Publication No. F2009/000049-1; SARDI Research Report Series No 331.



Printed in Adelaide, January 2009

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Approved by: Dr Jason Tanner

Signed:
Date: 2 February 2009
Distribution: PIRSA Marine Biosecurity, SAASC Library
Circulation: Public Domain

## Executive Summary

Despite numerous eradication attempts, the marine pest *Caulerpa taxifolia* has substantially expanded its range in South Australia and cannot be eradicated with current technology. A survey was conducted in October 2008 and found that despite eradication and control attempts (in late 2004 and 2005) the distribution of *C. taxifolia* in the upper Port River has recovered to show little change from surveys conducted in early 2004. As in 2004 there are higher densities in areas immediately north and south of the Jervois Bridge and on the north bank of the channel west of the Birkenhead Bridge. The population further south of the Jervois Bridge has decreased in biomass, possibly due to the decommissioning of the Port Adelaide Wastewater Treatment plant which used to discharge nutrient rich freshwater into the upper Port River. The importance of public education and vigilance in the upper Port River is essential to mitigate the risk of *C. taxifolia* being inadvertently transported to other high risk areas around the state, including marinas and boat havens.

## Acknowledgements

The author wishes to thank Kathryn Wiltshire and Jason Nichols for assistance with the field program; funding to undertake this work was provided by PIRSA Marine Biosecurity. Dr Marty Deveney and Mandee Theil provided valuable comments on the manuscript.

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# 1. Background

The distribution of the marine pest, *Caulerpa taxifolia,* in South Australia has substantially expanded, such that the alga cannot be eradicated from the State with current technology. The approach to management of this alga has thus shifted from eradication to containment of the existing population. It is hoped that *C. taxifolia* can be prevented from spreading, and a recent risk assessment of the potential future spread and impacts of the alga on the local environment recommended ongoing monitoring of the population as critical to the management of the alga (Deveney et al. 2008).

Despite restrictions on anchoring in the Port River/Barker Inlet area, there is substantial boating traffic and equipment associated with recreational vessels (in particular anchors) that have been identified as high-risk vectors of *C. taxifolia* (see Sant et al. 1996). Due to the existing and new urban developments that are currently being undertaken in the upper Port River (Figure 1), the likelihood of boat traffic transporting whole *C. taxifolia* plants or fragments from this area has increased.


**Figure 1.** Location of the upper Port River survey site (Yellow Square) within the Port River/Barker Inlet system

The distribution of *C. taxifolia* within the upper Port River region has previously been investigated (Figure 2; Westphalen et al. 2004). Efforts were made to eradicate the alga from the upper Port River area by suction dredging (2004), smothering using PVC sheeting (2004) and smothering with rock salt (2005). Surveys were completed in this area at those times to assess the efficacy of these eradication efforts and found that almost all of the alga had been eradicated, although some isolated plants remained (Rowling and Westphalen 2005).

Recently (late 2007), *C. taxifolia* was found in grab samples that were taken for another project in this area, possibly indicating that the distribution and biomass of *C. taxifolia* had increased again (SARDI unpublished data). Consequently, developing an understanding of the current *C. taxifolia* distribution in the area has been identified as a priority to aid in the ongoing management of the alga.

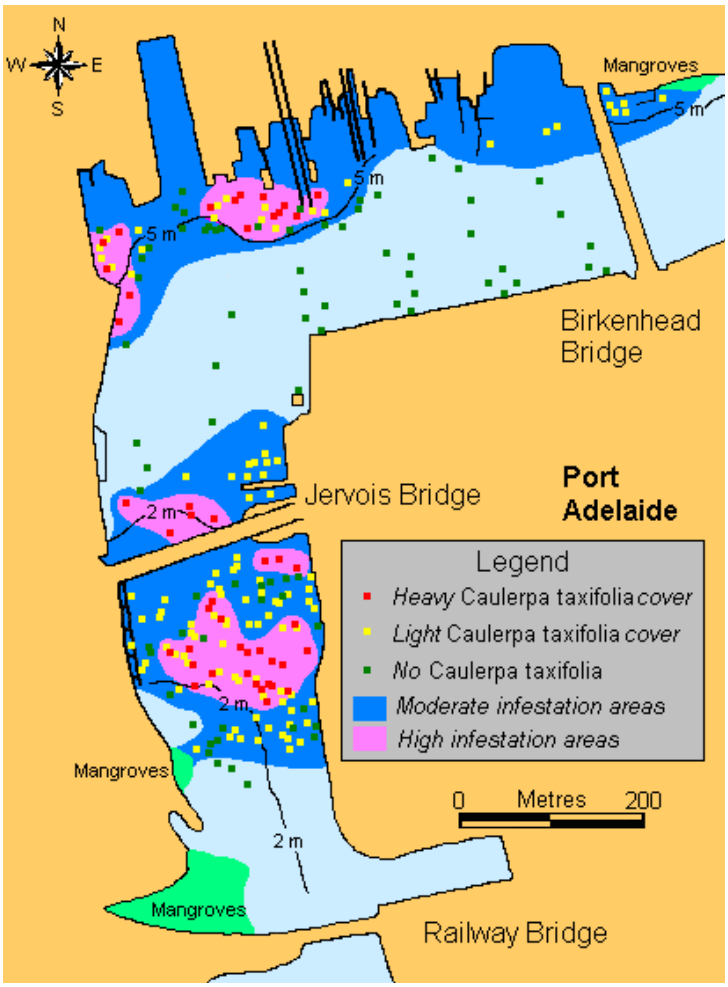


**Figure 2**. February – April 2004 surveys for *C. taxifolia* in the upper Port River (taken from Westphalen et al 2004)

## 2. Methods

The upper Port River surveys comprised 6.9 km of 100 m SCUBA diving transects in the area. Coverage of *C. taxifolia* was estimated in terms of a modified Braun-Blanquet scale (Table 1; Mueller-Dombois and Ellenberg 1974). The start and end point of each transect was referenced using a GPS (Garmin GPS72) from the tender vessel.

There were also Braun-Blanquet estimates made of the cover of major community types (seagrasses, bare sand, etc) as well as other *Caulerpa* species (notably *C. racemosa* var. *cylindracea*) and any large marine pests (*Sabella spallanzanii*, *Ciona intestinalis*, etc) were noted for future reference. The surveys took 5 days and were completed between the 2nd and 22nd October 2008.

The Geographic Information Systems (GIS) package ArcView (ver 9.3, ESRI California) was used to construct a map of the distribution as revealed in this survey. Percent cover values from Table 1 were mapped as: 0 (absent), 1 – 5 % (light cover), 6 – 50 % (moderate cover) and 51 to 100 % (heavy cover).

**Table 1.** Braun-Blanquet scale that was used to record coverage of *C. taxifolia* (and other major community types) during the survey (based on a method developed in Mueller-Dombois and Ellenberg 1974)

| Scale | Percent cover |
|---|---|
| 0 | Absent |
| 1 | < 5 % |
| 2 | 5 – 25 % |
| 3 | 25 – 50 % |
| 4 | 50 – 75 % |
| 5 | 75 – 95 % |
| 6 | > 95 % |

## 3. Results

*Caulerpa taxifolia* infestation in the upper Port River is heavy in two main areas, immediately around the Jervois Bridge and on the north bank of the channel west of the Birkenhead Bridge (Figure 3). Cover is moderate in areas interspersed with and adjacent to the heavy infestations, while there is light cover in the rest of the area south of the Jervois Bridge and against the wharf areas in most of the survey area. Many areas in the centre of the channel between the Jervois and Birkenhead bridges (which have been previously dredged) have no *C. taxifolia* although occasionally there is light cover.

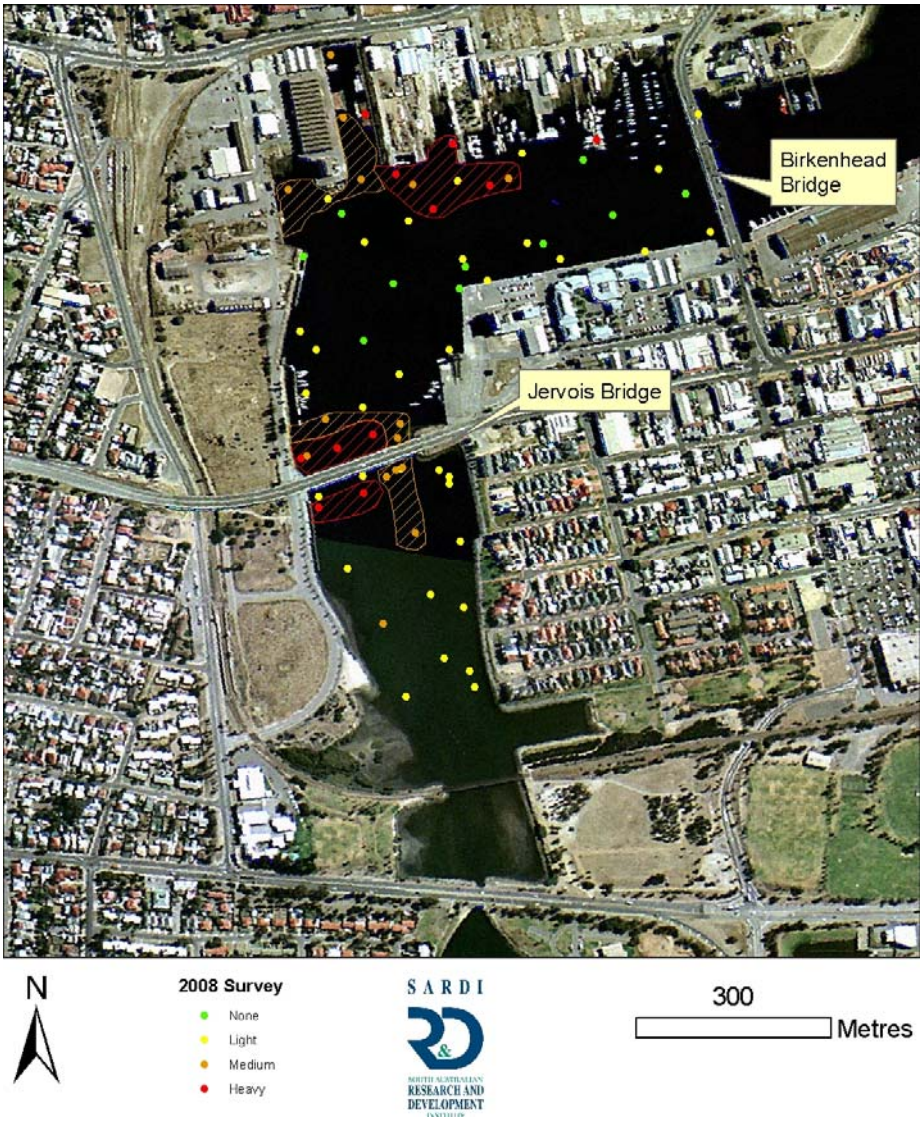


**Figure 3.** October 2008 surveys for *C. taxifolia* in the upper Port River. Red hatched area indicates a heavy infestation; orange hatched indicates a moderate infestation.

## 4. Discussion

There appears to be little difference between the 2004 and 2008 distributions of *C. taxifolia* (Figure 2; Figure 3). The heavy and moderate infestations of the alga south of the Jervois Bridge appear to have contracted to an area closer to the bridge (Figure 3) in relation to the much larger extent in the 2004 survey (Figure 2). Decreases in nutrient availability may have influenced the decreased biomass of the alga south of the Jervois Bridge, and could be related to the decommissioning of the Port Adelaide Wastewater Treatment plant which used to discharge nutrient rich freshwater into the upper Port River.

Factors determining the biomass and distribution of *C. taxifolia* in the upper Port River also include depth (most of the alga was located between 2–5 m) and substrate type, with the alga growing better on more stable substrate than the unstable fine silty sediment that is prevalent in the dredged channels. It is likely that light availability at the substrate is the main factor that contributes to limiting the depth to which *C. taxifolia* can survive, and light penetration is limited by high turbidity in the upper Port River area.

Poor water clarity resulted in low visibility, which influenced the accuracy of the survey, such that substantial patches of *C. taxifolia* may have gone unnoticed even if the diver passed within one metre of them. As a consequence, the non-observance of the alga on individual transects and the accuracy of cover estimates cannot be confidently extrapolated through the entire area, but trends in distribution are noticeable, particularly along a continual transect line.

The fact that the distribution of *C. taxifolia* in many areas of the upper Port River has reached levels comparable to the pre-treatment stage of 2004 indicates that the eradication techniques previously employed in this area have been unsuccessful. The importance of public education and vigilance in the upper Port River is essential to mitigate the risk of *C. taxifolia* being inadvertently transported to other high risk areas around the state, including marinas and boat havens.

## 5. References


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Westphalen, G., Collings, G., Rowling, K., Theil, M. and Cheshire, A. (2004). *Caulerpa taxifolia* control and eradication research and monitoring: Port River and Barker Inlet *Caulerpa taxifolia* (Vahl) C Agardh distribution and eradication. SARDI Aquatic Sciences Publication No. RD02/0161-10. Report to PIRSA Marine Habitat Program.

## 6. Appendix

Coordinates (WGS 84) for each transect. BB refers to Braun Blanquet Estimate given the percent cover of *C. taxifolia* in each transect (Table 1).

| Southing | Easting | *C. taxifolia* Cover (BB) | Southing | Easting | *C. taxifolia* Cover (BB) |
|---|---|---|---|---|---|
| -34.84303 | 138.50162 | 1 | -34.84935 | 138.49836 | 1 |
| -34.8433 | 138.50072 | 1 | -34.84251 | 138.50128 | 0 |
| -34.84341 | 138.49954 | 1 | -34.8428 | 138.50027 | 0 |
| -34.8437 | 138.49853 | 1 | -34.8432 | 138.49931 | 0 |
| -34.84341 | 138.49819 | 1 | -34.84352 | 138.49823 | 0 |
| -34.84319 | 138.49909 | 1 | -34.84375 | 138.49723 | 0 |
| -34.84258 | 138.49633 | 1 | -34.84454 | 138.49682 | 0 |
| -34.84288 | 138.49744 | 1 | -34.84546 | 138.49681 | 1 |
| -34.84233 | 138.49812 | 1 | -34.84642 | 138.49714 | 2 |
| -34.84195 | 138.49902 | 1 | -34.8472 | 138.49754 | 2 |
| -34.84176 | 138.50005 | 5 | -34.84807 | 138.49775 | 1 |
| -34.84217 | 138.5009 | 1 | -34.84895 | 138.49794 | 1 |
| -34.84141 | 138.50146 | 1 | -34.84912 | 138.49829 | 1 |
| -34.84382 | 138.49815 | 0 | -34.84824 | 138.49821 | 1 |
| -34.84467 | 138.49801 | 1 | -34.84731 | 138.49816 | 1 |
| -34.84501 | 138.49732 | 1 | -34.84642 | 138.49801 | 1 |
| -34.84569 | 138.49733 | 2 | -34.84204 | 138.49986 | 0 |
| -34.84563 | 138.49629 | 3 | -34.8423 | 138.49883 | 2 |
| -34.84466 | 138.49617 | 1 | -34.84272 | 138.49779 | 4 |
| -34.84338 | 138.49599 | 0 | -34.84317 | 138.49684 | 1 |
| -34.84245 | 138.49578 | 2 | -34.84278 | 138.49652 | 0 |
| -34.84231 | 138.49679 | 3 | -34.84238 | 138.4975 | 3 |
| -34.84145 | 138.49654 | 2 | -34.84239 | 138.49857 | 5 |
| -34.84058 | 138.49637 | 2 | -34.84617 | 138.49595 | 5 |
| -34.84141 | 138.49685 | 5 | -34.84602 | 138.49646 | 5 |
| -34.84224 | 138.49727 | 5 | -34.84584 | 138.49695 | 4 |
| -34.84182 | 138.49806 | 4 | -34.84588 | 138.49729 | 2 |
| -34.84441 | 138.49594 | 1 | -34.84632 | 138.49733 | 1 |
| -34.84526 | 138.49602 | 1 | -34.84633 | 138.49787 | 1 |
| -34.84613 | 138.49604 | 2 | -34.84652 | 138.49801 | 1 |
| -34.84685 | 138.4962 | 4 | -34.84633 | 138.49727 | 2 |
| -34.8477 | 138.4966 | 1 | -34.84665 | 138.49682 | 5 |
| -34.84847 | 138.49709 | 2 | -34.84669 | 138.4962 | 1 |
| -34.84947 | 138.49741 | 1 | -34.84641 | 138.49681 | 1 |
| | | | -34.84629 | 138.49736 | 3 |