

# Porirua Harbour

## Intertidal Macroalgal Monitoring 2008/09



Prepared  
for  
**Greater  
Wellington  
Regional  
Council**  
June  
2009

Cover Photo: Macroalgae on tidal flats, east side of Pauatahanui Arm.

# Porirua Harbour

## Intertidal Macroalgal Monitoring 2008/09

Prepared for  
Greater Wellington Regional Council

By

Leigh Stevens and Barry Robertson

# Contents

1. Introduction and Methods . . . . . 1  
2. Results, Rating and Management . . . . . 3

## Figures and Tables

Figure 1. Map of macroalgal cover - Porirua Harbour, January 2009 . . . . . 3  
Table 1. Summary of macroalgal cover results, January 2009. . . . . 3



# 1. INTRODUCTION AND METHODS

## INTRODUCTION



Developing an understanding of the condition and risks to estuarine habitats is critical to resource management in the Wellington region. This brief report summarises the 2009 intertidal macroalgal monitoring results for Porirua Harbour, one of the key estuaries in the Greater Wellington Regional Council (GWRC) long term estuary monitoring programme. The report describes the intertidal macroalgal cover of the estuary in January 2009, and applies the results to the macroalgae estuary condition rating (and recommended management responses) developed for Wellington's estuaries. The next monitoring in Porirua Harbour is due in January 2010.

## METHODS

Broad scale mapping of the percentage cover of macroalgae throughout all the intertidal habitat of Porirua Harbour was undertaken in January 2009 using a combination of aerial photography, ground-truthing, and ArcMap 9.2 GIS-based digital mapping. The procedure, originally described for use in NZ estuaries by Robertson et al. (2002), has subsequently been modified and successfully applied to various estuaries to develop a separate GIS macroalgal layer (e.g. Robertson and Stevens 2008).

Rectified GWRC aerial photographs (~0.5 metre per pixel) of the estuary, flown in 2005 were used as base maps. Experienced coastal scientists then recorded the percentage cover of macroalgae directly onto laminated photos during field assessment of macroalgal cover. The field maps were then used to create a GIS layer from which the percentage cover information was subsequently calculated.

The report outputs are used to both identify and classify macroalgal cover, and to show changes in macroalgal cover over time by comparisons with previous surveys (annually if a problem estuary, or 5 yearly if not). The current report presents the 2009 percentage cover of macroalgae within the estuary as a GIS-based map (Figure 1), and a summary table of the dominant species and percentage cover classes (Table 1). The report also rates macroalgal condition and provides recommended management actions based on the estuary condition rating (described below).

## WELLINGTON ESTUARIES: MACROALGAE CONDITION RATING

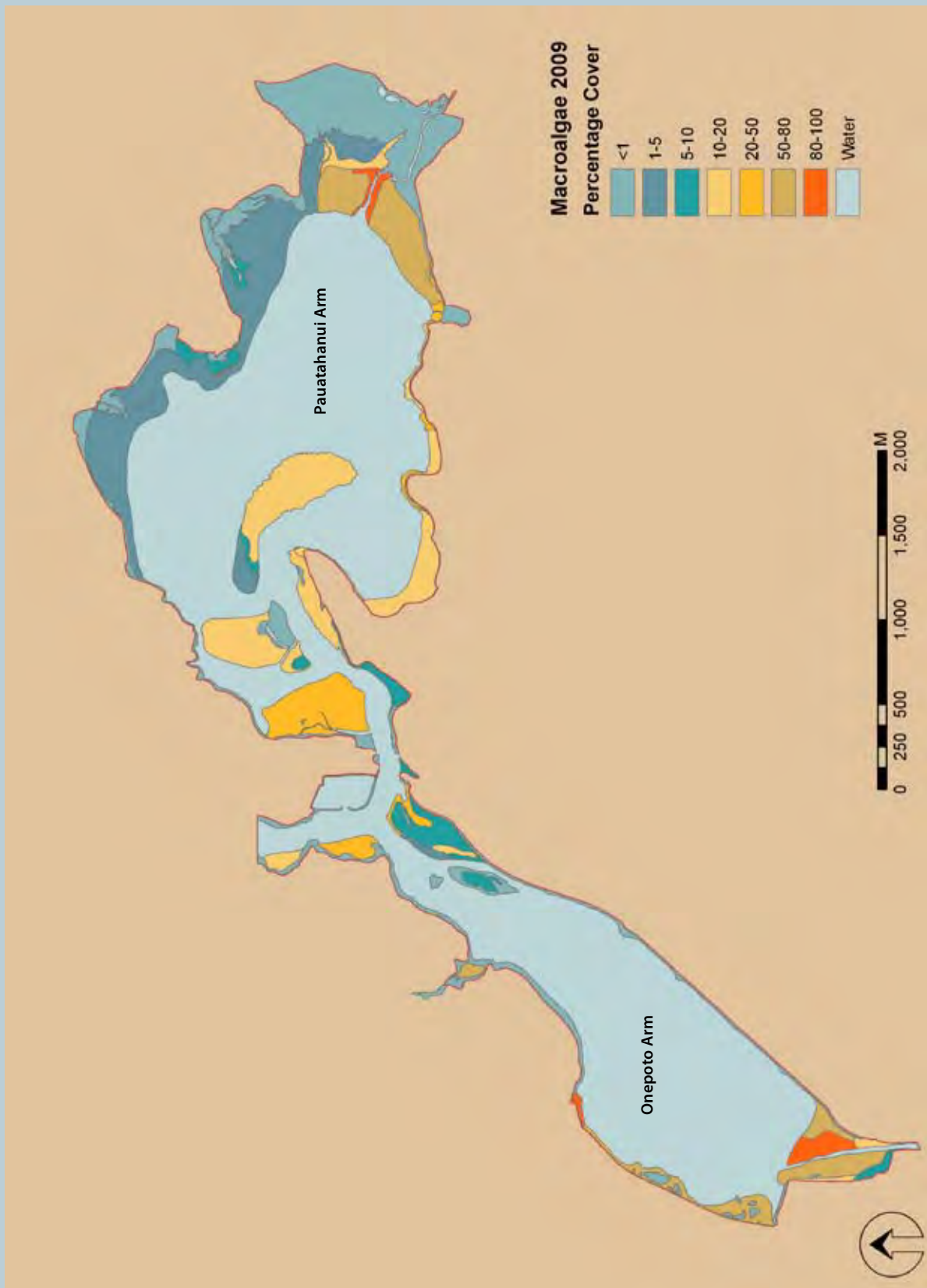
Certain types of macroalgae can grow to nuisance levels in nutrient-enriched estuaries causing sediment deterioration, oxygen depletion, bad odours and adverse impacts to biota. A continuous index (the macroalgae coefficient - MC) has been developed to rate macroalgal condition based on the percentage cover of macroalgae in defined categories using the following equation:  $MC = ((0 \times \% \text{macroalgal cover} < 1\%) + (0.5 \times \% \text{cover } 1-5\%) + (1 \times \% \text{cover } 5-10\%) + (3 \times \% \text{cover } 10-20\%) + (4.5 \times \% \text{cover } 20-50\%) + (6 \times \% \text{cover } 50-80\%) + (7.5 \times \% \text{cover} > 80\%)) / 100$ . Overriding the MC is the presence of either nuisance conditions within the estuary, or where >5% of the intertidal area has macroalgal cover >50%. In these situations the estuary is given a minimum rating of FAIR and should be monitored annually with an Evaluation & Response Plan initiated. This index will continue to be refined as it is applied to estuary data from throughout NZ.



### MACROALGAE CONDITION RATING

RATING		DEFINITION (+Macroalgae Coefficient)	RECOMMENDED RESPONSE
Over-riding rating:	Fair	Nuisance conditions exist, or >50% cover over >5% of estuary	Monitor yearly. Initiate Evaluation & Response Plan
Very Good		Very Low (0.0 - 0.2)	Monitor at 5 year intervals after baseline established
Good		Low (0.2 - 0.8)	Monitor at 5 year intervals after baseline established
		Low Low-Moderate (0.8 - 1.5)	Monitor at 5 year intervals after baseline established
Fair		Low-Moderate (1.5 - 2.2)	Monitor yearly. Initiate Evaluation & Response Plan
		Moderate (2.2 - 4.5)	Monitor yearly. Initiate Evaluation & Response Plan
Poor		High (4.5 - 7.0)	Monitor yearly. Initiate Evaluation & Response Plan
		Very High (>7.0)	Monitor yearly. Initiate Evaluation & Response Plan
Early Warning Trigger		Trend of increasing Macroalgae Coefficient	Initiate Evaluation and Response Plan

FIGURE 1. MAP OF INTERTIDAL MACROALGAL COVER - PORIRUA HARBOUR, JAN. 2009



## 2. RESULTS, RATING AND MANAGEMENT

### RESULTS



#### MACROALGAL COVER CONDITION RATING

**FAIR**

Macroalgal blooms are a symptom of estuary eutrophication. These can deprive seagrass areas of light causing their eventual decline, while decaying macroalgae can accumulate in subtidal areas and on shorelines causing depletion of sediment dissolved oxygen and nuisance odours. Figure 1 and Table 1 summarise the results of intertidal macroalgal mapping within Porirua Harbour.

Overall, 139ha (49% of the intertidal area within Porirua Harbour) had a >5% cover of macroalgae (Table 1). Cover was dominated by the green alga *Enteromorpha* sp. and, to a lesser extent, by the red alga *Gracilaria* sp., with *Ulva* (sea lettuce) widespread but at low densities.

The Macroalgae Coefficient (MC) for the harbour was 2.1, a condition rating of “fair”. This rating reflects that 15% of the estuary had >50% cover - 23ha (10.2%) in the Pauatahanui Arm, and 21ha (33.7%) in the Onepoto Arm. Localised nuisance conditions were present in both arms.

Compared to the 2008 monitoring results (see Stevens and Robertson 2008) there were some notable changes. In the Pauatahanui Arm, cover along most of the northern shoreline had decreased from 10-20% to 1-5% cover. However, this improvement was offset by a large increase in cover around the Pauatahanui Stream mouth. Here macroalgae had increased from 10-20% cover to 50-80% cover over much of the area, with 80-100% cover along the edges of the stream. *Enteromorpha* had replaced *Gracilaria* as the dominant species. The increase in cover had created nuisance conditions with a very shallow RPD depth indicating sediment oxygenation was poor, while rotting macroalgae was creating sulphide rich conditions.

Elsewhere in the harbour, there was a slight increase in cover near the Porirua Stream mouth, although conditions remained similar to 2008. Again, where dense mats of macroalgae were present, sediments were commonly soft, anaerobic, and sulphide rich.

**Table 1. Summary of macroalgal cover results, January 2009.**

MACROALGAE 2008/09	Pauatahanui Arm			Porirua Arm			Entire Estuary	
Percentage Cover	Ha	%	Dominant species	Ha	%	Dominant species	Ha	%
Unvegetated	65.6	29.3	-	20.5	33.2	-	86.1	30.2
1-5%	58.6	26.2	<i>Ulva</i>	1.2	1.9	<i>Gracilaria</i>	59.7	20.9
5-10%	8.7	3.9	<i>Ulva, Gracilaria</i>	9.6	15.6	<i>Gracilaria, Enteromorpha</i>	18.3	6.4
10-20%	49.8	22.3	<i>Gracilaria, Ulva, Enteromorpha</i>	4.3	7.0	<i>Gracilaria, Enteromorpha</i>	54.2	19.0
20-50%	18.1	8.1	<i>Enteromorpha, Gracilaria, Ulva</i>	5.3	8.6	<i>Gracilaria, Ulva</i>	23.3	8.2
50-80%	20.6	9.2	<i>Enteromorpha</i>	15.9	25.8	<i>Enteromorpha, Ulva</i>	36.4	12.8
>80%	2.2	1.0	<i>Enteromorpha, Ulva</i>	4.9	7.9	<i>Enteromorpha, Ulva</i>	7.1	2.5
<b>TOTAL</b>	<b>224</b>	<b>100</b>		<b>62</b>	<b>100</b>		<b>286</b>	<b>100</b>

### CONCLUSION

Macroalgal cover had a condition rating of “fair”, with localised nuisance conditions (rotting macroalgae and poorly oxygenated and sulphide rich sediments).

### RECOMMENDED MANAGEMENT

The increase in macroalgal cover from 2008 (see Robertson and Stevens 2008), combined with the presence of nuisance conditions means macroalgae should be monitored annually. The likely cause of macroalgal growths should also be further evaluated (e.g. catchment wide nutrient inputs or localised sources), and a management response plan initiated.

### REFERENCES

Robertson, B.M., Gillespie, P.A., Asher, R.A., Frisk, S., Keeley, N.B., Hopkins, G.A., Thompson, S.J., Tuckey, B.J. 2002. *Estuarine Environmental Assessment and Monitoring: A National Protocol. Part A. Development, Part B. Appendices, and Part C. Application. Prepared for supporting Councils and the Ministry for the Environment, Sustainable Management Fund Contract No. 5096. Part A. 93p. Part B. 159p. Part C. 40p plus field sheets.*

Stevens, L. and Robertson, B.M. 2008. *Porirua Harbour; Broad Scale Habitat Mapping 2007/08. Prepared for Greater Wellington Regional Council. 29p.*