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Porirua Harbour

Intertidal Macroalgal Monitoring 2010/11

Prepared for Greater Wellington Regional Council May 2011

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By

Leigh Stevens and Barry Robertson

Wriggle Limited, PO Box 1622, Nelson 7040, NZ. Ph 03 545 6315, 021 417 936; 03 545 1550, 0275 417 935, www.wriggle.co.nz

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Gracilaria on intertidal flats in the lower Onepoto Arm.

1. INTRODUCTION AND METHODS

INTRODUCTION

Macroalgae is an important feature of estuaries, contributing to their high productivity and biodiversity. However, when high nutrient inputs combine with suitable growing conditions, nuisance blooms of rapidly growing algae (e.g. *Ulva* (sea lettuce), *Gracilaria*) can occur. At nuisance levels such growths can deprive seagrass of light causing its eventual decline, while decaying macroalgae can accumulate on shorelines causing localised depletion of sediment oxygen, and nuisance odours.

This brief report summarises the results of the second annual survey of intertidal macroalgal cover in Porirua, undertaken in January 2011. The report describes intertidal macroalgal cover - a broad scale indicator of estuary eutrophication - using a macroalgal coefficient (described below) developed for Wellington's estuaries to rate the condition of the estuary, and recommend monitoring and management actions. These actions need to be considered in conjunction with the fine scale monitoring presented in Robertson and Stevens (2008, 2009, 2010).

METHODS

Broad scale mapping of the percentage cover of macroalgae throughout all the intertidal habitat of Porirua Harbour was undertaken in January 2011 using a combination of aerial photography, ground-truthing, and ArcMap 9.3 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. Stevens and Robertson 2008, 2009, 2010).

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 2011 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).

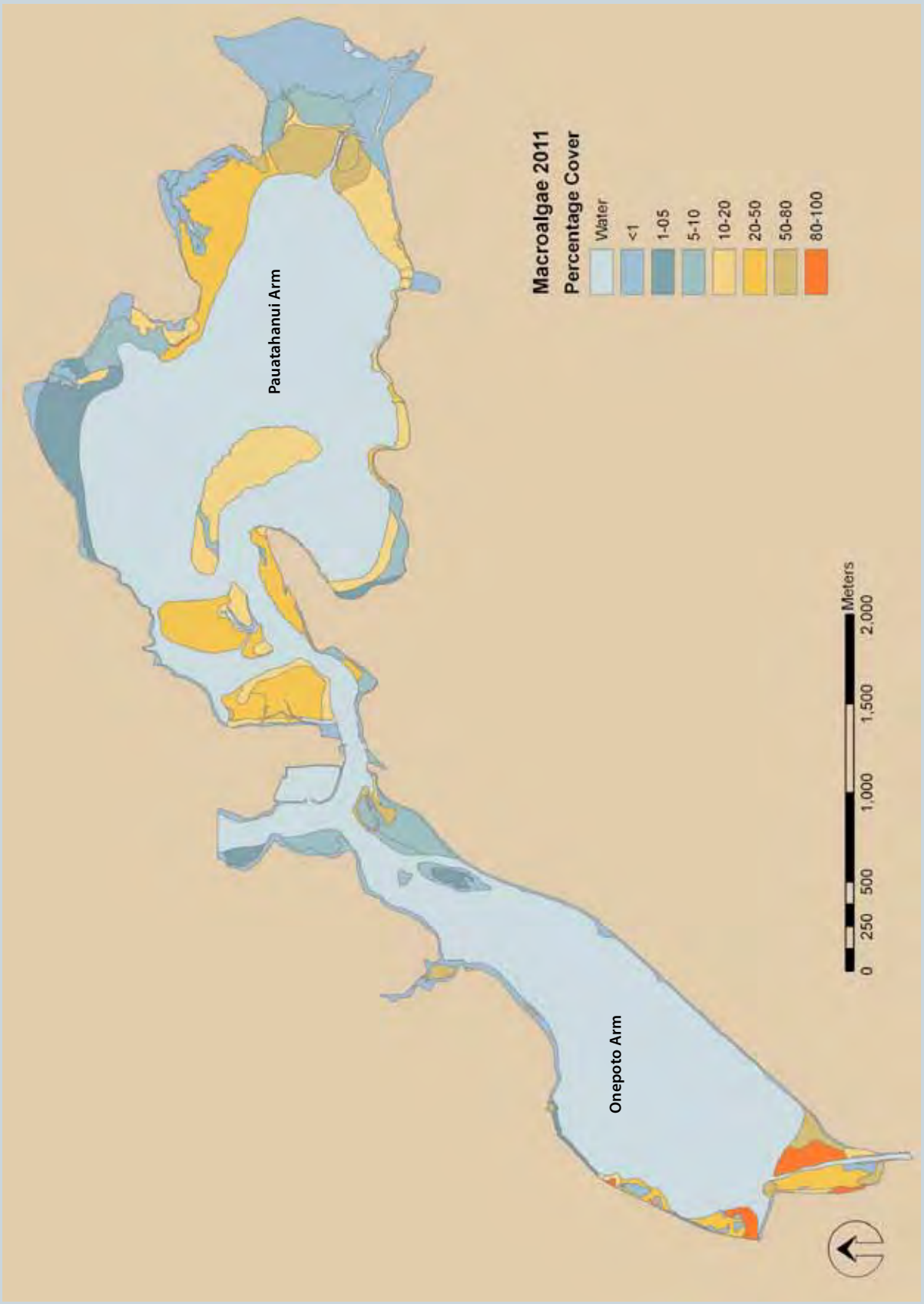
WELLINGTON ESTUARIES: MACROALGAE CONDITION RATING

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 x %macroalgal cover <1%)+(0.5 x %cover 1-5%)+(1 x %cover 5-10%)+(3 x %cover 10-20%)+(4.5 x %cover 20-50%)+(6 x %cover 50-80%)+(7.5 x %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.

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. 2011



2. RESULTS, RATING AND MANAGEMENT

RESULTS

2011 MACROALGAL COVER CONDITION RATING
FAIR

Figure 1 and Table 1 summarise the results of intertidal macroalgal mapping within Porirua Harbour. The Macroalgae Coefficient (MC) for the harbour was 2.3, a condition rating of "fair". This rating reflects that 179ha (63%) of the intertidal area within Porirua Harbour had cover exceeding 5%. This comprised 143ha (64%) of the Pauatahanui Arm, and 36ha (58%) of the Onepoto Arm. Localised nuisance conditions were present in both arms with 10% of the estuary exceeding 50% cover - 14.8ha (6.6%) in the Pauatahanui Arm, and 13.7ha (22.2%) in the Onepoto Arm. Cover was dominated by the red alga *Gracilaria* and the green alga *Ulva sp.* (sea lettuce). However, compared to 2010 (see Stevens and Robertson 2010), less *Ulva* sp. and more *Ulva* (*Enteromorpha) intestinalis* was evident. *Ulva ramulosa* was recorded for the first time on the Pauatahanui sandflats near the boatsheds in 2011.

Table 1. Summary of macroalgal cover results, 17-19 January 2011.

MACROALGAE 2010/11	Pauatahanui Arm			Porirua Arm			Entire Estuary	
Percentage Cover	Ha	%	Dominant species	Ha	%	Dominant species	Ha	%
Unvegetated	62.3	27.8	-	21.1	34.1	-	83.4	29.2
1-5%	18.4	8.2	*Gracilaria, Ulva sp.*	4.5	7.3	*Gracilaria, Ulva sp.*	22.9	8.0
5-10%	23.8	10.6	*Gracilaria, Ulva sp., U. intestinalis*	11.6	18.8	*Gracilaria, Ulva sp.*	35.4	12.4
10-20%	50.0	22.4	*Gracilaria, U. intestinalis, Ulva sp.*	2.1	3.4	*U. intestinalis, Gracilaria*	52.1	18.3
20-50%	54.4	24.3	*Gracilaria, U. intestinalis, Ulva sp., U. ramulosa*	8.6	14.0	*U. intestinalis, Gracilaria, Ulva sp.*	63.0	22.1
50-80%	14.6	6.5	*Gracilaria, U. intestinalis, Ulva sp.*	7.1	11.5	*U. intestinalis, Ulva sp., Gracilaria*	21.7	7.6
>80%	0.2	0.1	*Ulva sp., Gracilaria, U. intestinalis*	6.6	10.7	*U. intestinalis, Ulva sp., Gracilaria*	6.8	2.4
TOTAL	**224**	**100**		**62**	**100**		**286**	**100**

* Note, *Ulva intestinalis* is synonymous with *Enteromorpha intestinalis (*reported as *Enteromorpha* in Stevens and Robertson 2010) .

Table 2 summarises the Condition Rating and Macroalgal Coefficient (MC) results for the 2008-2011 period. The rating has remained constant across years (due to the extent of estuary with a >50% cover and the presence of nuisance conditions).

Around the Pauatahanui Stream mouth, nuisance conditions remained with a very shallow RPD depth indicating sediment oxygenation was poor, while rotting macroalgae was creating sulphide rich conditions. This was also the case in the upper reaches of the Onepoto Arm where dense mats of macroalgae (often wind blown accumulations) were present. Elsewhere in the harbour, there was a reduction in the cover of *Ulva* sp., but conditions remained similar to those observed since 2008.

Table 2. Summary of condition rating and results, 2008-2011.

Year	Rating	MC	Result
2008	FAIR	2.2	High cover (50-80%) near Porirua Stream mouth in Onepoto Arm dominated by *Ulva*. 10-20% cover across most of Pauatahanui Arm, dominated by *Gracilaria*.
2009	FAIR	2.1	High cover (50-80%) near Porirua Stream mouth in Onepoto Arm dominated by *Ulva*. Large increase in growth near Pauatahanui Stream mouth (50-80% cover dominated by *U. intestinalis*). Increased growth by Paremata boathouses (20-50% cover).
2010	FAIR	2.4	High cover (50-80%) near Porirua Stream mouth in Onepoto Arm dominated by *Ulva* sp. Dominant cover near Pauatahanui Stream mouth changed from *U. intestinalis* to *Ulva* sp. Cover in northeast of Pauatahanui Arm increased from 1-5% to 20-50%.
2011	FAIR	2.3	High cover (50-100%) near Porirua Stream mouth in Onepoto Arm dominated by *Ulva* sp. High cover (50-80%) near Pauatahanui Stream mouth dominated by *Gracilaria*.

CONCLUSION

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

2. Results, Rating and Management (Continued)

RECOMMENDED MONITORING AND MANAGEMENT	The widespread cover of macroalgae, and the presence of nuisance conditions, indicates a need for annual monitoring. The next monitoring in Porirua Harbour is due in January 2012, and the latest aerial photographs from the estuary should be used where available. 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.
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