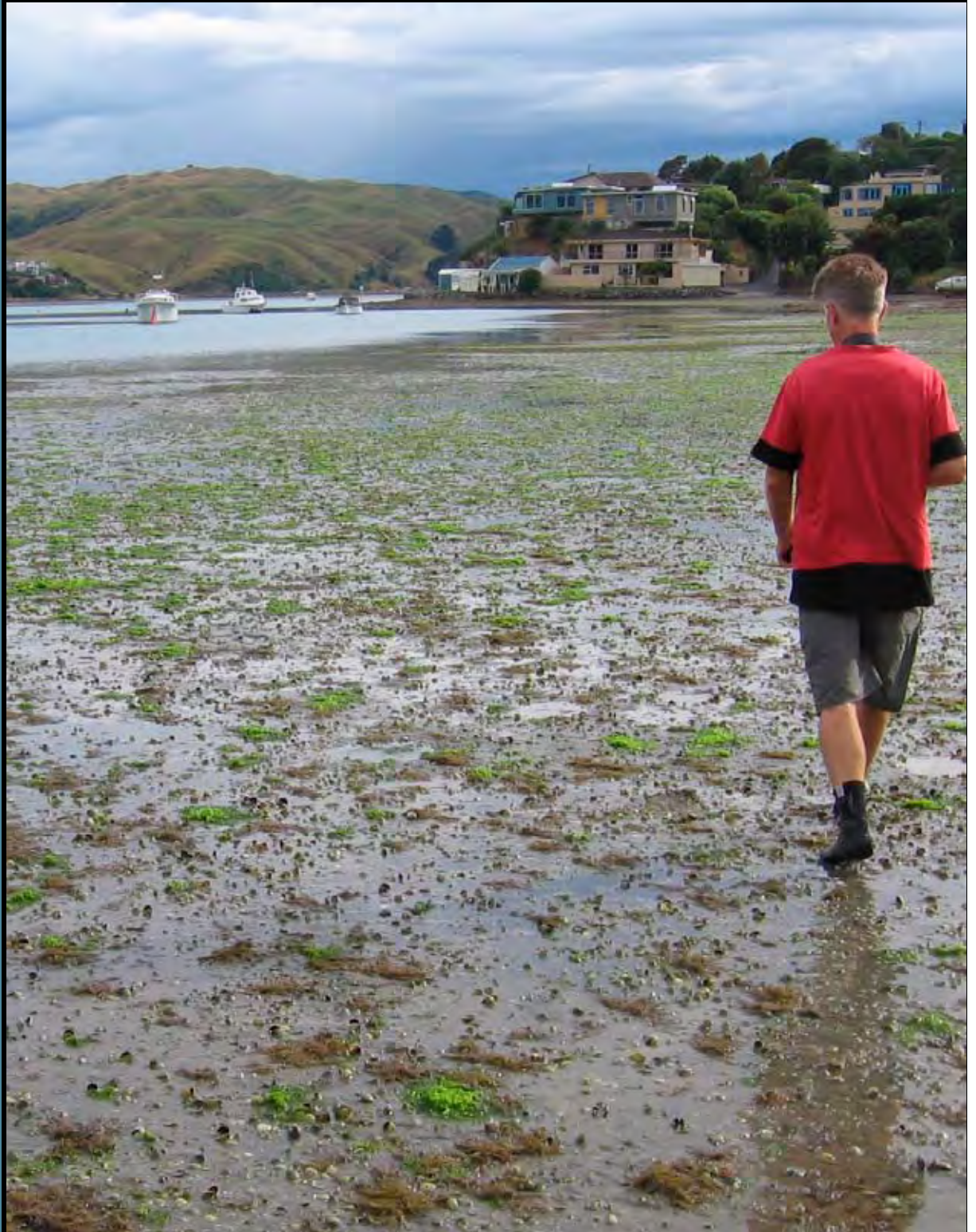


Porirua Harbour

Intertidal Macroalgal Monitoring 2009/10



Prepared
for
**Greater
Wellington
Regional
Council**
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By

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References

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Ulva and Gracilaria on intertidal flats near the Porirua Stream mouth.

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*, *Enteromorpha*) can occur. At nuisance levels such growths can deprive sea-grass 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 2010 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 2010, and uses a macroalgal coefficient (described below) developed for Wellington's estuaries to rate the condition of the estuary, and recommend monitoring and management actions. The next monitoring in Porirua Harbour is due in January 2011.

METHODS

Broad scale mapping of the percentage cover of macroalgae throughout all the intertidal habitat of Porirua Harbour was undertaken in January 2010 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).

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 2010 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

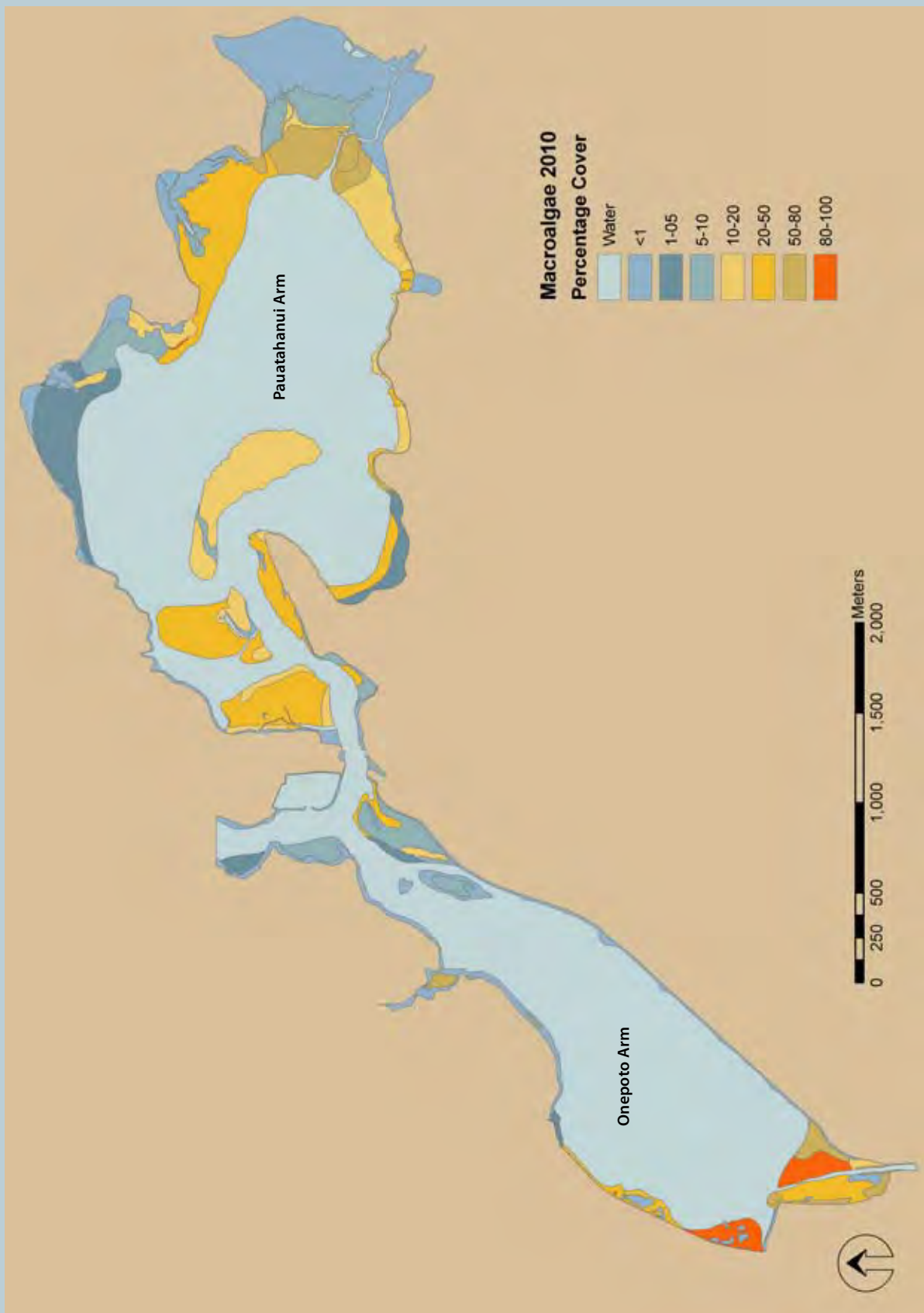
A continuous index (the macroalgae coefficient - MC) has been developed to rate macroalgal condition based on the percentage cover of macroalgae in defined categories using the following equation: $MC = ((0 \times \% \text{macroalgal cover} < 1\%) + (0.5 \times \% \text{cover } 1-5\%) + (1 \times \% \text{cover } 5-10\%) + (3 \times \% \text{cover } 10-20\%) + (4.5 \times \% \text{cover } 20-50\%) + (6 \times \% \text{cover } 50-80\%) + (7.5 \times \% \text{cover } > 80\%)) / 100$. 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.



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. 2010



2. RESULTS, RATING AND MANAGEMENT

RESULTS

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 2.4, a condition rating of “fair”. This rating reflects that 177ha (62%) of the intertidal area within Porirua Harbour had cover exceeding 5%. This comprised 140ha (62%) of the Pauatahanui Arm, and 37ha (60%) of the Onepoto Arm. Localised nuisance conditions were present in both arms with 10% of the estuary exceeding 50% cover - 14.9ha (6.7%) in the Pauatahanui Arm, and 14.3ha (23.1%) in the Onepoto Arm. Cover was dominated by the red alga *Gracilaria* and the green alga *Ulva* (sea lettuce). *Enteromorpha* was located predominantly near freshwater inputs and was most extensive near the Porirua Stream mouth.

Table 1. Summary of macroalgal cover results, January 2010.

MACROALGAE 2009/10 Percentage Cover	Pauatahanui Arm			Porirua Arm			Entire Estuary	
	Ha	%	Dominant species	Ha	%	Dominant species	Ha	%
Unvegetated	62.3	27.8	-	21.1	34.1	-	83.4	29.2
1-5%	21.8	9.7	<i>Gracilaria, Ulva</i>	3.5	5.7	<i>Gracilaria, Ulva, Enteromorpha</i>	25.3	8.9
5-10%	20.2	9.0	<i>Gracilaria, Ulva, Enteromorpha</i>	11.4	18.4	<i>Gracilaria, Ulva</i>	31.6	11.1
10-20%	45.4	20.3	<i>Gracilaria, Ulva, Enteromorpha</i>	1.7	2.8	<i>Gracilaria, Enteromorpha</i>	47.1	16.5
20-50%	59.2	26.5	<i>Gracilaria, Enteromorpha, Ulva</i>	9.8	15.9	<i>Enteromorpha, Gracilaria, Ulva</i>	69.0	24.2
50-80%	14.7	6.6	<i>Gracilaria, Enteromorpha, Ulva</i>	6.1	9.9	<i>Ulva, Enteromorpha</i>	20.8	7.3
>80%	0.2	0.1	<i>Ulva</i>	8.2	13.3	<i>Enteromorpha, Ulva</i>	8.4	2.9
TOTAL	224	100		62	100		286	100



Table 2 summarises the Condition Rating and Macroalgal Coefficient (MC) results for the 2008-2010 period. Although the rating has remained constant across years (due to the extent of estuary with a >50% cover and the presence of nuisance conditions), there have been several changes in macroalgal cover. The biggest occurred in the Pauatahanui Arm where the cover of *Gracilaria* along the northeast shoreline increased over the past year from 1-5% to 20-50%. Over the same period, macroalgal cover decreased slightly around the Pauatahanui Stream mouth, and dominance switched from *Enteromorpha* to *Ulva*. However nuisance conditions remained 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 redistribution of cover near the Porirua Stream mouth, but conditions remained similar to 2008 and 2009. Where dense mats of macroalgae were present in the Onepoto Arm (often wind blown accumulations), sediments were commonly soft, anaerobic, and sulphide rich.

Table 2. Summary of condition rating and results, 2008-2010.

Year	Rating	MC	Result
2008	FAIR	2.2	High cover (50-80%) near Porirua Stream mouth in Onepoto Arm dominated by <i>Ulva</i> . 10-20% cover across most of Pauatahanui Arm, dominated by <i>Gracilaria</i> .
2009	FAIR	2.1	High cover (50-80%) near Porirua Stream mouth in Onepoto Arm dominated by <i>Ulva</i> . Large increase in growth near Pauatahanui Stream mouth (50-80% cover dominated by <i>Enteromorpha</i>). 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 <i>Ulva</i> . Dominant cover near Pauatahanui Stream mouth changed from <i>Enteromorpha</i> to <i>Ulva</i> . Cover in northeast of Pauatahanui Arm increased from 1-5% to 20-50%.

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, its widespread extent, and 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.