Wriggle

coastalmanagement

Waikanae River Estuary

Intertidal Macroalgal Monitoring 2011/12

Prepared for
Greater Wellington Regional Council
June 2012

Cover Photo: Lower Waikanae River Estuary.

Waikanae River Estuary

Intertidal Macroalgal Monitoring 2011/12

Prepared for
Greater Wellington Regional Council

By

Leigh Stevens and Barry Robertson

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

Contents

Figures and Tables

Accumulations of rotting macroalgae adjacent to the flapgate, lower Waikanae River Estuary, Feb. 2012.

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 third annual survey of intertidal macroalgal cover in Waikanae River Estuary, undertaken in February 2012. 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 (2010, 2011, 2012).

METHODS

Broad scale mapping of the percentage cover of macroalgae throughout all the intertidal habitat of Waikanae River Estuary was undertaken in February 2012 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 2010).

Rectified aerial photographs of the estuary (2010 Greater Wellington Regional Council ~0.3 metre per pixel images) 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 2012 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).

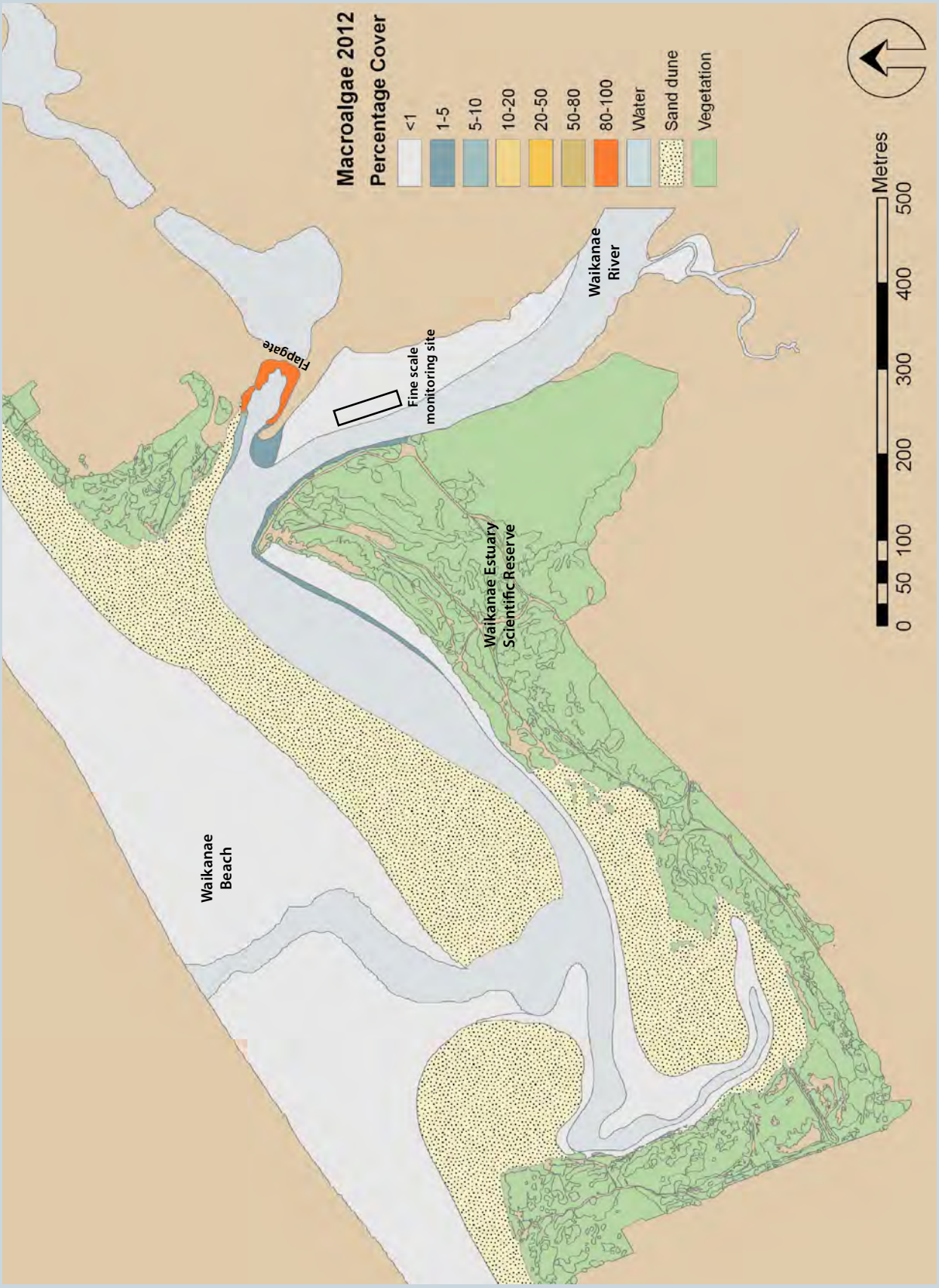
WELLINGTON ESTUARIES: MACROALGAE CONDITION RATING

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 - WAIKANAE ESTUARY, FEB. 2012



2. RESULTS, RATING AND MANAGEMENT

RESULTS

2012 MACROALGAL COVER CONDITION RATING
GOOD

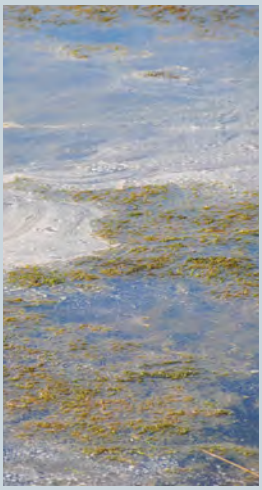


Figure 1 and Table 1 summarise the results of intertidal macroalgal mapping within Waikanae River Estuary. Overall, the vast majority of the intertidal area (90%) had no macroalgae growth. Macroalgae was observed as a sparse growth (1-5% cover) of *Ulva intestinalis* on boulders along the lower true left bank of the Waikanae Estuary, and accumulations of *U. intestinalis* in and around the embayment near the flapgate. In the embayment, localised nuisance conditions (anoxic sediments, odours) were present due to rotting macroalgae.

Table 1. Summary of macroalgal cover results, 20 February 2012.

MACROALGAE	Waikanae River Estuary		
Percentage Cover	Ha	%	Dominant species
<1%	5.2	90.4%	
1-5%	0.34	5.9%	*Ulva intestinalis**
5-10%	0.05	0.9%	*Ulva intestinalis**
10-20%	0	0	
20-50%	0	0	
50-80%	0	0	
>80%	0.16	2.8%	*Ulva intestinalis**
TOTAL	**5.75**	**100.0**	

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

The 2012 Macroalgae Coefficient (MC) for the estuary was 0.25, a condition rating of "good".

This has increased slightly from 2010 and 2011 (see Stevens and Robertson 2010, 2011) due to increased cover and nuisance conditions (e.g. rotting macroalgae and poorly oxygenated and sulphide rich sediments) in the poorly flushed embayment next to the flapgate (see photos on page iv and bottom of this page).

Although the MC was low, other indicators of increasing eutrophication of the estuary were present. These, reported on in Robertson and Stevens (2012), were:

- A reduction in sediment oxygenation (RPD depth).
- Increased sediment nutrient concentrations(total nitrogen and phosphorus).
- Increased organic content (measured as total organic carbon).
- Dense microalgal mats growing on estuary sediments.
- A distinctive green tinge (chlorophyll a) in the estuary water, particularly in temperature/salinity stratified bottom waters.

Based on the combined trend of an increasing MC, and the presence of these eutrophication indicators, it is recommended that macroalgae be quickly reassessed in conjunction with sediment rate monitoring in January/February 2013, and thereafter based on the condition ratings.

Table 2. Summary of condition rating and results, 2010-12.

Year	Rating	MC	Result
2010	VERY GOOD	0.05	Macroalgae absent from the vast majority of the estuary. Very low cover of *Ulva intestinalis* along the lower true left bank.
2011	VERY GOOD	0.20	Macroalgae absent from the vast majority of the estuary. Very low cover of *Ulva intestinalis* along the true left bank. Increase in nuisance conditions near flapgate.
2012	GOOD	0.25	Macroalgae absent from the vast majority of the estuary. Low cover of *Ulva intestinalis* along the lower true left bank. Increase in nuisance conditions near flapgate.

2. RESULTS, RATING AND MANAGEMENT

CONCLUSION	Macroalgal cover had a condition rating of "good". Minor localised nuisance conditions (rotting macroalgae, poorly oxygenated and sulphide rich sediments) were present in one small part of the estuary. Other indicators of eutrophication show a decline in estuary quality over the past three years.
RECOMMENDED MONITORING AND MANAGEMENT	Macroalgal growth should be quickly assessed at the same time sedimentation monitoring is undertaken to ensure growths or nuisance conditions have not increased. The latest available aerial photographs from the estuary should be used where appropriate. The next monitoring in Waikanae River Estuary is therefore due in January/ February 2013.
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.* *Robertson, B.M. and Stevens, L. 2010. Waikanae Estuary: Fine Scale Monitoring 2009/10. Prepared for Greater Wellington Regional Council. 19p.* *Robertson, B.M. and Stevens, L. 2011. Waikanae Estuary: Fine Scale Monitoring 2010/11. Prepared for Greater Wellington Regional Council. 21p.* *Robertson, B.M. and Stevens, L. 2012. Waikanae Estuary: Fine Scale Monitoring 2011/12. Prepared for Greater Wellington Regional Council.* *Stevens, L. and Robertson, B.M. 2010. Waikanae River Estuary: Intertidal Macroalgal Monitoring 2009/10. Prepared for Greater Wellington Regional Council. 3p.* *Stevens, L. and Robertson, B.M. 2011. Waikanae River Estuary: Intertidal Macroalgal Monitoring 2010/11. Prepared for Greater Wellington Regional Council. 3p.*
ACKNOWLEDGEMENT	This survey and report was completed with the support of Greater Wellington Regional Council. The assistance and feedback of Juliet Milne and Megan Oliver is much appreciated.