

Fortrose (Toetoes) Estuary

Macroalgal Monitoring 2008/09



Prepared
for
**Environment
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Cover Photo: *Enteromorpha* and *Gracilaria* growing along eastern flats of Toetoes Estuary.

Enteromorpha growing along the eastern shoreline adjacent to Fortrose.



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By

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Contents

1. Introduction and Methods 1
2. Results, Rating and Management 2
3. References 4

List of Figures

Figure 1. Map of macroalgal cover - Toetoes (Fortrose) Estuary, February 2009. 2

List of Tables

Table 1. Summary of macroalgal percentage cover results, February 2009. 2
Table 2. Summary of macroalgal monitoring results, 2009. 3



All photos by Wriggle except where noted otherwise.



1. INTRODUCTION AND METHODS

INTRODUCTION

Developing an understanding of the condition and risks to estuarine habitats is critical to resource management in the Southland region. This brief report summarises macroalgal cover within Fortrose Estuary, one of the key estuaries in the Environment Southland’s long term estuary monitoring programme. Although Fortrose Estuary was not scheduled for macroalgal monitoring in 2009, it was included following reports of the most extensive macroalgal growth seen in the estuary for many years. The report describes macroalgae present in February 2009, and applies the results to the macroalgae estuary condition rating (and recommended management responses) developed for Southland’s estuaries. The next monitoring in Fortrose Estuary is due in February 2010.

METHODS

Broad scale mapping of the percentage cover of macroalgae throughout all the intertidal habitat of Fortrose Estuary was undertaken in February 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 2007).

Environment Southland supplied rectified aerial photographs (~0.3 metre per pixel, scale 1:10,000) of the estuary, flown in February 2008. Experienced coastal scientists then recorded the percentage cover of macroalgae directly onto laminated photos during field assessment of macroalgal cover. The photographs also formed the GIS base layer onto which the percentage cover information was subsequently digitised.

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).

SOUTHLAND 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.

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

2. RESULTS, RATING AND MANAGEMENT

RESULTS

Extensive macroalgal growth is not common in Fortrose Estuary and the 2009 monitoring was initiated following reports of unusually high macroalgal growth over the summer of 2008/09. Figure 1 and Table 1 summarise the results of monitoring undertaken in February 2009. They show that macroalgal cover was sparse in the western and lower estuary, but relatively widespread throughout the central basin and eastern side of the estuary.

Figure 1. Map of macroalgal cover - Fortrose (Toetoes) Estuary, February 2009.

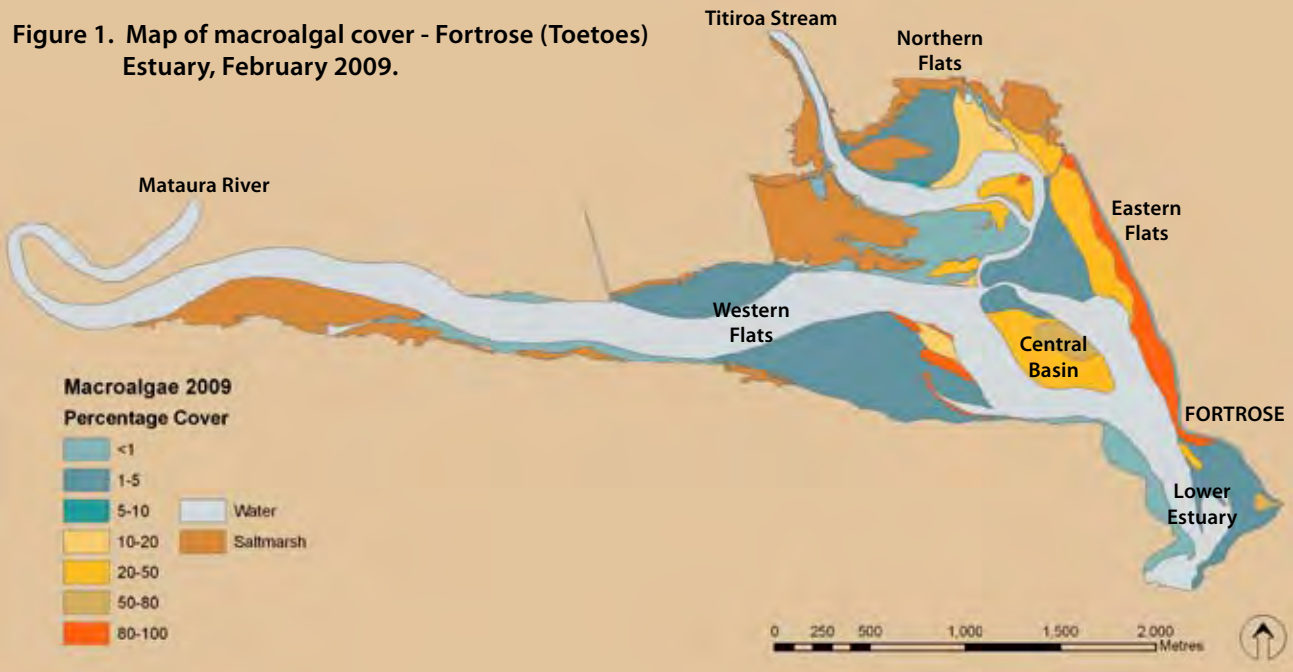


Table 1. Summary of macroalgal percentage cover results, February 2009.

MACROALGAE Percentage Cover	Fortrose (Toetoes) Estuary		
	Ha	%	Dominant species
<1%	43	20.2	-
1-5%	104	48.4	<i>Enteromorpha, Gracilaria</i>
5-10%	1	0.3	<i>Enteromorpha, Gracilaria</i>
10-20%	13	5.9	<i>Enteromorpha, Gracilaria</i>
20-50%	35	16.2	<i>Enteromorpha, Gracilaria</i>
50-80%	5	2.3	<i>Enteromorpha, Gracilaria</i>
>80%	15	6.8	<i>Enteromorpha, Gracilaria</i>
TOTAL	214	100	

2009 MACROALGAL COVER CONDITION RATING

FAIR

The Macroalgae Coefficient (MC) was 1.8, which equates to a condition rating of "fair" (Table 2). Despite the relatively widespread macroalgae present, nuisance conditions of anoxic muds and sulphide odours were uncommon and restricted to small localised areas in the east of the estuary.

2. Results, Rating and Management (Continued)

RESULTS



Table 2. Summary of macroalgal monitoring results, 2009.

Year	Rating	MC	Result
2009	FAIR	1.8	Widespread growth in central basin and eastern side of estuary. Little growth in the west and across lower estuary, but localised concentrations of windblown algae.

Across the vast majority of the estuary (195Ha, 91%), macroalgal cover was below 50% and plants were attached to the sediments and growing well. Sediment oxygenation was high, and no nuisance conditions were apparent (see photo of right sediment core and sidebar photos). The green alga *Enteromorpha* was the most common species in the estuary. It was dominant along the edge of the river channel margins (e.g. top sidebar photo), and present across the intertidal flats where it dominated over the red alga *Gracilaria*.

Sediment conditions in the central basin were good in areas of higher macroalgal cover (>50%) (bottom left photo). These areas are well flushed and only uncovered for a brief period at low tide. Elsewhere, where growth exceeded 50% cover and was combined with windblown accumulations of macroalgae (bottom right photo), the RPD depth indicated sediment oxygen levels were being reduced and the organic content of the sediments was increasing (see photo of left core).



The current estimated N load to the estuary is high (approximately 2,500 tonnesN/yr), but because the estuary is relatively small in comparison to the very large freshwater inflow (mean flow 76m³/s), most of the N inflow is rapidly flushed out to sea. However, estuaries like this are still susceptible to nuisance macroalgal problems. When N inputs are high, excessive growths of nuisance macroalgae will establish in areas close to the main channel (i.e. areas exposed to elevated nutrient concentrations and low salinity conditions). The nuisance macroalgae is usually *Enteromorpha*, which is very tolerant of low salinity, and these growths can break away and be transported to other areas of the estuary through wind and current action. This response to high nutrient inputs is currently evident in Toetoes Estuary.

As such, setting nutrient limits on inputs and identification and management of nutrient sources is seen as a high priority.



CONCLUSION

2009 macroalgal cover had a condition rating of "fair", with macroalgae relatively widespread throughout the central basin and eastern side of the estuary. Nuisance conditions of anoxic muds and sulphide odours were uncommon away from localised areas associated with high cover or windblown accumulations of macroalgae.

2. Results, Rating and Management (Continued)

RECOMMENDED MONITORING AND MANAGEMENT

The condition rating, and the increase in macroalgal growth in 2009 compared to previous years, trigger annual monitoring which will establish a baseline and allow for any deterioration of sediment quality to be assessed. In addition, the following management is recommended:

Set Limits on Nutrient Inputs

- Nutrient inputs to Fortrose Estuary are high, are strongly related to eutrophication symptoms (Robertson and Stevens 2008), and macroalgal growth had recently accelerated and was widespread throughout the central basin and eastern side of the estuary. Further work is needed before a definitive limit can be set, but inputs need to be reduced below current levels to achieve a more moderately enriched estuary and to protect it from further degradation.

Identify and Manage Major Nutrient Sources

- The identification of nutrient sources to the estuary is seen as a priority given the very significant nature of both point and non-point discharges. Once identified, a plan should be developed to prioritise and reduce the key inputs.



20-50% cover in the northern estuary.
Titiroa Stream channel in the background.

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