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Fortrose (Toetoes) Estuary

Macroalgal Monitoring 2009/10

Prepared
for
Environment
Southland
April
2010

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

Leigh Stevens and Barry Robertson

Wriggle Limited, PO Box 1622, Nelson 7040, NZ. Ph 03 545 6315, 021 417 936, or 03 546 1550, 0275 417 935, www.wriggle.co.nz

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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 seagrass of light causing its eventual decline, while decaying macroalgae can accumulate on shorelines causing localised depletion of sediment oxygen, and nuisance odours.

This report summarises the fourth year of macroalgal monitoring in the Fortrose Estuary, one of the key estuaries in the Environment Southland's long term estuary monitoring programme. The report describes the intertidal macroalgal cover of the estuary in February 2010, and uses a macroalgal coefficient (described below) developed for Southland's estuaries to rate the condition of the estuary, and recommend monitoring and management actions. The next scheduled monitoring in Fortrose Estuary is in February 2011.

METHODS

Broad scale mapping of the percentage cover of macroalgae throughout all the intertidal habitat of Fortrose Estuary was undertaken in February 2010. Using a combination of aerial photography and ground-truthing, ArcMap 9.3 GIS-based digital maps were produced. 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 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. A summary table of the dominant species and classes of percentage cover is also produced, and management recommended.

SOUTHLAND 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

2. RESULTS, RATING AND MANAGEMENT

RESULTS

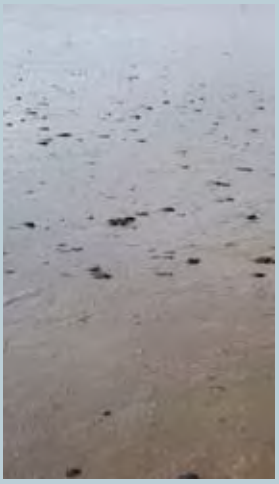

Figure 1 and Table 1 summarise the results of the 2010 macroalgal mapping of Fortrose Estuary. Across the vast majority of the estuary (194Ha, 91%), macroalgal cover was below 50%, with the highest densities of macroalgae growing predominantly in the well flushed lower intertidal reaches of the Central Basin and Eastern Flats. Nuisance conditions of anoxic muds and sulphide odours were uncommon and largely restricted to localised areas in the estuary where wind and current-deposited macroalgae accumulates (predominantly along the eastern shoreline).

The green alga *Enteromorpha* was the most common species in the estuary and dominated the red alga *Gracilaria* in all areas of the estuary, including subtidally. The most extensive macroalgal growths were in subtidal areas wherever substrate allowed macroalgae to gain a foothold, while *Enteromorpha* was most common intertidally along the edge of the river channel margins.

Table 1. Summary of macroalgal percentage cover results, February 2010.

MACROALGAE	Fortrose (Toetoes) Estuary		
Percentage Cover	**Ha**	**%**	**Dominant species**
<1%	59	27.4	-
1-5%	105	48.8	*Enteromorpha, Gracilaria*
5-10%	13	6.0	*Enteromorpha, Gracilaria*
10-20%	14	6.6	*Enteromorpha, Gracilaria*
20-50%	4	1.8	*Enteromorpha, Gracilaria*
50-80%	9	4.1	*Enteromorpha, Gracilaria*
>80%	11	5.3	*Enteromorpha, Gracilaria*
TOTAL	**214**	**100**	

Table 2. Summary of condition rating and results, 2009-10.

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.
2010	FAIR	1.2	Most macroalgal growth and localised concentrations of windblown algae located on the Eastern Flats. Little growth across the north, west or lower estuary flats.

2010 MACROALGAL COVER CONDITION RATING
FAIR

Table 2 summarises the Condition Rating and Macroalgal Coefficient (MC) results for the 2009-2010 period. Macroalgal cover decreased in the Central Basin and in the lower intertidal sections of the Northern and Eastern Flats from Feb. 2009-Feb. 2010, with the Macroalgae Coefficient (MC) reducing from 1.8 to 1.2. The reduction in the MC related to a decrease in the amount of the estuary with >80% cover, as well as an increase in areas with <5% cover. The condition rating remained "fair" because of >50% cover over >5% of the estuary. The decrease in the unusually high macroalgal growth observed in Fortrose Estuary during summer 2008/09, and the general absence of nuisance conditions is a positive sign. However, extensive growths of macroalgae in subtidal areas, which contribute to localised impacts where shoreline accumulations occur, require monitoring and management action.

2. Results, Rating and Management (Continued)

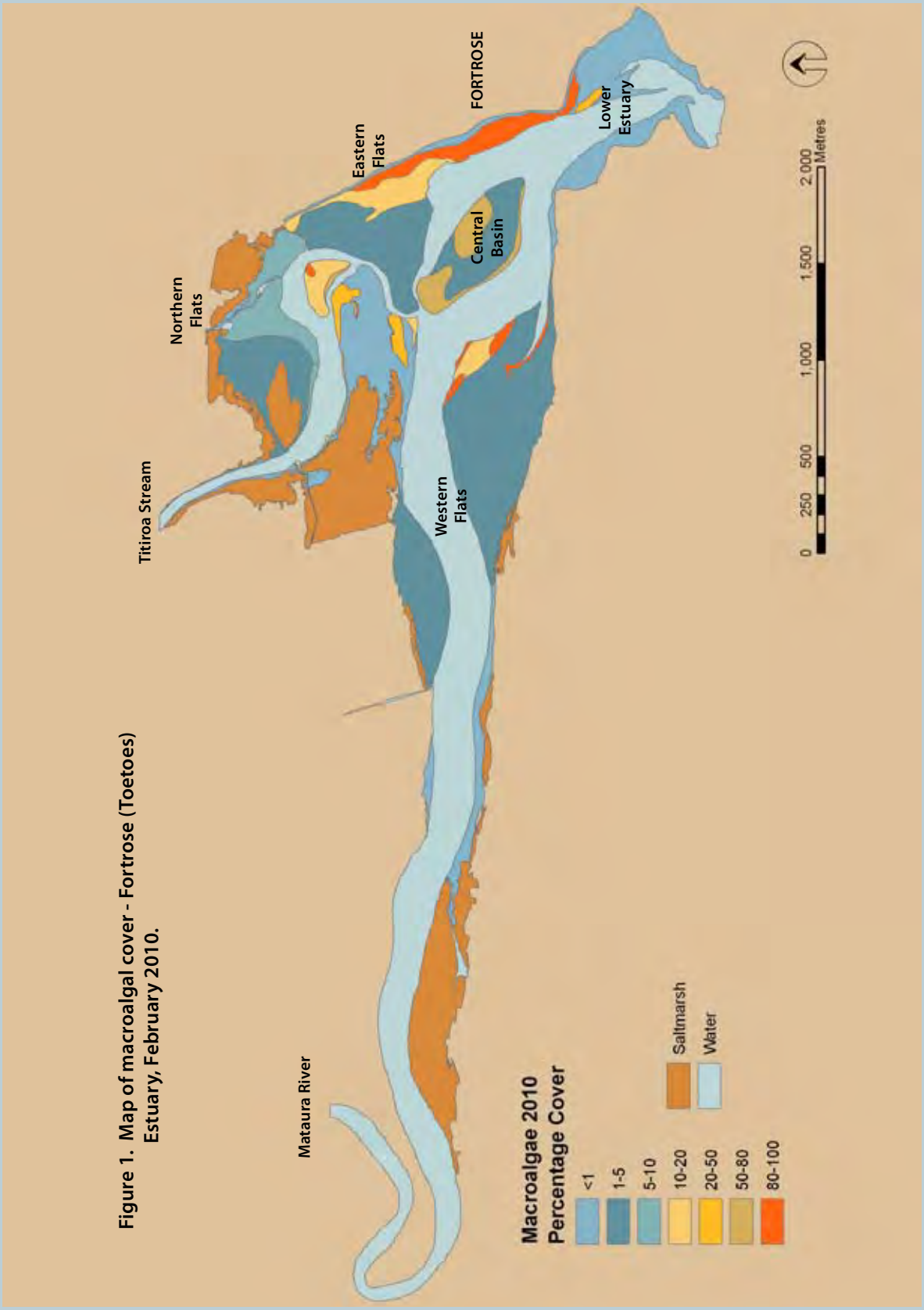

Figure 1. Map of macroalgal cover - Fortrose (Toetoes) Estuary, February 2010.

2. Results, Rating and Management (Continued)

RESULTS	This extensive subtidal growth present in the estuary is driven by the high nutrient loads entering the estuary (estimated N load 2,500 tonnesN/yr based on NIWA's WRENZ model). Because the estuary is relatively small in comparison to the very large freshwater inflow (mean flow 76m^3/s), most of the N inflow is rapidly flushed out to sea. However, the high N inputs support excessive growths of nuisance macroalgae 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. At present, extensive growths of macroalgae in subtidal areas of Fortrose Estuary reflect the estuary's response to high nutrient inputs. Consequently, setting limits on nutrient inputs, and the identification and management of nutrient sources is considered a priority.
CONCLUSION	2010 macroalgal cover had a condition rating of "fair", with the highest densities of macroalgae in subtidal channels, and in 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.
RECOMMENDED MONITORING AND MANAGEMENT	The condition rating triggers annual monitoring to 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 priortise and reduce the key inputs.

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