TOKOMAIRIRO ESTUARY: 2021/2022 INTERTIDAL SEDIMENT MONITORING SUMMARY

Salt Ecology Short Report 006. Prepared by Barrie Forrest for Otago Regional Council, March 2022

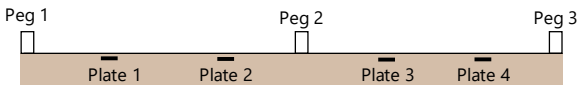
OVERVIEW

Since Dec-2017, Otago Regional Council has undertaken annual State of the Environment monitoring in Tokomairiro Estuary to assess trends in the deposition rate, mud content, and oxygenation of intertidal sediments. Sediment monitoring was initially undertaken at three sites, with ongoing monitoring at Sites B and C only (Fig. 1). The latest survey was carried out on 23 November 2021.

Fig. 1. Location of Tokomairiro Estuary monitoring sites. Site A has been discontinued as measurement plates could not be found at the time of the Jan-2021 survey.

METHODS

Estuary sedimentation is measured using the 'sediment plate' method (e.g. Forrest et al. 2021). The approach involves measuring sediment depth from the sediment surface to the top of each of four buried concrete pavers.



Measurements are averaged across each plate (n=3) and used to calculate a mean annual sedimentation rate for each site. A composite sample of the surface 20mm of sediment is collected adjacent to the plates and analysed for particle grain size (wet sieve, RJ Hill laboratories). This approach allows changes in sediment muddiness to be determined even where there are no changes in sediment depth.

Sediment oxygenation is an ancillary biological health variable that is visually assessed in the field by measuring the depth at which sediments show a change in colour to grey/black, commonly referred to as the apparent Redox Potential Discontinuity (aRPD). Results for all indicators are compared to condition ratings of ecological state shown in Table 1.

RESULTS

Table 2 shows a summary of results for the latest survey and their respective condition ratings corresponding to the colours in Table 1.

Table 2. Indicator values and condition ratings from the Nov-2021 survey.

Indicator	A**	B	C
Sedimentation (mm/yr)*	-6.69	3.17	0.80
Mud content (%)	11.1	63.2	57.0
aRPD (mm)	>50	17	8

* Mean annual sedimentation rate relative to the baseline (n=1-4 years). Five years of data are required to assess a meaningful trend.
** The Site A data are from the last monitored date, Dec-2019.

Sedimentation rate

The cumulative change in sediment depth over plates at each site is shown in Fig. 2. The greatest accumulation was at Site B, where the mean annual sedimentation was rated 'poor' due to exceedance of

Table 1. Summary of condition ratings for sediment plate monitoring.

Indicator	Unit	Very Good	Good	Fair	Poor
Sedimentation rate[1]	mm/yr	< 0.5	≥0.5 to < 1	≥1 to < 2	≥ 2
Mud content[2]	%	< 5	5 to < 10	10 to < 25	≥ 25
aRPD[3]	mm	≥ 50	20 to < 50	10 to < 20	< 10

Condition ratings derived or modified from: [1]Townsend and Lohrer (2015), [2]Robertson et al. (2016), [3]FGDC (2012).

the 2mm/yr guideline value (Table 1). The sedimentation between Jan-2021 and Nov-2021 equated to almost 10mm/yr. By contrast, sedimentation was low at Site C (rated 'good'). The erosion in Dec-2019 at Site A (where monitoring has been discontinued) reflects the dynamic hydrological environment and movement of mobile sands in the lower estuary.

Sediment mud content and oxygenation

Sediment mud content was rated as 'poor' at mid- and upper estuary Sites B and C, where it exceeded the biologically relevant threshold of 25%. Mud content has been consistently high across all monitoring years at these sites (Fig. 3). Tokomairiro Estuary drains a large catchment whose land uses are predominantly agriculture (54%) and forestry (35%), which are known sources of muddy sediment (Forrest et al. 2020).

The average aRPD depth was shallow at Sites B and C, corresponding to condition ratings of 'poor' and 'fair', respectively. The elevated mud content in the sediment acts as a barrier to oxygenation. Macroalgae and/or microalgae at these sites was suggestive of excess nutrient enrichment (see photos). By contrast, the aRPD is quite deep in the porous sandy sediments of the lower estuary around Site A where there is no evidence of excessive algal growths.

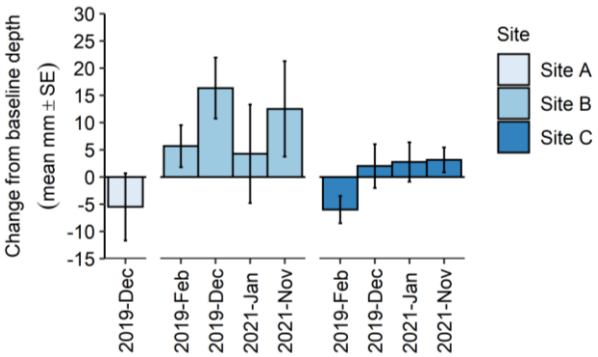


Fig. 2. Change in mean sediment depth over buried plates (±SE) relative to the baseline.

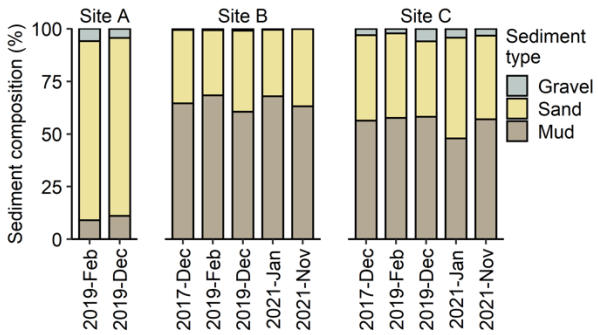


Fig. 3. Sediment particle grain size at each site. The baseline result for each site is also shown.

CONCLUSIONS

The sedimentation rate since Dec-2017 has been greatest at Site B, where it has exceeded the 2mm/yr national guideline value. The Nov-2021 results overall show that the mid and upper river margins at Sites B and C remain under pressure from fine sediment and organic/nutrient enrichment impacts, and further reinforce previous recommendations (e.g. Forrest et al. 2020) to manage catchment inputs to the estuary.

In Nov-2021 benthic microalgae were conspicuous at Site B (left), with filamentous macroalgae conspicuous at Site C (right).

RECOMMENDED MONITORING

Continue annual monitoring of sedimentation rate, sediment grain size and aRPD depth, and report results annually via a summary report. Comprehensive reporting should be undertaken 5-yearly as part of 'fine scale' ecological and sediment monitoring (next due in the summer of 2024/25).

REFERENCES

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