WAIKOUAITI ESTUARY: 2021/2022 INTERTIDAL SEDIMENT MONITORING SUMMARY

Salt Ecology Short Report 005. Prepared by Barrie Forrest for Otago Regional Council, March 2022

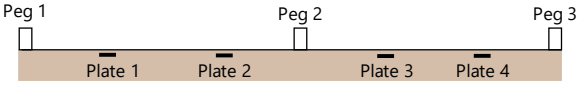
OVERVIEW

Since Dec-2016, Otago Regional Council has undertaken annual State of the Environment (SOE) monitoring in Waikouaiti Estuary to assess trends in the deposition rate, mud content, and oxygenation of intertidal sediments. Sediment monitoring is undertaken at three sites (Fig. 1), with the latest survey carried out on 24 November 2021.

Fig. 1. Location of Waikouaiti Estuary monitoring sites. Site B1 replaced nearby Site B, which was washed away.

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	B1	C
Sedimentation (mm/yr)*	1.29	-7.15	-3.93
Mud content (%)	6.6	4.6	26.5
aRPD (mm)	50	8	12

* Mean annual sedimentation rate relative to the baseline (n=2 yrs for Sites A & B1, n=5 yrs for Site C). Five years of data are required to assess a meaningful trend.

Sedimentation rate

The cumulative change in sediment depth over plates at each site is shown in Fig. 2. There has been a low level of annual sedimentation at Site A (rated 'fair'), with high variability between plates likely owing to the dynamic hydrological environment near the estuary entrance, and the presence of shell hash.

Sites B1 and C have shown consistent erosion since monitoring began. In Waikouaiti Estuary high river flows can cause scouring of the tidal flats, which at former Site B led to the sediment above installed

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).

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plates being eroded away. Site C in the upper estuary comprises fine muddy sediments and is located near two small stream inputs that could have a localised influence on sediment movement and erosion.

Sediment mud content and oxygenation

Mud content was low at Sites A and B1, where sand and gravel (>2mm particle diameter) fractions were dominant. By contrast, at upper estuary Site C the sediment condition was rated as 'poor' due to the mud content exceeding the biologically relevant threshold of 25% (Fig. 3). Sediment mud content has remained at a consistent level within each site across each monitoring survey to date.

The relatively deep aRPD depth of 50mm at Site A (condition rating 'very good', Table 2) likely reflects the sandy sediment at this site, with oxygenation also maintained by the presence of crabs, numerous cockles and other organisms, which turn over surface sediments and create voids that allow air and water to transfer oxygen to underlying layers. The relatively shallow aRPD at Sites B1 and C is indicative of moderate organic enrichment, with condition ratings of 'poor' and 'fair', respectively. At Site C there were also moderate growths of filamentous algae (see photo) that had not been recorded previously.

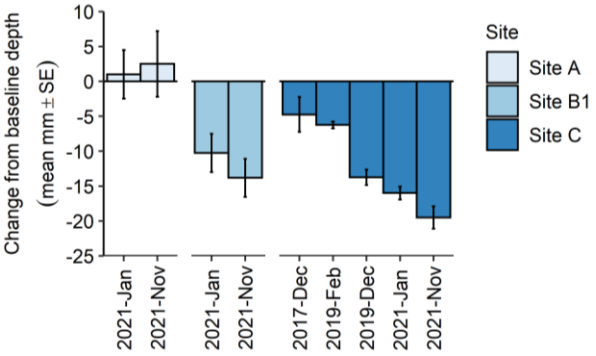

Fig. 2. Change in mean sediment depth over buried plates (±SE) relative to the baseline.

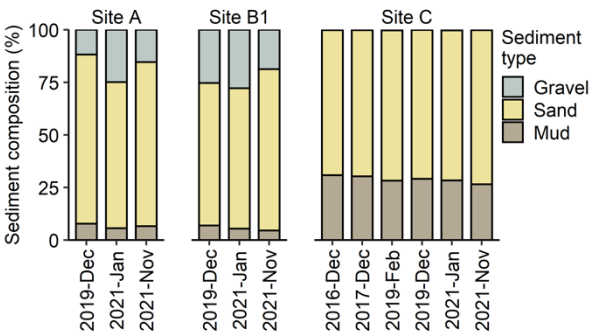

Fig. 3. Sediment particle grain size at each site. The baseline result for each site is also shown.

CONCLUSIONS

There has been no significant sedimentation at the Waikouaiti Estuary monitoring sites, with scouring and erosion due to hydrodyamic processes appearing to override any depositional pressure of sediment from the catchment. Nonetheless, the Nov-2021 results show that upper estuary Site C is consistently muddy. Additionally, Sites B1 and C are both expressing moderate enrichment effects. As such, the results reinforce previous recommendations (e.g. Robertson et al. 2017) to manage catchment influences on the estuary.

Algal growth at Site C (left) and firm sand with cockles at Site A (right) in Nov-2021.

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 2023/24).

REFERENCES

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