CATLINS ESTUARY: 2022/2023 INTERTIDAL SEDIMENT MONITORING SUMMARY

Salt Ecology Short Report 025. Prepared by Barrie Forrest for Otago Regional Council, March 2023

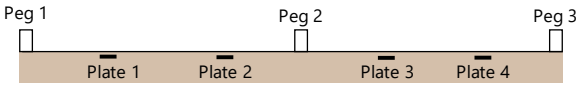
OVERVIEW

Since December 2016, Otago Regional Council has undertaken annual State of the Environment monitoring in Catlins River Estuary to assess trends in the deposition rate, mud content, and oxygenation of intertidal sediments. Sediment monitoring is undertaken at two sites (Fig. 1), with the latest survey carried out on 30 November 2022.

Fig. 1. Location of Catlins River Estuary monitoring sites. Site A was washed away in 2020 and replaced by Site A1 in the same general location.

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), enabling assessment of sediment muddiness.

Sediment oxygenation 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 and the respective condition ratings. Annual results for all surveys are provided in Table 3.

Table 2. Indicator summary and condition ratings from the November 2022 survey.

Indicator	A1	B
Sedimentation (mm/yr)*	8.5	5.8
Mud content (%)	3.4	29.4
aRPD (mm)	21	20

* Long-term mean sedimentation is calculated relative to the baseline for Site A1 (n=3 yrs), with a 5-yr value shown for Site B. Five years of data are required for a meaningful trend.

Sedimentation rate

The cumulative change in sediment depth over plates at each site is shown in Fig. 2. There has been steady sediment accrual at both sites, with annual mean values significantly exceeding the 2mm/yr guideline (rated 'poor'). High variability among plates at Site A1 (Fig. 2) reflects the dynamic hydrological environment near the estuary entrance, where sediment accrual reflects the movement of sand rather than fine sediment deposition from catchment sources. In contrast sedimentation in the upper estuary (Site B) likely reflects catchment sources.

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).

Sediment mud content and oxygenation

Sediments were sandy at lower estuary Site A1. By contrast, the mud content at upper estuary Site B exceeded the biologically relevant threshold of 25% and was rated 'poor' (Table 2). Combined with the elevated sedimentation rate, these results suggest there is significant ongoing deposition of muddy sediment in the upper estuary, which likely reflect catchment sources, including inputs from the dominant pastoral farming catchment land use (Stevens & Robertson 2017).

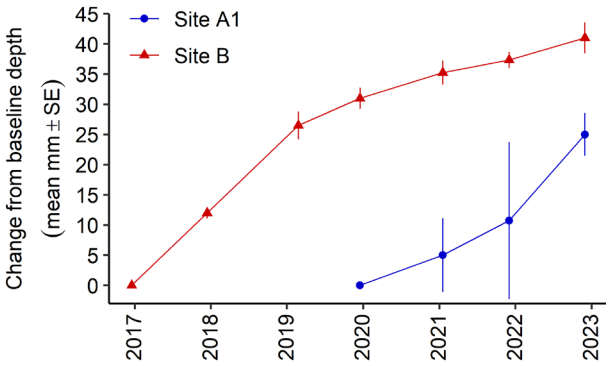


Fig. 2. Temporal change in mean sediment depth over buried plates (±SE) relative to the baselines for Site A1 (Dec-2019) and B (Dec-2016).

Table 3. Annual sedimentation, grain size and aRPD results up to November 2022.

Site	Survey	Sed rate mm/yr	Gravel %	Sand %	Mud %	aRPD mm
A1	Dec-2019	na	0.1	96.9	3.1	200
	Jan-2021	4.6	< 0.1	97.7	2.3	70
	Dec-2021	6.6	0.3	96.7	3.0	20
	Nov-2022	14.3	< 0.1	96.6	3.4	21
B	Dec-2016	na	0.1	75.2	24.7	20
	Dec-2017	12.1	0.1	69.6	30.4	-
	Feb-2019	12.1	0.1	57.1	42.9	10
	Dec-2019	5.5	0.1	59.0	41.0	35
	Jan-2021	3.9	< 0.1	67.6	32.4	25
	Dec-2021	2.4	< 0.1	65.4	34.6	30
	Nov-2022	3.7	< 0.1	70.6	29.4	20

< All values below lab detection limit

The aRPD depths at the two sites have been ≥20mm over the last four surveys (rated 'good' or 'very good, Table 3). As such, despite the deposition of mud at Site B, the sediment has not become excessively enriched. Neither site showed any other symptoms of excessive enrichment such as prolific algal growths. However, in the wider vicinity of Site B, the estuary margins are characterised by extensive growths of the opportunistic macroalgae *Agarophyton* spp.

Mobile, sand-dominated sediment at Site A1 (left), and mud-dominated upper estuary sediment at Site B (right) in November 2022

CONCLUSIONS

The significant sedimentation measured at upper estuary Site B over the last 5 years is consistent with the deposition of catchment-derived muddy sediment. By contrast, sand-dominated Site A1 appears to be exposed to hydrodyamic processes (e.g. scouring and erosion) that will likely limit the accrual of muddy sediments from the catchment; sediment accrual at that site is probably a reflection of the local movement of mobile sand. The November 2022 results overall show that the upper estuary at Site B and the wider area is relatively degraded, which reinforces previous recommendations (e.g. Stevens & Rovertson. 2017) to manage catchment inputs to the estuary.

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 scheduled in the summer of 2023/24).

REFERENCES

FGDC. 2012. Coastal and Marine Ecological Classification Standard Catalog of Units, Federal Geographic Data Committee FGDC-STD-018-2012. 343p.

Forrest BM, Roberts, KL, Stevens LM. 2021. Fine Scale Intertidal Monitoring of Blueskin Bay. Salt Ecology Report 070, prepared for Otago Regional Council. 34p.

Robertson BM, Stevens L., Robertson BP, et al. 2016. NZ Estuary Trophic Index. Screening Tool 2. Envirolink Tools Project, MBIE/NIWA Contract No: C01X1420. 68p.

Stevens LM, Robertson BM. 2017. Catlins Estuary broad scale habitat mapping 2016/17. Prepared for Otago Regional Council. 38p.

Townsend M, Lohrer D. 2015. ANZECC Guidance for Estuary Sedimentation. NIWA client report number HAM2015-096, prepared for Ministry for the Environment 45p.