WHANGARAE ESTUARY: 2022/2023 BROAD-SCALE INTERTIDAL HABITAT MAPPING SUMMARY

Salt Ecology Short Report 028. Prepared by Keryn Roberts for Marlborough District Council, June 2023

OVERVIEW

In March 2016, Marlborough District Council (MDC) commenced State of the Environment monitoring in Whangarae Estuary (125ha) to establish a broad-scale baseline record of intertidal substrate and vegetation (described in Stevens & Robertson 2016). In 2023, MDC contracted Salt Ecology to undertake repeat mapping, with outputs limited to provision of data, and a short report (presented here) summarising broad-scale results and any key changes since 2016.

METHODS

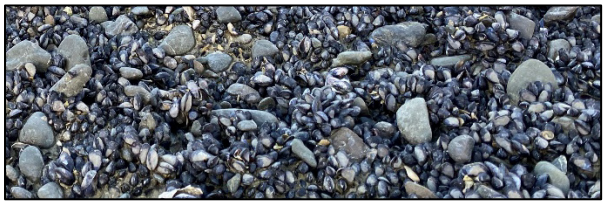
Broad scale mapping was undertaken on 22 March 2023 using National Estuary Monitoring Protocol (NEMP) methods (Robertson et al. 2002), and refinements by Salt Ecology that improve the utility and accuracy of the NEMP approach as detailed in Stevens et al. (2023). In short, broad scale mapping characterises the spatial extent and location of dominant intertidal substrates and vegetation types, with temporal changes in features providing valuable indicators of estuary condition.

The approach combined the use of aerial imagery, detailed field ground-truthing, and post-field digital mapping using GIS technology. Aerial imagery for Whangarae Estuary was sourced from LINZ Data Service and consisted of 30cm/pixel colour aerial imagery captured in December 2018. QA/QC procedures applied through the phases of field data collection, digitising, and GIS data collation and processing are described in Stevens et al. (2023).

The main broad scale survey elements were as follows.

- Substrate mapping subjectively classified sediments according to Stevens et al. (2023). As mud is a key stressor on estuary habitats, an important focus was to map the spatial extent of (and changes in) muddy (>25% mud) sediments.
- Vegetation mapping characterised high-value features, namely salt marsh, seagrass and nuisance 'opportunistic' macroalgae.

For macroalgae, field data collection included wet-weighing macroalgal biomass to enable calculation of Opportunistic Macroalgal Blooming Tool (OMBT) scores. The OMBT is a multi-metric index that combines different measures of opportunistic macroalgal proliferation into an integrated measure of ecological condition (see Stevens et al. 2023 and references therein). In addition to the authors' expert interpretation, results are assessed against established or developing estuarine health metrics, drawing on approaches from New Zealand and overseas (Table 1; Stevens et al. 2023).



Mussels growing in gravels near the entrance.

Table 1. Indicators used to assess results in the current report.

Indicator	Unit	Very good	Good	Fair	Poor
Mapped indicators					
200m terrestrial margin[1]	% densely vegetated	≥ 80 to 100	≥ 50 to 80	≥ 25 to 50	< 25
Mud-elevated substrate[2, 3]	% intertidal area >25% mud	< 1	1 to 5	> 5 to 15	> 15
Macroalgae (OMBT)[2,4]	Ecological Quality Rating	≥0.8 to 1.0	≥0.6 to <0.8	≥0.4 to <0.6	0.0 to <0.4
Seagrass[1]	% decrease from baseline	< 5	≥ 5 to 10	≥ 10 to 20	≥ 20
Salt marsh extent (current)[1]	% of intertidal area	> 20	> 10 to 20	> 5 to 10	0 to 5
Historical salt marsh extent[1,5]	% historical remaining	≥ 80 to 100	≥ 60 to 80	≥ 40 to 60	< 40
High Enrichment Conditions[1,6]	ha	< 0.5	≥ 0.5 to 5	≥ 5 to 20	≥ 20
High Enrichment Conditions[1,6]	% of estuary	< 1	≥ 1 to 5	≥ 5 to 10	≥ 10

1. General guidance as used in SOE reports for council(s) since 2007.
2. Ratings derived from Estuary Trophic Index (see references in Stevens et al. 2023).
3. Mud-elevated substrate modified from Estuary Trophic Index to apply to the intertidal area excluding salt marsh, not the whole estuary area.
4. OMBT = Opportunistic Macroalgal Blooming Tool (see method references in Stevens et al. 2023).
5. Estimated from historic aerial imagery.
6. The final condition rating is based on the worst of the two High Enrichment Condition (HEC) scores.

KEY FINDINGS

A summary of the Whangarae Estuary 22 March 2023 broad scale mapping survey is provided below and in Fig. 1 and Table 2. Supporting GIS files, spreadsheet summaries and maps have been separately supplied to MDC.

The catchment surrounding the estuary was dominated by regenerating indigenous forest, mānuka and/or kānuka and broadleaved indigenous hardwoods, with 96% of the 200m terrestrial margin of the estuary densely vegetated. Indigenous forest/scrub transitioned directly to salt marsh in most areas apart from where it was restricted by low cliffs or grassland was adjacent to residential dwellings. Introduced weeds (i.e., gorse) were well established on the barrier spit separating the estuary from Whangarae Bay.

Vehicle tracks were common along the seaward edge of the salt marsh in the south-west arm and gravel areas on the western margin where there is a path used to access the residential areas.

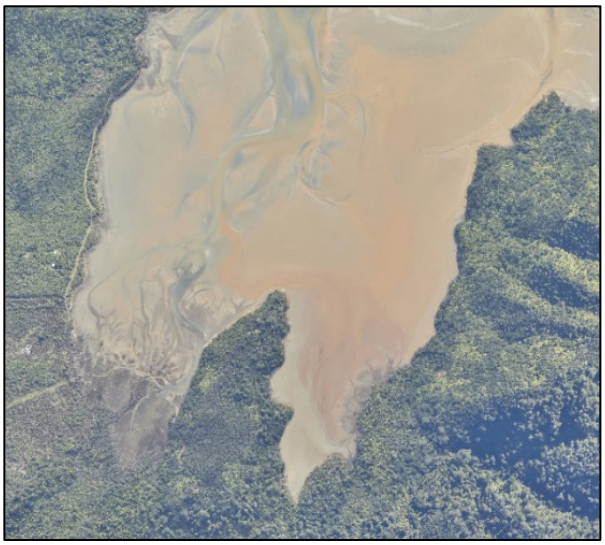
Salt marsh comprised 5.7ha of rushland (*Juncus kraussii* and *Apodasmia similis*) and 2.4ha of herbfield (*Samolus repens* and *Sarcocornia quinqueflora*; Fig. 1). The main area of rushland, located in the south-west arm, was growing in soft sandy mud, with sediments likely sourced from the Castor Stream catchment which is the main freshwater input to the estuary. Other areas of rushland in the northern arm, and along the fringing margins, were predominantly growing in gravels or muddy sand (<25% mud). Herbfield was most prominent near the estuary entrance growing in firm gravel and cobble substrates.

Rushland transitioning into native forest (top) and in the northern arm with sparse rushland cover on the seaward edge (bottom).

Since 2016, there has been a 1.2ha reduction in mapped salt marsh. Some of the reduction reflects improvements in mapping accuracy due to higher resolution aerial imagery being available in 2023 enabling better delineation of salt marsh margins. However, small losses were apparent in the northern arm where there was a reduction in the sparse rushland cover along the seaward edge (see photo). Other areas of salt marsh showed no appreciable change to those mapped in 2016 (Stevens & Robertson 2016).

The main tidal flats were dominated by firm and mobile sands, with relatively extensive areas of gravel field on the fringing margins, near the entrance, and in the southern arms. Shellfish beds (mussels - see photo on previous page) were present near the entrance, and benefit from strong tidal flushing with clean waters from the Bay. Other shellfish (predominantly cockle and to a lesser extent pipi) were also common, however, anecdotal reports indicate numbers have declined in recent years.

Outside of salt marsh areas, soft/very soft sandy mud (>50% mud) comprised 4.7% of the intertidal area and was located in the south-east arm. Since 2016, fine sediment (>25% mud) has expanded northward, with sediment plate monitoring recording an annual mean sedimentation rate of 4.4mm/y between 2016 and 2023 (a condition rating of 'poor' – see Stevens et al. 2023), indicating increased sediment deposition in the estuary. This has likely arisen from several large flood events in Marlborough in recent years. Although there was no evidence of residual fine sediments on the main sandy tidal flats in March 2023, aerial imagery taken post-flood in August 2022 (see photo below) shows extensive deposition of fine sediments in the south-east arm and on the eastern margin.



Imagery post-flood August 2022 (LINZ Data Service), orange areas represent deposition of fine sediments.

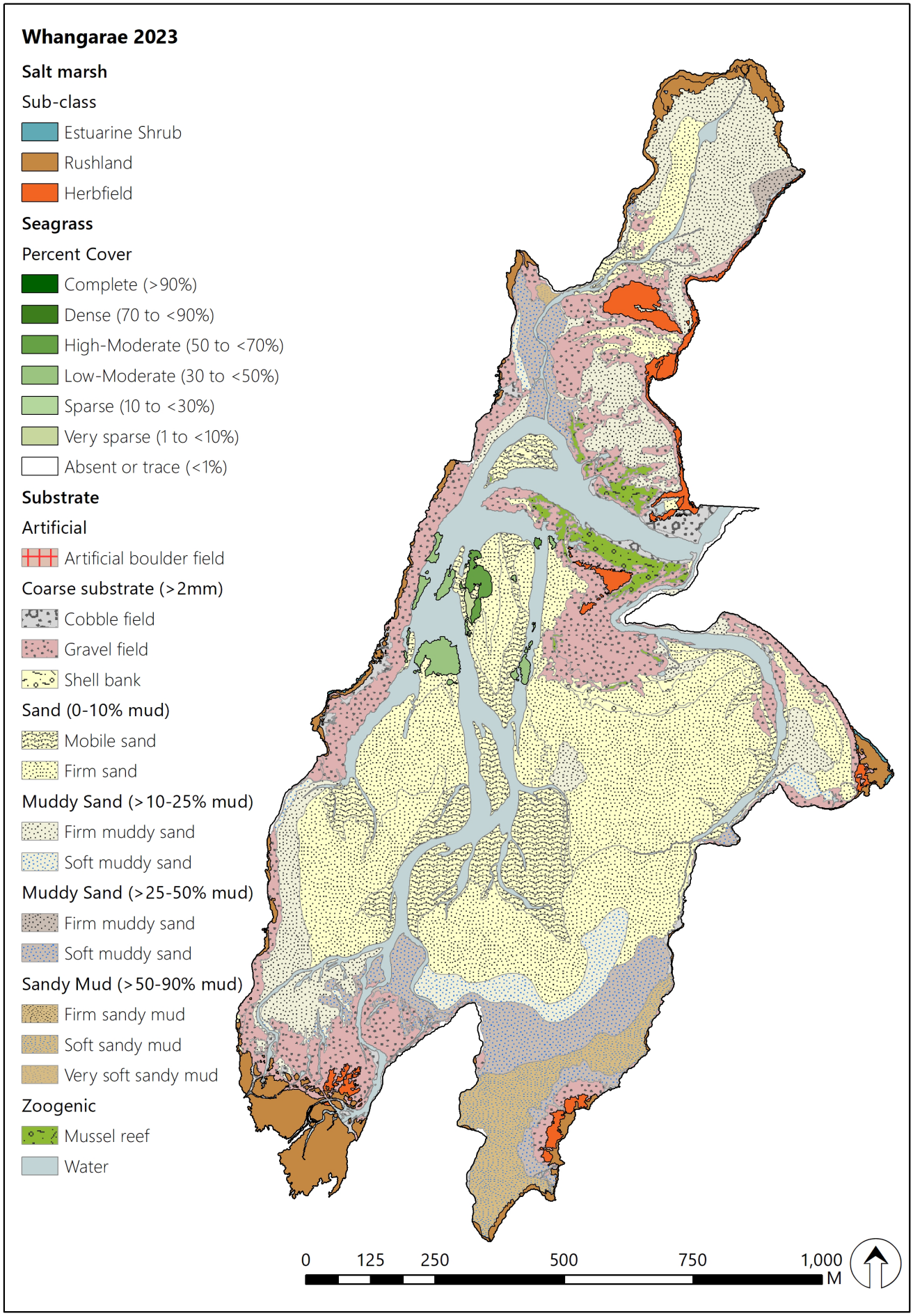


Fig. 1. Distribution of salt marsh, seagrass and substrate, Whangarae Estuary, March 2023.

*Mapping was undertaken by Thomas Scott-Simmonds and Leigh Stevens. Maps were digitised by Thomas Scott-Simmonds.

Seagrass comprised 1.4ha and was located on the lower estuary flats toward the entrance (Fig. 1). Since 2016, there has been a small decline and a shift in the location of patches and percent cover. Areas of seagrass on the margins of the eastern channel in 2016 had decreased in size, with areas on the western margin expanding in 2023. A cursory review of historic imagery indicates that seagrass in Whangarae Estuary has been spatially variable over time, likely owing to its location near the main channels. However, there has been a large, estimated decline (~74% loss) in overall extent since 1943 (first available aerial imagery), with ~50% of the losses occurring between 1943 and 1974. In March 2023, the remaining seagrass appeared in good condition with only a sparse cover of macroalgae and a small amount leaf discoloration observed in the northern most patch.

Seagrass patch looking toward the estuary entrance.

Macroalgae is a natural feature of estuaries, however if it reaches nuisance levels, usually as a consequence of elevated nutrient inputs, it can lead to deterioration of the underlying sediments. Whangarae Estuary had no growths of concern, with a sparse (<30%) cover of low biomass (<70g/m^2 wet weight) limited to the main intertidal sand flats in the central basin of the estuary. Reflecting the lack of growth at nuisance levels, the OMBT score (0.960) was rated 'very good'. Detail on macroalgal cover is included in the electronic output.

SUMMARY

Overall, the broad-scale condition ratings indicate Whangarae Estuary was in 'very good' condition (Table 2), with well flushed tidal flats dominated by firm substrate, and the presence of shellfish beds and seagrass. However, mud-elevated sediments (rated 'fair') have expanded since 2016 in the south-east arm, likely attributed to repeat flood events in recent years. Rated 'fair' based on overall extent, salt marsh was growing in virtually all available habitat in the estuary but had decreased in the northern arm since 2016. In contrast to the other indicators, seagrass was rated 'poor' because it has declined over time. While the cause is uncertain it is plausible that early losses occurred following catchment disturbance (e.g., burning for land clearance). Other possible causes include channel movement and erosion, increased sea surface temperatures and fine sediment deposition following flood events. Because there are limited human pressures, Whangarae Estuary represents an important reference site in which comparison can be made to other estuaries in Marlborough.

REFERENCES

Robertson B, Gillespie P, Asher R, Frisk S, Keeley N, Hopkins G, Thompson S, Tuckey B 2002. Estuarine Environmental Assessment and Monitoring: A National Protocol. Prepared for supporting Councils and the Ministry for the Environment, Sustainable Management Fund Contract No. 5096. Part A Development, 93p; Part B Appendices, 159p; Part C Application, 40p +field sheets.

Stevens LM, Robertson BM 2016. Whangarae Estuary: Broad Scale Habitat Mapping 2016. Wriggle Coastal Management report prepared for Marlborough District Council. 29p.

Stevens LM, Roberts KL, Forrest BM, Scott-Simmonds T 2023. Synoptic Broad Scale Ecological Assessment of Pūrākaunui Inlet. Salt Ecology Report 113, prepared for Otago Regional Council, June 2023. 53p.

Table 2. Summary of broad scale indicator condition ratings.

Very Good	Good	Fair	Poor

Broadscale Indicators	Unit	2016*	2023
Mapped indicators			
200m terrestrial margin	% densely vegetated	97.0[1]	95.9[1]
Mud-elevated substrate	% intertidal area >25% mud[2]	11.9	12.9
Macroalgae (OMBT[3])	Ecological Quality Rating (EQR)	0.959	0.960
Seagrass (2016 baseline)	% decrease from baseline (2.0ha in 2016)	baseline	32
Seagrass (1943 baseline)	% decrease from baseline (~5.1ha in 1943)	61	74
Salt marsh extent (current)	% of intertidal area	8.1	7.5
Historical salt marsh extent[4]	% of historical remaining	>80%	>80%
High Enrichment Conditions	ha	0.0	0.0
High Enrichment Conditions	% of estuary	0.0	0.0

[1]Changes reflect more detailed mapping of the terrestrial margin in 2023; [2]Excludes salt marsh area; [3]OMBT = Opportunistic Macroalgal Blooming Tool; [4]Estimated from historic aerial imagery. *2016 GIS layers were QA/QC checked using GIS scripting tools and updated as appropriate. As such, results may differ slightly to those presented in Stevens & Robertson (2016).