



State of knowledge on the Otago Coast

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Overview of presentation

Context: ORC's role in managing the coast

Science:

- Overview of key projects
- State of knowledge held by ORC

Natural hazards:

- Overview of key projects
- State of knowledge held by ORC

Next steps



The context

The Coast

- Coastal Marine Area (CMA), the zone from high-tide mark to 12 nautical miles at sea, is governed by multiple legislative frameworks (E.g. Marine and Coastal Area (Takutai Moana) Act 2011, Māori Commercial Aquaculture Claims Settlement Act 2004, Marine Reserves Act 1971, Maritime Transport Act 1994, Resource Management Act 1991 and many more)
- CMA managed by a range of agencies (E.g. regional councils, Department of Conservation, Ministry for Primary Industries, Iwi /Hapū)
- CMA and wider coastal environment supports a wide array of cultural, ecological, recreational and social values
- CMA and coastal environment plays key role in our local, regional and wider economy, with new economic opportunities emerging
- our understanding of coastal processes, ecosystems, and the impacts of human activities and climate change is still evolving

Current role of ORC in managing the Coast

Under the Resource Management Act, ORC is responsible for:

- managing the following activities in the CMA:
 - Taking, use, damming, diversion of coastal water
 - Disturbance of seabed
 - Discharges to coastal water
 - Manage land use affecting the coast, incl. soil conservation, natural hazards (e.g. erosion)
- preparing a regional coastal plan
- granting coastal permits

Future role of ORC in managing the Coast

No substantial changes proposed to the role of regional councils in managing the CMA under RMA reform proposals.

Under the Natural Environment Bill, ORC must:

- continue to manage the CMA
- develop a Natural Environment Plan
- allocate coastal resources (e.g. space, water, materials for extraction)
- set environmental limits (for ecosystem health)
- issue permits for coastal activities
- develop / implement action plans where limits are exceeded

RM reform implementation & LTP targets

Reasonable alignment between ORC's coastal planning programme and the RM reform implementation timeframe

Natural Environment Bill and Planning Bill implementation timeframes (Tentative)	ORC LTP TARGET
Regional Spatial Plan notified 15 months after bills become law - Est. September 2027	By 30 June 2026 – Issues and Options Papers
Combined Plan (Natural Environment and Land Use plans) notified 9 months from spatial plan decisions - Est. December 2028)	By 30 June 2028 – New Coast Plan ready for notification

How will our technical work on the Coast inform what ORC is doing?



Science Coastal Programme

Coastal monitoring

Focus on:

- Estuaries
- Kelp Forest
- Significant Ecological areas

Background:

- The coastal science programme started in 2019. Since then data has been gathered for Otago's 16 estuaries providing baseline data on the state of each estuary. Specific investigation studies have also occurred
- Beyond the estuaries there has been habitat mapping, tow video, diving, and a kelp forest monitoring plan developed



Bryozoan reef and sponge garden



Blue cod on soft sediment sponge gardens

Monitoring – Estuary SoE programme

Purpose

To understand trends/state of estuarine health and inform:

- Development of non-regulatory actions (working with catchment groups and farmers)
- Development of regulatory approaches (coastal provisions in new natural environment plan)
- Providing technical expertise into resource consent applications

Estuary SOE programme under review to make it as efficient and cost effective as possible. Review due by end of FY

Monitoring – Estuary SoE programme

Broad scale habitat mapping

- Mapping of habitats within estuaries.
- After baseline mapping, estuary habitat mapping occurs every 5 to 10 years depending on state of the estuary (example reports found here [Estuary reports](#)).

Fine scale habitat mapping

- 3 years of baseline mapping (sediment mud content, macrofauna, heavy metals and other parameters) and sediment plate monitoring for sediment deposition and erosion. (example reports [Estuary reports](#) and example table from Shag River sed plate report opposite).

Table 3. Annual sedimentation, grain size and aRPD results up to November 2023.

Site	Survey	Sed rate mm/yr	Gravel %	Sand %	Mud %	aRPD mm
A	Dec-2016	na	3.5	77.4	19.1	30
	Dec-2017	-1.2	1.0	80.0	19.0	-
	Feb-2019	3.4	2.8	78.6	18.6	38
	Dec-2019	-6.7	3.0	79.5	17.5	45
	Jan-2021	13.1	0.7	44.0	55.3	45
	Nov-2021	-8.9	0.9	71.5	27.6	30
	Nov-2022	9.4	0.9	69.8	29.3	45
	Nov-2023	5.1	1.1	69.5	29.4	30
B	Dec-2016	na	25.1	51.9	23.0	30
	Dec-2017	-3.0	6.3	77.2	16.5	-
	Feb-2019	1.0	13.3	63.0	23.7	35
	Dec-2019	-4.5	9.2	69.8	21.0	35
	Jan-2021	1.9	6.4	70.2	23.4	45
	Nov-2021	0.7	2.9	71.5	25.7	30
	Nov-2022	3.9	7.0	64.1	28.9	50
	Nov-2023	6.8	3.7	66.4	29.8	27

SOE output examples: habitat maps

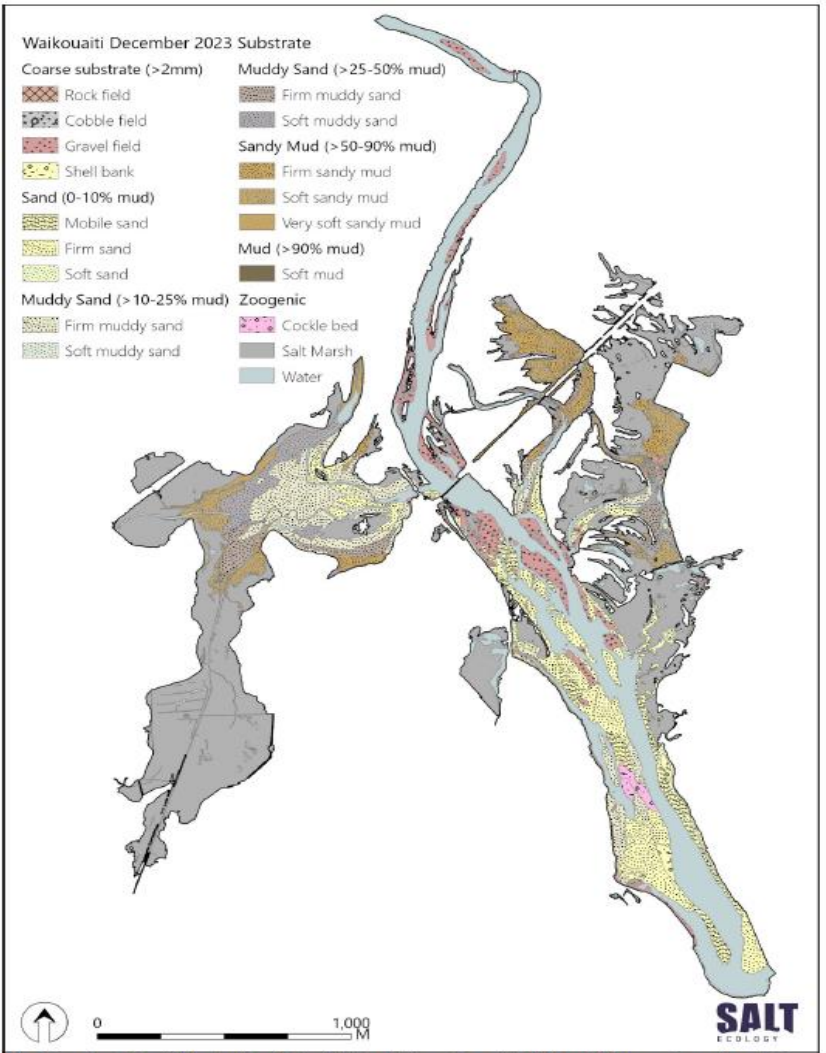


Fig. 8. Dominant intertidal substrate in the AIH (excluding salt marsh), Waikouaiti Estuary, December 2023.

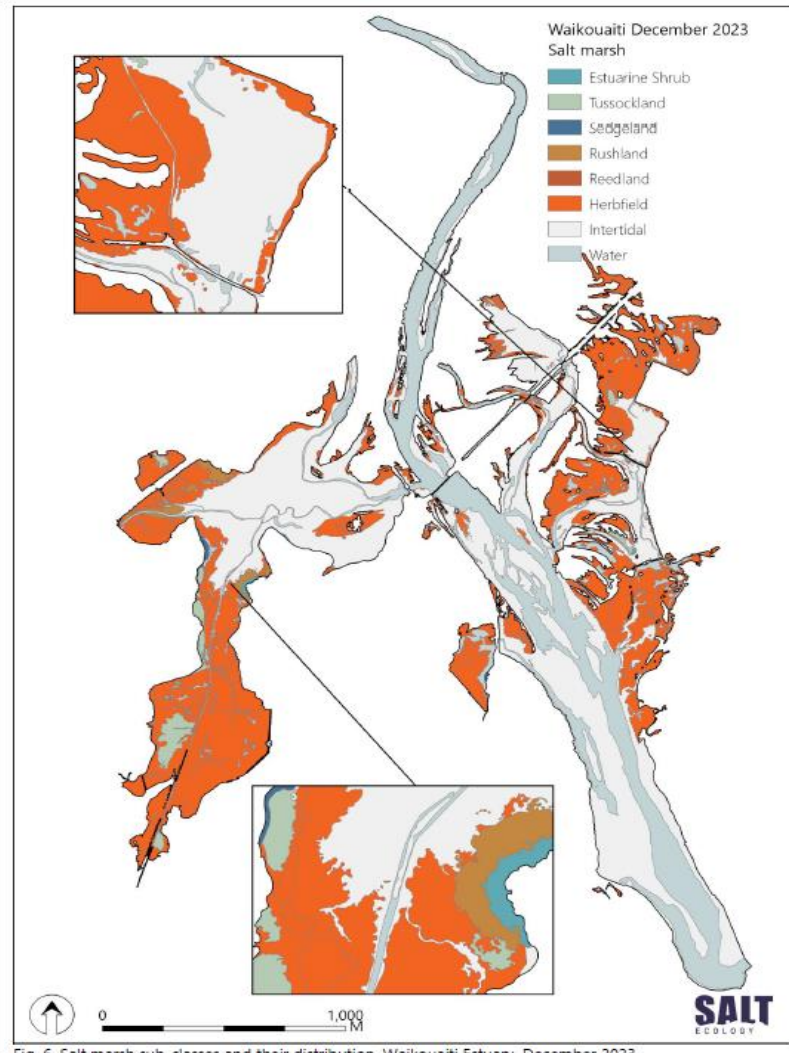


Fig. 6. Salt marsh sub-classes and their distribution, Waikouaiti Estuary, December 2023.

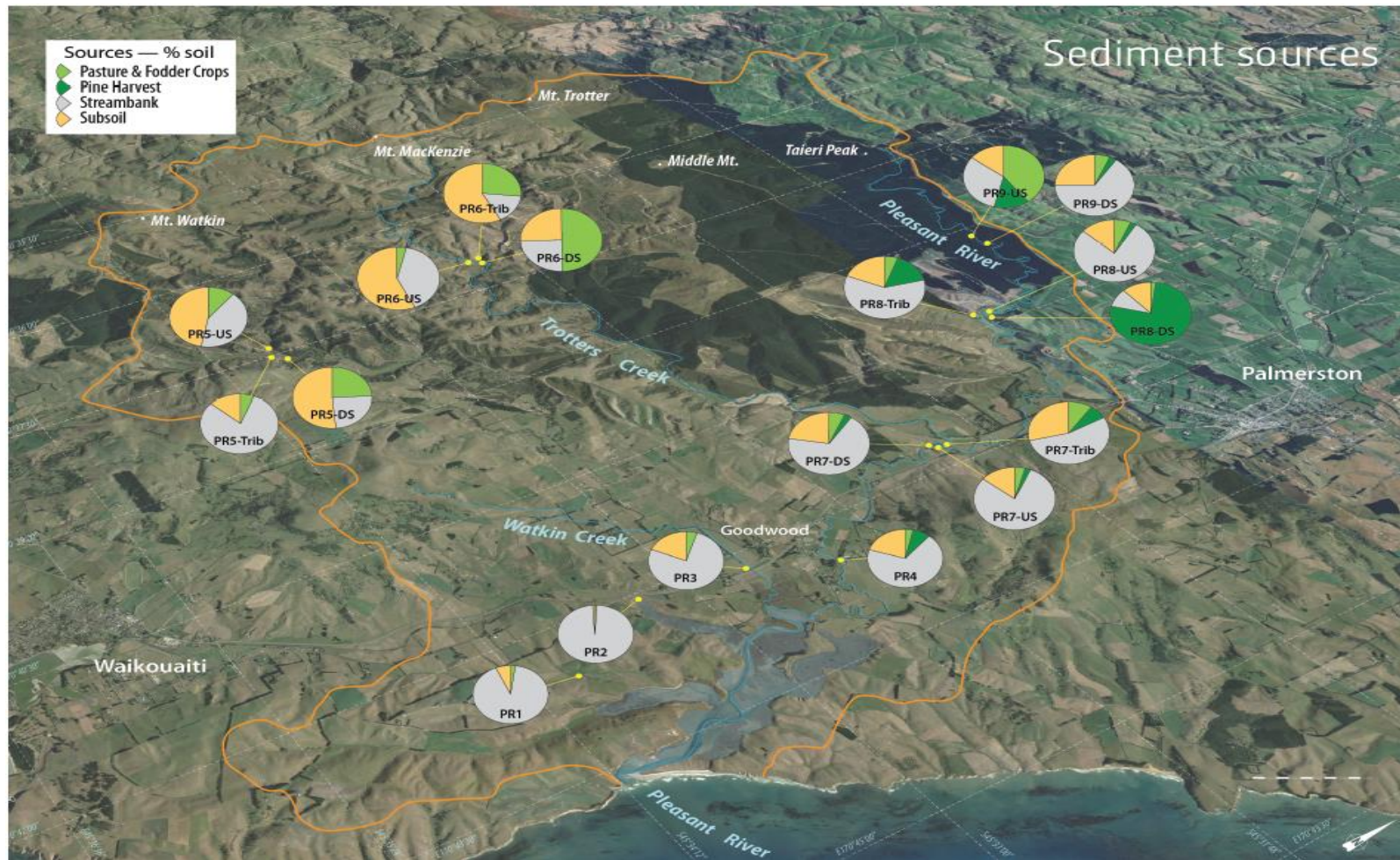
Other estuary investigations

Investigations/targeted studies

- Projects that investigate certain issues or stressors to inform management
 - Examples include macroalgae mapping, sediment source tracking, blue carbon mapping (report examples [Estuary reports](#)).
- Catlins Estuary model – sediment and nutrient fate study forthcoming.



Sediment source tracking – Pleasant River Estuary (2023)



Monitoring – Kelp forest monitoring

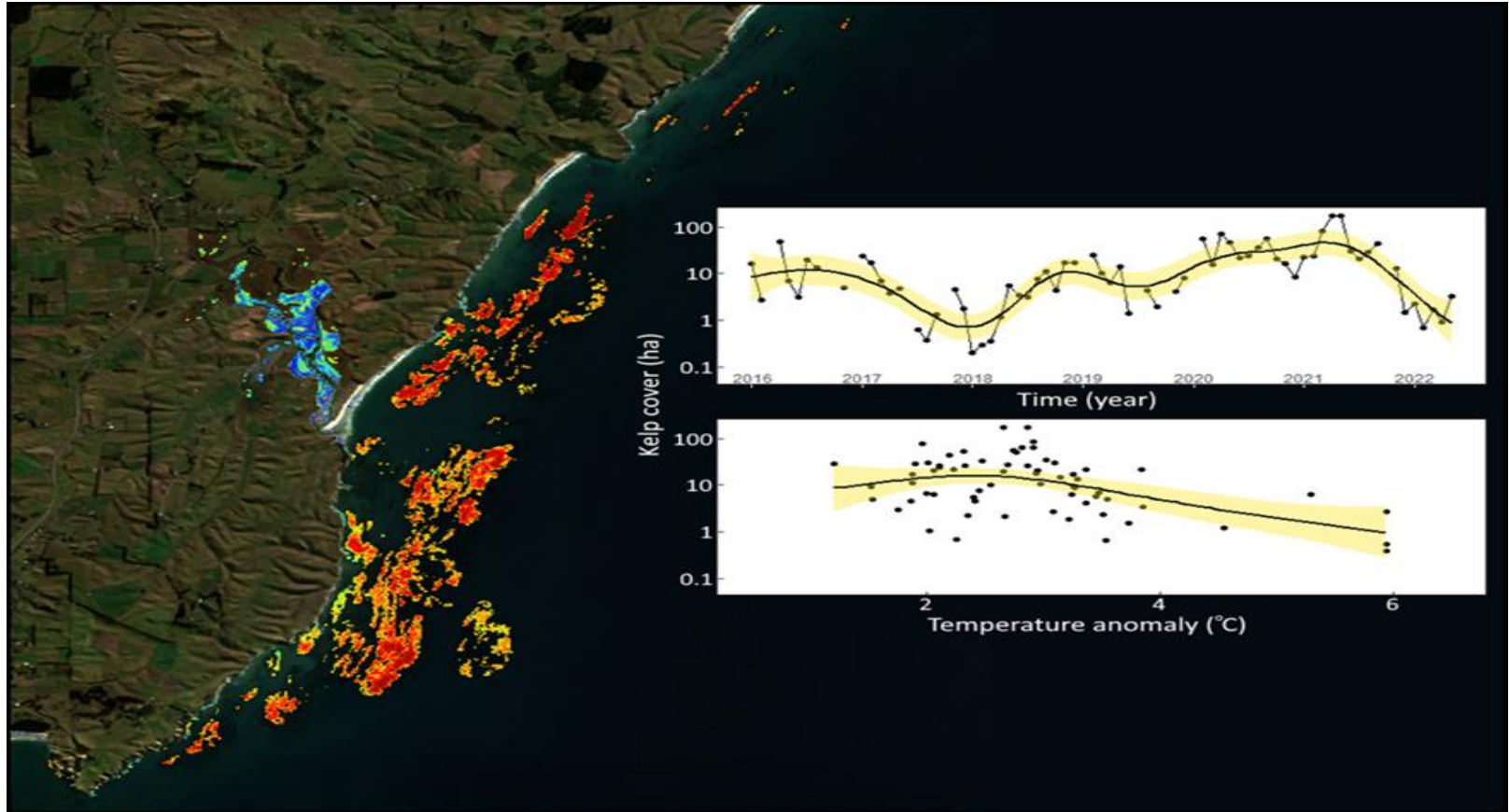
Kelp forest monitoring programme development

- A 5-year project to develop a suitable kelp forest monitoring programme using satellites, drones, diving and ROVs (remote operated vehicle's) (first report 2022).
- Final report outlining monitoring frequency and plan is due end of FY 2026

[Giant Macrocystis forests](#)



Kelp forest as mapped from satellite



Monitoring – Significant ecological areas

Marine significant ecological area mapping

- Mapping of significant ecological areas (SEA) in the coast (June 2022)

([Coast reports](#))

Ground truthing of marine significant ecological areas

- Ground truthing using tow cameras and drop cameras (footage of 140 tows analysed to understand what ecosystems are present and compare results with the SEA mapping)
- To support coastal programme development and coast plan review

Example output of significant ecological area maps and tow photos

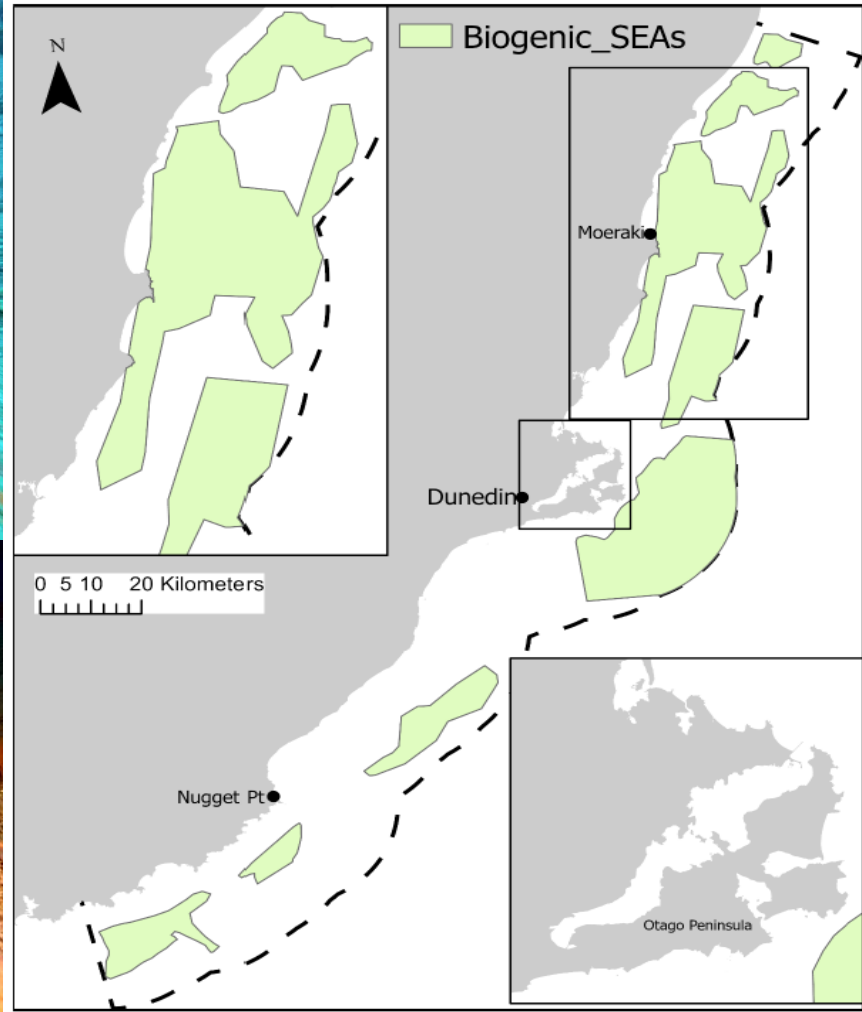
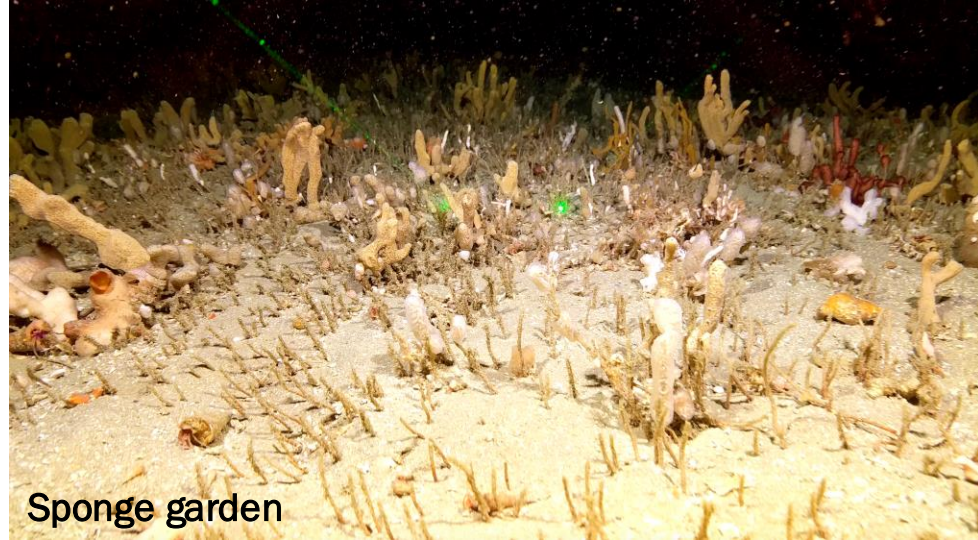


Figure 3-11: SEAs for the biogenic habitats management class.

Future coastal monitoring programme

- Currently, outside of the estuaries the monitoring programme is in the development phase to gather data and baseline information to inform a future monitoring programme.
- Lagoon, sand dune and rare coastal ecosystem mapping and monitoring programmes are also being developed



Sponge garden



Sponge garden

Science focus to inform plan development

- Provide information on what habitats exist in the coast, including (where possible) the location, state and extent of these habitats
- Gather information to inform coastal and estuarine management and provide advice or recommendations for management of certain habitats
- Projects have been prioritised to allow for development of new plans under the Natural Environment Bill, but were in the longer-term Coastal science work pipeline
- Key projects are complemented by various other, smaller projects

Key projects to inform plan development

'State of knowledge' project for coastal Otago

- Two reports that pull together data and information on the coast to highlight habitats, data and trends where possible:
 - identify gaps in science knowledge & issues facing coastal Otago
 - provide state of knowledge about current health of coastal ecosystems
- A geospatial map will also be provided with all GIS data and information for coastal Otago

Estuary State of the Environment Report

- Brings together all estuary monitoring to date,
- Highlights trends where possible
- Provides information on most at risk estuaries and catchments

Key projects to inform plan development

Water and Ecological Quality Report

- Report on water quality and ecological condition from data provided by consents for the Otago Harbour and wider Otago coast
- Repeat of a 2005 report

Coastal environment mapping

- Brings together all habitat maps for the coastal environment (e.g. sand dunes, wetlands, salt marsh, endangered lizards, naturally uncommon ecosystems in the coast, coastal vegetation and estuaries)
- Combination of existing/completed and newly contracted work

Key projects to inform plan development

Key bird roosting habitat, nesting and feeding sites

- Mapping key bird habitats along the Otago coastline

Aquaculture in the Otago Region

- Information and advice for managing ecological effects of aquaculture under regulatory plans

Potential issues in the coastal environment

- Past and ongoing science work have led to identification of various potential issues in Otago's Coastal environment, including:
 - **Sedimentation:** run off from land-based activities, often a major stressor in estuaries and coast
 - **Habitat modification:** for example, structures/infrastructure blocking off tidal flows or trampling and grazing
 - **Water quality:** for example, nutrient and heavy metal discharges
 - **Biosecurity:** spread of invasive species
 - **Marine litter:** for example, dumping of waste in or near coast

Potential issues in the coastal environment (cont.)

- **Climate change:** including sea level rise, increasing acidification and temperature
 - **Marine aquaculture:** Currently no large-scale marine aquaculture in Otago but growing demand expected. This activity can create issues if not managed to appropriate standards
 - **Overfishing and benthic impacts:** for example dredging
 - **Cumulative effects:** more than one stressor (e.g. sediment) accumulates over time, and then interacts with other stressors (e.g. nutrients). Can cause many different changes.
- While ORC's technical science work identifies key environmental health issues in the coastal environment, there are broader social, cultural, and economic issues and opportunities relevant to the Coast Plan. These will be identified through other processes, such as community and stakeholder engagement, review of literature and management plans, etc.



Natural Hazards

Coastal Hazard Issues

- Coastal hazards (erosion, inundation, groundwater, and tsunami) can negatively impact communities, infrastructure, and the environment.
- Coastal hazards already impact coastal communities but climate change will make these impacts worse in the future.
- Climate change is causing accelerated sea-level rise and changing patterns of storminess, both of which will exacerbate coastal hazards.
- There are large uncertainties relating to when we will experience different increments of sea-level rise.

Definitions of Key Coastal Hazards

- **Coastal erosion:** wearing away, retreat, and reworking of coastal sediments or bedrock by waves, tides, currents, and wind.
- **Coastal inundation:** flooding as a result of coastal processes such as storm surges, often interacts with flooding from rivers or other sources.
- **Coastal groundwater rise and saltwater intrusion:** rise in shallow groundwater as a result of sea-level rise, can lead to emergent groundwater, which can cause or exacerbate flooding and also potentially indirectly cause health issues. Saltwater intrusion can affect coastal agriculture and degrade aquifer water quality.
- **Tsunami:** powerful series of waves or surges caused by underwater earthquake, landslide, or volcanic eruption.

Coastal Hazard Mapping

Relevant high-level national work

Key maps, tools and information:

- National 'bathtub' coastal inundation hazard mapping [NZ NIWA Sea Level App](#)
- National historic shoreline position change mapping [Aotearoa's Coastal Change Dataset](#)
- National shallow groundwater occurrence screening tool [Shallow groundwater screening tool | Earth Sciences New Zealand | NIWA](#)
- National sea-level rise projections including vertical land movement - [NZ SeaRise | Our Changing Coast](#)

Coastal Hazard Mapping

Relevant high-level national work

Take-away messages:

- Provides a national ‘picture’ of coastal change and coastal hazards under sea-level rise.
- Useful ‘first-cut’ of coastal hazards in NZ and can be used as screening tools to find areas where issues might exist now or in the future.
- Not an appropriate substitute for detailed site-specific information, as their wide spatial coverage trades off data resolution and/or uncertainty.
- No national future coastal erosion dataset, only historic shoreline position change.

Coastal Hazard Mapping

National inundation mapping example, 1:100 year storm surge plus 0.3 m of sea-level rise - [NZ NIWA Sea Level App](#)



Coastal Hazard Mapping

High-level (regional or district scale)

Key maps and information:

- Waitaki District coastal erosion and inundation mapping [NIWA Client report](#)
- Dunedin City coastal erosion and shallow groundwater [dunedin-city-coastal-communities-hazard-summary.pdf](#) and (WSP, 2024)
- Clutha District coastal erosion mapping (ORC, 2026)
- Otago Tsunami and storm surge inundation mapping (selected coastal communities) [Microsoft Word - chc2007_030_START 121107.doc](#) and [Microsoft Word - chc2008_047 part 1.doc](#)

Coastal Hazard Mapping

High-level (regional or district scale)

Take-away messages:

- Similar to the national work, regional/district scale hazard mapping is useful as screening tools and as high-level information on coastal hazards under different increments of sea-level rise.
- Unlike national-scale projections, regional- and district-scale projections of areas potentially affected by coastal erosion are available.
- In general, information resolution and accuracy tend to be higher than national-scale.

Coastal Hazard Mapping

High-level (regional or district scale) – Otago tsunami inundation mapping example – Pounaweia, 1:100 year remote source tsunami no sea-level rise. [Microsoft Word - chc2007_030_START121107.doc](#)



Coastal Hazard Mapping

Site-specific studies

- South Dunedin groundwater modelling [GNS SR 2023/43](#)
- Clutha Delta coastal erosion and inundation modelling
[Molyneux Bay and Clutha Delta Morphology Investigation \(Dec 2021\).pdf](#)
- Saint Clair/Saint Kilda Coastal Plan work (DCC in progress)

Coastal Hazard Mapping

Site-specific studies

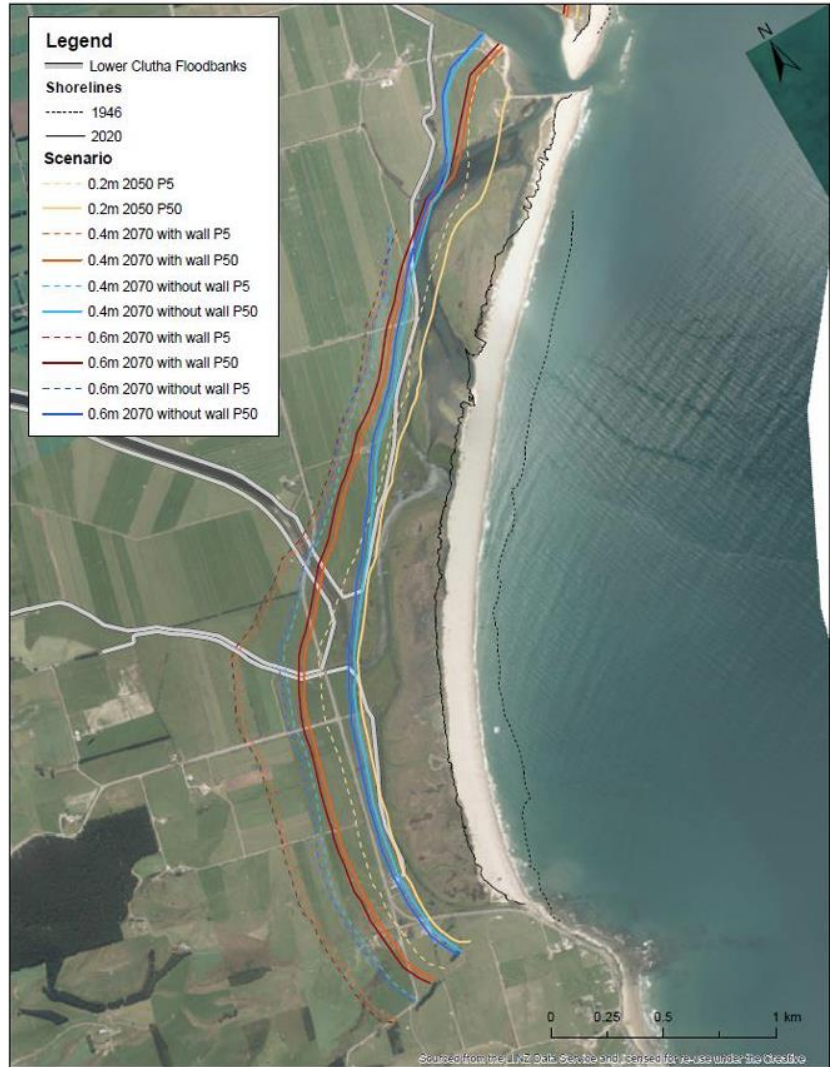
Take-away messages:

- Site-specific studies provide finer resolution and lower uncertainty and address a specific coastal hazard management or adaptation issue.
- The trade-off is that they require more data inputs, often needing a monitoring programme in place years in advance to gather necessary data.
- Although these provide the highest quality information, the coastal environment is highly dynamic and sensitive; therefore, varying degrees of uncertainty remain. In addition, high uncertainty in timeframes for sea-level rise exists, which adds further uncertainty.

Coastal Hazard Mapping

Site-specific studies – Molyneux Bay erosion mapping example – coastal erosion projections for south of the Koau Mouth under various engineering and sea-level rise scenarios – results are provided in terms of likelihood (5% and 50% probabilities)

[Molyneux Bay and Clutha Delta Morphology Investigation \(Dec 2021\).pdf](#)



Coastal Hazard Monitoring

Current state of monitoring

- **Coastal hazards monitoring:** data collection on the physical processes (waves, tides, sea-level) and geomorphic changes (topographic and bathymetric) that drive coastal hazards.
- Currently, limited monitoring of physical coastal processes occurs in Otago.
- Examples are specific projects (e.g., South Dunedin groundwater and vertical land movement), monitoring as per consent conditions, Dunedin wave buoys, and the Green Island sea-level recorder and port tide gauges

Coastal Hazard Monitoring

Opportunities for improvement

- Further monitoring will be required to address future problems under climate change and sea-level rise and enable the best possible decision making for Otago's coastal communities.
- ORC Natural Hazards team has a work programme to screen the Otago coast and develop an Otago Coastal Hazards Monitoring Plan including a site-specific prioritisation based on potential future coastal hazard exposure and feedback from relevant coastal stakeholders.



Proposed next step

- Engage with communities and key stakeholders on issues and opportunities (environmental, cultural, social/recreational, economic) – Paper coming to Council on 27 May 2026