Before the Hearings Panel

In the Matter of	the Resource Management Act 1991
And	
In the Matter of	the Proposed Marlborough Environment Plan
And	
In the Matter of	Hearing Block 2 (Topic 6 – Indigenous Biodiversity)

Overview of Marlborough District Council sponsored research:

Seabed disturbance in Marlborough Coastal Waters

Prepared at the request of the Hearings Panel by

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14 February 2018

Overview

Since 2014, Council has undertaken a number of research projects to characterise the effects of different disturbances of seabed ecosystems in the Marlborough Sounds. The key understanding that has emerged from this research has been the shift from a marine environment containing abundant and diverse marine life, to one of relative scarcity over the course of the 20th century.

The three main interacting causes of the decline in marine biodiversity, ecological functioning and ecosystem services were determined to be: **overfishing**; **habitat damage and destruction**; and **sedimentation**.

Council has undertaken research into historic ecosystem change by way of commissioned literature reviews, inviting community members to share reminisces, and by sediment coring into the seabed to reconstruct past and recent sedimentation rates and changes to shellfish communities over time https://www.marlborough.govt.nz/environment/coastal/historical-ecosystem-change.

The first record of damage to the seabed occurred in 1939, when The Auckland Star reported the comments of Sir Harry Twyford. Twyford had revisited Tōtaranui/Queen Charlotte Sound after 35 years of living overseas, during which time he became Lord Mayor of London. He was asked about his observations of his latest visit to the country. The Auckland Star records:

"He notes a great deterioration of sea fishing in Queen Charlotte Sound. He said he had been told fishermen blamed trawlers for destroying breeding grounds, and he the Government would be wise if it made it illegal to fish within a stated limit of the shore." [1]

The following is a synopsis of projects and key findings along with a link to each report:

1. **The history of benthic change in Pelorus Sound (Te Hoiere), Marlborough.** Dr Sean Handley, February 2015. Prepared for MDC by NIWA.

   Overview: NIWA searched historical newspaper accounts and local histories, as well as interviewing several long-term residents, and reviewed scientific reports to understand how the seabed of the Pelorus Sound may have changed since European settlement.

   Key findings: There have been dramatic changes to the ecology of the Pelorus Sound from sedimentation, over-fishing, bottom-trawling and dredging over the last 150 years. Since the establishment of Havelock in 1860, land uses in the Pelorus Sound and river catchments have included: native forest harvesting and clearance for farmland, farming, pine forestry, gold mining, fishing, dredging and the widespread hand picking of shellfish. These have collectively caused a loss of biodiversity by the removal of naturally occurring green-lipped mussel and oyster beds, and by excessive sediment loadings into coastal waters. Large areas of mud now cover the seabed. Fish abundance, size and diversity have also declined.

   Link: Covering agenda item presented to Council's Environment Committee on 2 February 2015 https://www.marlborough.govt.nz/repository/libraries/id:1w1mps0ir17q9sgxanf9/hierarchy/Documents/Your%20Council/Meetings/2015/Environment%202015%20List/Environment_12_February_2015_Agenda.pdf

   Report: https://www.marlborough.govt.nz/repository/libraries/id:1w1mps0ir17q9sgxanf9/hierarchy/Documents/Environment/Coastal/Historical%20Ecosystem%20Change%20List/The_history_of_benthic_change_Pelorus_Sound-Final.pdf

   YouTube video of Dr Sean Handley presenting to Council*:* https://youtu.be/O1QXHoNbsiA

[1] Auckland Star 1939, Volume LXX Issue 78, 3 April 1939 in Handley, S, 2016, page 24.

2. **History of Benthic Change in Queen Charlotte Sound/ Totaranui, Marlborough.** Dr Sean Handley. March 2016. Prepared for MDC by NIWA.

   Overview: NIWA searched historical newspaper accounts and local histories, as well as interviewing several long-term residents, and reviewed scientific reports to understand how the seabed of the Tōtaranui/Queen Charlotte Sound may have changed since European settlement.

   Key findings: There have been dramatic changes to the ecology and habitats of Tōtaranui/Queen Charlotte Sound from sedimentation, over-fishing, bottom-trawling and dredging over the last 150 years. These impacts have caused a loss of biodiversity by the removal of biogenic habitats and increased silt covering the seabed. Fish abundance, size and diversity have also declined. Historic seabed communities were much more diverse and included more biogenic habitats than what we currently see. These habitats hosted a diversity and abundance of sea life that is rarely encountered now.

   Link: Covering agenda item presented to Council's Environment Committee on 24 March 2016 https://www.marlborough.govt.nz/repository/libraries/id:1w1mps0ir17q9sgxanf9/hierarchy/Documents/Environment/Coastal/Historical%20Ecosystem%20Change%20List/History_of_Benthic_Change_in_Queen_Charlotte_Sound_Totaranui_Marlborough.pdf

   Report: https://www.marlborough.govt.nz/repository/libraries/id:1w1mps0ir17q9sgxanf9/hierarchy/Documents/Environment/Coastal/Historical%20Ecosystem%20Change%20List/History_of_Benthic_Change_in_Queen_Charlotte_Sound_Totaranui_Marlborough.pdf

   YouTube: video of Dr Sean Handley presenting to Council: https://youtu.be/AoyQ5VqRIbg

3. **A 1,000 year history of seabed change in Pelorus Sound/Te Hoiere, Marlborough.** S Handley, M Gibbs, A Swales, G Olsen, R Ovenden, A Bradley. April 2017. Prepared for MDC by NIWA.

   Overview: NIWA extracted sediment cores from the seabed in Kenepuru Sound and Beatrix Bay within Pelorus Sound. They reconstructed past sedimentation rates by dating the cores using radionuclide and carbon dating at different depths of the ~2 metre cores. They identified sources of sediment using compound specific stable isotope analyses, which "fingerprint" sediments in different layers of the cores back to different land uses.

   Key findings: There have been profound changes to sedimentation rates and shellfish composition since the late 1800s. Sedimentation rates have increased substantially since European settlement in the late 1800s. The sedimentation rates have not abated, with modern rates 4-10 times over pre-European times. There have been significant changes to shellfish communities and a lack of recovery of extensive green-lipped mussel beds since they were dredged out in the 1960s. The past extent of mussel beds appears to have been linked to the consequences of widespread burning and clearing of native forests for pasture in the late 1800s. It is clear from the research that a tipping point has been passed, where the ecosystem is maintained in a disturbed state with excessive sedimentation smothering the seafloor. The main sources contributing to contemporary sediment accumulation rates are the inputs from the Pelorus and Kaituna Rivers, pine forestry and subsoils from slips associated with different land uses. A coring study is now underway in the Havelock estuary and Mahau Sound to characterise the past and current sources of sediment, and to identify the land uses and sub-catchments which are contributing the most sediment to the Havelock inflow. The NIWA coring report recommends that measures be taken to reduce and mitigate sediment inputs from different land uses

Link: Covering agenda item presented to Council's Environment Committee on 27 April 2017:

https://www.marlborough.govt.nz/repository/libraries/id:1w1mps0ir17q9sqxanf9/hierarchy/Documents/Your%20Council/Meetings/2017/Environment%202017%20List/Environment_Committee_Agenda_27_April_2017_Agenda.pdf

Report:

https://www.marlborough.govt.nz/repository/libraries/id:1w1mps0ir17q9sqxanf9/hierarchy/Documents/Your%20Council/Meetings/2017/Environment%202017%20List/Item_5_27_April_2017_A_1%2C000_year_history_of_seabed_change_in_Pelorus_Sound_Te_Hoiere.PDF

Poster summarising research:

https://www.marlborough.govt.nz/repository/libraries/id:1w1mps0ir17q9sqxanf9/hierarchy/Documents/Environment/Coastal/Scientific%20Investigations%20List/Pelorus_Te_Hoiere_1000_yr_seabed_history_NIWA_Poster.pdf

YouTube: video of Dr Sean Handley presenting to Council: *https://www.youtube.com/watch?v=O1QXHoNbsiA&list=PLqPZqbU7SYq60STCMH4_w4M9zubGRQhfX&index=11&t=4s*

4. **Seabed disturbance in our marine waters – a national issue of international significance**. Dr Steve Urlich. Resource Management Journal April 2017.

Overview: The Ministry for the Environment and Statistics New Zealand issued a report on the state of our coastal and marine ecosystems; entitled *Our Marine Environment 2016*.

http://www.mfe.govt.nz/sites/default/files/media/Environmental%20reporting/our-marine-environment.pdf.

This is the first national domain report required under the Environmental Reporting Act 2015. The Act's purpose is to report regularly on the environment, which is divided into different domains: air, atmosphere and climate, freshwater, land and marine.

Key findings: The overriding finding of *Our Marine Environment 2016* is that human pressures are causing change to our oceans and marine biodiversity that have implications for generations of New Zealanders. The cumulative effects of these changes are resulting in serious threats to the benefits that current and future generations receive from the ocean.

The report identifies three major areas of concern: a) Global greenhouse gas emissions causing ocean acidification and warming. b) Most native marine birds and mammals are threatened with extinction. c) Coastal marine habitats and ecosystems are degraded.

The most important coastal pressures, alongside ocean acidification and climate change impacts, identified in Our Marine Environment 2016 are:

a) Excess sedimentation
b) Seabed trawling and dredging for fish and shellfish
c) Marine pests
d) Excess nutrients carried down waterways

The report noted that disturbance of the seabed re-suspends sediment into the water column. Not only are benthic invertebrate communities which provide food and habitat for fish damaged or destroyed, plumes of sediment can disrupt photosynthesis. This results in a loss of

ecosystem productivity which echoes through the marine food web. Sedimentation and loss of habitat reduce the abundance of shellfish and fish.

Link: Presented by Dr Steve Urlich to Council's Environment Committee on 24 November 2016. https://www.marlborough.govt.nz/repository/libraries/id:1w1mps0ir17q9sgxanf9/hierarchy/Documents/Your%20Council/Meetings/2016/Environment%202016%20List/E_Agenda_24_November_2016.pdf

Subsequent work: Council's coastal scientist analysed the data on Statistics NZ website on the scale and intensity of seabed bottom-trawling and dredging. Approximately 38,000,000 million hectares of seabed in NZ's EEZ have been contacted by heavy bottom-trawling equipment since 1990. This is a larger area than the deforestation that has occurred in the equivalent-sized Brazilian Amazon to our EEZ over the same period. From maps in Ministry for Primary Industry publications in 2014 and 2015, NZ's inshore waters resemble a 'ploughed aquatic paddock'. Marlborough's seabed over extensive areas have not been exempt from frequent and intense disturbance. The consequences to biodiversity have undoubtedly been severe, long-term, and cumulative, resulting in loss of ecological function and degradation of ecosystem services.

http://www.rmla.org.nz/2017/06/08/a-national-issue-of-international-significance-seabed-disturbance-in-our-marine-waters/

5. In addition to the above reports, Council commissioned a review of environmental information in 2016 on how the Picton Bays (Waikawa, Picton Harbour and Shakespeare Bay) have changed over time. There has been some recovery of seagrass beds in Shakespeare Bay following the removal of an unfiltered abattoir outfall in the 1980s. The seabed has been affected by habitat damage and destruction by historical dredging and sedimentation.

   Link: Covering agenda item presented to Council's Environment Committee on 24 March 2016: https://www.marlborough.govt.nz/repository/libraries/id:1w1mps0ir17q9sgxanf9/hierarchy/Documents/Environment/Coastal/Historical%20Ecosystem%20Change%20List/History_of_Benthic_Change_in_Queen_Charlotte_Sound_Totaranui_Marlborough.pdf

   Report:

   https://www.marlborough.govt.nz/repository/libraries/id:1w1mps0ir17q9sgxanf9/hierarchy/Documents/Your%20Council/Meetings/2016/Environment%202016%20List/E_24_March_2016_Item_2-Picton_Bays_Environmental_Cawthron_Report.PDF

   YouTube: video of Dr Emma Newcombe presenting to Council: *https://www.youtube.com/watch?v=lc00wnI09OA&list=PLqPZqbU7SYg60STCMH4_w4M9zubGRQhfX&index=5*

6. Council have commissioned a number of reports on the condition of different estuaries in Marlborough. In the inner part of Te Hoiere/Pelorus Sound the Mahakipawa, Havelock and Kaiuma estuaries are becoming muddier, and seagrass is being smothered and lost. These three estuaries are amongst the muddiest in New Zealand.

   Estuaries in Totaranui/Queen Charlotte Sound, Croisilles Harbour and D'Urville Island are in better condition, reflecting more stable catchments with less soil disturbance from land-use:

   https://www.marlborough.govt.nz/environment/coastal/coastal-ecosystems/estuaries