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Natural vs human-induced changes at the Tauranga Harbour area (New Zealand): a time -series acoustic seabed classification comparison

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The Tauranga Harbour Bay (New Zealand) is a mesotidal estuary system, enclosed by the Matakana barrier island. It hosts the leading export port in New Zealand and the second largest import port by value.
Coastal changes are well documented over the last decades, mainly at the southern entrance of the area, between Matakana Island and Mt. Maunganui. It is an extremely dynamic environment, where natural processes are strongly influenced by human activities. In particular, the understanding of the recent evolution of the system is crucial for policymakers. In fact, the cumulative impact due to the maintenance of the port (mainly dredging activities, shipping, facilities construction, but also increasing tourism) and its already approved expansion clashes with the claim of the local Maori communities, which recently leaded to a court action.

A hydroacoustic multiple-device survey (Side-scan Sonar SSS, Multibeam Echo-sounder MBES and Single Beam Echo-sounder) coupled with sediment sampling was carried out in March 2011 over an area of 0.8 km2, southern Matakana Island, along the Western Channel. The area is not directly impacted by dredging activities, resulting in an optimal testing site for assessing indirect effects of human disturbance on coastal dynamics.

The main goals were:
1. To test the response of different acoustic systems in such a highly dynamic environment;
2. To study the influence of dredging activities on sediment dynamics and habitat changes, by means of comparing the current data with existing ones, in order to distinguish between natural and human induced changes

Results demonstrate a good agreement between acoustic classifications from different systems. They seem to be mainly driven by the sediment distribution, with a distinctive fingerprint given by shells and shell fragments. Nevertheless, the presence of relevant topographic features (i.e. large bedform fields) influences swath-looking systems (SSS and MBES). SSS and MBES classifications tend to be described by a larger number of acoustic classes, allowing a better sub-division of acoustic zones that carries both the sedimentological and the topographic information into the final map.

The evolution of the channel morphology and occurred largely in the past, thus the differences observed in the data can not be univocally ascribed to the dredging operations. Changes in the distribution of surface sediments, bedforms and shell lags can also be mapped. Although a general sedimentary pattern can be recognised over the time series data, a reduction in the shell coverage and the shallowing of the lower Western Channel could be related to an adjustment of the hydrodynamic conditions due to the dredging activities in the shipping channel nearby.