

EFLSG2 - How vulnerable are Scottish loch-head salt marshes to climate change?

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1. Introduction: Loch-head salt marshes in Scotland are the main type of salt marsh along the West coast. In this 'emerging from lockdown' project funded by MASTS we have conducted fieldwork in eight loch-head marshes (Fig. 1) looking at sedimentation and the hydrology of these marshes. Here, we present a summary of the activities that were carried out between July and November 2021 and discuss preliminary results.

2. Activities:

In July 2021 sediment traps were deployed at all eight loch-head marsh (1m from the seaward edge) alongside a Hobo G logger to record inundation duration at the traps (Fig. 2). These traps were retrieved in September for 7 sites and analysed in the laboratory. In addition to the G loggers, pressure sensors were deployed at 3 sites (Feochan, Caolisport and Creran) to quantify inundation at the marsh edge.

Loch Feochan (Fig. 3), was the focus study site for this project. Detailed investigations of hydrodynamics (Acoustic Doppler Velocimeter and salinity logger) in the main channel were carried out in July 2021 for 12 high tides. Vegetation surveys, elevation (using DGPS) and sediment cores of 1m depth were taken at 12 locations across the marsh to quantify the thickness of the salt marsh soils in relation to marsh zonation. The site was further surveyed using a UAV in September and [Mini Buoys](#) were trialled within the tidal channels. A MSc. dissertation is currently being written up using the UAV survey and additional data to look at channel network patterns across loch-head marshes in Scotland.

In addition to the fieldwork, we have re-analysed tide gauge data for the region to query the trends in tidal datums relevant to marsh inundation (i.e. MHWN and MHWS).

I would like to thank Lea Stolpmann, Dr. Cai Ladd, Dr. Alejandra Vovides, Kenny Roberts, Rosanna Milburn from UoG for joining field and laboratory work.

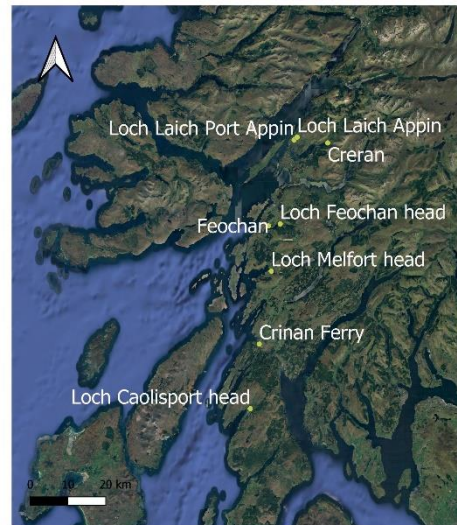


Fig. 1: Loch-head marsh study sites along the Scottish west coast



Fig. 2 Sediment traps and Hobo-G logger used as a Mini-Buoy to record inundation duration



Fig. 3 Loch Feochan head marsh September 2021

2. Preliminary results:

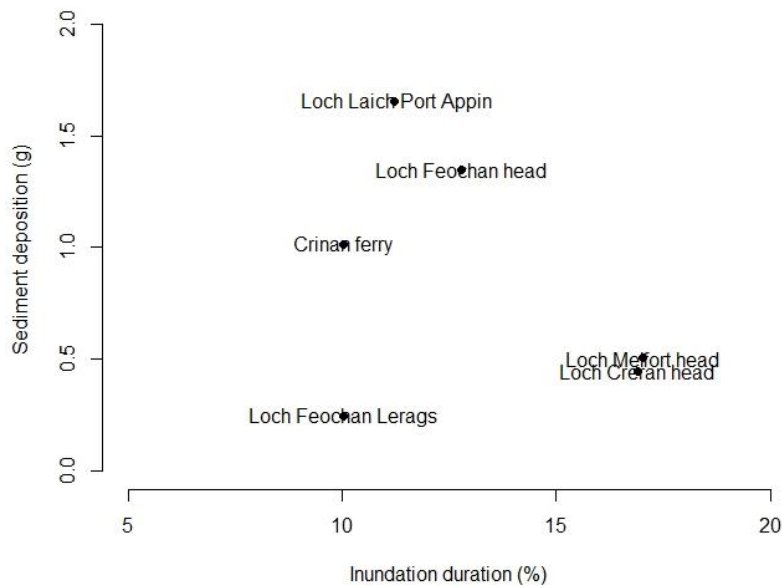


Fig.4 Sediment deposition in the traps between July to September 2021. Loch Caolisport is not shown, where the traps were almost entirely filled with sand with 39g deposited and an inundation duration of only 2.2%. This may be due to wave exposure from Southwest.

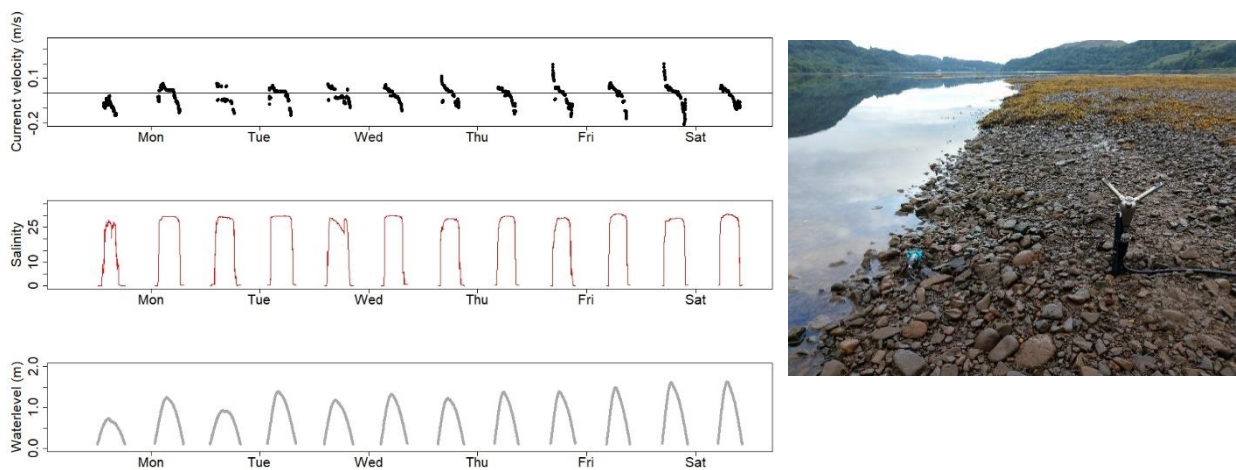


Fig. 5 Detailed Hydrology of the main channel at Loch Feochan (where negative flow velocities are ebb directions) in July 2021. The data shows a clear influence of the river input on the channel hydrology with velocities mainly in ebb directions during neap tide and flood velocities only dominant towards spring high tides at the end of the week. The monitoring period in July was dry with a single rainfall event on Wednesday night, which lead to a drop in salinity during high tide.

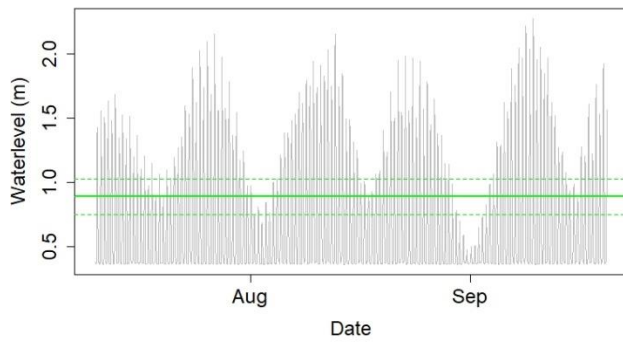


Fig. 6 Loch Feochan inundation time series and marsh-tidal flat transition (in green)

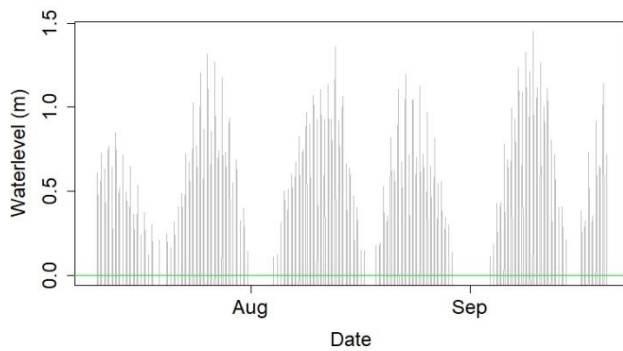


Fig. 7 Loch Creran inundation time series and marsh-tidal flat transition (in green)

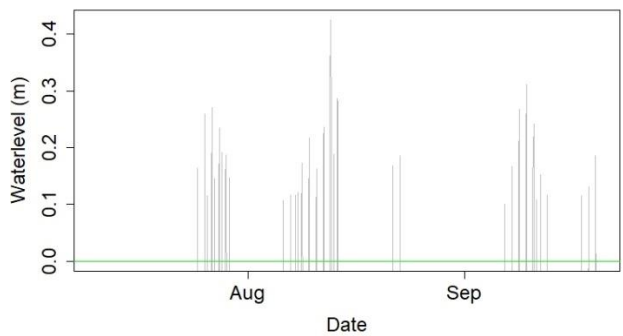


Fig. 8 Loch Caolisport inundation time series and marsh-tidal flat transition (in green)

Fig. 6-8: There is a large difference in the inundation duration that the marshes receive (also see Fig. 4). This may be explained by wave exposure pushing the marsh edge to higher elevations at Caolisport loch head. Overall the marsh edge is well above the MHWN demarcation and hence the seaward marsh edge is typically not flooded during most neap high tides.

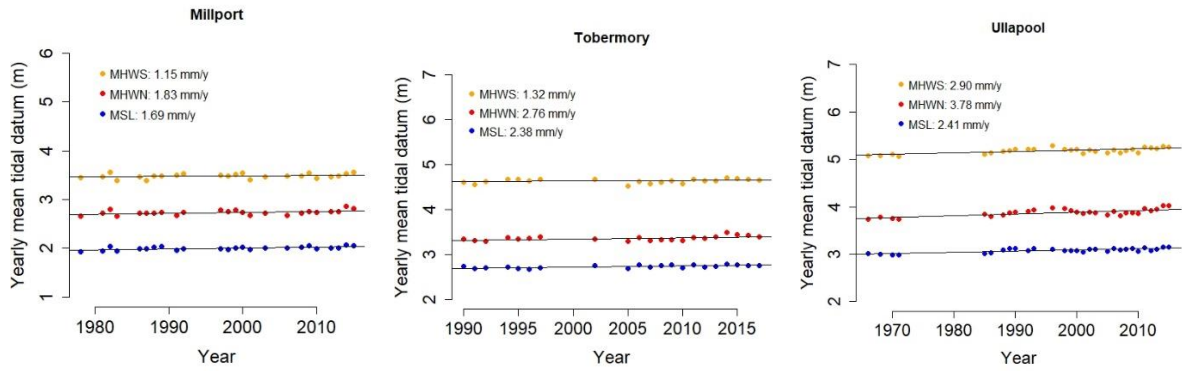


Fig. 9: Trends (annual means) of tidal datums from measured UK tide gauge data along the Scottish west coast. The increase in mean high water of neap tides (MHWN), the hydrological demarcation of the seaward salt marsh edge, is increasing faster than mean sea level (MSL) and the mean high water of spring tides (MHWS), typically the upper limit of marsh vegetation. This raises a few questions about how the effects of rising sea levels in this region may need to be addressed.