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Carbon concentrations and transformations in peatland pools

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Although inland waters have been recognised as important components of the global carbon (C) cycle, most research has focused on lakes or large river systems. Peatland pools represent a key interface between a C rich terrestrial system and an aquatic system and represent a potential hotspot for organic matter processing. Yet data that enable the extent of this processing to be quantified are sparse even though previous studies have suggested that these pools can be strong sources of carbon dioxide (CO_2) and methane (CH_4). In addition, the number and surface area of peatland pools is increasing due to warming in the arctic[1] and peatland restoration[2], where a small area of open water is often formed behind drain blocks. The aim of this study was to (i) determine whether peatland pools are active sites for the production, transformation, storage and release of C and (ii) ascertain whether C cycling in artificial pools is similar to that in natural pools. Aquatic C concentrations in nearby natural and artificial pool systems were monitored at three sites in northern Scotland over a three-year period. We found significant ($p<0.01$) differences in pool water carbon concentrations between pool types with larger dissolved organic carbon (DOC) and dissolved CO_2 in artificial pools. The differences were strong for all sites and occurred in all seasons. Dissolved CH_4 concentrations were not significantly different between pool types but the concentrations were always above atmospheric levels with values ~ 200 times atmospheric concentrations not uncommon. Dissolved CO_2 concentrations in the artificial pools were extremely large; typically ~20 times atmospheric levels while those in natural pools were typically only just above atmospheric levels. Overall the data shows that artificial pools are more acidic and coloured, have lower dissolved oxygen and contain more DOC and dissolved CO_2 than natural pools. In contrast, conductivity, particulate organic C (POC) and dissolved CH_4 did not vary between pool types. Data on the composition of the DOC (absorbance ratios, specific ultraviolet absorbance) suggested that natural pools tended to have DOC that had been processed, and was older (radiocarbon dating) while the DOC in artificial pools was younger and had not undergone much biochemical processing. This was supported by the fact that DOC concentrations in outflows from the natural pools were markedly lower than the DOC flowing into natural pools suggesting that processes in the pools were transforming and removing the DOC. In contrast, DOC concentrations in the inflows and outflows of the artificial pools were similar.

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