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SPATIAL AND TEMPORAL HETEROGENEITY OF SURFACE AND GROUNDWATER ACROSS HAMELIN POOL, SHARK BAY, WESTERN AUSTRALIA

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INTRODUCTION

Hamelin Pool is home to one of the two modern marine stromatolite colonies in the world, and is part of the UNESCO protected Shark Bay Marine Reserve

The Faure Sill, the northern boundary of Hamelin Pool, restricts water across it which, along with the arid climate, causes the hypersaline conditions seen in Hamelin Pool[1]

Hamelin Pool's unique environment, namely the hypersaline conditions, is thought to be the factor allowing stromatolites to flourish[2]

Hamelin Pool is susceptible to climate change as well as local environmental effects due to ranching and mining[3,4]

The aim of this study is to expand the knowledge of the spatial and temporal heterogeneity of the geochemistry in Hamelin Pool, so as to better understand what factors influence the growth of stromatolites

METHODS

- 8 coastal sites (blue dots) had surface and groundwater samples collected periodically starting in November 2015
- Two small boat surveys collected surface water samples (red dots) from the across all of Hamelin Pool in October 2017 and April 2019
- Environmental parameters were collected in situ and isotope analysis was conducted at University of Miami's Stable Isotope Lab

RESULTS

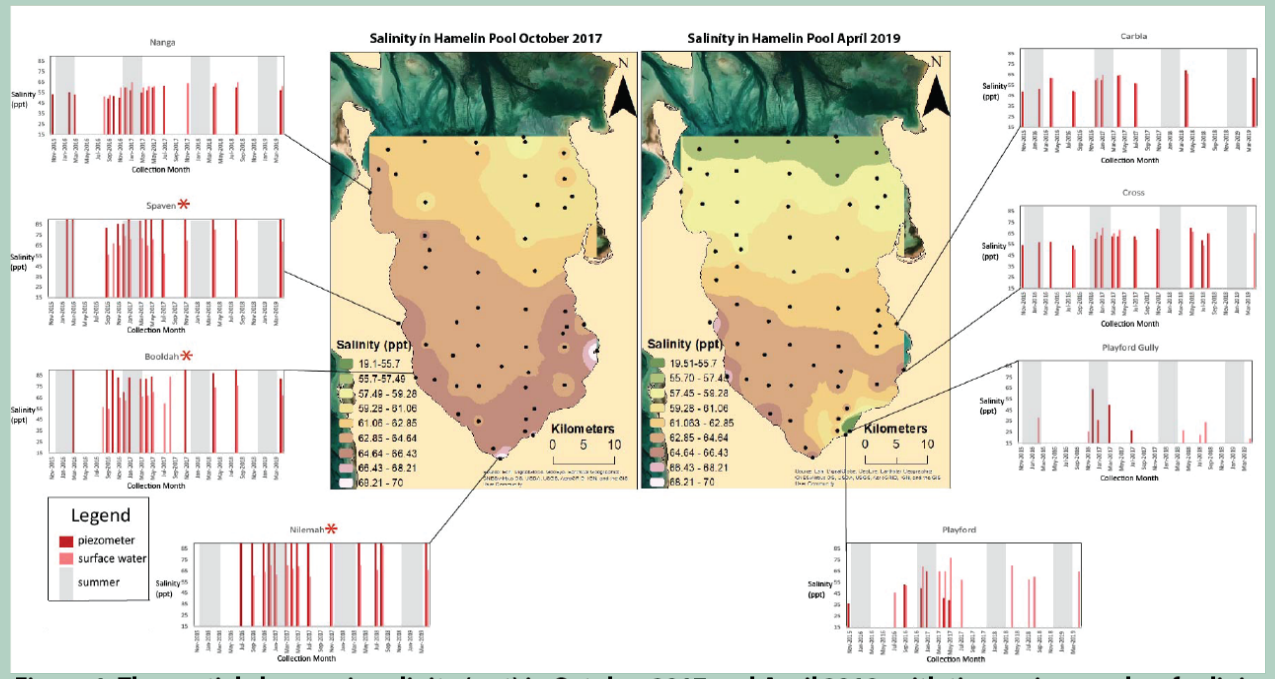

Figure 1. The spatial changes in salinity (ppt) in October 2017 and April 2019, with timeseries graphs of salinity linked to each paired point. The starred graphs have salinities that exceed the y-axis. The salinity increases toward the south of Hamelin Pool in both years, with a notable less saline input from the Playford Gully region in April 2019. The groundwater spatial heterogeneity is well demonstrated in the difference between the high salinity groundwater at Nilemah, Spaven and Booldah and the lower salinity groundwater at Playford and Playford Gully

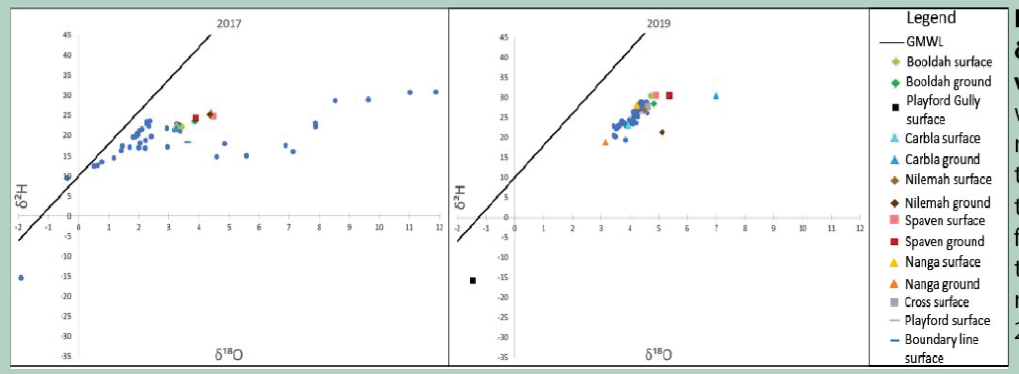

Figure 2. The ratio of $\delta^{18}O$ to $\delta^{2}H$ isotope values. The surface water samples exhibit more variability in October 2017 compared to April 2019 and fall farther to the right of the GMWL indicating more evaporation in 2017.

CONCLUSIONS

- Groundwater plays a previously unrecognized role in the water balance of Hamelin Pool
- There may be two geochemically distinct sources of groundwater: a low-salinity water from the southeast margin near the iconic Playford Transect, and a high salinity brine that occurs along the southwest margin near Nilemah Province.
- The Playford Gully region routinely shows an unusual surface water chemistry that could be indicative of another previously unidentified water input to the region
- There appears to be a temporal affect on evaporation, shown by both the isotope and salinity values, with higher evaporation in April (Austral fall) than in October (Austral spring), potentially impacted by the lower water level in Austral spring[5]

FUTURE RESEARCH

- Collecting a more comprehensive seasonally resolved set of surface water samples from all four seasons and multiple years to yield more insight about temporal and inter-annual variability.
- Increased sampling from the 8 coastal sites in the summer would greatly assist in analysis of spatial and temporal patterns throughout Hamelin Pool (both groundwater and surface water).

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