

MORPHODYNAMICS OF TWO RIVERINE ESTUARIES IN NSW

Madeline SS. Broadfoot, University of Newcastle, Australia, madelaine.broadfoot@uon.edu.au
Tom B. Doyle, Department of Planning & Environment, Australia, thomas.doyle@environment.nsw.gov.au
Annette C. Burke, University of Newcastle, Australia, annette.burke@newcastle.edu.au
Hannah E. Power, University of Newcastle, Australia, hannah.power@newcastle.edu.au

Australian communities place a very high value on coastal environments and this is reflected with 85% of the population living within 50 km of the coast (Clark & Johnston 2016). Estuaries make up a large portion of the coastal environment so it is important to understand how such settings may respond to future pressures. It is generally accepted that estuaries will undergo significant alteration due to climate change related impacts such as sea level rise (SLR) and changes in the frequency and magnitude of storm events (Passeri et al. 2016). Most previous research in southeast Australia has focused on coastal lake estuary types (e.g. Young et al. 2014 & Hart et al. 2019), yet our understanding of how riverine estuary systems (i.e., more mature and infilled systems) will respond to future SLR is much less certain.

To increase our understanding of how the morphodynamics of riverine estuaries may change with climate change, this study has investigated the tidal hydrodynamics, water level records, and inlet morphologies of two riverine estuaries in NSW: Boambee Creek (around 500 km north of Sydney) and Camden Haven Inlet (around 350 km north of Sydney).

Analyses of long-term water level records have shown that the tidal range at Boambee Creek recorded a sudden increase of ~0.14 m in 2009 (~17% of pre-2009 tidal range; Figure 1A). During the same time period, the tidal range in Camden Haven remained relatively unchanged suggesting a local rather than regional factor driving this change. These water level record data indicate that a considerable change in the hydrodynamics occurred.

Changes to inlet morphology were recorded in satellite imagery taken in 2009 and 2016 (Figures 1B & 1C). In this time period, the entrance channel widened and migrated northward, likely increasing the inlet cross-sectional area. The coupled change in estuary water level and channel form could demonstrate a key interaction between morphology and hydrodynamics within Boambee Creek.

Based on the observed changes to Boambee Creek, it is hypothesised that the observed increase in estuary tidal range is linked to the observed changes in inlet morphology (a likely increase in inlet cross-sectional area) and the subsequent associated increased in hydraulic efficiency. This response has also been identified in coastal lakes by Hart et al. (2019), where the construction of the Lake Illawarra training walls was shown to increase the cross-sectional area of the inlet, which increased the hydraulic efficiency and altered the tidal range within the lake. This relationship may have important implications for potential future responses of riverine estuaries to SLR, considering that entrance

channel cross sectional areas may increase in the future with SLR.

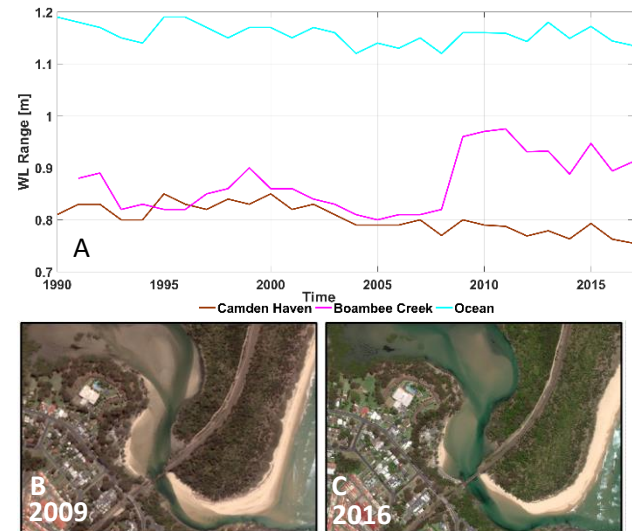


Figure 1 - A Tidal range defined by the difference between the 95% exceedance and 5% exceedance water levels at Boambee Creek and B & C aerial imagery collected by DPE.

By examining changes to tidal hydrodynamics, water levels, and the inlet morphology of these two riverine estuaries through time, we evaluate the role of channel morphology on the vulnerability of riverine systems to climate change. Potential morphodynamic responses of riverine estuaries to SLR are also evaluated in our paper. These findings will help us understand the resiliency of the communities found around estuarine environments in NSW moving into the future.

REFERENCES

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