

The influence of sediment compositions on the decline of *Metapenaeus dalli* in a temperate Australian estuary

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INTRODUCTION

- Recreational fishers indicate that the spatial distribution of Western School Prawns (*Metapenaeus dalli*) has declined in the Swan-Canning Estuary, with this species no longer being caught in the upper reaches of the system.
- The seasonal upstream migration of prawns is known to coincide with increases in salinity.
- As declining rainfall has resulted in these reaches becoming more saline for longer than previously, changes in salinity are unlikely to be responsible for the decline in prawn abundance.
- Reduced freshwater flows are thought to have increased siltation in the upper reaches of the estuary, thus making these areas less desirable.



Fig. 1: Aerial photo of the Swan-Canning Estuary, looking downstream.

AIMS

- Characterise sediments in the Swan-Canning Estuary into sediment types.
- Investigate the relationship between prawn abundance/distribution and sediment type.
- Experimentally test whether different sizes of Western School Prawns exhibit a preference for particular sediment types.



Fig. 2: Western School Prawn (*Metapenaeus dalli*).

DETERMINATION OF SEDIMENT TYPES

- Sediment collected from 20 shallow sites (*i.e.* <1.5 m deep) and 16 deep sites (*i.e.* 1.5 to 17 m deep) in February 2014 using an Ekman grab.
- Organic matter content calculated using loss on ignition at 550° C for two hours.
- The remaining inorganic portion was wet sieved through Wentworth grain size meshes, dried, weighed and converted to a percentage.



Fig. 3: (a) Sampling with an Ekman grab, (b) typical sediment from deep waters and (c) sifted inorganic fractions.

DETERMINATION OF SEDIMENT TYPES CONT.

- Data averaged for each site, $\sqrt{}$ transformed, weighted (organic 100% & inorganic 100%) and subjected to CLUSTER-SIMPROF in Primer v6.
- Analysis statistically identifies a suite of sediment types without employing an *a priori* hypothesis.

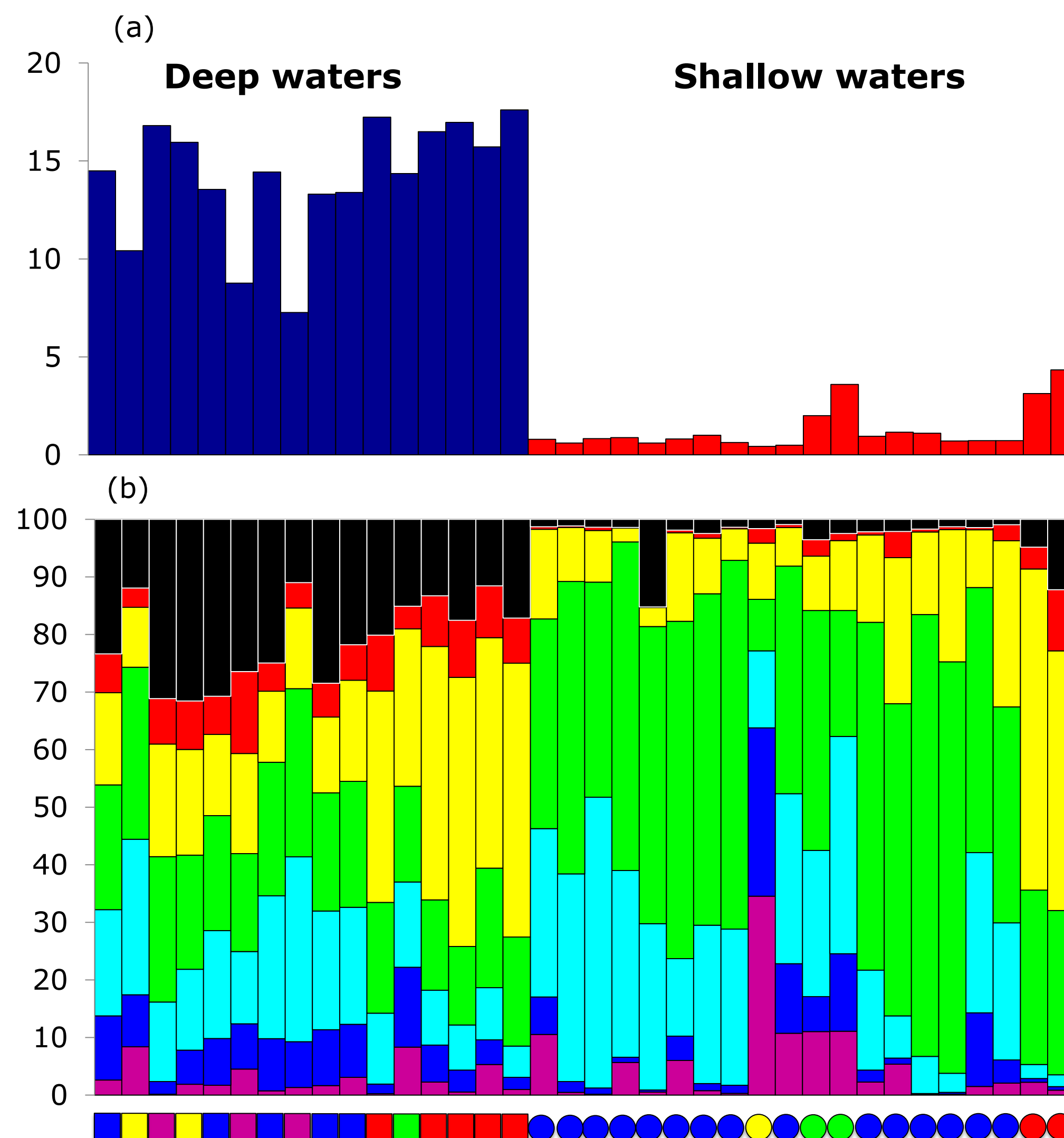


Fig. 4: Percentage contribution of (a) organic matter and (b) various inorganic grain sizes, *i.e.* ■=<63 μm, ■=63-124 μm, ■=125-249 μm, ■=250-499 μm, ■= 500-999 μm, ■= 1,000-1,900 μm, ■=>2,000 μm. The coloured symbols indicate the sediment type found at the site. Circles and squares represent shallow and deep sites, respectively.

- Marked differences in sediment between water depths. Sediment in deeper water contains far larger proportions of organic matter and finer inorganic grain sizes.
- CLUSTER-SIMPROF identified eleven statistically different sediment types.
- Four sediment types in shallow waters and five in deep waters.

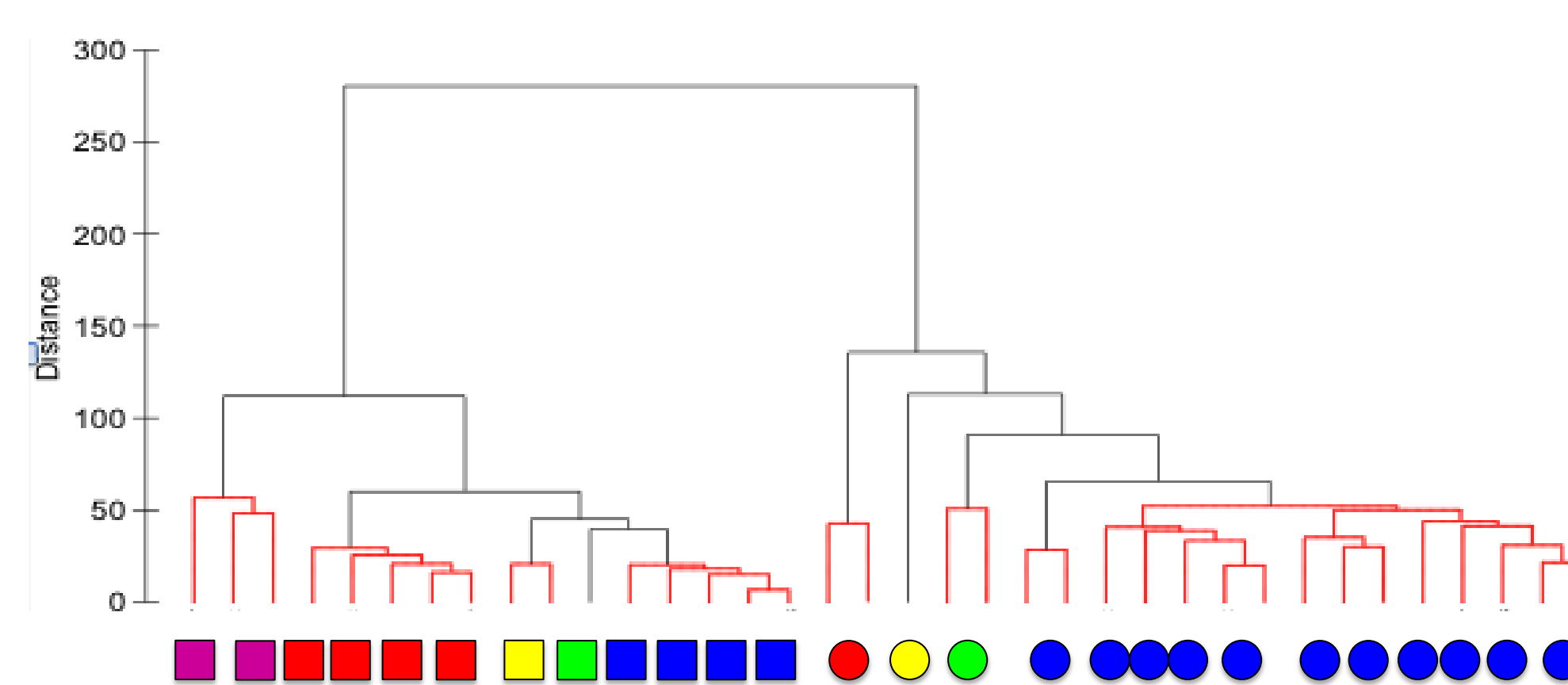


Fig. 5: CLUSTER-SIMPROF dendrogram of sediment composition. Red lines indicate no significant differences between samples. The coloured symbols indicate the sediment type found at the site. Circles and squares represent shallow and deep sites, respectively.

MAPPING PRAWN ABUNDANCE

- Western School Prawns collected at 20 shallow and 16 deep sites, every 28 days on the new moon between October 2013 and March 2014.
- A 4 m wide hand trawl (9 mm mesh) was employed in shallow waters and a 2.6 m wide otter trawl (25 mm mesh) used in deep waters.
- Total abundance of prawns overlaid on a map of sediment types.
- Detailed statistical analysis to follow, once an entire year of prawn abundance data is collected.

MAPPING PRAWN ABUNDANCE CONT.

- In shallow waters, Western School Prawns most abundant in the blue sediment type and lowest in the green and red types, agreeing anecdotal evidence from recreational fishers.
- In deep waters, prawns again most abundant in sediment types found in middle estuary (*i.e.* red and green) and least further upstream (*i.e.* yellow and magenta).

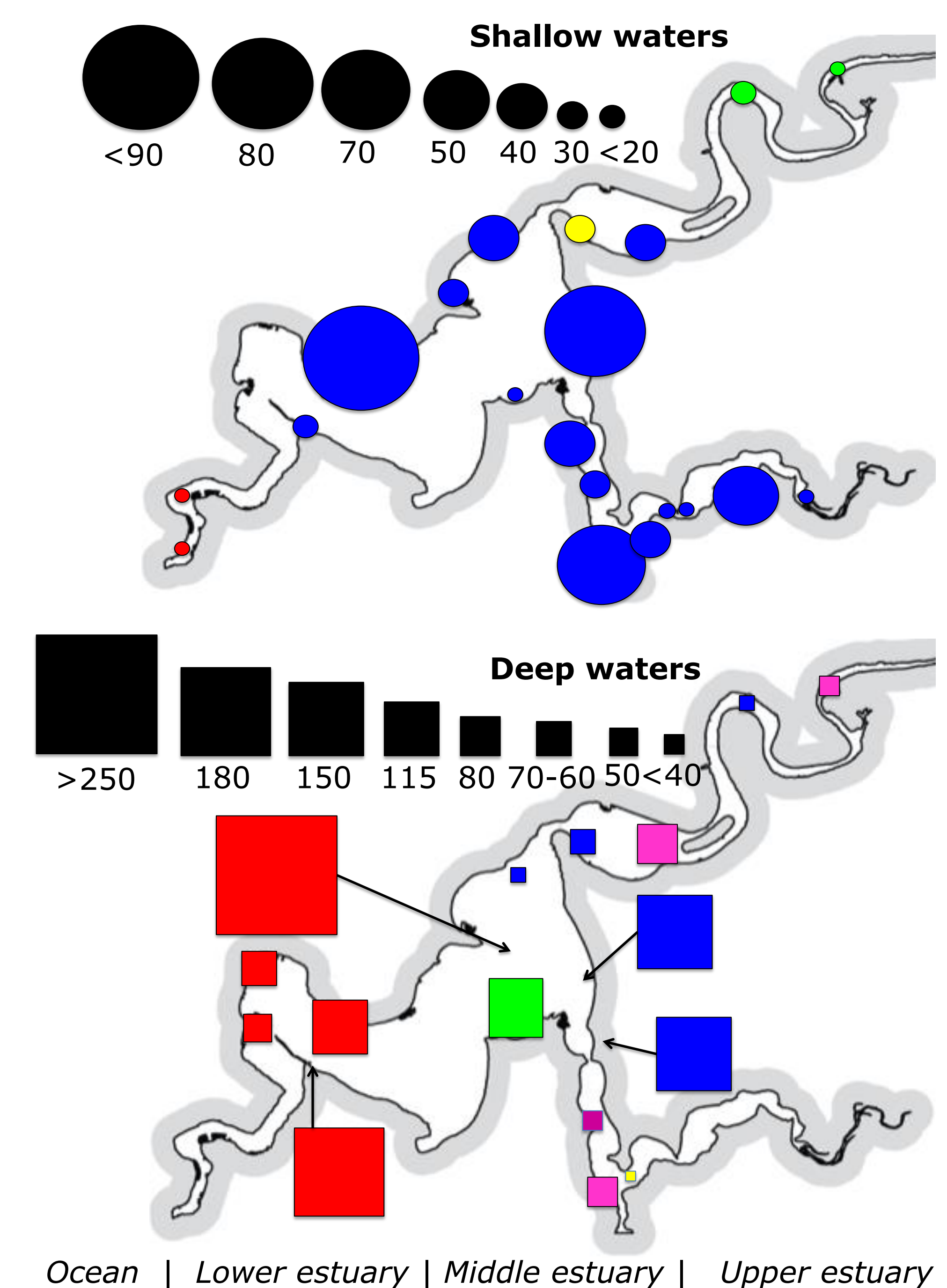


Fig. 6: Maps showing the total abundance of Western School Prawns in the Swan-Canning Estuary between October 2013 and March 2014. Sizes of shapes indicate relative total abundance and the colour the sediment type.

LABORATORY TRIALS

- Sediment preference experiments to be conducted in the laboratory in the near future to support field observations.



Fig. 7: Photos showing a prawn burying during a tank trial.

IMPLICATIONS

- The results of this study, once complete, will help elucidate the extent to which changes in sediment composition have contributed to the decline in the Western School Prawn and will inform the sites at which cultured post larvae will be released.

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