Assessing the sediment preference of a penaeid prawn to inform release strategies

Amber Bennett, James R. Tweedley, Brian Poh & Neil R. Loneragan

Centre for Fish and Fisheries Research, Murdoch University, Australia

INTRODUCTION

- Release program underway to restock the Western School Prawns (*Metapenaeus dalli*) in the Swan-Canning Estuary.
- Recreational fishers indicate that the spatial distribution of the prawns has shrunk, with this species no longer being caught in the upper reaches of the system.
- **Aim:** Determine whether changes in sediment composition, due to reduced freshwater flows, may be responsible for the change. Use the results to inform release strategies.

COMPONENT 1

Characterise sediments in the Swan-Canning Estuary into sediment types.

- Sediment collected from 20 shallow sites (<1.5 m) and 16 deep sites (1.5-17 m) in Feb and Aug 2014 using an Ekman grab.
- Organic matter content calculated using loss on ignition at 550˚ C for 2 hours.
- Inorganic portion wet sieved through Wentworth grain size meshes, dried, weighed and converted to a percentage.
- Data √ transformed, weighted and subjected to CLUSTER-SIMPROF in Primer v6.

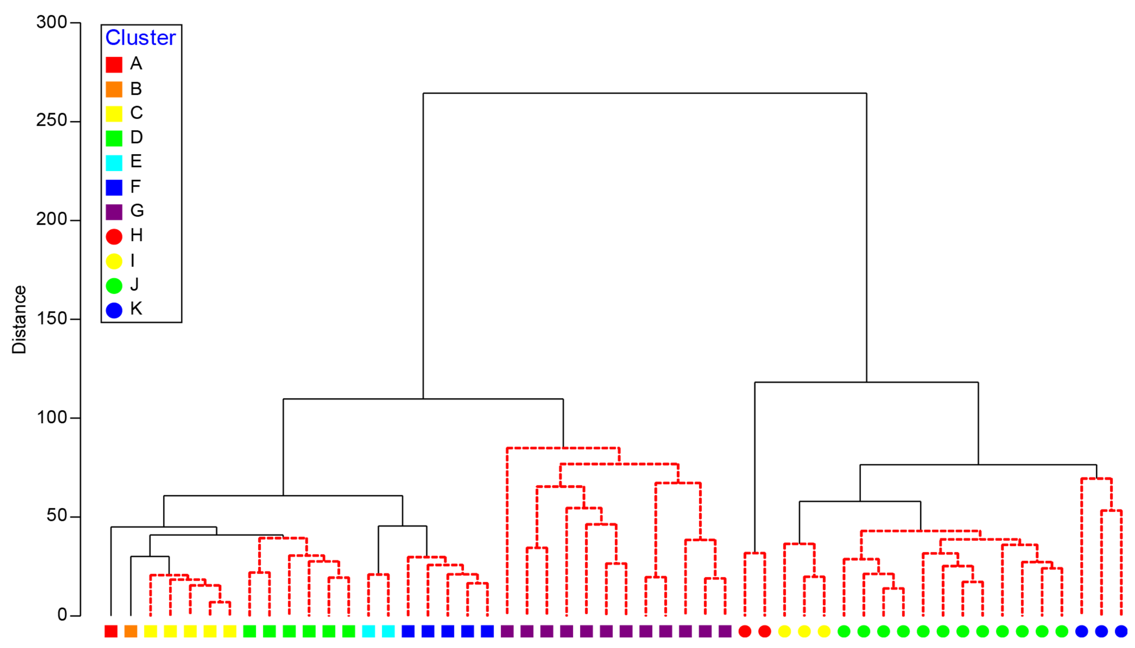

Fig. 1: CLUSTER-SIMPROF dendrogram of sediment composition. Red lines indicate no significant differences between samples. The coloured symbols indicate the sediment type found at the site. Squares and circles represent deep and shallow sites, respectively.

- CLUSTER-SIMPROF identified 11 statistically different sediment types (7 deep & 4 shallow; Fig. 1).
- Sediment in deeper water contains far larger proportions of organic matter and finer inorganic grain sizes (Fig. 2).

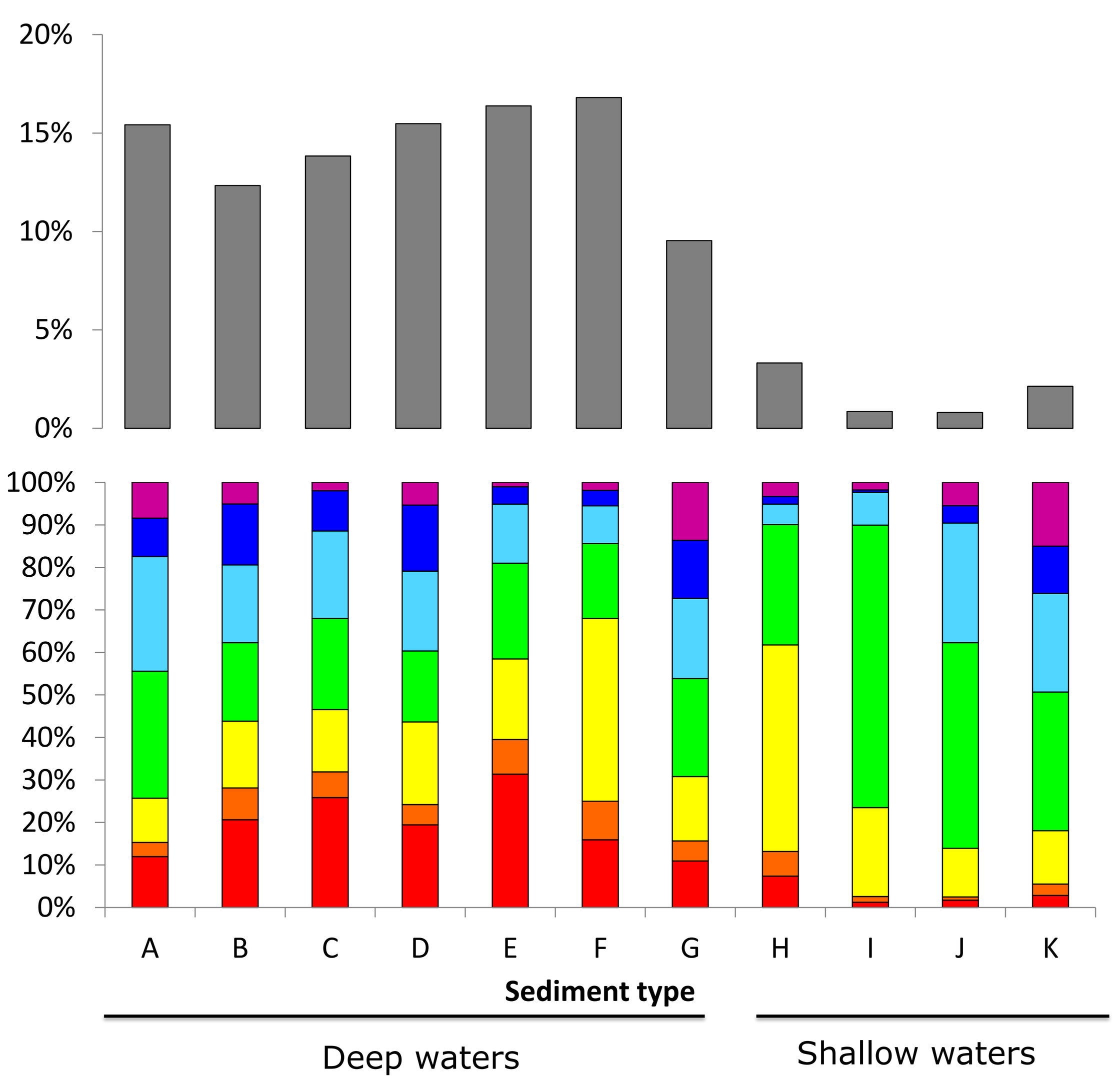

Fig. 2: Percentage contribution of organic matter (top) and various inorganic grain sizes (bottom), *i.e.* ■=<63 µm, ■ =63-124 µm, ■=125-249 µm, ■=250-499 µm, ■= 500-999 µm, ■ 1,000-1,900 µm, ■=>2,000 µm.

COMPONENT 2

Investigate the relationship between prawn abundance/distribution and sediment type.

- Western School Prawns collected at the same 20 shallow and 16 deep sites, every 28 days on the new moon from Oct 2013-Aug 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 (Fig. 3).

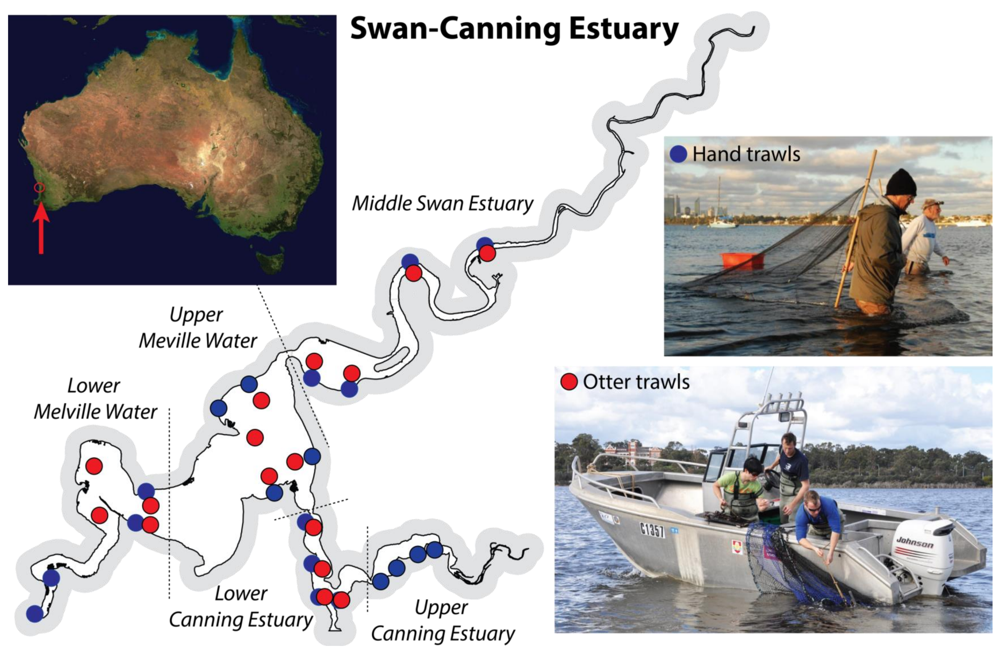

Fig. 3: Map showing the location of the Swan-Canning Estuary in Australia and the sites sampled during this study using hand or otter trawls.

- Prawn abundance differed among sediment types during summer (P=0.01%; Fig. 4), but not during winter (P=70.73%).
- Sediments more homogeneous in winter when heavy freshwater discharge moves finer particles further downstream.
- No significant differences in carapace size among habitats in either season.

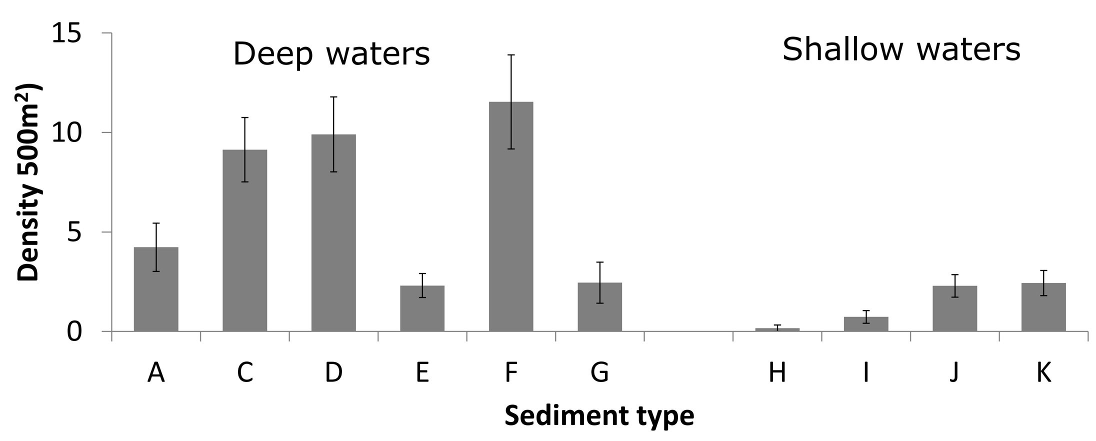

Fig. 4: Mean density of prawns per 500 m² at sites belonging the various sediment types during summer.

- Differences in prawn density in summer were correlated among those sediment types (P=3.20%; ρ=0.354; Fig. 5).
- Prawn density not related to differences in salinity, water temperature and dissolved oxygen (P=68.80%; ρ=-0.106).

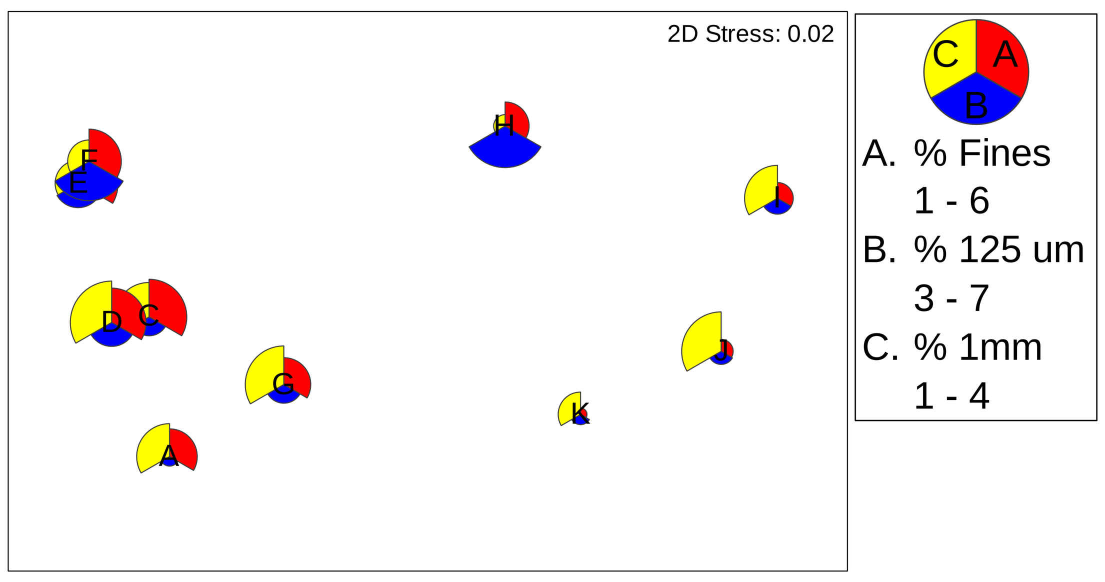

Fig. 5: Bubble plots of mean density of prawns and the subset of three sediment characters selected by the BIOENV procedure that best match the spatial pattern displayed in the sediment types.

COMPONENT 3

Experimentally test whether different sizes of Western School Prawns exhibit a preference for particular sediment types.

- Prawns collected from estuary and acclimatised in the laboratory for one week.
- Six experimental tanks set up, each comprising areas with sediments from the lower and upper estuary (Fig. 6).
- Five prawns released into each side during day. Prawns dug up two days later and number on each side counted.
- Experiment conducted twice with sediment from i) deep and ii) shallow waters.

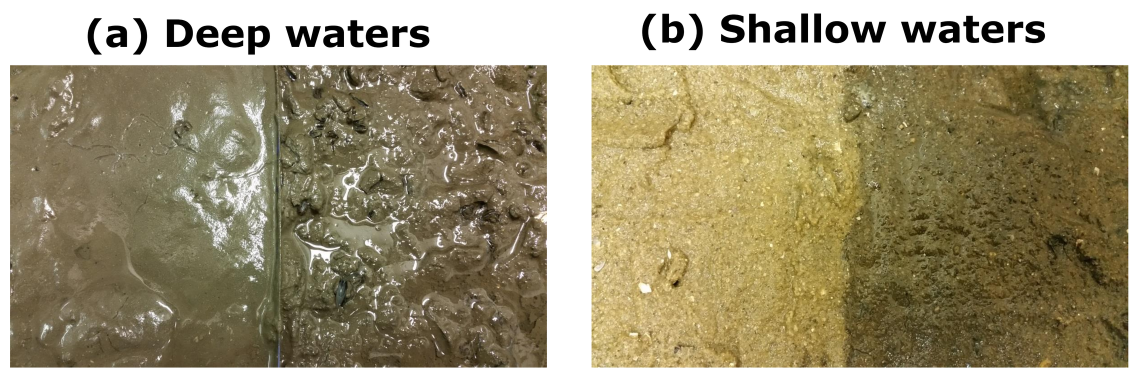

Fig. 6: Photos looking into the experimental tanks containing sediment from (a) deep and (b) shallow waters. Sediment from lower estuary on left hand side.

- **Deep waters:** 68% of prawns preferred the downstream sediment. Chi-squared: X^2= 7.36; p=0.007.
- **Shallow waters:** 65% of prawns preferred the downstream sediment. Chi-squared: X^2= 4.82; p=0.028.

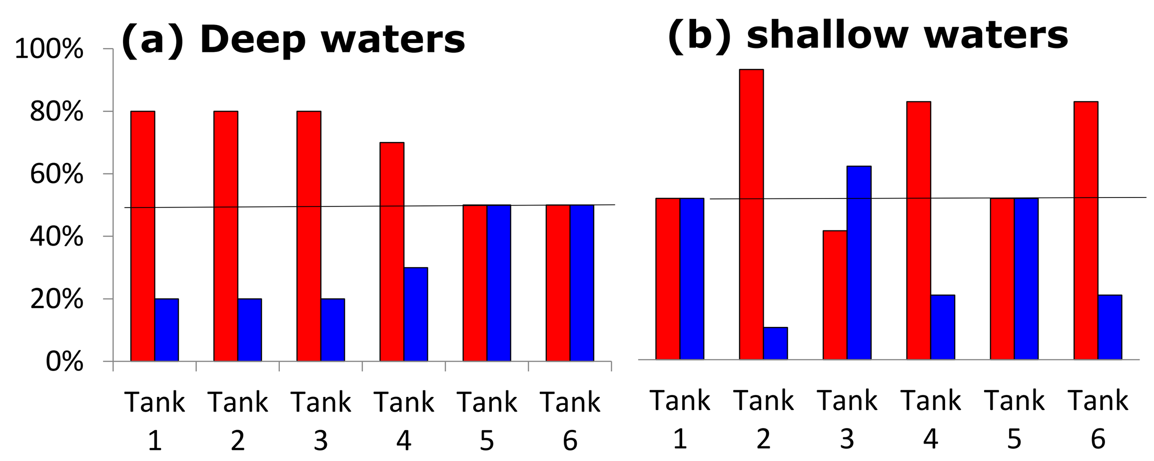

Fig. 7: % occurrence of prawns found buried in the upstream (■) or downstream (■) sediment after 48h.

- Prawns completely buried in 17 seconds in downstream sediments.
- Burial took twice as long in upstream sediments.

Fig. 8: Western School Prawn burying

IMPLICATIONS

The results of this study demonstrate that sediment composition has a significant influence of the Western School Prawn and thus should be taken into consideration when selecting the sites at which cultured post larvae will be released.

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