Title [4949]: *The role of connectivity and physicochemical conditions in effective habitat of two exploited penaeid species*

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Definitions:

- 'penaeid' means any prawn of the family Penaeidae, many of which have economic importance.

Please note: This summary focusses on the results relevant to Eastern King Prawn. Limited research results relating to School Prawn or other species is included. Readers are directed to the paper for the full research results.

Summary

Exceptional numbers of Eastern King Prawn (EKP) were found in the subtidal channels within the Hexham wetland, and elevated abundance of School Prawn were present in the Kooragang and Tomago wetlands. The Hexham wetland appears to be optimal for EKP as it receives good recruitment (has good connectivity with ocean waters), and contains good habitat (suitable salinity range and shallow littoral habitat).

What prompted the research

Estuaries are increasingly the focus of habitat protection, rehabilitation and restoration efforts however, the relatively high cost of repair means these efforts need to be targeted, usually in relation to the increased productivity of high value exploited species. The greatest benefits derived from habitat repair will only be possible where repair is appropriately targeted based on species life-history patterns and recruitment dynamics. Eastern King Prawn (*Melicertus plebejus*) and School Prawn (*Metapenaeus macleayi*) are two of the most valuable species of penaeid prawns exploited in eastern Australia and rely on estuarine habitats during their juvenile phase.

The relative importance of different habitat areas to these prawns provides information useful for assessing nursery habitats within an estuary. This knowledge will allow a better understanding of the outcomes of previous habitat rehabilitation efforts and will inform future rehabilitation for the benefit of these species.

What we did

The study area was the Hunter River estuary, a wave-dominated barrier estuary located on the mid-northern coast of New South Wales, Australia. By the latter half of the 20th century the wetland systems in the lower Hunter River estuary had become severely degraded through development, grazing, and/or the installation of dykes and floodgates that removed connectivity between wetlands and the main estuary channels. Several rehabilitation projects have been carried out on these systems in recent decades, largely restoring connectivity of the marsh and mangrove habitats to the estuary, thus allowing tidal flushing of these habitats. It is important to note that the repair of these locations is relatively recent, and ongoing changes may have future implications for their productivity.

Sampling was conducted over the 2013/14 and 2014/15 summer and autumn and included collection of material for stable isotope analysis and, in the second year, a quantitative assessment of juvenile prawn abundance across the lower estuary.

Stable isotopes were used to identify from which areas and repaired habitats in the lower estuary emigrating prawns originated. This approach involved sampling prawns from possible nursery habitat areas to characterise the stable isotope signature of those areas, and assigning the origin of prawns captured as they emigrated from the estuary among those possible nursery habitat areas on the basis of their isotopic similarity.

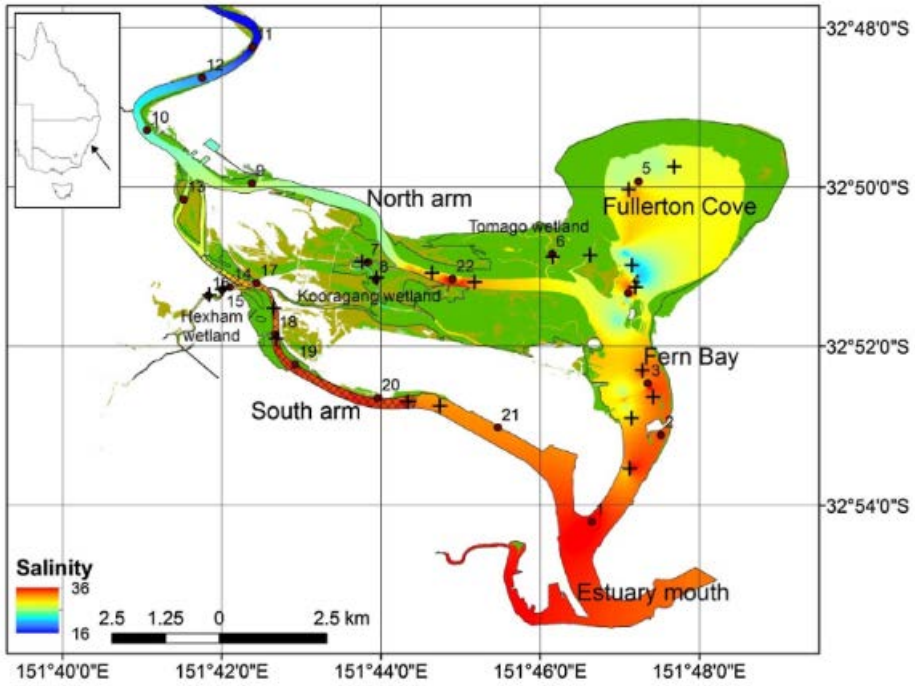

Fig. 1. Map of the Hunter River estuary and associated saltmarsh (shaded in brown) and mangrove habitat (shaded in green).

What we found

In both years, the majority (> 90%) of emigrating EKP were assigned to the higher salinity areas near the lower end of the estuary, and within Fullerton Cove, with very small relative contributions from marsh systems in the lower estuary. On the basis of the isotopic data, areas 3, 4, 5 and 21 (see Figure 1) represented effective juvenile habitat.

Assignment of School Prawn (SP) in 2013/14 saw the majority (~70%) of emigrating individuals assigned to areas in the south arm of the river and much smaller contributions from other areas across the lower estuary. In 2014/15, emigrating School Prawn were assigned to all possible nursery habitat areas that were sampled, with the greatest contributions from the rehabilitated marsh areas in Tomago, Kooragang and Hexham, and the furthest area from the sea. In both years, areas spanning the length of the lower estuary were classified as Effective Juvenile Habitat.

The abundance of both EKP and SP varied across the lower estuary. EKP juveniles were generally more abundant than SP in this region of the estuary, but this may be a product of nocturnal sampling. EKP were most abundant in the areas around Fern Bay, Fullerton Cove, and within the Hexham wetland. SP juveniles were only abundant in the Kooragang wetland and Fullerton Cove.

Important habitats for EKP were mostly confined to the lower part of the estuary and primarily included shallow unvegetated sedimentary habitat. However, the Hexham wetland did support a high abundance of prawns which was likely due to strong connectivity and appropriate salinity at this location. EKP abundance is maximised in habitat of depth less than 2m. Fern Bay and Fullerton

Cove contain the most expansive area of such habitat within the system and also have low water velocity that is ideal for juvenile prawns. Being directly adjacent to a higher velocity waters (the main river channel) is important for the supply of recruits on the incoming tide. Secondly, the salinity of this area generally ranges from 26 to 32 (as these areas are under the influence of freshwater inflows from the River's north arm) which is ideal conditions for juvenile EKP.

Different habitats across the lower estuary were important for SP, especially the shallower (< 1 m) more brackish, turbid reaches of the rehabilitated Kooragang and Tomago marshes, and lower salinity areas further up the estuary.

Implications

Our study reinforces that a range of factors will determine the value of different estuarine areas, especially connectivity and salinity in the case of EKP. Other studies have shown that following reinstatement of full connectivity to the Hexham wetland, SP increased in abundance over 15 times in the upper reaches of the wetland. A combination of different approaches can improve our knowledge of potential nursery value for penaeid prawns, which is important in targeting future habitat repair efforts such that the fisheries outcomes for prawns are maximised. In the Hunter River estuary, restoring some tidal connectivity from the south arm of the estuary into the channels draining the Kooragang marsh will likely lead to increased value of the channels in this wetland for EKP.