

Mass mortalities of moon pipis (*Mactra contraria* Reeve, 1854) in subtropical eastern Australia

Steve Smith, National Marine Science Centre

Email: ssmith@nmsc.edu.au

Mass mortalities of bivalves have been reported from many locations around the globe and can result from a variety of causes including extreme weather/tides, low oxygen events and infection by a range of pathogens. However, mass stranding events are relatively uncommon in Australia. Prior to late 2009, only one stranding event has been recorded in northern NSW over the past 2 decades. This was a single, albeit massive, stranding of juvenile pipis (*Donax deltoides*) on South Ballina Beach over a 3-day period in November 2007 (Bob Moffatt, personal communication). In this context, the recent stranding events which occurred over a 350-km stretch of coastline in northern NSW and southern Qld, and over a period of 10 months, are both dramatic and unusual (Figure 1).



Figure 1. A dense stranding of *Mactra contraria* south of the Richmond River in September 2010 (Photo: Bob Moffatt).

The first reports of wash-up of bivalves occurred at South Ballina Beach in late 2009 through into early 2010. In March 2010, reports by beach users at Arrawarra Beach, north of Coffs Harbour, of dense pockets of beached and gaping bivalves at the tidal strandline provided the first evidence that this wasn't just a localised event. At Arrawarra Beach, investigations by David Greenhalgh from the Marine Parks Authority indicated that approximately 10 000 animals were present over an 800-m length of beach. Almost all animals were from a single species – *Mactra contraria* (Figure 2).



Figure 2. Close up of stranded *Mactra contraria* at New Brighton Beach, August 2010.

Report of strandings became more widespread over the next few months spanning beaches from Coffs Harbour to South Stradbroke Island and involving the same species. With fears that the mass mortality was caused by a contagious pathogen, Marcus Riches (I&I NSW Fisheries, Wollongbar) sent batches of animals for toxicity screening in December 2009 and March 2010. However, these tests failed to provide definitive evidence of the cause of mortality. Initial speculation was that aggregations of detached marine algae had accumulated over *Mactra*-inhabited sandy subtidal areas reducing dissolved oxygen which caused mortality. However, this hypothesis failed to explain why only one species appeared to be affected and why mortalities were so geographically widespread, and at sites with no obvious evidence of algal accumulation.

Strandings continued to spread over the next few months and Marcus Riches compiled reports from many sites across the NSW north coast (including Wooli, Evans Head, Iluka, Hastings Point). In July 2010, Leighton Upton (Community Volunteer Coordinator, South Stradbroke Island Landcare) organised regular checks of beaches between Pottsville and Jumpinpin (the northern point of South Stradbroke Island) and compiled records of strandings: Jumpinpin was the northern extent of *Mactra* wash-up. At Wooli, Geoff Butcher estimated densities of up to 500 m⁻² at the height of the strandings in April, declining to 10-20 m⁻² by July/August. David Greenhalgh observed that the majority of strandings at southern localities were adjacent to (usually on the northern side) of creek/river entrances. This pattern was also evident north of the Brunswick River. Strandings mostly comprised animals of similar sizes (Figure 1) and were an almost daily event at many sites (e.g. Wooli and Ballina). The frequency and density of wash-ups declined across the region by the end of September. Since then, and up to the time of writing (15th December 2010), only sporadic strandings have been reported from a few sites.

As the strandings resulted in the mortality of many hundreds of thousands, if not millions, of animals, predators enjoyed a veritable glut of food. Bob Moffatt recorded presumed excellent body condition and increased numbers of breeding birds and breeding attempts compared with the previous 4+ years for the “endangered” Pied Oystercatcher between Ballina and Evans Head. He suspected that this was due to the abundance of stranded *Mactra* on the local beaches (unfortunately subsequent fledgling success was low). Geoff and Paul Butcher (I&I NSW Fisheries, Coffs Harbour) recorded unprecedented fishing success off Wooli Beach during periods of strandings. Examination of gut contents found that most species caught (black fish, whiting, dart and bream) were feeding primarily on *Mactra*. Catch rates of blackfish were especially high. In August, at New Brighton Beach north of the Brunswick River, silver gulls made the most of the foraging opportunity gorging themselves on stranded bivalves (Figure 3).



Figure 3. A silver gull feasting on stranded bivalves at New Brighton Beach, August 2010.

Opportunistic sampling of aggregations was conducted at a number of sites including at New Brighton Beach in August. At this time, densities averaged approximately 40 *Mactra* m⁻² over a 300-m section of beach. All animals were of a very similar size (~50 mm in length) suggesting that they were from the same cohort. Samples collected at Woolli in July and August had a similar size range (~40-50 mm).

The cause of the strandings remains a mystery. There are a number of factors that can contribute to mass mortalities of bivalves. Given the broad spatial and temporal spread of strandings, it is unlikely that events such as low dissolved oxygen or unusual weather or sea conditions were the primary cause. Such events are likely to be either synchronous across the region (e.g. weather/tide events) or localised. Two laboratory examinations of samples of stranded animals suggested that there was some evidence of tissue inflammation which can be symptomatic of exposure to a pathogen: the apparent, progressive spread across the region is in keeping with this aetiology. However, the laboratory reports failed to find a pathogenic agent and also returned different results with respect to gut contents and animal condition (one indicating the presence of feed material and the other noting its absence).

As little is known about the biology and ecology of *Mactra*, life history characteristics can not readily be factored into any putative explanation. For example, it is possible that, given the extensive rainfall in the region in 2009 (the NSW north coast region was declared a natural disaster area due to flooding on 3 occasions), food supply for suspension-feeding organisms was particularly high in coastal waters. If this resulted in higher reproductive and recruitment success, it is possible that *Mactra* populations were at very high densities across the region and thus even 'normal' mortality rates would result in high absolute mortalities (*Mactra contraria* shells were a common component of death assemblages on beaches and headlands in the region even before the 2009/2010 strandings). The association of many of the strandings with creek mouths also suggests that freshwater inputs may be implicated in mortalities. A further hypothesis is that unusual currents (e.g. upwelling of cool water or transport of warm water onshore) may have been involved. The actual explanation will probably involve interactions between a number of these different factors. Clearly, this stranding has highlighted the need for much more biological and ecological information to help interpret this unusual event.

Acknowledgements: This brief report summarises observations from a large number of people across Australia's subtropical east coast. The following people provided information that was invaluable in preparing this synopsis: Marcus Riches, David Greenhalgh, Bob Moffatt, Leighton Upton, Geoff and Paul Butcher, Matt Harrison.