The Sun, the Moon and the Sea: Effects of geophysical cycles on reproductive rhythmicity and catchability of an exploited crab

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Crabs are key players in mangrove ecosystems, regardless of their diversity. Brazilian mangrove forests, for example, are inhabited by few crab species only. However, particularly the largest species, *Ucides cordatus*, sustains important ecosystem functions and services such as acceleration of nutrient cycling (Nordhaus et al. 2006) and provision of proteins and income through fisheries yields of up to 7 tons per annum per km^2 (Diele et al. 2010). *U. cordatus* exhibits conspicuous cycles of mate-searching and mating, a phenomenon called andada. Mate-searching specimens are unusually active outside their burrows and therefore particularly easy to catch. It is common knowledge that andada occurs at syzygies only, but the particular moon phase, full, new or rarely both, varies for unknown reasons between and sometimes within years. For preventing unsustainable high exploitation rates, crab capture is therefore banned at *both* new and full moons as a precautionary measure, even though andada mostly only takes place during *one* of the two moons. This has led to conflicts between fishermen and regulatory agencies and to non-compliance of laws. We hypothesized that the rhythm of andada is linked to geophysical cycles and thus predictive in time. If true, this could help to improve the correct placement of temporal capture bans. We tested this hypothesis locally by assessing presence and intensity of andada as well the timing of andada with respect to the light-dark- and tidal cycle between 2006 and 2011. Our results show that the rhythm of andada is linked to a so far only rarely noticed cycle (but see Skov et al. 2005), the syzygy tide inequality cycle (STIC) (Schmidt et al. in press): we observed a shift of andada between new and full moon, depending upon which moon phase had the higher amplitude tides. The likely ultimate cause of andada is increased larval survival by synchronous release at highest amplitude spring tides one month later. Such anticipatory behaviour is probably under endogenous control. Our results will help to improve the placements of capture bans for this harvested species and we will further test the predictability hypothesis over the species full distributional range. *U. cordatus* is a good example of how basic studies of animal behaviour can benefit both the animal studied and those who rely on the animal for food and their livelihood. A meta-analysis will help identify other intertidal and marine species influenced by STIC.

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