

Bulkhead configurations and horseshoe crab spawning on sandy shorelines in Delaware Bay, New Jersey

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Problem Statement



- Bulkheads are shore parallel walls designed to protect upland from erosion and flooding.
- Studies on ocean beaches suggest that shore parallel walls reduce frontal foreshore widths and eliminate or truncate habitat for species that use the foreshore for spawning, nesting or foraging.
- Bulkheads are the most common response to bayside erosion in developed areas.

The rationale for this study is a need to understand the interactions between shore protection structures such as bulkheads and spawning populations of horseshoe crabs on estuarine beaches.

Delaware Bay is an important location for spawning horseshoe crabs.

Most of the beaches heavily used for spawning are also backed by human settlements.



Many bulkheads are built incrementally over time and intersect the shoreline at different elevations.

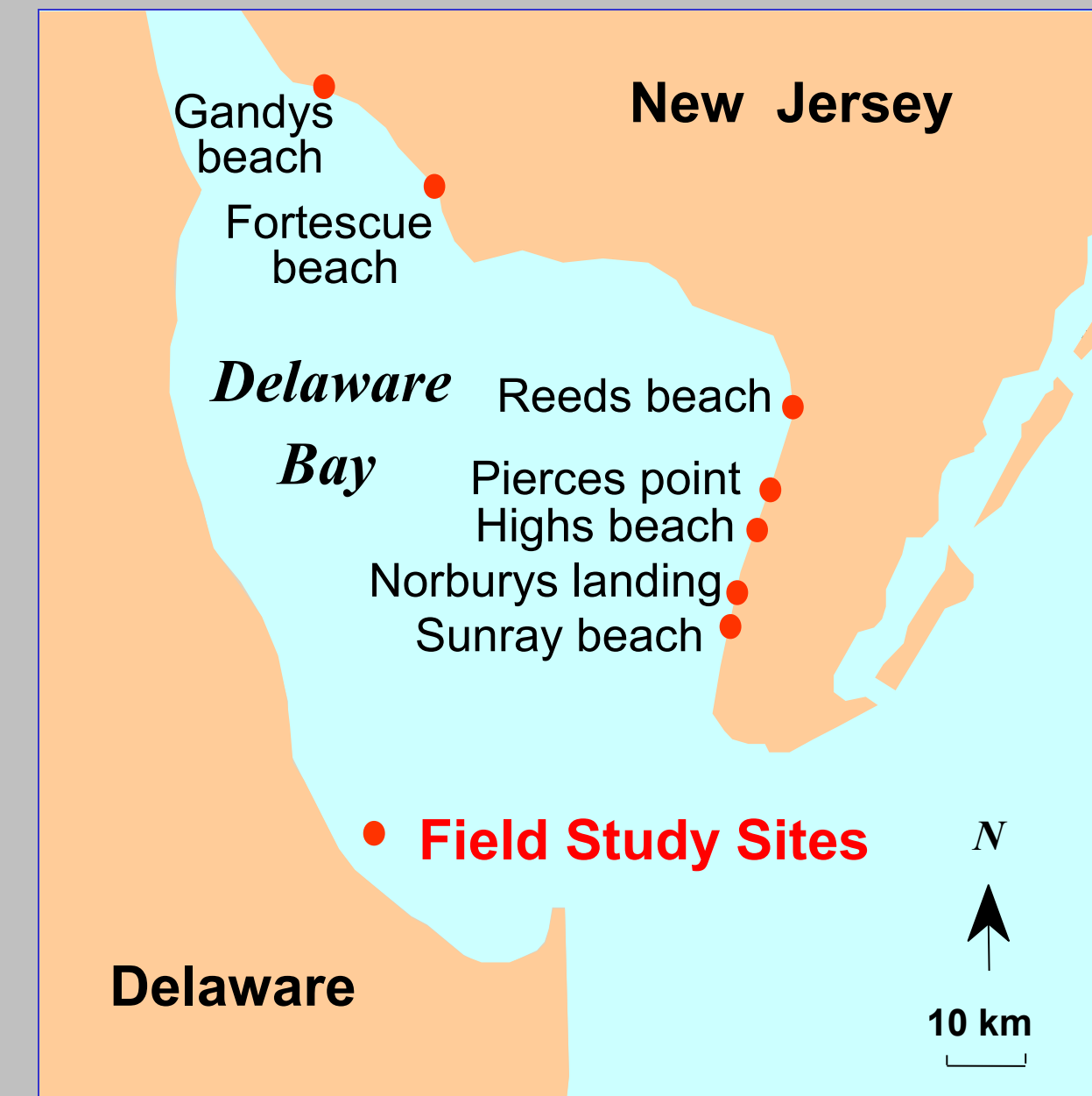
Discontinuous alignment creates enclaves of relatively wide sandy intertidal beach between segments of exposed bulkhead.

Objective

The main objectives of this study are to :

1. Document the physical configurations of bulkheads on the New Jersey shoreline of Delaware Bay.
2. Assess the suitability of bulkheaded beach enclaves for horseshoe crabs spawning.

Study area



Mean tidal range: 1.6 - 1.9 m

Foreshore slope: 5 - 9 degrees

Sediment- Medium to coarse sand

Dominant waves are locally generated

Methods



A ground assessment of bulkheaded and adjacent unbulkheaded beach segments was conducted at 7 sites.

Sandy enclave lengths and active foreshore widths bounded by a shore perpendicular bulkhead were determined.

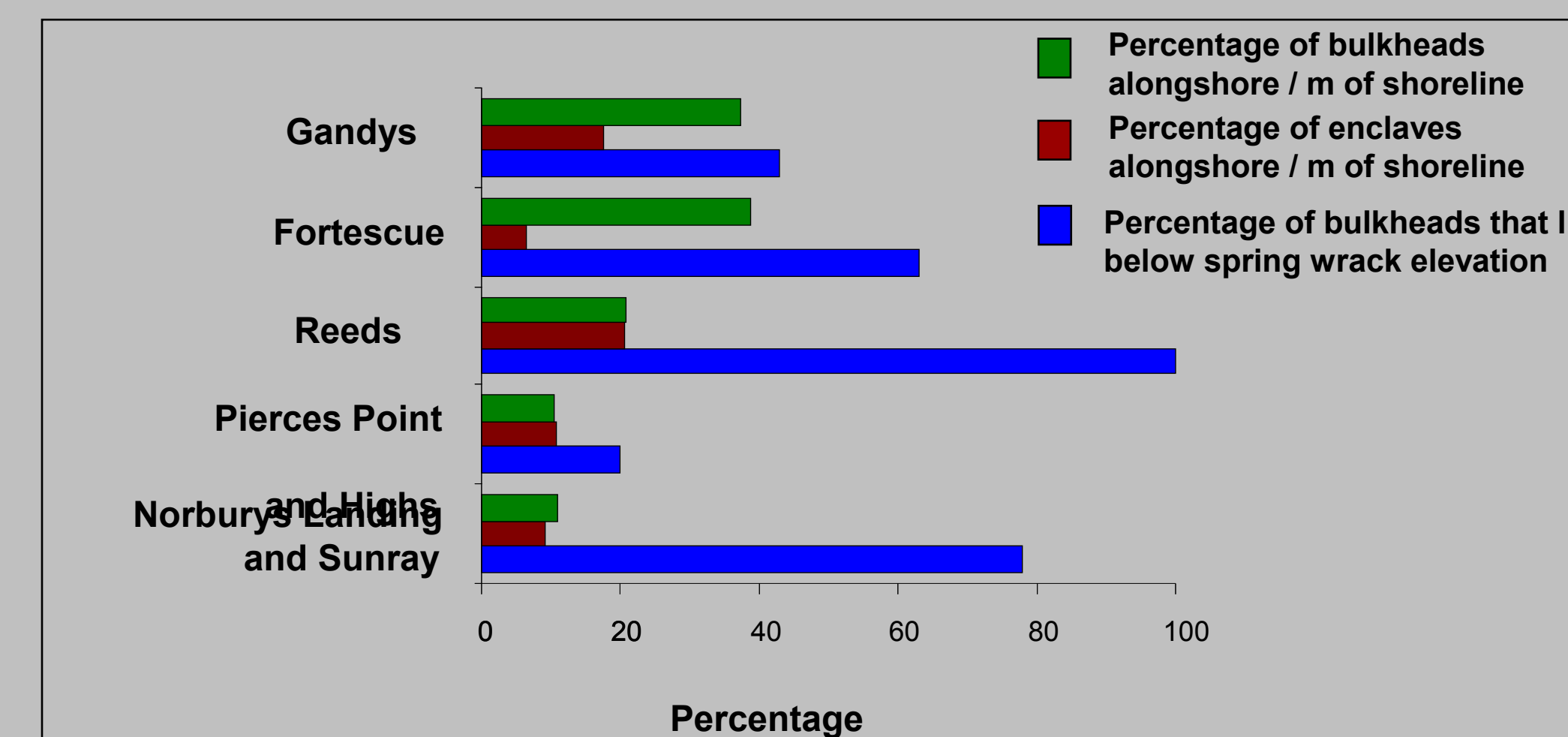


3 enclaves and an unarmored segment of shoreline were selected at Reeds and Fortescue to enumerate spawning abundance.



Counts of spawning horseshoe crabs were made at high tide and one hour before and after high tide.

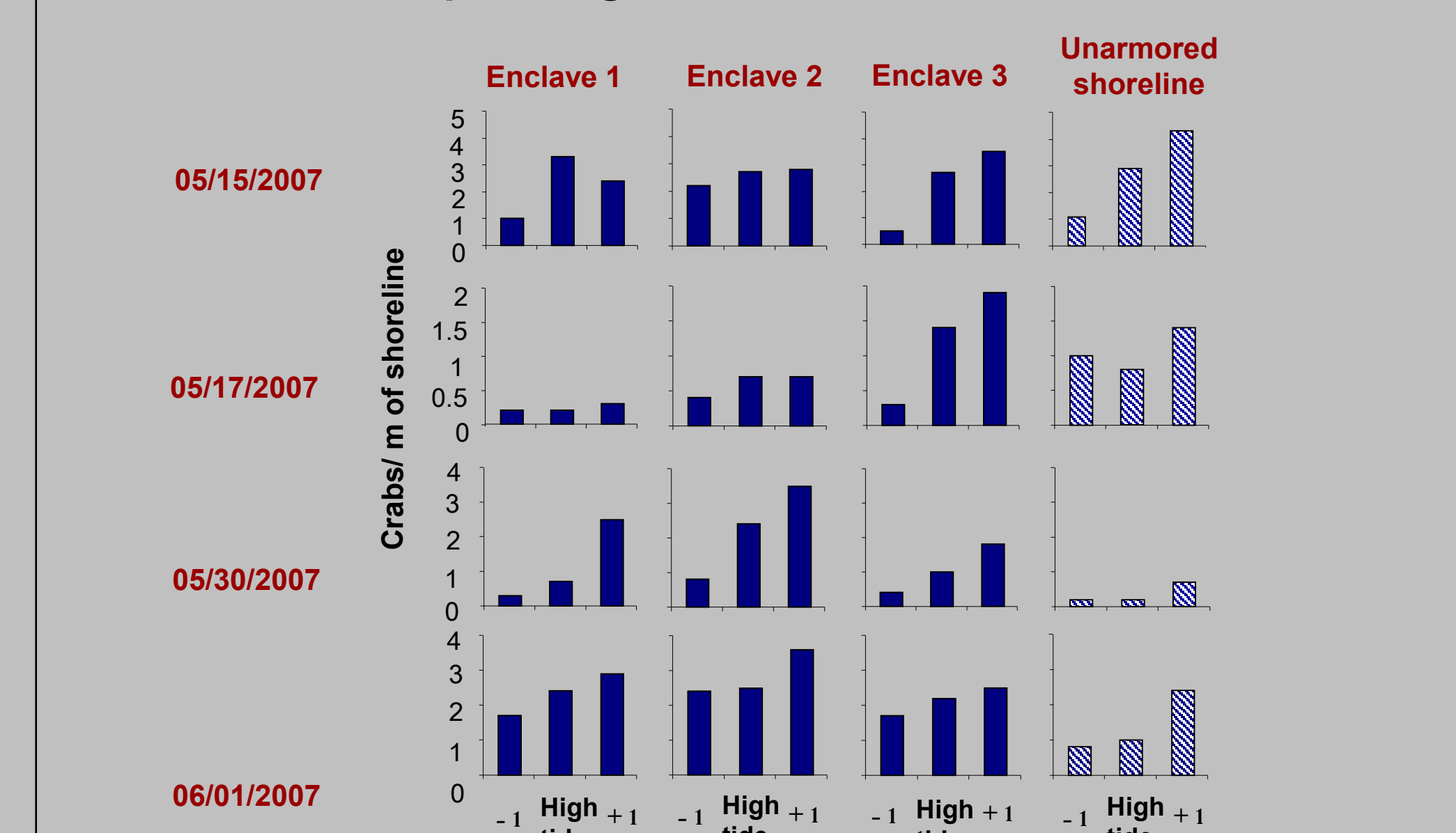
Results



- Fortescue and Gandys have the highest percentage of bulkheads.
- Pierces Point and Highs beach have the lowest percentage of bulkheads.
- Fortescue and Reeds have the lowest and highest percentage of enclaves along their shorelines respectively.
- All bulkheads on Reeds beach lie below the spring wrack elevation.

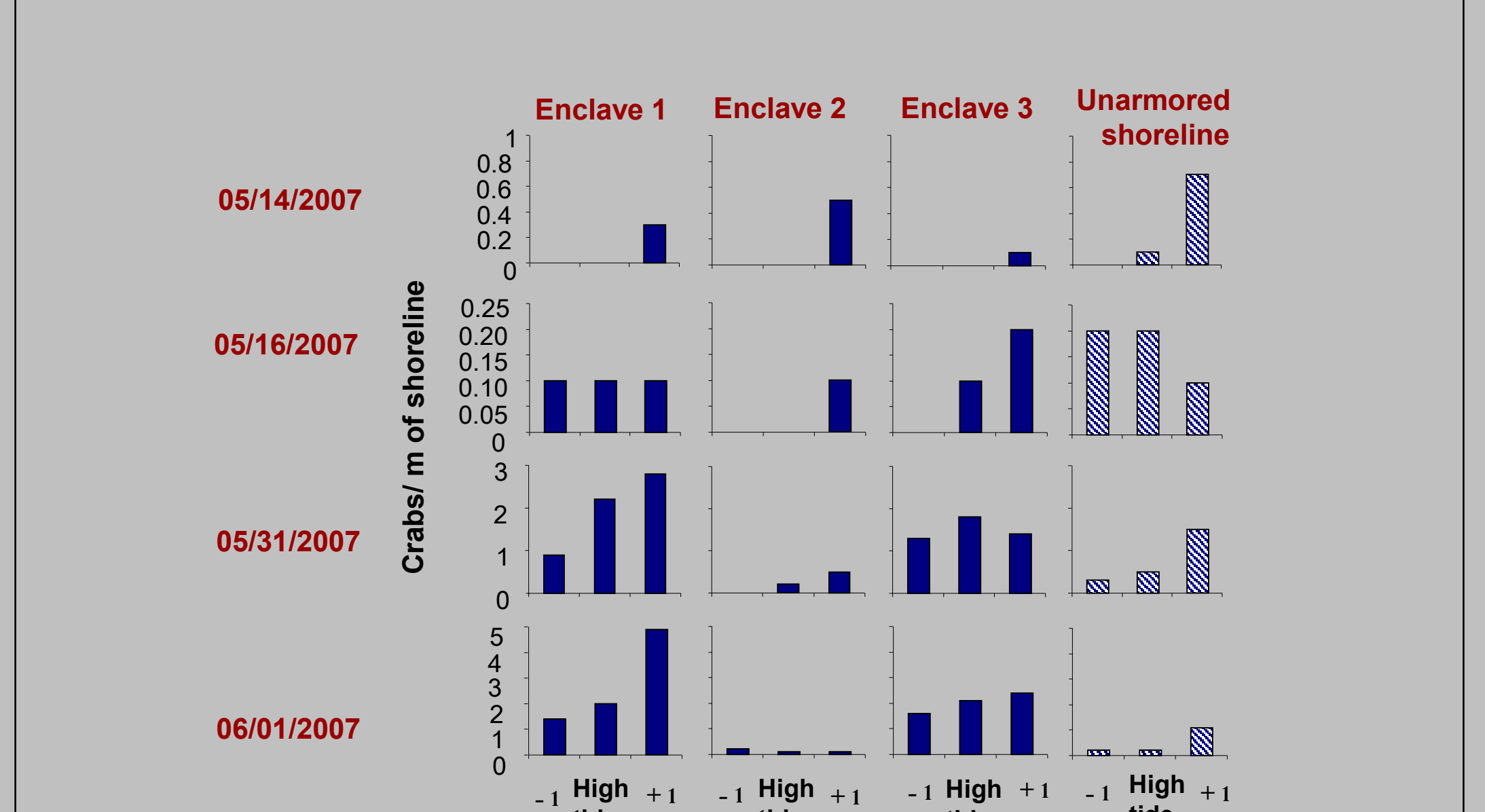
Beach	Day	Mean Wind speed (m/s)	Wind direction	Significant wave height (m)
Reeds beach	5/15/2007	3.8	SE	0.53
	5/17/2007	3.2	NE	0.60
	5/30/2007	4.5	SE	0.40
	6/1/2007	3.9	SE	0.40
Fortescue beach	5/14/2007	5.3	SE	0.50
	5/16/2007	1.1	Variable	0.67
	5/31/2007	4.2	SE	0.47
	6/1/2007	3.4	SE	no data

Abundance of spawning horseshoe crabs at Reeds Beach



- Horseshoe crab spawning counts generally greater an hour after high tide.
- Densities of spawning horseshoe crabs greater in enclaves.

Abundance of spawning horseshoe crabs at Fortescue Beach.



- Low horseshoe crab spawning activity within enclaves and unarmored sections of shoreline.

Preliminary Findings



- Approximately 60 % of bulkheads on the New Jersey shoreline are below spring wrack elevation and may interfere with horseshoe crab spawning.
- Relatively high waves revealed greater densities of horseshoe crabs in the enclaves, with more horseshoe crabs clustered in the shadow zones along bulkheads relative to wind direction.
- Waves approaching the shoreline at an angle break at the base of bulkheads; dissipating wave energy before entering the enclave.
- Density of spawning crabs increases an hour after high tide as crabs cluster in shadow zones along bulkheads where wave and current velocities maybe lower.
- Enclaves on Reeds beach appear to be a more favorable location for spawning crabs when compared to the unarmored site during high water.
- Enclaves on Fortescue beach not favorable for crabs to spawn due to sites being inundated during high water.

Acknowledgements

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