

# Sticking and sinking: when sediments rise, coral gametes fall

Gerard F. Ricardo <sup>a,b,c,\*</sup>, Ross J. Jones <sup>b,c</sup>, Roman Stocker <sup>d</sup>, Peta L. Clode <sup>a</sup>, Adriana Humanes <sup>b,e</sup>, Natalie Giofre <sup>b</sup>, Andrew P. Negri <sup>b,c</sup>

<sup>a</sup>Centre for Microscopy, Characterisation and Analysis, and Oceans Institute, University of Western Australia, W.A, Australia, <sup>b</sup>Australian Institute of Marine Science, QLD & W.A, Australia, <sup>c</sup>Western Australian Marine Science Institution, <sup>d</sup>Department of Civil, Environmental and Geomatic Engineering, ETH Zurich, Switzerland. <sup>e</sup>ARC of Excellence for Coral Reef Studies, James Cook University, QLD, Australia. \*Ph: (07) 4753 4423, email: gerard.ricardo@research.uwa.edu.au

## Background

Dredging operations are often paused during coral spawning events. However, the mechanisms by which dredge-sediment impact the early life history stages of corals are poorly understood or remain unexplored, bringing into question the effectiveness of the shut-down period. Here, we investigate novel mechanisms through which suspended sediments concentrations (SSC) impact pre-fertilisation processes, that subsequently may result in fewer egg-sperm encounters and lower fertilisation success.

### Ballasted bundles



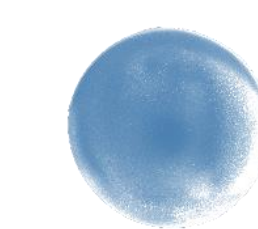
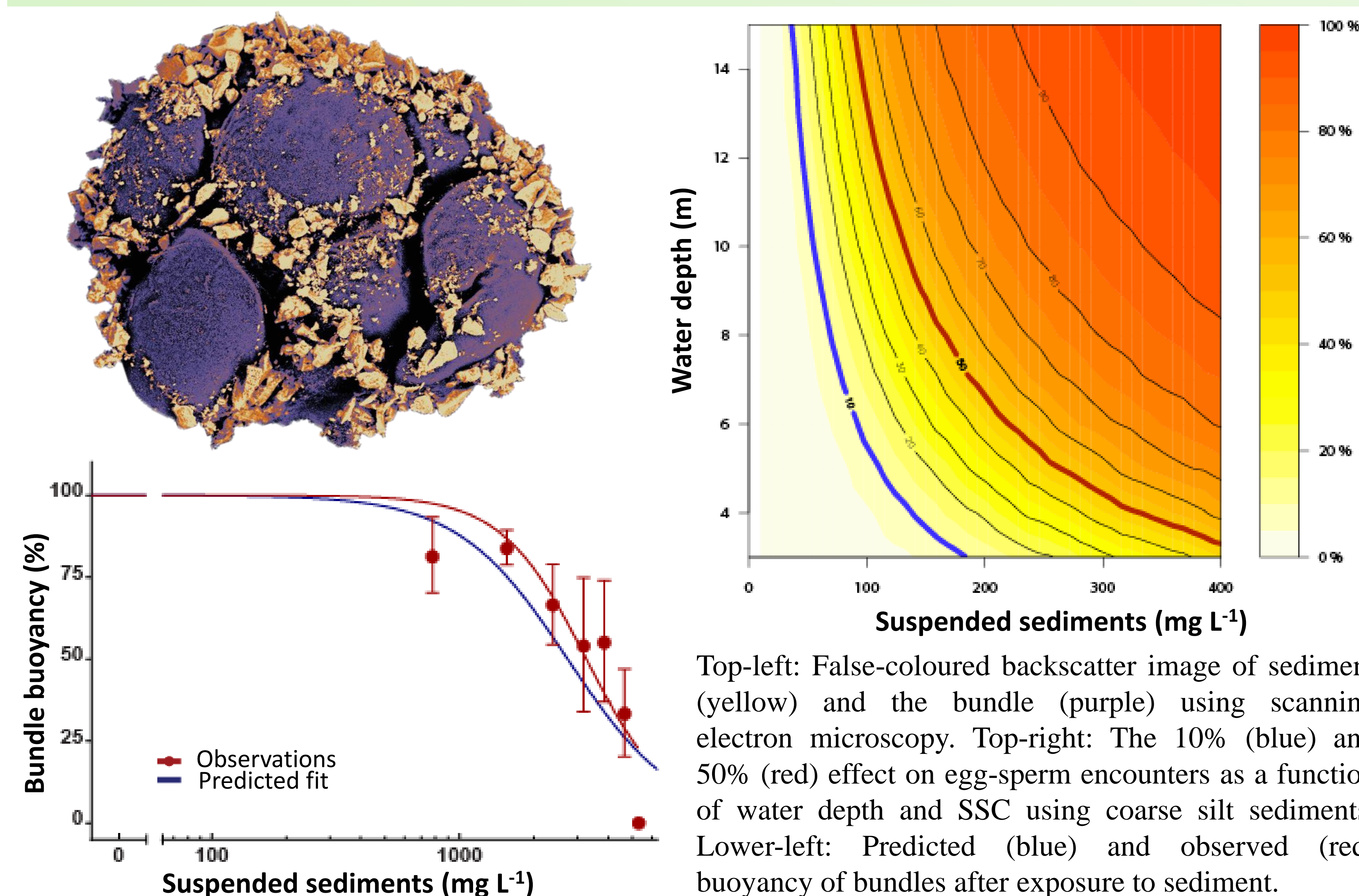
#### Methods:

- Ballasting of coral egg-sperm bundles by suspended sediment was predicted using a mathematical model.
- The model predictions were validated experimentally.

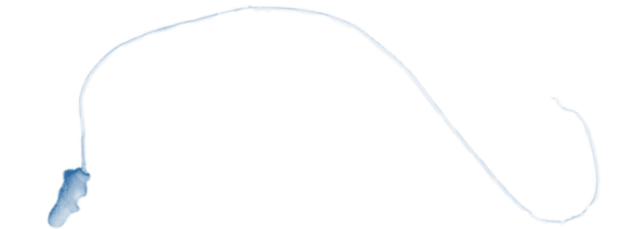
#### Results:

- Sediments can ballast and delay bundles from reaching the water's surface.
- The model predicted ballasting within 20% of the experimental observations.
- Bundle ballasting is a function of **depth**, **sediment grain size** and **SSC**.
- Fewer bundles reaching the water surface result in a 10% decrease in egg-sperm encounters at SSC as low as **35 mg L<sup>-1</sup>\***.

\*typical of suspended sediments recorded within three km of a dredge.



### Sunken sperm



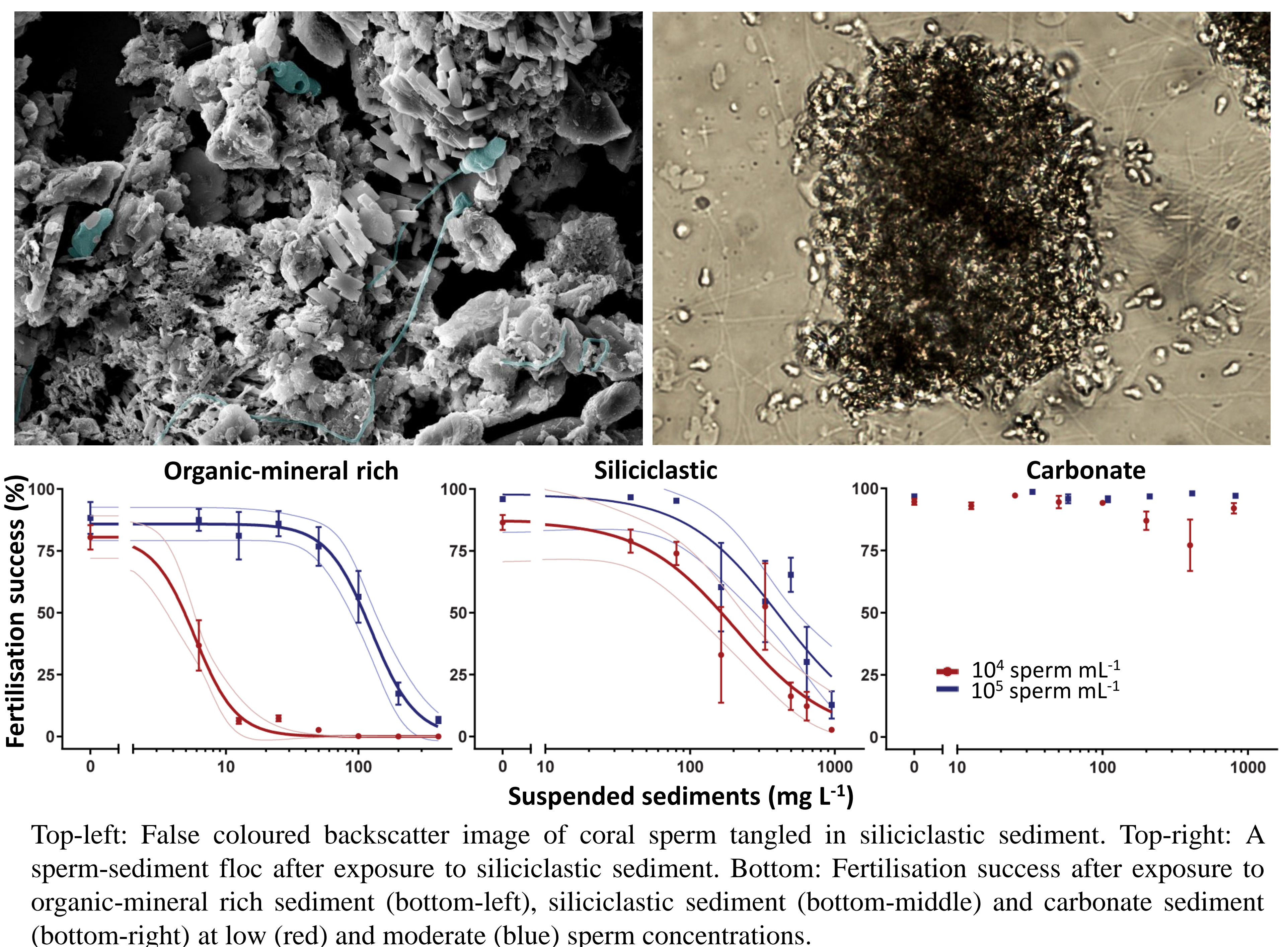
#### Methods:

- Coral gametes (eggs and sperm separately) were exposed to various suspended sediment types, and the components that caused flocculation of the sperm identified.

#### Results:

- Sediments flocculate coral sperm before they fertilise the egg.
- Fertilisation inhibition is a function of **sperm concentration**, and **organic** and **mineral** components of the sediment.
- SSC caused a 10% decrease in fertilisation success as low as **3 mg L<sup>-1</sup>\*** with organic-mineral rich sediment, but no effect with clean carbonate sediments.

\*typical of suspended sediments recorded during a windy day in inshore reefs.



Publications: Ballasted bundles: Ricardo, G. F., Negri, A. P., Jones, R. J. & Stocker, R. That sinking feeling: Suspended sediments can prevent the ascent of coral egg bundles. *Scientific Reports* 6, 21567 (2016). Sunken sperm: Ricardo, G. F., Jones, R. J., Clode, P. L., Humanes, A. & Negri, A. P. Suspended sediments limit coral sperm availability. *Scientific Reports* 5, 18084 (2015).