

## Abstract

Foraminifera are effective tools for assessing and monitoring ecosystem quality due to their pervasive distributions, high abundances, short generation times, reliable fossil record, and environmental sensitivities. Indices have been proposed whereby resource managers can monitor the condition of benthic environments and evaluate restoration efforts by analyzing foraminiferal densities. Paleocological data from fossilized foraminiferal tests also provide invaluable historical perspectives to ecologists and restoration planners. To evaluate this indicator for the Indian River Lagoon (IRL) benthic ecosystem, the densities and distributions of *Ammonia parkinsoniana*, a hypoxia/anoxia tolerant facultative anaerobe, were measured in Turkey Creek (Palm Bay, Florida) and nearby sites. Peak densities of large individuals (tests >.5 mm), within Turkey Creek exhibited a significant negative ( $p < 0.01$ ;  $R^2 = 0.334$ ) correlation with increasing silt/clay content.

## Introduction

The Indian River Lagoon (IRL) is a diverse, shallow water estuary that spans the east coast of Florida from Ponce de León Inlet (Volusia County, Florida) to Jupiter Inlet (West Palm Beach, FL). In the past 50 years, development and anthropogenic influences have led to increased nutrient inputs (street runoff, residential and commercial fertilizers, septic and sewer discharges) and accumulation of silt and clay particles (soil erosion), resulting in a buildup of fine-grained, organic-rich sediments in the IRL, known as "muck" (> 10% of the IRL benthic area, Trefry *et al.*, 1990).

Muck serves as an internal source of nutrients (Nitrogen and Phosphorus) to the lagoon (Trefry *et al.*, 2007), furthering eutrophication which feeds algal blooms and subsequently leads to hypoxic or anoxic conditions. This promotes anaerobic decomposition, fostering the release of toxic hydrogen sulfide into the water column where it can impact the benthos, fish and other pelagic species.

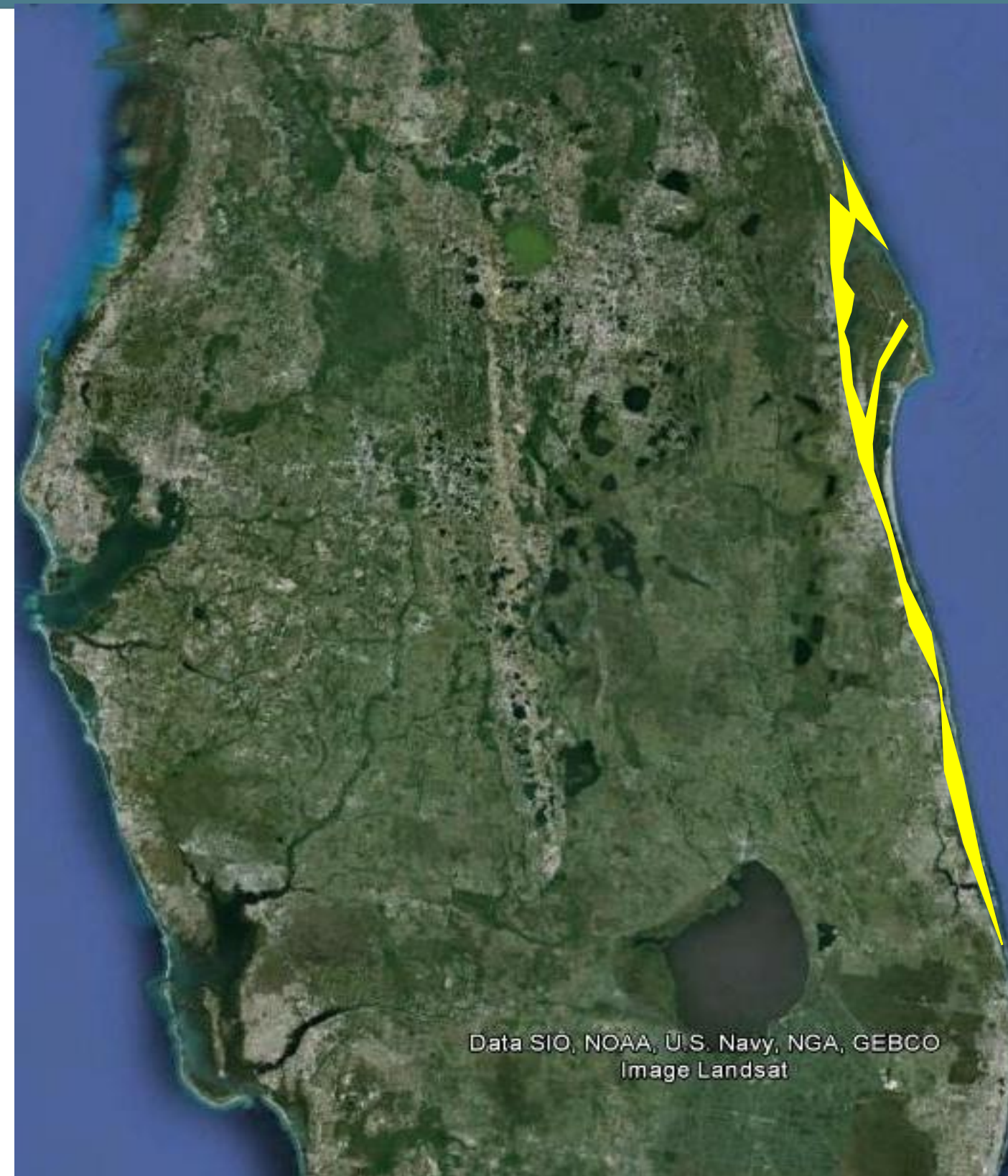


Figure 1. The IRL is a biologically diverse estuary spanning 156 miles along the east coast of Florida

## Objective

Analyze foraminiferal assemblages and sediment characteristics in IRL habitats undergoing restoration in order to evaluate overall ecosystem quality, and the efficacy of habitat improvements.

## Methods and Materials



Fig. 2 Crane Creek Muck stations (red) and IRL stations near Crane Creek (yellow).

### Sample collection:

- 3 replicate samples per station
- Crane Creek (Fig. 2): 2 muck stations (CCM), 4 Lagoon stations (CCL)
- Turkey Creek (Fig. 3): 2 Muck stations (TCM), 4 Lagoon stations (TCL), 4 Palm Bay stations (TC)

### Sediment Characterization:

- Silt/clay percentage determined by contrasting dry weights before and after sieving through 63  $\mu$ m mesh

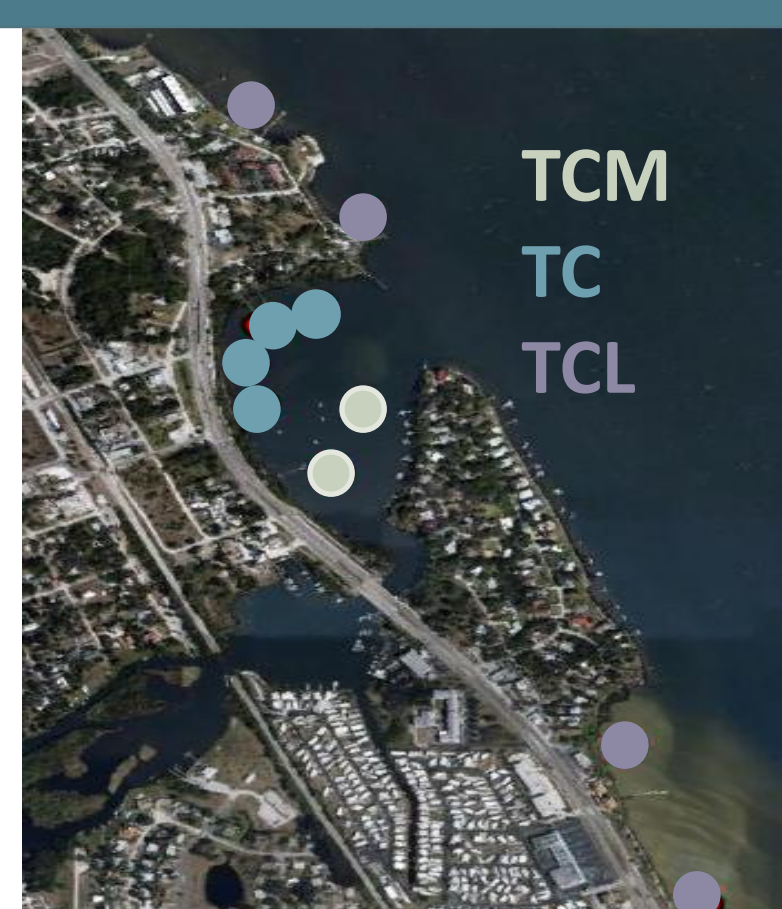


Fig. 3 Turkey Creek Muck stations (white), Turkey Creek Intermediate stations (blue) and IRL stations near Turkey Creek (purple).

## Results

Chart 1. Spatial and temporal differences in *Ammonia parkinsoniana* densities ( $\# m^{-2}$ ) showing asynchronous pulsating patches.

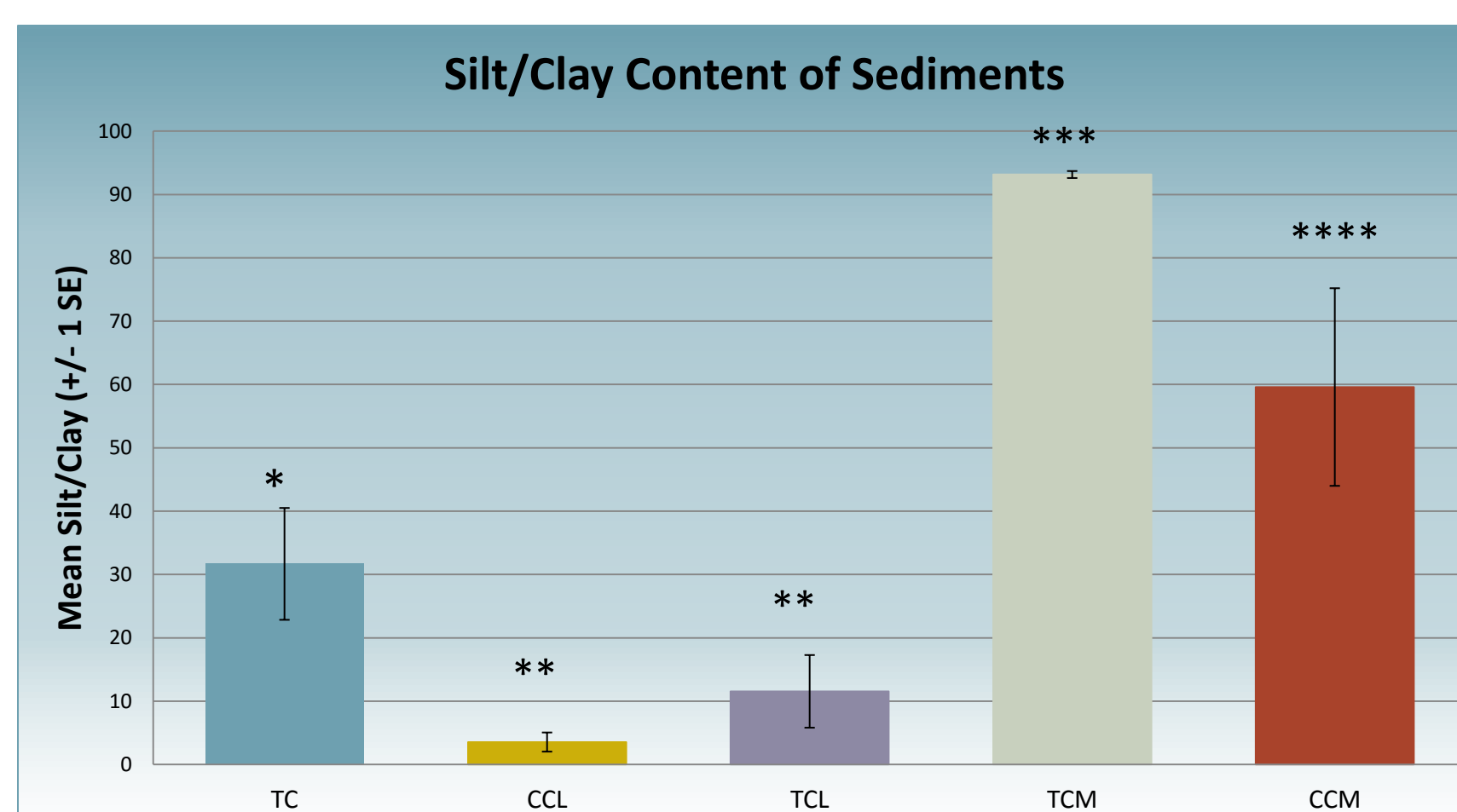
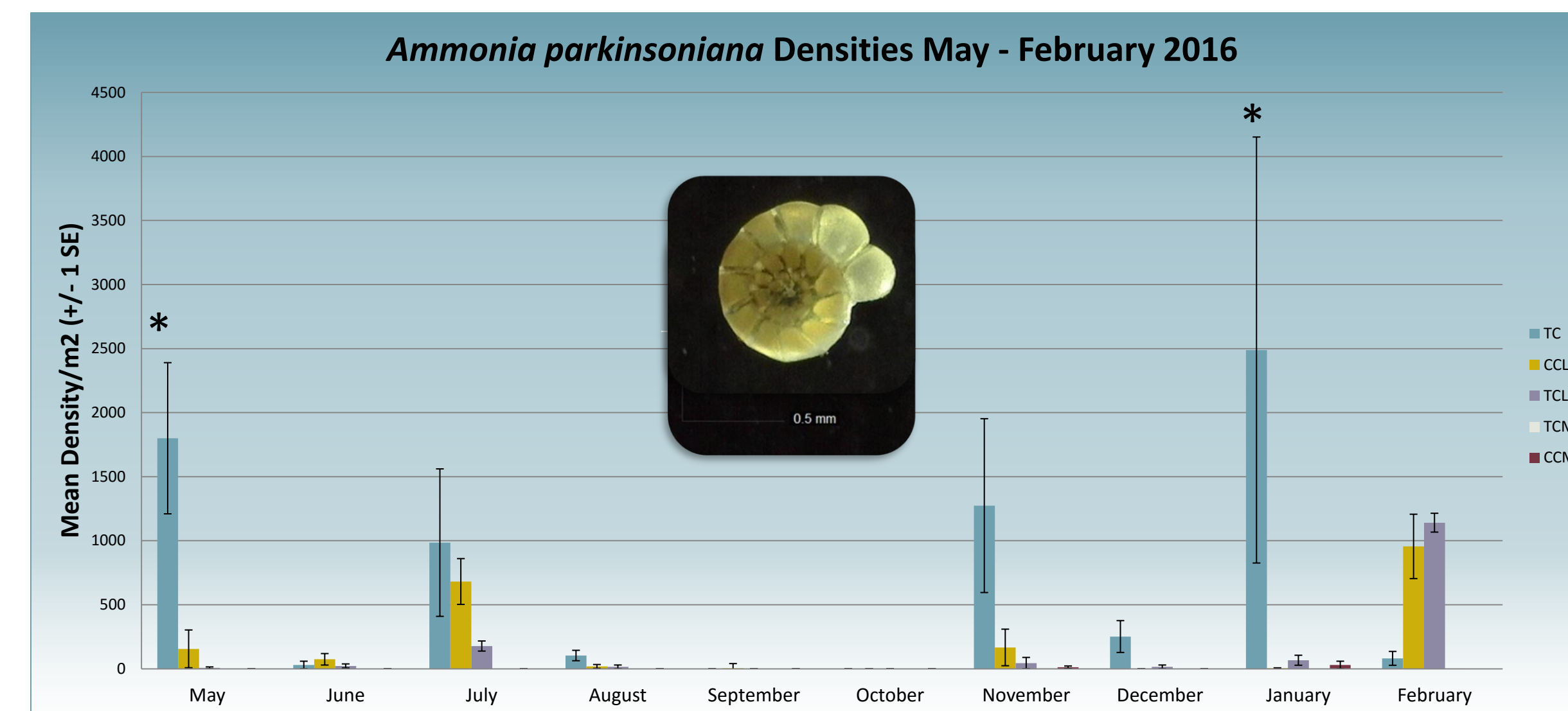
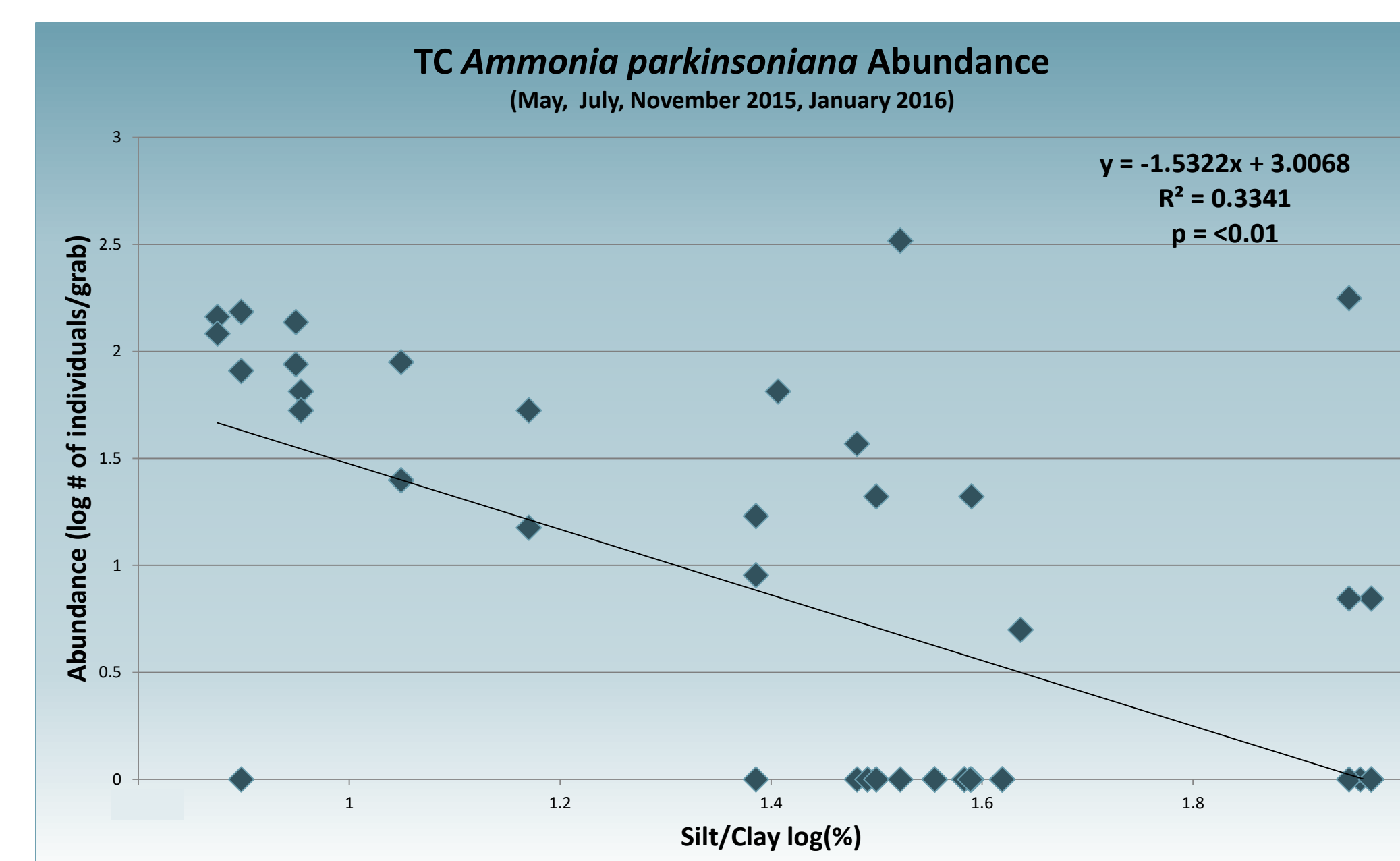


Chart 2. % silt /clay content by location. Muck sites have the highest silt/clay content (>60% as per the operational definition of true muck). IRL stations have the least silt/clay content, and, Turkey Creek stations have an intermediate silt/clay content.

Chart 3. The relationship of foraminiferal abundance with silt/clay content of sediment (log transformed linear regression) in Turkey Creek through the 4 most abundant months.



## Discussion/Conclusion

*Ammonia parkinsoniana* are present throughout the year and exhibit asynchronous pulsating patches as described in other regions of the IRL by Buzas *et al.* (2002). Their density ranges from 0 to ~25,000 individuals  $m^{-3}$ , and they are even present in largely uninhabited muck areas. *A. parkinsoniana* are tolerant of silt/clay sediments and may dominate in these areas. In spite of this, however, they exhibit decreasing abundance as % silt/clay increases. Eventually such unpleasant conditions exceed the tolerances of even the most forbearing species. Overall, comparing densities of foraminifera is a valuable approach to evaluating ecosystem quality.

## Ongoing research

Fig. 4 Example of cores for examining modern foraminiferal assemblages



Modern muck substrate



Historic sandy substrate

Fig. 5 Example of deep cores for examining "pre-muck" vs. "post-muck" assemblages.

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## References

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2. Trefry JH, Trocine RP, and Woodall DW. 2007. Composition and sources of suspended matter in the Indian River Lagoon, Florida. Florida Sci. 70: 363-382.
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## Acknowledgement

