Juvenile Sunray Venus Clam Salinity Tolerance

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Introduction: Florida's bivalve aquaculture industry has a farm-gate value of approximately US $19 million, but is based primarily on a single species; the hard clam *Mercenaria mercenaria* (Fig 1). The industry's economic growth may increase through utilization and domestication of other species. The sunray venus clam (SRV), *Macrocallista nimbosa* (Fig 2), is a potential culture candidate as it is native to Florida and was once commercially fished. Previous research indicated the SRV clam is amenable to culture conditions in Florida. As climate change may bring on greater salinity variation through storms and droughts, the salinity tolerance of this species should be examined.

Fig 1. Hard clam aquaculture in the Indian River Lagoon.

Methods

- Cultured sunray venus clams (SRV) were obtained from an experimental field site (24 ppt) at Cedar Key.
- SRV initially weighed an average 6.6±0.5 g and had an average shell length of 35.8±0.2 mm (~2/3 market size).
- Ten SRV were added to triplicate 15 L containers of 16, 24, 32, and 40 ppt saltwater (Fig. 3).
- SRV were fed 2 times per day with microalgae (T-Iso) at 100,000 cells/mL and water changed every other day.
- Dissolved oxygen, salinity, pH, temperature, and mortality were recorded daily for 28 d.

Fig 2. Adult sunray venus clam, tagged.

Fig 4.
Sunray venus clam exhibiting gaping behavior

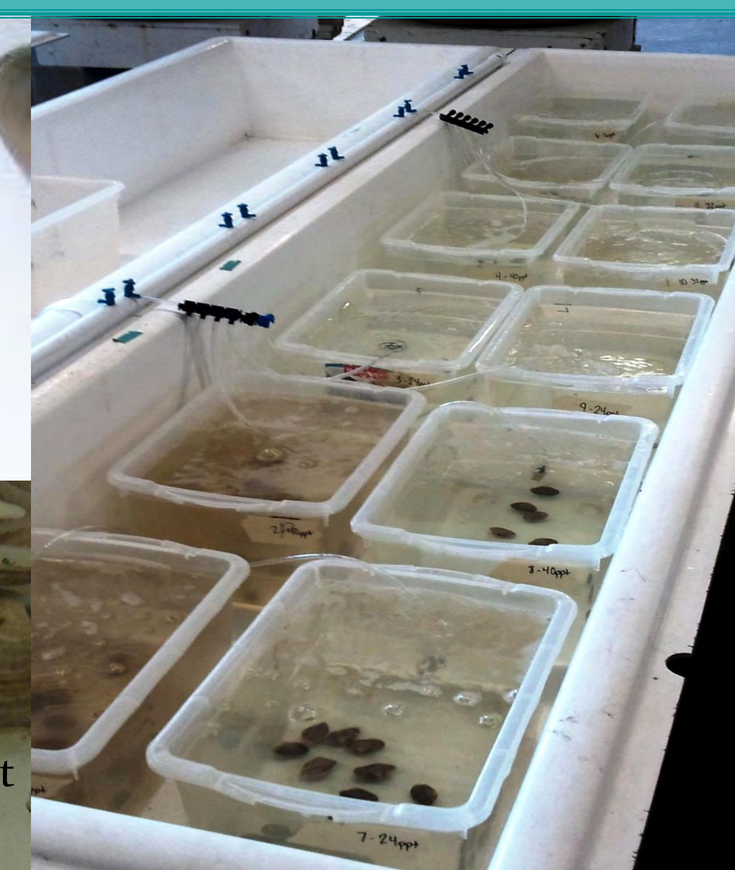

Fig 3.
Tank set up.

Results

- Salinity treatments were close to target values (mean ± s.d.): 16.6 ± 0.7, 24.6 ± 0.4, 32.1 ± 0.3, and 39.4 ± 0.4 (n=28).
- Environmental parameters were similar among all treatments (mean ± s.d.): temperature 25.9° ± 0.7, dissolved oxygen 6.5 ± 0.5 ppm (92.1 ± 6.6 % saturation), and pH 7.9 ± 0.2.
- Mean survival of sunray venus (SRV) clams taken from 24 ppt and exposed for 28 days to 16, 24, 32 and 40 ppt was 100%, 100%, 93% and 70%, respectively (Fig. 5); 40 ppt was significantly less than other treatments ($P \leq 0.0039$)
- Mean weight gain of SRV clams exposed for 28 days to 16, 24, 32 and 40 ppt was 4.8%, 10.5%, 10.8% and 9.8%, respectively; no sign. diff. (P=0.21).
- Mean condition index of SRV clams exposed for 28 days to 16, 24, 32 and 40 ppt was 8.9, 10.5, 9.8 and 10.7, respectively; 16 ppt treatment value was not significantly different (P=0.70) from initial value (9.1).
- Hemolymph osmolality (mOsm) of surviving SRV clams followed water osmolality (R^2 = 0.9994).

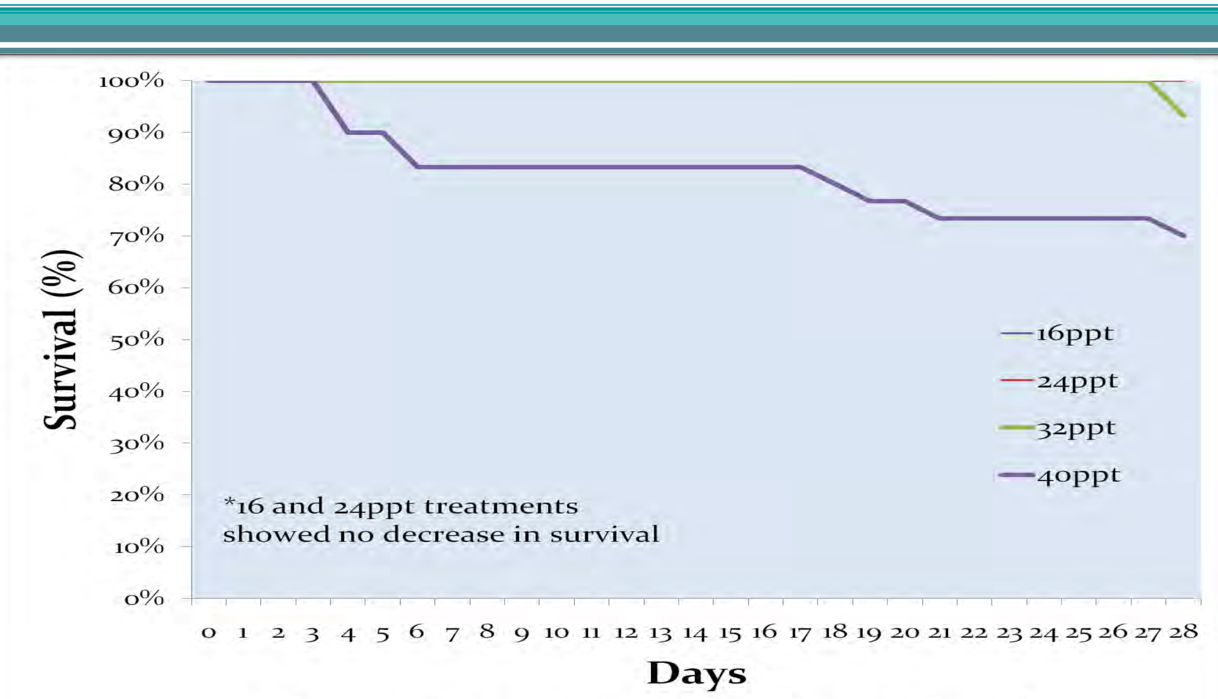

Fig 5: Percentage of survival

Discussion

- Sunray venus (SRV) clam survival was lowest in the 40 ppt treatment. This may have occurred as SRV clams were taken from 24 ppt salinity; thus the 16 and 32 ppt treatments were only one step change of 8 ppt, whereas the 40 ppt treatment was a two step change of 16 ppt.
- Hemolymph osmolality followed that of the environment, which indicates surviving clams were osmoconforming.
- Although weight gain was not significantly different in SRV exposed to 16 ppt, they had the lowest weight gain and no change in condition index. If the experiment had gone further, mortality and weight gain for SRV clams at 16 ppt may have differed from 24 and 32 ppt.
- Gaping clams (Fig. 3) were seen in the 32 ppt treatment. All three replicates tanks had 2-4 gaping clams. As sunray venus clams grow in sand, the observed gaping behavior may correlate to the lack of sand substrate as the external salinity may have not been stressful.

Conclusion: SRV juvenile clams can withstand abrupt 8 ppt changes from 24 ppt with little mortality, although 16 ppt may be nearing their low-end and 40 ppt their high-end for osmoconforming, growth, and survival.

So What Now…

- What is the effect of prior salinity acclimation on salinity tolerance?
- What is the salinity tolerance of sunray venus clams at different life stages?
- Would the sunray venus clam show a difference in salinity tolerance using a gradual change versus a step change in salinity?
- Does the sunray venus clam have genetic potential for expanding salinity tolerance?

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