Salinity tolerances of invasive ascidians in the San Francisco Bay

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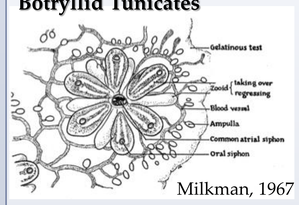
Background

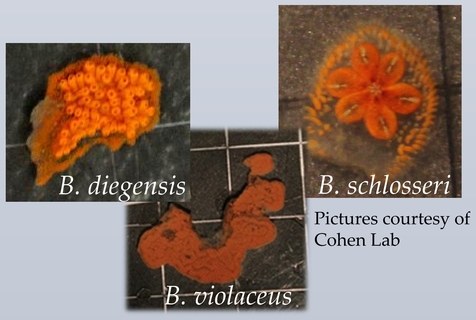
Botryllid Tunicates



Milkman, 1967

- Basal chordates
- Sessile filter feeders
- Colonial species
- Whole body regeneration abilities

- Shared circulatory system throughout colony
  - capable of reversing blood flow
- 3 globally distributed species invasive in San Francisco Bay: *Botrylloides diegensis, Botrylloides violaceus, Botryllus schlosseri*
- Problems created by invasive species:
  - alter native habitats
  - reduce native species richness
  - smother organisms in aquaculture
- Salinity tolerance data can help predict future invasions & control their spread[1]
- Reported salinity ranges from laboratory experiments[1] as seen in Table 1
  - *B. violaceus* : 20-38 ppt
  - *B. schlosseri:* 14-44 ppt[1,2]
- Salinities in the central SF Bay can drastically drop in winter months[3]



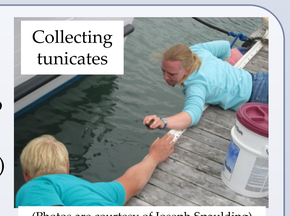
Pictures courtesy of Cohen Lab

Research Questions

- ✓ **Can these botryllid species survive short term exposure to salinities below their reported range?**
- ✓ **Are there differences in survival among these species?**
- ✓ **Is there a difference seen in survival several days after exposure to low salinities?**

Methods

- Collection sites: Sausalito, Richmond, San Francisco
- Various sized colonies (0.1-13.5 cm^2) were collected & attached to glass slides & cultured in the lab
- Colonies exposed to 5 salinities: 10, 15, 18, 20, 32(control) ppt
- Exposed for 14 hrs to each salinity treatment, & then immediately returned to seawater (31-32 ppt)
- Checked for survival (used dissecting microscope at 30-40x magnification):
  - zooid response (muscular response from touch with a needle at incurrent siphon)
  - blood flow (travel of blood cells between colony units)
- Monitored in RTC culture lab for up to a week after treatment



(Photos are courtesy of Joseph Spaulding)

Excurrent Siphon of colony

Results

Salinity range comparison to previous data shows different tolerances

Species	Lowest reported range	Lowest salinity showing survival in our study
Botryllus schlosseri	14 ppt	15 ppt
Botrylloides violaceus	20 ppt	10 ppt
Botrylloides diegensis	ND	10 ppt

Table 1. Lowest salinity tolerance comparison between published data looking at lab trials with colonies from British Columbia[1] and our study with colonies from San Francisco Bay.

Strong difference between % survival of *Botryllus sp.* in comparison to *Botrylloides spp.* at 10 ppt

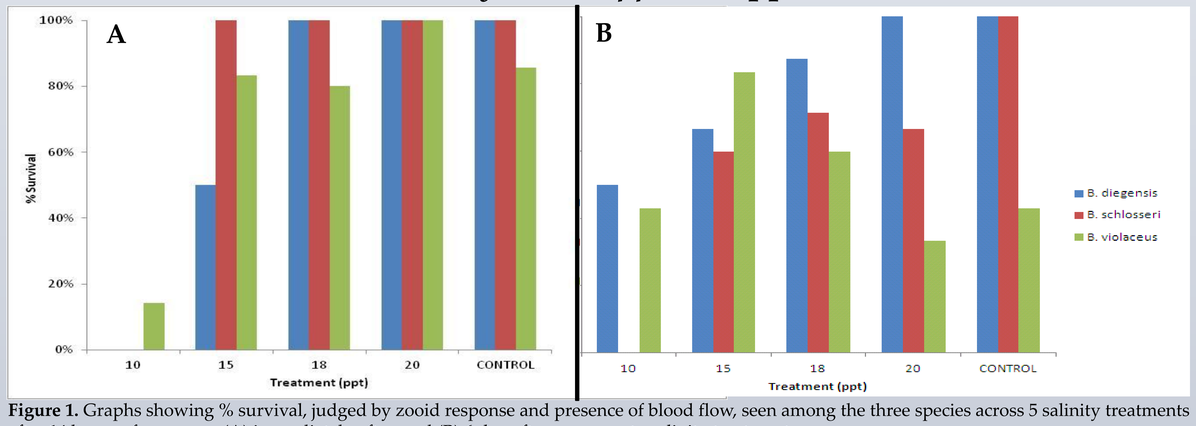


Figure 1. Graphs showing % survival, judged by zooid response and presence of blood flow, seen among the three species across 5 salinity treatments after 14 hours of exposure: (A) immediately after, and (B) 6 day after exposure to salinity treatments.

Differences in blood flow (A) and zooid response (B) at different times were seen in *B. diegensis* and *B. violaceus*, respectively

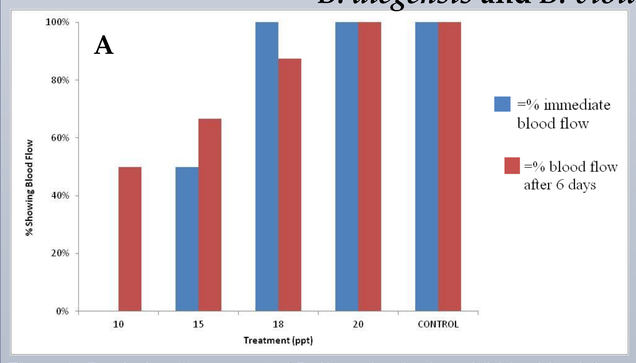


Figure 2. Graph showing percent of *B. diegensis* colonies exhibiting blood flow immediately after (blue) and 6 days after (red) exposure to each salinity treatment.

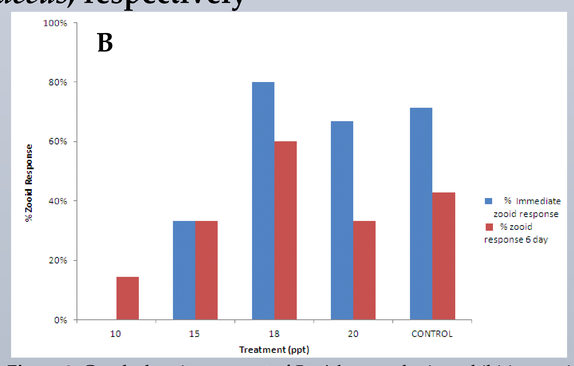


Figure 3. Graph showing percent of *B. violaceus* colonies exhibiting zooid response immediately after (blue) and 6 days after (red) exposure to each salinity treatment.

Discussion

- *B. violaceus* survived salinities below reported tolerance
- New salinity tolerance data for less studied species, *B. diegensis*
- Longer monitoring period showed more accurate detection of survival , using two metrics, compared to immediate observations
- Decreasing trend in survival rate seen *in B. schlosseri* and *B. diegensis*
  - Stress from low salinity environment may have delayed affect on colony health
- *B. violaceus* results harder to interpret, as survival of control colonies showed decrease
  - hardest species to culture in lab

Further Research

Further research on the regeneration processes of these species may be of interest in predicting the potential spread of these invasive species as well.

Significance

This data can help build more accurate models for predicting the distribution and spread of these globally invasive organisms.

References

1. Epelbaum, a., Herborg, L. M., Therriault, T. W., & Pearce, C. M. (2009). *Journal of Experimental Marine Biology and Ecology*, *369*(1), 43-52.
2. Brunetti, R., Beghi, L., Bressan, M., Marin, M.G., 1980. Mar. Ecol. Prog. Ser. 2, 303–314.
3. SF Bay Environmental Assessment and Monitoring Station. Romberg Tiburon Center, San Francisco State University. July 2012. <http://sfbeams.sfsu.edu/>

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