

South Bay Salt Pond Restoration Sentinel Species Condition



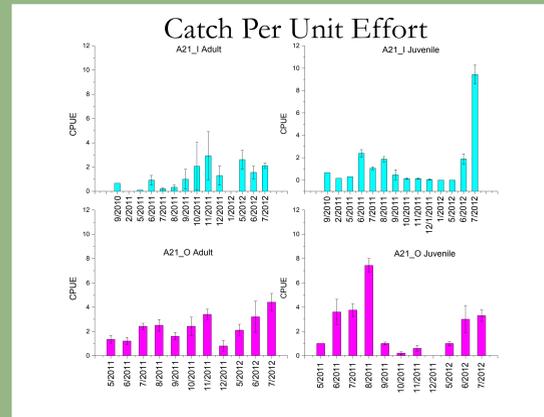
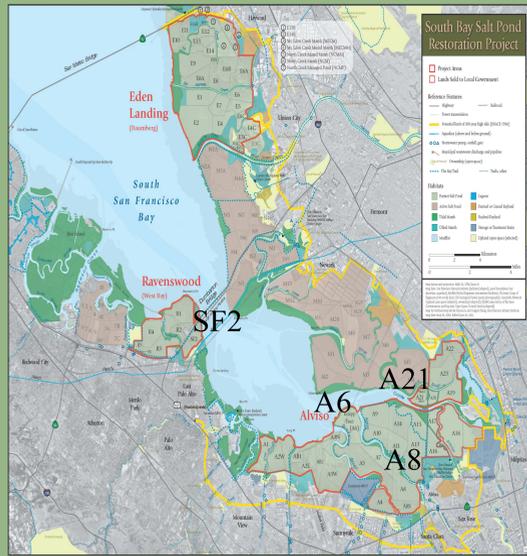
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Objective

- To determine the effects of habitat restoration of tidal salt marshes in South San Francisco Bay by investigating the health, on the individual and on the population scale, of a sentinel species (*Gilichthys mirabilis*).
- Compare the somatic condition, through Fulton's condition factor (FCFI) and hepatosomatic indices, of *G. mirabilis* within restoration sites (inside) to those in remnant marsh habitat (outside).
- Assess the growth rate of the sentinel species "inside" to the growth rate of those "outside", through otolith micro-structure analysis.
- Assess the difference between "inside" and "outside" *G. mirabilis* abundance of both adults and juvenile recruits.



Monthly CPUE for the sites A21_I and A21_O for adult and juvenile longjaw mudsucker. Error bars depict 1 SE

Methods Continued

Otolith Micro-structure Analysis

- Otoliths were mounted on glass slides, sanded and polished on the sagittal plane with a variable speed grinder-polisher machine.
- Next, they were photographed through a 10x Olympus CH30 microscope. Multiple photographs were merged together using Photoshop.
- Otolith increment radii was measured in Image J® by following a linear transect from the core to the rostral edge. Multiple readings were performed, and a percent agreement of within 10% was used to ensure a reliable age estimate and growth rates.

Take Home Points

CPUE

- G. mirabilis* was more abundant in remnant salt marsh habitat compared to the abundance found inside the salt pond restoration sites.
- Juvenile abundance in pond A21 was less variable inside when compared to outside sites. In pond A6 juveniles were less abundant than outside in remnant habitat. This trend was also seen in the SF2 pond.

Health

- Mudsuckers in ponds A8 and SF2 had lower general health condition than all other sites sampled.
- Ponds with both inside and out reference sites (A21 and A6) showed that over all health was fair.
- The condition factor of all mudsuckers decreased slightly during the spring season; and were relatively the same between inside, outside and muted, tidal reference sites.

Growth Rate

- Otolith growth rates did not correspond to some of the health trends; except for pond A21 which had slower growth rates outside compared to inside sites.
- Pond A6 had greater growth rates inside compared to its outside reference site.

As climate change hastens to impact ecological linkages in coastal habitat areas globally, these data serve as an important baseline for ongoing studies in salt marsh restoration projects.

Acknowledgement

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Methods

Abundance

- Monthly sampling was conducted by using 1-5 baited minnow traps (a "string") with 3-5 string replicates per inside and adjacent outside reference sites; traps were fishing for a duration of at least 12hrs. overnight, during the highest monthly tide (full moon spring tides).

- All mudsuckers caught were measured (standard length), weighed and sexed (by the terminal position of maxillae in relation to their opercular apertures).

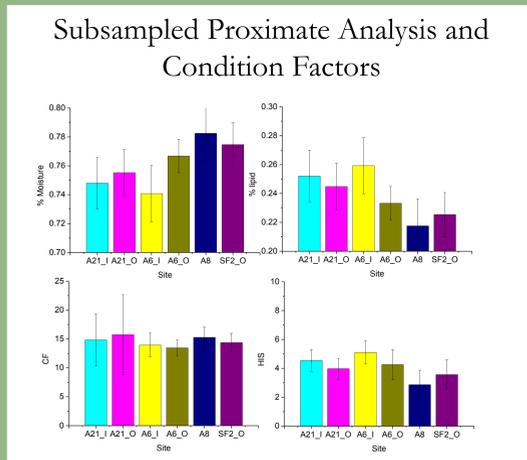
- Adult and juveniles were classified by length. Adults >80mm, juveniles <80mm.

- Catch per unit effort, CPUE (monthly abundance) was calculated by averaging the number of longjaw mudsuckers caught in the (1-5) traps for each creek and then averaging the mean catch per trap across the replicate creeks (3-5) for each site (inside, outside).

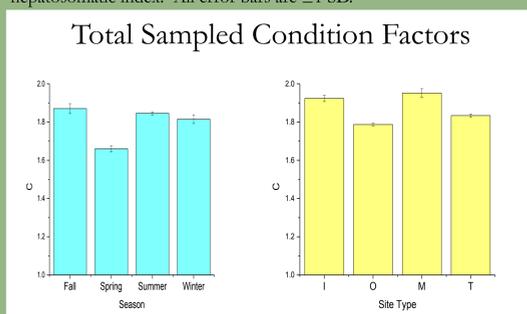
Health Indicators

- Wet weight and standard length measurements were taken in the field of all the monthly trapped mudsuckers and used to calculate the FCFI. A subsample of up to 10 individuals per site were euthanized and necropsied so that liver weight could be obtained for the hepatosomatic index calculations.

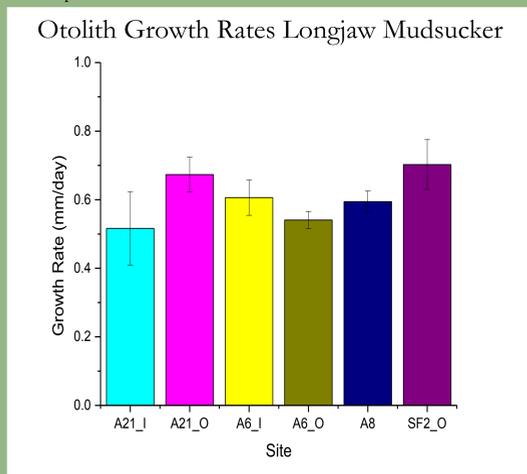
- Proximate analysis, the measurement of the major constituents of the body, including moisture, lipids, and proteins is reported as percentage of the total body weight.



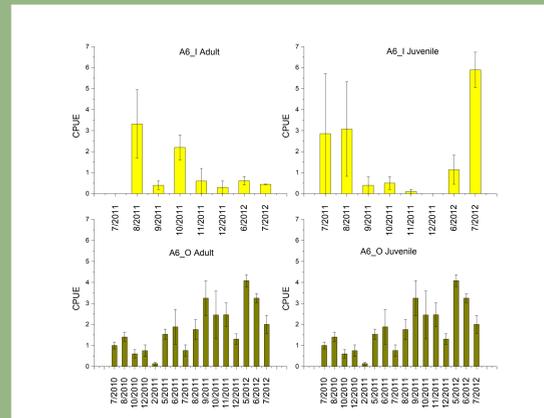
(Top-Left) The percent body moisture for a sample of 8 individuals collected in fall of 2011. (Top-Right) The percent lipid content, (Bottom-Left) Fulton's condition factor, and (Bottom-Right) the hepatosomatic index. All error bars are ±1 SD.



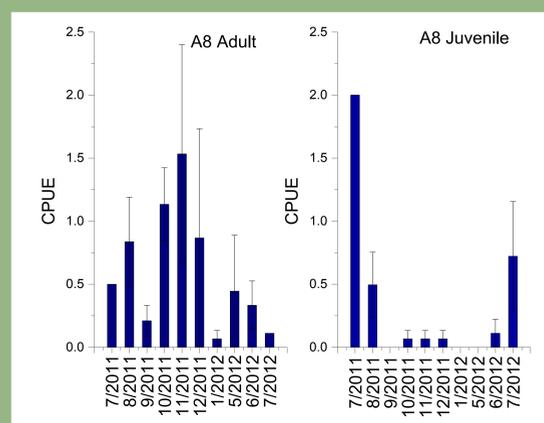
Condition factor for longjaw mudsucker collected during monthly surveys. (Left) season trends and (Right) different restoration types (I= inside restoration ponds, O= outside restoration ponds, M = muted tide-stage ponds A8 and SF2, and T = fully tidal ponds). Error bars depict 1 SE.



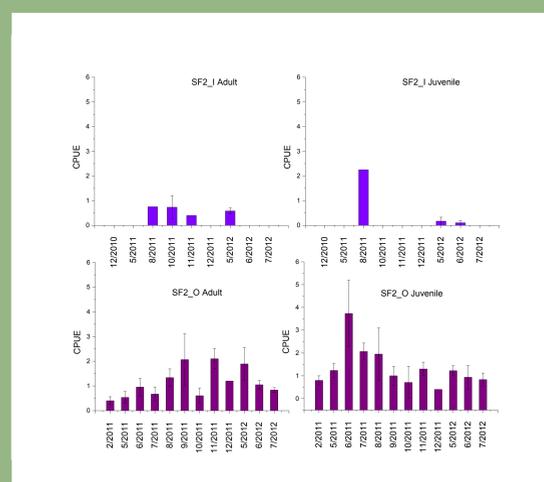
Summer otolith daily growth rate back-calculated from otolith increment widths from the settlement check to the edge of the otolith or the point at which daily increments were not visible. Error bars depict 1 SE.



Monthly CPUE for the sites A6_I and A6_O for adult and juvenile longjaw mudsucker. Error bars depict 1 SE.



Monthly CPUE for the sites A8_I for adult and juvenile longjaw mudsucker. Error bars depict 1 SE.



Monthly CPUE for the sites SF2_I and SF2_O for adult and juvenile longjaw mudsucker. Error bars depict 1 SE.