Results

Twenty-one filtration trials, across the four study sites, were included in the analyses. A single filtration trial at Deanza (2019-4-17; Table 4) was removed from the analysis because the mean upstream Chl α (M = 0.1, SD = 0.54) was within the detection limit of the sensor (± 0.1 g/L). Filtration trials across sites were not distributed equally (Table 4), Deanza had more than twice the amount filtration trials (N = 9) as San Rafael (N = 4), Morro Bay (N = 4), and Shellmaker (N = 4).

Habitat Clearance Rates

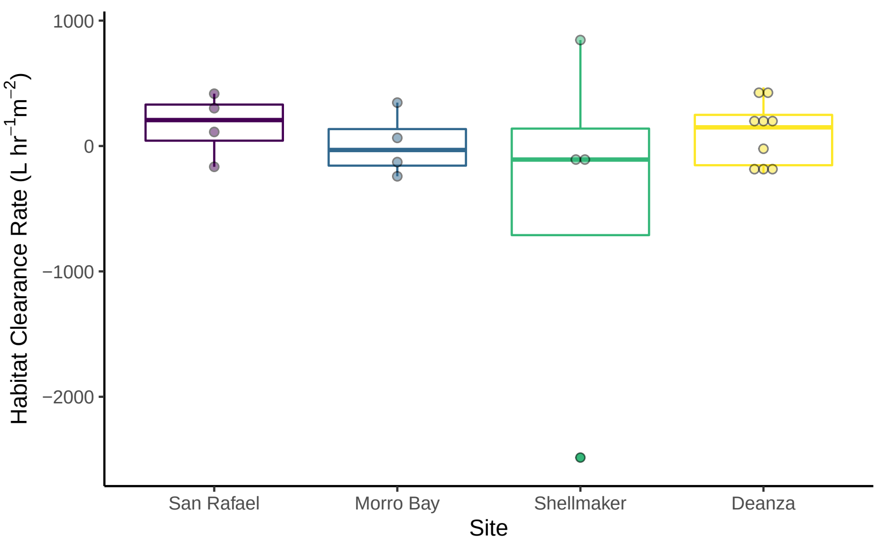

Figure 1: Box plots of habitat clearance rates (HCR) during filtration trials; control trials are listed in Table 1. Each data point is the mean of a single filtration trial. HCR was not statistically different among sites (one-way Kruskal-Wallis). Filtration trials were conducted between February 2018 to June 2019 at San Rafael, CA (restored *O. lurida* reefs); Morro Bay, CA (Morro Bay Oyster Company *C. gigas* aquaculture); and Newport Bay, CA (Shellmaker and Deanza, restored beds).

Mean HCR (Habitat Cearance Rates) at San Rafael was 166.252 L hr^{-1} m^{-2} (N = 4, SD = 254.7), 10.3 L hr^{-1} m^{-2} (N = to 4, SD = 257.1) at Morro Bay, -463.9 L hr^{-1} m^{-2} (N = 4, SD = 1420.2) at Shellmaker, and 104.6 L hr^{-1} m^{-2} (N = 9, SD = 250.9) at Deanza (Figure 1). There is not sufficient evidence to conclude that HCR was significantly different among sites (one-way Kruskal-Wallis, p = 0.83) (Figure 1). A random forest regression containing only filtration trials (R^2 = 0.63) indicated that OC (25.8047396%) had the highest relative importance to the model, followed by Salinity (14.5610946%), Site (21.1123895%), Temp (14.7495674%), TPM (13.6340826%), and Turbidity (10.1381263%).

Particle Selection

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Statistical comparisons of particle preference between O. lurida and M. gigas supports significant differences in both overall mass consumption as well as differences in particle size preference between the two species when the total volume among particle size classes are kept equal (Table 1). When particles concentrations were equal among size classes, there was no significant difference in the total amount of particles consumed between O. lurida and M. gigas (Table 2). In the first experiment in which an equal volume of particles were introduced into the ecosystem, both species were much more likely to consume the more prevalent smaller particles. However, when larger particle sizes became more available in the second experiment, the preference of both animals included higher frequencies of the larger pellets. There is statistical evidence supporting different particle preference distributions between the species, though the results of the two experiments are somewhat contradictory with regards to which species is more likely to prefer larger food particles in general. (See Table 1 & 2 for statistical information).

Two LaTeX tables here in Overleaf

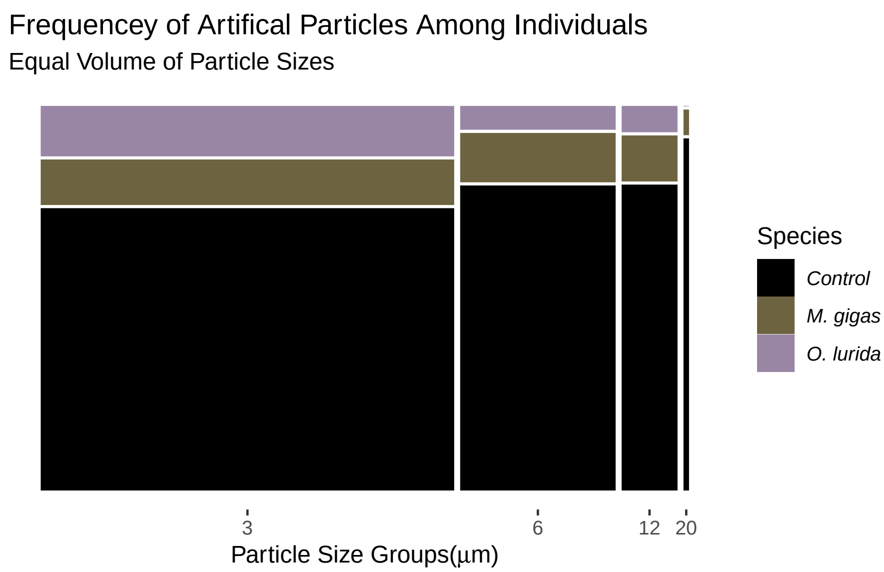

Figure 2: Caption Needed From Matt

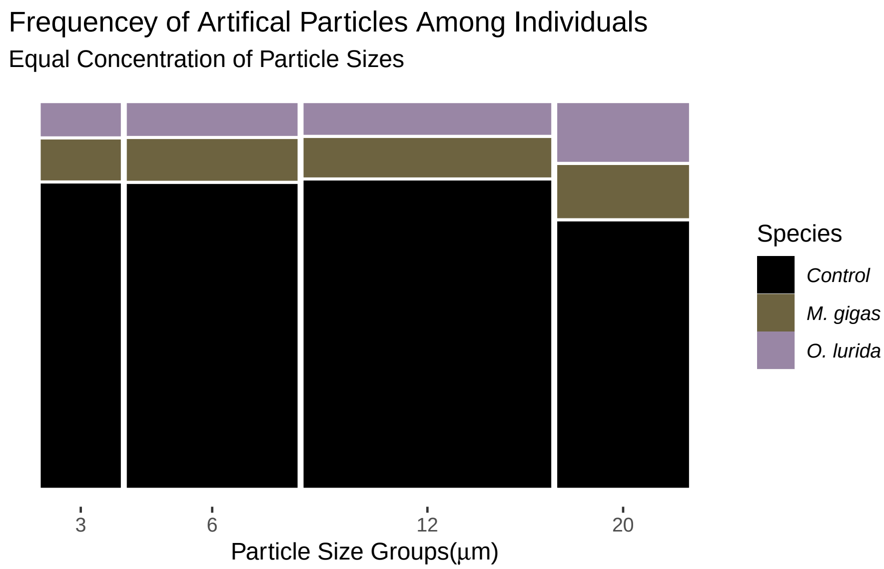

Figure 3: Caption Needed From Matt

Allometric Predictor of Biomass

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Pairwise parameter comparison of models relating allometric predictors of biomass reveal that there are statistically significant differences between each of the three observed O. lurida populations (San Diego, CA, Deanza, CA, Yaquina Bay, OR). Most notably, evidence supports that animals observed in Yaquina Bay, in general, are longer and proportionally support higher dry tissue weight than species found at the Deanza and San Diego sites. Though there are less notable yet still significant differences between the populations sampled at the two Southern California sites.

Supplemental / Repository

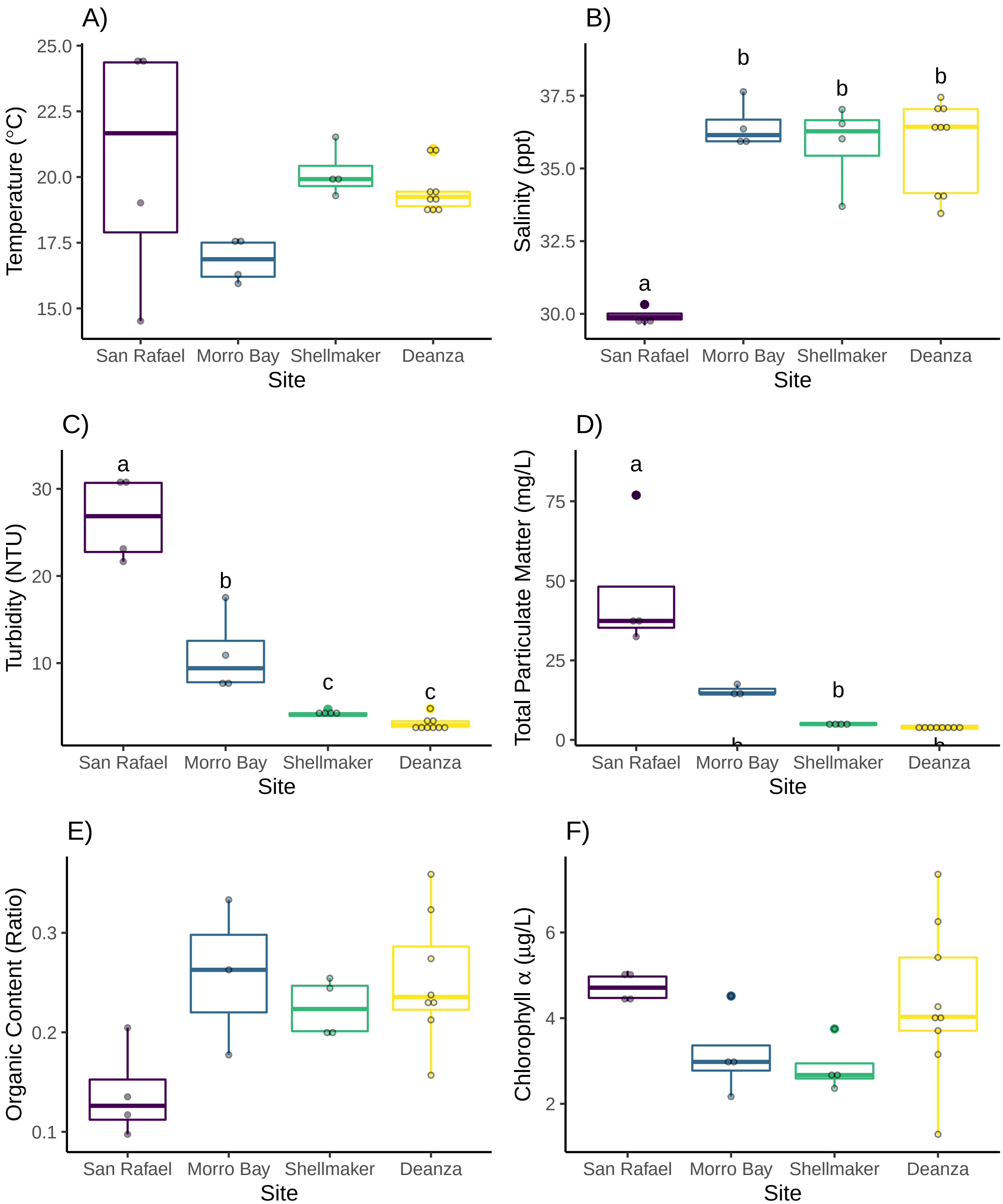

Figure 4: Box plots of ambient (upstream) A) temperature, B) salinity, C) turbidity, D) total particulate matter, E) organic content, and F) chlorophyll α from filtration trials. One-way ANOVAs compared the difference between water quality variables and site. Significantly different results were grouped by a post-hoc Tukey's HSD; significantly different sites do not share a common letter, and non-significant differences share letters. Site effects on OC were significant, and a Newman-Keuls post-hoc analysis determined a significant difference between San Rafael and Deanza undetected by Tukey's HSD. Trials were conducted from February 2018 to June 2019 at San Rafael, CA (restored reefs); Morro Bay, CA (Morro Bay Oyster Company, aquaculture); and Newport Bay, CA (Shellmaker and Deanza, restored beds).

Ambient water quality during filtration trials varied within and among sites (Figure 4). Salinity was significantly different among sites as determined by a one-way ANOVA at a $p < 0.05$ ($F(3, 17) = 24.7$, $p < 0.001$), along with turbidity ($F(3, 17) = 66.74$, $p < 0.001$), and TPM ($F(3, 15) = 20.06$, $p = < 0.001$) (Figure 4). Temperature ($F(3, 17) = 2.43$, $p = 0.10$), and Chl α ($F(3, 17) = 2.17$, $p = 0.13$) were not different among sites (Figure 4). OC was significant among sites ($F(3, 15) = 3.92$, $p = 0.03$), but the post-hoc Tukey HSD did not reveal significant differences among sites. Therefore, I use a less conservative post-hoc analysis, the Newman-Keuls method, and found that OC was significantly different between Shellmaker and Deanza ($p = 0.01$).

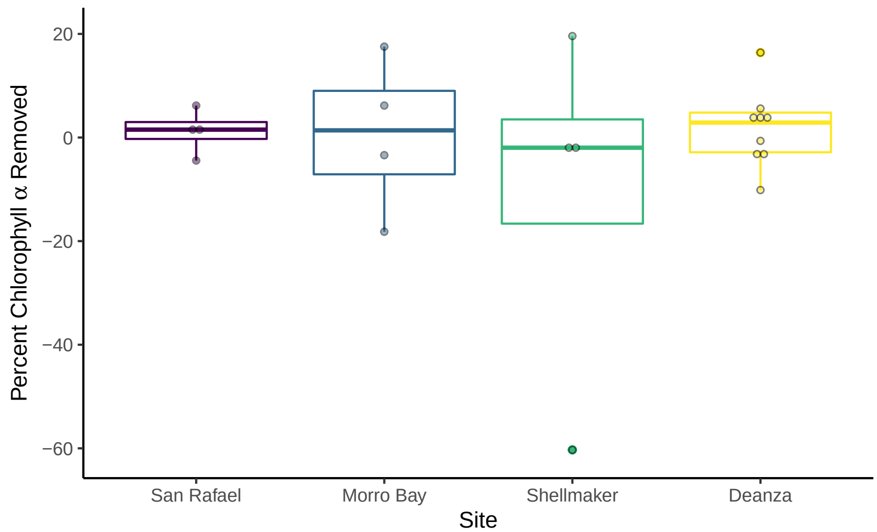

Figure 5: Box plots of percent chlorophyll α removal (Chl_{up} - Chl_{down} / Chl_{up} * 100) during filtration trials, control trials are listed in Table 1. Each data point is the mean of a single filtration trial. Filtration trials were conducted between February 2018 to June 2019 at San Rafael, CA (restored reefs); Morro Bay, CA (Morro Bay Oyster Company aquaculture); and Newport Bay, CA (Shellmaker and Deanza, restored beds).

Percent Chlorophyll α Removal

The mean percent Chl α removal at the San Rafael site was 1.2% ($N = 4$, $SD = 4.36$) (Figure 5). Filtration trials at Morro Bay had a mean Chl α removal of 0.5% ($N = 4$, $SD = 15.1$). At Deanza, mean Chl α removal was 1.9% ($N = 9$, $SD = 7.5$). Mean Shellmaker Chl α removal was -11.2 % ($N = 4$, $SD = 34.3$) (Figure 5). Chl α removal in filtration trials did not differ significantly between sites (one-way Kruskal-Wallis, $p = 0.98$).

Seston Quantity and Quality

Northern San Francisco Bay (San Rafael) TPM averaged 42.84 mg/L ($N = 5$, $SD = 19.33$), and Morro Bay TPM averaged 14.85 mg/L ($N = 4$, $SD = 1.97$) (Figure **??**). Newport Bay (Deanza and Shellmaker) TPM averaged 4.18 mg/L ($N = 15$, $SD = 0.87$). Northern San Francisco Bay (San Rafael) OC averaged 0.15 ($N = 5$, $SD = 0.04$), and Morro Bay OC averaged 0.25 ($N = 4$, $SD = 0$). Newport Bay (Deanza and Shellmaker) OC averaged 0.237 ($N = 15$, $SD = 0.05$) (Figure **??**).

Filter Feeding Community

In November 2017 the estimated bivalve density at San Rafael was 420 individuals/m^2, all of which were *Ostrea lurida* (Figure 6). Other bivalves were noted, but were rare, and were not detected in sample bags (C. Zabin, unpublished data). Morro Bay had an estimated 409 *Crassostrea gigas* individuals/m^2 in the summer of 2018 (Morro Bay Oyster Company); personal field observations confirm the lack of bivalve fouling on the aquaculture lines. In May 2018, Shellmaker had an estimated 1283.2 individuals/m^2, composed of *Adula diegensis* (545.6 individuals/m^2), *Musculista senhousia* (438.4 individuals/m^2), *O. lurida* (238.4 individuals/m^2), *Mytilus galloprovincialis* (51.2 individuals/m^2), *Geukensia demissa* (8 individuals/m^2), and *Argopecten ventricosa* (1.6 individuals/m^2) (Figure 6). Deanza had an estimated 2588.8 individuals/m^2 in May 2018, and was composed of *M. senhousia* (1979.2 individuals/m^2), *A. diegensis* (296 individuals/m^2), *O. lurida* (233.6 individuals/m^2), *M. galloprovincialis* (80 individuals/m^2) (Figure 6).

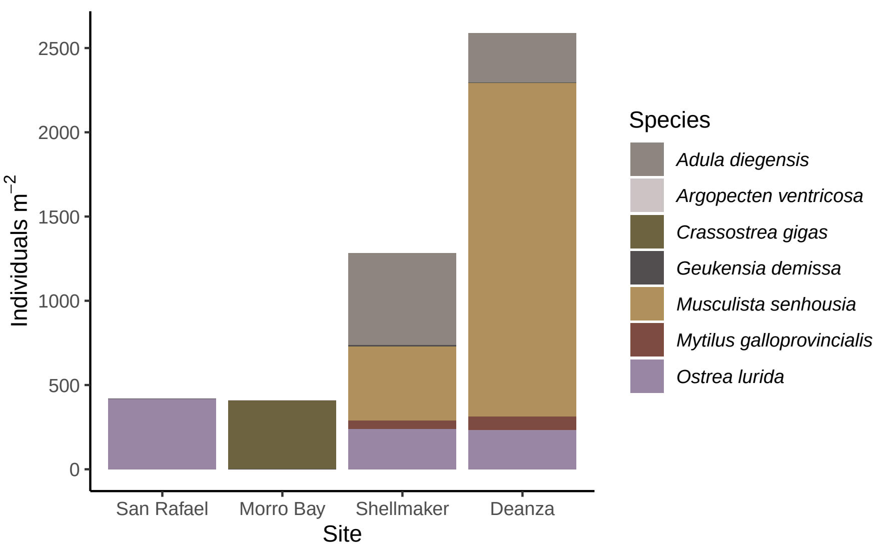

Figure 6: Bivalve community density and composition for each study site. San Rafael data were collected November 2017 by the Zabin lab at SERC, Morro Bay was estimated by Morro Bay Oyster Company in 2018, and Shellmaker and Deanza were surveyed in May 2018 by the Zacherl lab at CSUF.

Direct biomass data were only available for Deanza, which estimated 39.96 g/m^2 of bivalve dry tissue weight (DTW) (Figure 7). *O. lurida* had the highest DTW with 20.47 g/m^2, followed by *M. galloprovincialis* (2 g/m^2), an unknown *Modiolus* sp. (0.62 g/m^2), *A. diegensis* (2.29 g/m^2), and *M. senhousia* (14.3 g/m^2) (Figure 7).

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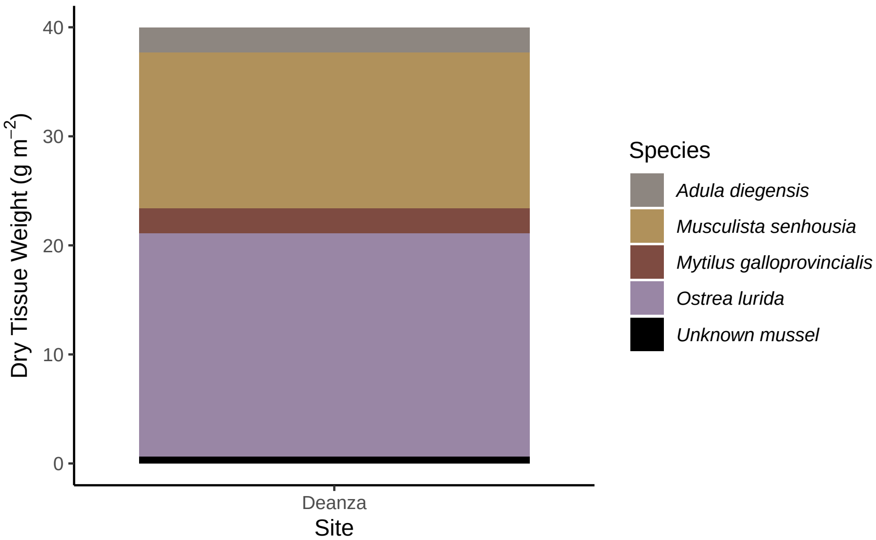

Figure 7: Estimated biomass of *O. lurida* habitat at Deanza and San Rafael sites. Data for Deanza was collected by the Zacherl lab (CSUF) in May 2018, the relationship between *O. lurida* shell length and dry tissue weight (DTW) from the survey was used to estimate DTW at San Rafael with shell length data collected by the Zabin lab (SERC) in November 2017.