Temporal Change in Rocky Intertidal Macroflora and Macrofauna Community Composition at Little Corona del Mar, Newport Beach, CA

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Summary

The percent cover, biodiversity, and community structure of rocky intertidal macrophytes and macroinvertebrates at Little Corona del Mar, Newport Beach, CA were compared over a decade of intermittent spring sampling. Transect sampling was conducted in 2003, 2007, 2008, 2012, and 2013 and compared temporally using both univariate statistics on species/taxa cover and diversity data and multivariate statistics on community composition data. In general, select species and functional group cover, evenness, and community composition varied over time but few consistent, directional, long-term patterns were observed. In other words, most species fluctuated over time but did not consistently increase or decrease from one sampling period to the next. Based on the data set for this site, the macroflora and macrofauna did not change substantially over the past decade.

Methods

The percent cover of rocky intertidal macrophytes and macroinvertebrates were determined using a modified point contact method along five permanent transect lines placed perpendicular to shore at Little Corona del Mar in Newport Beach, CA (Figures 1 and 2). These transects were originally established in 2003 by Bullard (2005) and previously sampled in 2003 (Bullard), 2007 (Smith), and 2008 (Smith). Transects were resampled for this effort in 2012 and 2013; all sampling occurred during late spring (May/June). Along each transect, the species falling below contact points at 10 cm intervals were determined. Lines ranged from 31 to 38 m in length resulting in a total of 1,780 point-contacts. All species were identified to the lowest possible taxon. In cases, where layering was present, more than one species was recorded for a

single point. Accounting for layering provides a more accurate record of species abundance at a site than accounting for only the top most species layer. The percent cover along each transect line (replicate) was determined based on the number of hits per species in relation to the total number of possible hits on the line.

Percent cover of individual species was compared over the sampling years in table form with a subset of the more common species analyzed using a One-Factor (sampling year) ANOVA and a Tukey's multiple comparisons test to determine, when significant, which sampling periods were statistically different from each other. Species were then grouped into ecological functions based on functional groups for macrophytes and feeding guilds for macroinvertebrates and compared among sampling periods using similar statistical analyses. A comparison of groupings reduces interpretation errors in changes at the species level as some species may be replaced by others providing the same ecological function.

In addition to analyzing data along each transect line, percent cover data were further compared among tidal intervals. Tidal heights were measured at 1 m intervals along each permanent transect in 2003 using a rotary laser (Lasermark Wizard rotary laser, CST Corp.) and a universal laser detector secured to a telescoping stadia rod. Tidal heights calculations were based on amplitudes of established reference points, which were determined by predicted tidal height data. Tidal heights were not remeasured following the 2003 sampling. Mean abiotic (rock/sand) and biotic cover was determined by calculating species cover standardized by tidal height for each 1.0 ft interval.

The community composition was compared among sampling years for both species level data and functional grouping aggregated data. Community structure was analyzed using multi-

variate analyses using a Bray-Curtis similarity with the statistical program PRIMER. The similarity then was used to create multi-dimensional scaling (MDS) plots in which each transect sample was placed onto a graph with replicates that were similar in community structure plotting closer to one another. An Analysis of Similarities (ANOSIM) was used to determine significant differences in community structure among sampling periods. A Similarities Percentage (SIMPER) test was used to determine which species are contributing most to dissimilarities among sampling years. Biodiversity was calculated using two measures (species richness and Pielou's Evenness) along each transect line over each sampling period for the species level data set. Biodiversity data were analyzed using a One-Factor (sampling year) ANOVA.

Results and Discussion

Percent cover of macrophytes and macroinvertebrates, as well as abiotic (rock and sand) cover, varied among sampling periods (Table 1). In general, there were few strong patterns of change in species cover that were consistent or directional over time. Species cover, with some minor exceptions, fluctuated over time; in other words, rarely was a consistent increase or decrease in species cover observed from one sampling year to the next. This is evident for the more common species where, if significant, Tukey's multiple comparisons tests indicate significantly similar groups among years in an unsystematic pattern (Table 2).

During all sampling periods, abiotic cover dominated the habitat, ranging from ~36% in 2012 to 50% in 2008. Observationally, bare rock cover at this site is higher than other comparable locations in the region where most rocky space is taken up by biotic cover, especially in the middle to lower intertidal zone. *Corallina vancouveriensis/pinnatifolia* was also common, ranging from 18-22% over time, but did not vary significantly. In general, the percent

cover of most taxa did not change markedly over the sampling years with exception of some weak patterns. The surfgrass *Phyllospadix torreyi* was unusually high (~5.5%) in 2012 and 2013 while relatively low in cover in previous years. Surfgrass has been increasing at other locations over the past several decades (Smith et al. unpublished data), despite the long-term declines in other fleshy macrophytes. The putative non-native alga *Caulacanthus ustulatus* exhibited a small decline over time with the cover in 2013 being lower than previously observed. This species has shown large fluctuation over time in other studies (Whiteside et al. 2007). While *Caulacanthus* removal experiments were conducted at this site, they did not fall within the transect sampling area. The erect coralline alga *Lithothrix aspergillum* was low in 2003 (1.5%) but increased in 2007 and subsequent sampling periods (mostly around ~10%). However, patterns in cover of the erect coralline functional group (see below) did not vary over time suggesting *Lithothrix* was replacing an ecological equivalent. The giant kelp *Macrocystis pyrifera* exhibited relatively high cover (~2%) in 2012 but was mostly absent during other sampling periods; this species is not typically found in the intertidal zone, and thus an episodic, short term recruitment event to the intertidal habitat may have occurred in 2012. The fleshy red alga *Pterocladiella capillacea* showed a pattern of increase over time, as did the non-native brown alga *Sargassum muticum*. Few patterns were observed with macroinvertebrate species with exception of minor declines in the barnacle *Balanus glandula* and the urchin *Strongylocentrotus purpuratus.* Declines in urchins were surprising given anecdotal observations of urchin increases in other parts of the site. Although very low in cover, the rockweed *Silvetia compressa* was present during 2012/2013 sampling, despite being absent previously. Efforts to restore *Silvetia compressa* at this site were conducted in 2007 and 2008 (Whitaker et al. 2010) with successful establishment over the entire

rocky shore of Little Corona del Mar. Total biotic cover did not vary much over time, with the exception of an increase in 2012.

When data were aggregated in functional groups for macrophytes and feeding guilds for macroinvertebrates, some weak patterns emerged (Tables 2 and 3). Erect corallines were the most common taxa but did not vary significantly among sampling years. Filamentous-like algae declined over time while seagrass and tough and leathery algae increased over time, mostly in 2012 and 2013. These changes may reflect some minor improvements at the site as filamentous types tend to be disturbance tolerant while tough and leathery algae are disturbance intolerant. However, erect corallines and crustose algae are also disturbance tolerant but did not change over time while other disturbance intolerant species, such as fleshy algae, also did not change. Blade algae were abundant in 2012 but variable in the other sampling periods. The increase in blade algae abundance observed in 2012 was driven mostly by the abundance of the opportunistic alga *Ulva*, usually an indicator of a recent disturbance or addition of nutrients. All of the macroinvertebrate groupings were similar over time.

When comparing data over tidal intervals, percent cover was more variable (Table 4a,b); this is likely due to the lower number of points distributed among the tidal ranges. As expected, cover of particular taxa varied greatly among tidal ranges, depending on the preferred habit of each species. Abiotic cover was higher in the upper intertidal ranges than that of the lower intertidal zone. Of note is the decline in cover of rock and sand in the lowest zone (0 to -1 ft range) in 2012 and 2013 (<3%) compared to a relatively high abiotic cover in 2003 (~28%). Crustose Corallines were also abundant in the lowest zone in 2003 (~14%) but were much less common in 2008 and subsequent years (<2%). In the lowest zone, there was also a marked increase in biotic cover. *Caulacanthus* was present throughout most of the intertidal ranges, with

exception of the lowest intertidal zone. Although *Caulacanthus* declined in all tidal ranges, the decline was more severe in the upper zones, albeit a weak pattern. Again, these patterns suggest some improvement at the site but numerous examples exist that are inconsistent with improved conditions.

Community composition comparisons using mult-variate statistics yielded significant patterns for both the species level data (Figure 3; ANOSIM Global R=0.602, p=0.001) and functional group aggregate data (Figure 4; ANOSIM Global R=0.270, p=0.003). For species level, community composition varied significantly among all sampling years while for aggregate data, community composition in 2012 and 2013 were significantly different than 2003, 2007, and 2008. Similarities percentage (SIMPER) tests indicate which species are contributing most to the dissimilarity among years for species level data (Table 5) and for aggregate data (Table 6). While community composition did vary over time, the dissimilarity among years was not directional in nature. In addition, the species contributing to differences among years were not consistent and the differences in cover between each comparison were, arguably, ecologically irrelevant.

Species richness, which ranged from 32.8 (2013) to 38.2 (2008; Figure 5), was similar among sampling years (ANOVA, df=4, MS=31.5, F=1.12, p=0.375). Conversely, evenness was significantly different among sampling years (Figure 5; ANOVA, df=4, MS=0.0046, F=3.43, p=0.027). Although the highest evenness values were observed in 2012 and 2013, there was no consistent or directional pattern (as indicated by Tukey's multiple comparisons test, Figure 5).

Conclusions

Comparisons of the percent cover of macroflora and macrofauna at Little Corona del Mar over multiple sampling periods over the past decade suggests, with a few minor exceptions, that

little substantial change has occurred. Although some significant differences were observed, particularly with community composition, some select species, and a few functional groups, the patterns tended not to be directional in nature. In other words, most species fluctuated over time but did not consistently increase or decrease from one sampling period to the next. Based on the data set for this site, the macroflora and macrofauna did not "improve" over the past decade. It is important to note that sampling was conducted at one site with no other sites sampled for comparison. Patterns, or lack thereof, must be taken with caution as this study does not document changes that may have occurred at other locations. For example, if other comparable sites in the region exhibited increases in disturbance tolerant species (such as crustose algae), subjectively indicating a decline in health, the lack of increase in these species at Little Corona del Mar would indicate a possible positive change.

Literature Cited

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Whiteside KE, Smith JR, Murray SN (2007) Distribution, habitat utilization, and reproductive patterns in *Caulacanthus ustulatus* (Caulacanthaceae, Gigartinales), a newly established seaweed on southern California shores. Bulletin of the Southern California Academy of Sciences. 106:89-90.

Table 1. Mean abiotic and biotic species cover of 5 transect replicates (+/- SE) for the 5 sampling periods.

	2003 Mean	2003 SE	**2007 Mean**	2007 SE	**2008 Mean**	2008 SE	**2012 Mean**	2012 SE	**2013 Mean**	2013 SE
Total abiotic	**44.60**	4.13	**46.10**	2.16	**49.08**	3.65	**35.61**	2.31	**42.37**	2.65
Macrophytes										
Acrosorum ciolatum	**0.00**	0.00	**0.00**	0.00	**0.48**	0.19	**2.90**	1.01	**0.86**	0.42
Bossiella orbigniana	**0.06**	0.06	**0.00**	0.00	**0.00**	0.00	**0.21**	0.15	**0.05**	0.05
***Bryopsis* spp.**	**0.42**	0.42	**0.00**	0.00	**0.06**	0.06	**0.00**	0.00	**0.00**	0.00
Caulacanthus ustulatus	**7.52**	0.76	**5.42**	0.38	**4.12**	0.58	**6.91**	1.89	**2.59**	0.46
Centroceras clavulatum	**1.35**	0.49	**0.75**	0.60	**0.11**	0.07	**0.21**	0.15	**0.71**	0.32
Ceramium/Corallophila	**1.17**	0.49	**2.77**	1.25	**0.54**	0.19	**1.39**	0.46	**0.90**	0.25
Chaetomorpha linum	**0.89**	0.46	**0.16**	0.16	**0.06**	0.06	**0.05**	0.05	**0.05**	0.05
Chondracanthus canaliculatus	**2.14**	1.07	**1.71**	0.69	**3.30**	1.92	**4.15**	1.01	**2.53**	0.16
Chondria achorizophora	**0.00**	0.00	**0.05**	0.05	**0.34**	0.21	**0.24**	0.17	**0.00**	0.00
***Cladophora* spp.**	**0.18**	0.07	**1.41**	0.48	**2.48**	0.68	**0.37**	0.23	**0.70**	0.29
Colpomenia peregrina	**0.00**	0.00	**0.05**	0.05	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Colpomenia sinuosa	**0.33**	0.10	**0.48**	0.20	**0.18**	0.13	**0.11**	0.11	**0.00**	0.00
Corallina chilensis	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.85**	0.54	**0.00**	0.00
Corallina pinnatifolila/vancouveriensis	**22.11**	3.69	**18.28**	1.56	**20.07**	0.59	**17.65**	1.38	**19.34**	2.32
Crustose Corallinaceae	**5.31**	0.67	**2.19**	0.66	**1.35**	0.24	**2.51**	0.50	**2.61**	0.37
Cryptopleura crispa	**0.39**	0.32	**0.72**	0.20	**1.16**	0.14	**0.95**	0.21	**1.73**	1.05
Dictyopterus undulata	**0.00**	0.00	**0.05**	0.05	**0.16**	0.07	**0.00**	0.00	**0.16**	0.16
Dictyota coriacea	**0.06**	0.06	**0.05**	0.05	**0.00**	0.00	**0.28**	0.14	**0.22**	0.16
Dictyota flabellata	**0.16**	0.16	**0.05**	0.05	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
***Ectocarpus* spp.**	**0.00**	0.00	**0.00**	0.00	**2.15**	1.11	**0.00**	0.00	**0.13**	0.13
Egregia menziesii	**2.10**	1.25	**3.01**	0.54	**1.24**	0.43	**3.44**	0.53	**1.88**	0.77
Eisenia arborea	**0.00**	0.00	**0.54**	0.46	**0.17**	0.11	**0.00**	0.00	**0.00**	0.00
Endarachne binghamiae	**0.00**	0.00	**0.11**	0.07	**0.05**	0.05	**0.05**	0.05	**0.00**	0.00

	2003 Mean	2003 SE	**2007 Mean**	2007 SE	**2008 Mean**	2008 SE	**2012 Mean**	2012 SE	**2013 Mean**	2013 SE
Erythrocystis saccata	**0.05**	0.05	**0.05**	0.05	**0.00**	0.00	**0.00**	0.00	**0.12**	0.07
Gastroclonium parvum	**2.59**	0.80	**0.52**	0.38	**0.33**	0.22	**0.22**	0.13	**0.12**	0.07
Gelidium coulteri/pusillum	**4.23**	1.39	**5.16**	1.02	**4.03**	0.94	**5.71**	0.42	**3.73**	0.51
Halidrys dioica	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.11**	0.11	**0.05**	0.05
Haliptylon gracile	**0.00**	0.00	**0.16**	0.16	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
***Herposiphonia* spp.**	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Hesperophycus californicus	**0.00**	0.00	**0.00**	0.00	**0.05**	0.05	**0.00**	0.00	**0.00**	0.00
Hypnea valentiae	**0.00**	0.00	**0.50**	0.23	**1.39**	0.50	**1.37**	0.52	**2.19**	0.85
Jania crassa	**0.00**	0.00	**0.11**	0.11	**0.00**	0.00	**0.06**	0.06	**0.00**	0.00
Laurencia pacifica	**0.56**	0.21	**0.67**	0.13	**0.33**	0.10	**0.79**	0.61	**1.74**	0.26
Lithothrix aspergillum	**1.54**	0.65	**8.46**	1.37	**11.80**	2.71	**11.48**	2.84	**9.92**	1.98
Lomentaria hakodatensis	**0.00**	0.00	**0.36**	0.16	**1.84**	0.50	**0.87**	0.40	**0.43**	0.31
Macrocystis pyrifera	**0.00**	0.00	**0.00**	0.00	**0.54**	0.25	**1.96**	0.93	**0.13**	0.13
Mazzaella affinus	**0.06**	0.06	**0.00**	0.00	**0.11**	0.07	**0.11**	0.11	**0.00**	0.00
Melobesia mediocris	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.25**	0.19	**0.06**	0.06
Osmundea sinicola	**1.82**	0.81	**1.68**	0.14	**1.52**	0.07	**0.63**	0.12	**1.25**	0.10
Petrospongium rugosum	**0.31**	0.20	**0.06**	0.06	**0.06**	0.06	**0.06**	0.06	**0.00**	0.00
Peyssonneliaceae	**0.22**	0.22	**0.11**	0.11	**0.11**	0.07	**0.00**	0.00	**0.05**	0.05
Phyllospadix torreyi	**0.05**	0.05	**0.65**	0.40	**0.61**	0.54	**5.66**	1.60	**5.39**	1.60
Plocamium cartilageneum	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.11**	0.11	**0.21**	0.21
***Polysiphonia* spp.**	**3.77**	1.92	**0.33**	0.25	**0.11**	0.11	**0.18**	0.07	**0.00**	0.00
Pseudolithoderma nigra	**3.62**	1.46	**4.72**	1.85	**3.76**	1.09	**5.26**	0.76	**7.41**	0.92
Pterocladiella capillacea	**0.11**	0.11	**0.11**	0.11	**0.21**	0.15	**1.10**	0.48	**1.18**	0.76
Pterosiphonia baileyi	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.06**	0.06
Pterosiphonia dendroidea	**0.00**	0.00	**0.00**	0.00	**0.06**	0.06	**0.00**	0.00	**0.00**	0.00
Ralfsiaceae	**3.46**	0.43	**1.93**	0.92	**2.17**	1.10	**1.48**	0.28	**0.82**	0.30
Rhodymenia californica	**0.00**	0.00	**0.06**	0.06	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Sargassum aghardianum	**0.06**	0.06	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Sargassum muticum	**0.36**	0.23	**1.48**	0.66	**1.86**	0.38	**1.61**	0.74	**4.66**	0.22

	2003 Mean	2003 SE	**2007 Mean**	2007 SE	**2008 Mean**	2008 SE	**2012 Mean**	2012 SE	**2013 Mean**	2013 SE
Scytisiphon canaliculata	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.05**	0.05	**0.00**	0.00
Silvetia compressa	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.06**	0.06	**0.06**	0.06
Smithora naidum	**0.00**	0.00	**0.00**	0.00	**0.06**	0.06	**0.00**	0.00	**0.06**	0.06
Ulva californica	**7.59**	1.63	**8.17**	0.62	**1.36**	0.95	**11.09**	1.97	**3.56**	0.89
***Ulva intestinalis* and others**	**0.06**	0.06	**0.32**	0.13	**6.80**	1.96	**0.05**	0.05	**0.00**	0.00
Unidentified Red Species A	**0.00**	0.00	**0.05**	0.05	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Unidentified Red Species B	**0.00**	0.00	**0.00**	0.00	**0.05**	0.05	**0.00**	0.00	**0.00**	0.00
Fauna										
Agnathistoma eiseni	**0.00**	0.00	**0.11**	0.06	**0.12**	0.07	**0.11**	0.11	**0.22**	0.05
Anthopleura elegantissma	**0.80**	0.18	**1.00**	0.59	**0.50**	0.38	**1.27**	0.68	**1.59**	0.30
Anthopleura sola	**0.32**	0.15	**1.09**	0.47	**1.04**	0.29	**0.56**	0.09	**0.00**	0.00
Aplysia californica	**0.11**	0.11	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Balanus glandula	**1.51**	0.43	**0.18**	0.12	**0.31**	0.18	**0.12**	0.07	**0.00**	0.00
Chlorostoma aureotincta	**0.05**	0.05	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Chlorostoma funebralis	**0.00**	0.00	**0.11**	0.11	**0.06**	0.06	**0.16**	0.11	**0.00**	0.00
Chlorostoma galllina	**0.11**	0.11	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Chthamalus fissus/dalli	**0.72**	0.37	**0.49**	0.25	**0.29**	0.13	**1.35**	0.53	**0.89**	0.48
Conus californicus	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.06**	0.06
Epitonium/Opalia	**0.00**	0.00	**0.00**	0.00	**0.05**	0.05	**0.00**	0.00	**0.00**	0.00
Erect Bryozoan	**0.00**	0.00	**0.05**	0.05	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Fissurella volcano	**0.05**	0.05	**0.06**	0.06	**0.06**	0.06	**0.06**	0.06	**0.00**	0.00
Lepidochitona hartwegii	**0.00**	0.00	**0.00**	0.00	**0.11**	0.11	**0.00**	0.00	**0.00**	0.00
***Littorina* spp.**	**0.71**	0.33	**0.23**	0.11	**0.47**	0.22	**0.60**	0.36	**0.38**	0.31
Lottia digitalis	**0.05**	0.05	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Lottia gigantea	**0.06**	0.06	**0.23**	0.11	**0.23**	0.12	**0.23**	0.11	**0.17**	0.07
Lottia limatula	**0.28**	0.14	**0.17**	0.07	**0.28**	0.01	**0.65**	0.30	**0.12**	0.07
Lottia scabra/conus	**1.84**	0.72	**0.78**	0.15	**1.75**	0.19	**2.16**	1.08	**1.00**	0.37
Lottia strigatella	**0.12**	0.07	**0.11**	0.07	**0.45**	0.12	**0.79**	0.18	**0.11**	0.07

	2003 Mean	2003 SE	**2007 Mean**	2007 SE	**2008 Mean**	2008 SE	**2012 Mean**	2012 SE	**2013 Mean**	2013 SE
***Maxwellia*spp.**	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.06**	0.06
Mytilus californianus	**1.40**	0.51	**1.94**	0.49	**1.53**	0.64	**0.05**	0.05	**0.06**	0.06
Mytilus galloprovincialis	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Notoacmaea incessa	**0.05**	0.05	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
***Nuttalina* spp.**	**0.40**	0.14	**0.34**	0.11	**0.59**	0.22	**0.96**	0.12	**0.54**	0.28
Pachyprapsus crassipes	**0.00**	0.00	**0.05**	0.05	**0.11**	0.11	**0.05**	0.05	**0.00**	0.00
Pagurus samuelis	**0.06**	0.06	**0.16**	0.11	**0.05**	0.05	**0.12**	0.07	**0.00**	0.00
Phragmatopoma californica	**1.01**	0.68	**0.28**	0.14	**0.05**	0.05	**0.06**	0.06	**0.00**	0.00
Piddock unidentified	**0.00**	0.00	**0.00**	0.00	**0.19**	0.19	**0.00**	0.00	**0.00**	0.00
Psuedochema exogyra	**0.00**	0.00	**0.00**	0.00	**0.05**	0.05	**0.00**	0.00	**0.00**	0.00
***Pugettia* sp.**	**0.05**	0.05	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Rock boring clam unidentified	**0.00**	0.00	**0.00**	0.00	**0.05**	0.05	**0.00**	0.00	**0.00**	0.00
Septifer bifurcatus	**0.12**	0.07	**0.11**	0.11	**0.00**	0.00	**0.06**	0.06	**0.11**	0.11
Serpulorbis squamigerus	**0.11**	0.11	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
***Spirorbis* spp.**	**0.00**	0.00	**0.11**	0.07	**0.26**	0.26	**0.00**	0.00	**0.00**	0.00
Strongylocentrotus purpuratus	**1.87**	0.46	**0.53**	0.53	**0.37**	0.31	**0.80**	0.34	**0.05**	0.05
Tetraclita rubescens	**0.13**	0.13	**0.11**	0.07	**0.00**	0.00	**0.24**	0.12	**0.29**	0.13
Tidepool sculpin	**0.00**	0.00	**0.05**	0.05	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00
Tylodina fungina	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.00**	0.00	**0.06**	0.06
Total Biotic	**86.56**	9.81	**81.72**	3.88	**86.17**	5.84	**102.95**	5.14	**83.38**	5.21
Total Cover	**131.15**	6.73	**127.82**	3.66	**135.26**	5.99	**138.56**	3.76	**125.75**	3.64

Table 2. One Factor ANOVA p-values for a subset of species and grouped taxa based on functional groups and feeding guilds. Letters represent significantly similar groups determined using Tukey's multiple comparisons test with cover rankings A>B>C.

Species	***Corallina* spp.**	***Lithothrix aspergillum***	***Ulva californica***	***Caula. ustulatus***	***Psuedo. nigra***	***Gelidium* spp.**	**Crustose Coralline**	***Chondra. canalic.***	***Sargassum muticum***	***Mytilus cal.***	***Hypnea valentiae***	***Strongy. purpuratus***
p-value	0.642	0.014	<0.001	0.013	0.260	0.539	<0.001	0.573	<0.001	0.012	0.054	0.027
2003	A	B	AB	A	A	A	A	A	B	AB	B	A
2007	A	AB	AB	AB	A	A	B	A	B	A	AB	AB
2008	A	A	C	AB	A	A	B	A	B	AB	AB	AB
2012	A	A	A	A	A	A	B	A	B	B	AB	AB
2013	A	AB	BC	B	A	A	B	A	A	B	A	B

Grouped Taxa	**Abiotic**	**Erect Corallines**	**Filamentous -Like**	**Fleshy**	**Crustose**	**Blades**	**Tough and Leathery**	**Seagrass**	**Scavenger**	**Herbivore**	**Filter Feeder**	**Carnivore**
p-value	0.058	0.390	0.008	0.787	0.056	0.004	0.006	0.001	0.361	0.098	0.071	0.190
2003	AB	A	A	A	A	B	B	B	A	A	A	A
2007	AB	A	AB	A	AB	AB	AB	B	A	A	A	A
2008	A	A	AB	A	B	AB	AB	B	A	A	A	A
2012	B	A	AB	A	AB	A	A	A	A	A	A	A
2013	AB	A	B	A	AB	B	A	A	A	A	A	A

Table 3. Mean cover of macrophyte functional groups and faunal feeding guilds of 5 transect replicates (+/- SE) for the 5 sampling periods.

	2003 Mean	2003 SE	**2007 Mean**	2007 SE	**2008 Mean**	2008 SE	**2012 Mean**	2012 SE	**2013 Mean**	2013 SE
Macrophyte Functional Groups										
Blade	**8.0**	1.9	**9.2**	0.9	**9.9**	1.4	**15.0**	1.5	**6.2**	1.2
Crustose	**12.9**	1.9	**9.0**	1.3	**7.5**	0.7	**9.6**	0.5	**11.0**	1.3
Erect Coralline	**23.7**	4.0	**27.0**	2.3	**31.9**	2.9	**30.3**	2.9	**29.3**	2.8
Filamentous-like	**15.3**	1.8	**10.8**	1.1	**9.7**	1.9	**9.1**	2.1	**5.1**	1.1
Fleshy	**12.1**	3.9	**11.7**	1.5	**13.9**	2.8	**15.7**	1.9	**13.9**	1.4
Seagrass	**0.1**	0.1	**0.6**	0.4	**0.6**	0.5	**5.7**	1.6	**5.4**	1.6
Tough and Leathery	**2.5**	1.1	**5.0**	1.2	**3.9**	0.7	**7.2**	0.6	**6.8**	0.7
Faunal Feeding Guilds										
Carnivore	**0.0**	0.0	**0.0**	0.0	**0.1**	0.1	**0.0**	0.0	**0.2**	0.1
Herbivore	**5.7**	1.1	**2.7**	0.6	**4.5**	0.8	**6.5**	2.1	**2.6**	0.5
Filter Feeder	**5.0**	1.1	**3.3**	0.5	**2.7**	1.3	**1.9**	0.6	**1.4**	0.5
Scavenger	**1.2**	0.2	**2.3**	0.4	**1.7**	0.3	**2.0**	0.6	**1.6**	0.3

Table 4a. Mean abiotic and biotic cover over 1 foot tidal intervals from the highest zone (5 to 4 ft) to mid zone (3 to 2 ft).

Tidal Range:			**5 to 4 ft**					**4 to 3 ft**					**3 to 2 ft**		
	2003	**2007**	**2008**	**2012**	**2013**	**2003**	**2007**	**2008**	**2012**	**2013**	**2003**	**2007**	**2008**	**2012**	**2013**
Total abiotic	64.80	83.60	84.60	63.60	83.00	71.75	82.70	77.98	74.72	80.91	53.83	55.18	54.98	41.51	49.96
Macrophytes															
Acrosorum ciolatum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	1.29	0.50
Bossiella orbigniana	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00
***Bryopsis* spp.**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Caulacanthus ustulatus	12.60	1.00	4.50	6.40	2.60	8.67	1.19	4.89	5.19	0.25	8.44	9.12	4.56	8.97	4.42
Centroceras clavulatum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.50	0.44	0.00	0.22	1.00
Ceramium/Corallophila	0.00	0.00	0.00	0.00	0.00	0.29	0.00	1.00	0.00	0.00	0.22	0.67	0.44	1.54	1.11
Chaetomorpha linum	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00
Chondracanthus canaliculatus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90	0.25	2.19	0.97	1.57
Chondria achorizophora	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
***Cladophora* spp.**	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.00	0.00	0.25	0.40	1.11	0.00	0.50
Colpomenia peregrina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Colpomenia sinuosa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.25	0.00	0.50	0.00
Corallina chilensis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Corallina pinnatifolila/ vancouveriensis	5.10	3.50	5.00	5.00	4.50	4.78	1.72	3.79	0.86	2.68	13.01	13.94	19.16	20.79	18.56
Crustose Corallinaceae	0.00	0.50	0.00	2.40	0.00	1.51	0.25	1.07	1.86	2.73	6.31	3.30	1.24	2.08	4.46
Cryptopleura crispa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	1.58	0.67
Dictyopterus undulata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dictyota coriacea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00
Dictyota flabellata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
***Ectocarpus* spp.**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.00	0.00
Egregia menziesii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.67	0.44	0.47	1.00
Eisenia arborea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tidal Range:	5 to 4 ft					4 to 3 ft					3 to 2 ft				
	2003	2007	2008	2012	2013	2003	2007	2008	2012	2013	2003	2007	2008	2012	2013
Endarachne binghamiae	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00
Erythrocystis saccata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gastroclonium parvum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.25	0.00	0.25	0.00
Gelidium coulteri/pusillum	0.00	0.00	0.50	0.80	0.00	0.75	0.00	0.00	1.71	0.00	1.62	2.64	0.90	3.71	2.11
Halidrys dioica	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Haliptylon gracile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00
***Herposiphonia* spp.**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hesperophycus californicus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00
Hypnea valentiae	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.84	0.00	0.75
Jania crassa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Laurencia pacifica	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.47	0.72	1.61
Lithothrix aspergillum	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	1.37	2.17	2.52	2.25
Lomentaria hakodatensis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.25
Macrocystis pyrifera	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.25
Mazzaella affinus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00
Melobesia mediocris	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Osmundea sinicola	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.29	0.25	1.42	0.94	0.94	1.83
Petrospongium rugosum	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.29	0.00	0.94	0.22	0.25	0.00	0.00
Peyssonneliaceae	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.22	0.00	0.00
Phyllospadix torreyi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Plocamium cartilageneum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
***Polysiphonia* spp.**	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.36	0.25	0.00	0.00	0.00
Pseudolithoderma nigra	1.50	1.40	0.80	3.80	1.50	3.82	5.21	2.36	2.82	5.64	6.54	6.89	7.65	7.13	11.17
Pterocladiella capillacea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00
Pterosiphonia baileyi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pterosiphonia dendroidea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ralfsiaceae	1.80	0.40	0.40	5.90	2.50	1.79	0.57	0.86	3.41	0.00	5.24	3.14	1.47	0.89	1.87
Rhodymenia californica	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sargassum aghardianum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tidal Range:	5 to 4 ft					4 to 3 ft					3 to 2 ft				
	2003	2007	2008	2012	2013	2003	2007	2008	2012	2013	2003	2007	2008	2012	2013
Sargassum muticum	2.00	2.00	2.00	0.00	0.00	0.50	0.25	0.75	0.00	0.00	0.00	0.00	0.22	0.00	1.86
Scytisiphon canaliculata	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Silvetia compressa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.25	0.00
Smithora naidum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ulva californica	0.80	0.00	0.50	1.00	0.00	0.50	0.00	1.14	3.68	0.29	3.26	2.76	0.25	10.89	3.42
***Ulva intestinalis* and others**	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.30	0.00	0.00	0.00	0.65	5.40	0.00	0.00
Unidentified Red Species A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unidentified Red Species B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fauna															
Agnathistoma eiseni	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22
Anthopleura elegantissma	0.00	0.00	0.00	0.40	1.80	0.86	1.29	0.00	1.96	1.19	0.87	1.72	1.22	1.80	2.34
Anthopleura sola	0.00	0.50	0.50	0.50	0.00	0.29	0.40	1.00	0.29	0.00	0.00	0.62	0.65	1.27	0.00
Aplysia californica	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Balanus glandula	5.50	1.50	1.00	0.00	0.00	1.84	0.25	0.57	0.40	0.00	2.05	0.00	0.25	0.25	0.00
Chlorostoma aureotincta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chlorostoma funebralis	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.25	0.25	0.00	0.00	0.00	0.00	0.00	0.00
Chlorostoma galllina	0.00	0.00	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chthamalus fissus/dalli	2.10	2.30	0.90	7.00	1.00	2.79	2.00	0.00	1.07	1.45	0.25	0.25	0.25	0.72	0.00
Conus californicus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Epitonium/Opalia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00
Erect Bryozoan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fissurella volcano	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00
Lepidochitona hartwegii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.00
***Littorina* spp.**	2.80	3.00	2.40	1.00	1.60	0.57	0.00	0.54	1.39	2.00	0.47	0.00	0.25	0.69	0.25
Lottia digitalis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lottia gigantea	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.29	0.00	0.29	0.25	0.22	0.72	0.87	0.47
Lottia limatula	0.00	0.40	0.00	1.00	0.00	0.00	0.29	1.29	0.50	0.29	0.47	0.00	0.44	0.69	0.22
Lottia scabra/conus	2.40	0.40	1.00	2.80	2.50	2.43	0.54	2.81	2.25	1.36	2.36	0.89	2.48	2.89	1.29

Tidal Range:	5 to 4 ft					4 to 3 ft					3 to 2 ft				
	2003	**2007**	**2008**	**2012**	**2013**	**2003**	**2007**	**2008**	**2012**	**2013**	**2003**	**2007**	**2008**	**2012**	**2013**
Lottia strigatella	0.00	0.00	0.40	0.00	0.50	0.00	0.00	1.79	0.29	0.00	0.47	0.00	0.47	1.84	0.00
***Maxwellia*spp.**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25
Mytilus californianus	1.40	0.00	0.00	0.00	0.00	0.57	1.71	1.14	0.00	0.00	3.93	4.71	3.14	0.00	0.25
Mytilus galloprovincialis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Notoacmaea incessa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
***Nuttalina* spp.**	0.00	0.00	0.00	1.90	0.00	0.25	0.00	0.29	0.29	0.50	0.25	0.47	0.69	2.01	0.69
Pachyprapsus crassipes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.29	0.00	0.00	0.22	0.22	0.00	0.00
Pagurus samuelis	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.67	0.00	0.47	0.00
Phragmatopoma californica	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.22	0.00
Piddock unidentified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00
Psuedochema exogyra	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00
***Pugettia* sp.**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rock boring clam unidentified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00
Septifer bifurcatus	0.50	1.00	0.00	0.00	0.00	0.25	0.25	0.00	0.00	0.40	0.00	0.00	0.00	0.22	0.00
Serpulorbis squamigerus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
***Spirorbis* spp.**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.00	0.00	0.00
Strongylocentrotus purpuratus	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.67	0.00	0.00	1.83	0.00
Tetraclita rubescens	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.72	0.22
Tidepool sculpin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tylodina fungina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00
Total Biotic	42.0	18.9	20.9	41.3	19.3	35.4	16.2	28.2	28.8	20.2	63.2	59.7	64.7	83.8	67.4
Total Cover	106.8	102.5	105.5	104.9	102.3	107.1	98.9	106.2	103.5	101.1	117.1	114.9	119.6	125.3	117.3

Table 4b. Mean abiotic and biotic cover over 1 foot tidal intervals from the mid zone (2 to 1 ft) to low zone (0 to -1 ft).

Tidal Range:	2 to 1 ft					1 to 0 ft					0 to -1 ft				
	2003	**2007**	**2008**	**2012**	**2013**	**2003**	**2007**	**2008**	**2012**	**2013**	**2003**	**2007**	**2008**	**2012**	**2013**
Total abiotic	35.04	32.82	42.34	23.90	29.03	19.09	10.34	16.77	8.14	12.49	28.67	7.78	16.00	3.33	1.11
Macrophytes															
Acrosorum ciolatum	0.00	0.00	0.14	3.23	0.92	0.00	0.00	1.26	4.89	1.43	0.00	0.00	2.44	19.11	3.33
Bossihella orbigniana	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.29	0.00	1.11	0.00	0.00	0.00	0.67
***Bryopsis* spp.**	1.00	0.00	0.14	0.00	0.00	0.40	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00
Caulacanthus ustulatus	8.93	10.47	4.61	7.33	4.03	3.69	1.17	3.71	4.69	0.69	0.00	0.00	0.00	0.00	0.00
Centroceras clavulatum	1.48	0.00	0.46	0.13	0.71	1.71	2.14	0.00	0.57	0.57	6.00	6.67	0.00	0.00	1.11
Ceramium/Corallophila	1.65	2.35	1.35	1.13	1.07	2.69	11.26	0.29	4.40	0.20	0.00	20.00	0.00	0.67	7.78
Chaetomorpha linum	1.00	0.50	0.00	0.13	0.13	3.14	0.40	0.20	0.00	0.00	3.33	0.00	0.00	0.00	0.00
Chondracanthus canaliculatus	2.28	1.54	4.22	6.85	2.41	4.77	5.37	6.37	13.46	4.37	0.00	3.33	0.00	3.11	12.00
Chondria achorizophora	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.77	1.29	0.00	0.00	0.67	1.11	2.22	0.00
***Cladophora* spp.**	0.00	2.91	3.27	0.63	1.06	0.49	3.23	6.09	0.69	0.49	0.00	0.00	2.22	0.67	0.00
Colpomenia peregrina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00
Colpomenia sinuosa	0.38	0.44	0.00	0.00	0.00	1.97	1.77	0.20	0.00	0.00	0.00	0.67	0.00	0.00	0.00
Corallina chilensis	0.00	0.00	0.00	2.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Corallina pinnatifolila/ vancouveriensis	28.91	24.74	25.43	26.72	28.28	41.23	34.34	38.40	22.31	27.97	20.89	47.33	28.00	10.67	18.22
Crustose Corallinaceae	5.65	2.68	2.38	3.33	2.14	9.66	2.00	1.60	1.89	1.00	14.44	6.67	0.67	1.33	1.33
Cryptopleura crispa	0.29	0.63	0.66	0.52	1.21	0.80	3.06	3.43	1.06	2.89	0.67	0.67	4.67	5.56	9.33
Dictyopterus undulata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.00	0.00	0.00	0.67	0.00	0.00	2.00
Dictyota coriacea	0.14	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.60	0.00	0.00	0.00	3.11	1.11
Dictyota flabellata	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.67	0.00	0.00	0.00
***Ectocarpus* spp.**	0.00	0.00	0.35	0.00	0.44	0.00	0.00	5.63	0.00	0.00	0.00	0.00	18.89	0.00	0.00
Egregia menziesii	0.66	4.22	0.64	1.83	1.44	8.23	10.40	3.69	15.03	3.40	0.00	10.89	2.89	7.56	8.00
Eisenia arborea	0.00	0.22	0.29	0.00	0.00	0.00	0.80	0.29	0.00	0.00	0.00	4.67	0.00	0.00	0.00

Tidal Range:	2 to 1 ft					1 to 0 ft					0 to -1 ft				
	2003	2007	2008	2012	2013	2003	2007	2008	2012	2013	2003	2007	2008	2012	2013
Endarachne binghamiae	0.00	0.33	0.00	0.13	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Erythrocystis saccata	0.00	0.25	0.00	0.00	0.47	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.00
Gastroclonium parvum	5.22	0.37	0.25	0.27	0.14	3.14	1.20	0.80	0.20	1.00	0.67	0.00	0.00	0.00	0.00
Gelidium coulteri/pusillum	7.95	10.45	8.76	10.52	5.47	5.51	11.23	6.74	8.86	7.71	3.33	4.00	9.11	1.78	14.00
Halidrys dioica	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.33	0.67
Haliptylon gracile	0.00	0.00	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
***Herposiphonia* spp.**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hesperophycus californicus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hypnea valentiae	0.00	0.69	1.25	1.35	3.95	0.00	1.29	2.80	2.74	2.43	0.00	1.33	8.22	8.67	12.89
Jania crassa	0.00	0.13	0.00	0.22	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Laurencia pacifica	0.62	1.32	0.68	2.63	3.38	1.09	1.97	0.00	0.00	3.71	1.78	1.11	0.67	0.67	0.00
Lithothrix aspergillum	2.82	5.62	8.15	12.88	11.86	2.51	29.06	33.46	33.60	20.66	2.22	20.89	42.00	47.11	36.22
Lomentaria hakodatensis	0.00	0.35	2.98	1.64	0.44	0.00	2.29	7.57	1.97	2.40	0.00	0.67	1.78	1.33	0.00
Macrocystis pyrifera	0.00	0.00	0.00	2.00	0.22	0.00	0.00	0.89	6.29	0.00	0.00	0.00	4.44	7.33	0.00
Mazzaella affinus	0.33	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00
Melobesia mediocris	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.29	0.00	0.00	0.00	7.78	0.00
Osmundea sinicola	4.21	2.90	1.82	0.71	1.38	1.86	2.83	3.46	1.49	1.46	0.00	0.67	12.67	0.67	3.33
Petrospongium rugosum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peyssonneliaceae	0.14	0.00	0.00	0.00	0.00	0.20	0.00	0.20	0.00	0.00	0.00	0.67	0.00	0.00	0.67
Phyllospadix torreyi	0.00	0.63	0.00	3.55	4.38	0.29	1.49	2.00	13.43	14.17	0.00	0.00	0.67	51.11	26.22
Plocamium cartilageneum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.33	2.67
***Polysiphonia* spp.**	3.85	0.00	0.00	0.14	0.00	5.94	1.20	0.40	1.00	0.00	18.89	1.33	0.00	1.11	0.00
Pseudolithoderma nigra	4.88	6.78	3.60	6.46	8.42	2.20	1.71	3.97	4.80	8.54	0.67	0.00	0.00	0.00	0.00
Pterocladiella capillacea	0.14	0.25	0.27	1.54	0.97	0.20	0.00	0.57	2.57	2.97	0.00	0.00	0.00	2.67	6.44
Pterosiphonia baileyi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00
Pterosiphonia dendroidea	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ralfsiaceae	4.45	3.32	4.27	0.87	0.54	1.86	1.60	0.29	0.49	0.20	2.00	0.00	0.00	0.00	0.00
Rhodymenia californica	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.11	0.00	0.00	0.00
Sargassum aghardianum	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tidal Range:	2 to 1 ft					1 to 0 ft					0 to -1 ft				
	2003	2007	2008	2012	2013	2003	2007	2008	2012	2013	2003	2007	2008	2012	2013
Sargassum muticum	0.44	1.81	2.33	3.75	9.48	0.00	4.77	3.94	1.94	6.31	0.00	2.67	1.33	1.33	3.33
Scytisiphon canaliculata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Silvetia compressa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Smithora naidum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	1.11
Ulva californica	12.12	12.74	1.48	15.18	4.56	12.46	17.89	3.20	16.03	6.57	11.11	12.22	3.33	2.00	2.22
***Ulva intestinalis* and others**	0.00	0.38	9.76	0.13	0.00	0.00	0.60	11.17	0.00	0.00	1.11	0.00	4.00	0.00	0.00
Unidentified Red Species A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00
Unidentified Red Species B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fauna															
Agnathistoma eiseni	0.00	0.13	0.25	0.25	0.38	0.00	0.00	1.00	0.00	0.20	0.00	0.67	0.00	0.00	0.00
Anthopleura elegantissma	0.51	1.14	0.78	1.52	2.07	0.49	0.57	0.00	0.00	0.77	2.44	0.00	0.00	0.00	0.00
Anthopleura sola	0.38	1.70	1.26	0.58	0.00	0.60	1.77	1.89	0.29	0.00	0.00	2.44	1.11	0.00	0.00
Aplysia californica	0.00	0.00	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Balanus glandula	0.60	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chlorostoma aureotincta	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chlorostoma funebralis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chlorostoma galllina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chthamalus fissus/dalli	0.25	0.13	0.38	0.57	0.62	0.00	0.00	0.00	0.29	1.20	0.00	0.00	0.00	0.00	0.00
Conus californicus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00
Epitonium/Opalia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Erect Bryozoan	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fissurella volcano	0.25	0.00	0.00	0.00	0.00	0.00	0.29	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lepidochitona hartwegii	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
***Littorina* spp.**	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lottia digitalis	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lottia gigantea	0.00	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00
Lottia limatula	0.47	0.14	0.14	1.00	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lottia scabra/conus	2.03	1.07	1.45	1.57	0.67	0.80	0.40	0.69	0.60	0.00	0.00	0.00	0.00	0.00	0.00

Tidal Range:	2 to 1 ft					1 to 0 ft					0 to -1 ft				
	2003	**2007**	**2008**	**2012**	**2013**	**2003**	**2007**	**2008**	**2012**	**2013**	**2003**	**2007**	**2008**	**2012**	**2013**
Lottia strigatella	0.00	0.46	0.25	0.88	0.14	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00
***Maxwellia*spp.**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mytilus californianus	1.54	1.70	1.51	0.13	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.67	0.67	0.00	0.00
Mytilus galloprovincialis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Notoacmaea incessa	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
***Nuttalina* spp.**	0.85	0.46	0.98	0.37	0.37	0.00	0.29	0.20	0.49	2.00	0.00	3.33	0.00	0.00	0.00
Pachyprapsus crassipes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pagurus samuelis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phragmatopoma californica	0.64	1.10	0.13	0.00	0.00	3.26	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.00
Piddock unidentified	0.00	0.00	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Psuedochema exogyra	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
***Pugettia* sp.**	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rock boring clam unidentified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Septifer bifurcatus	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Serpulorbis squamigerus	0.00	0.00	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
***Spirorbis* spp.**	0.00	0.00	0.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Strongylocentrotus purpuratus	0.55	0.50	0.00	0.00	0.00	7.06	0.00	0.00	0.00	0.00	6.67	5.33	5.11	9.33	0.67
Tetraclita rubescens	0.00	0.46	0.00	0.14	0.25	0.00	0.00	0.00	0.00	2.29	0.00	0.00	0.00	0.00	0.00
Tidepool sculpin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00
Tylodina fungina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Biotic	109.4	108.5	99.1	125.4	104.1	130.1	160.3	160.9	169.4	128.9	101.3	164.0	156.0	199.6	175.33
Total Cover	144.5	141.3	141.4	149.3	133.2	149.1	170.6	177.7	177.5	141.4	130.0	171.8	172.0	202.9	176.44

Table 5. Results of Similarities Percentage (SIMPER) tests for multivariate statistical analyses. Indicated is the dissimilarity comparison (%) between yearly sampling and the species that contribute >5% of the dissimilarity. Also reported is the average percent cover ("ave abund") for those species in each yearly comparison.

Groups 2003 & 2007						
Average dissimilarity = 29.42	Group 2003	Group 2007				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Total Abiotic	44.62	46.10	2.92	1.44	9.91	9.91
Lithothrix aspergillum	1.54	8.48	2.68	2.27	9.12	19.04
Corallina pinnatifolila/ vancouveriensis	22.10	18.28	2.51	1.17	8.53	27.57
Pseudolithoderma nigra	3.62	4.72	1.49	1.22	5.06	32.63
Groups 2003 & 2008						
Average dissimilarity = 36.67	Group 2003	Group 2008				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Lithothrix aspergillum	1.54	11.80	3.82	1.82	10.40	10.40
Total Abiotic	44.62	49.08	3.51	1.44	9.56	19.96
Ulva intestinalis and others	0.06	6.80	2.51	1.70	6.84	26.80
Ulva californica	7.56	1.34	2.38	1.99	6.49	33.29
Corallina pinnatifolila/ vancouveriensis	22.10	20.06	2.26	1.35	6.17	39.46
Groups 2007 & 2008						
Average dissimilarity = 27.79	Group 2007	Group 2008				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Total Abiotic	46.1	49.08	2.63	1.26	9.45	9.45
Ulva californica	8.18	1.34	2.59	3.02	9.32	18.77
Ulva intestinalis and others	0.32	6.80	2.48	1.75	8.92	27.69
Lithothrix aspergillum	8.48	11.8	2.14	1.42	7.72	35.40
Groups 2003 & 2012						
Average dissimilarity = 36.64	Group 2003	Group 2012				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Total Abiotic	44.62	35.58	4.09	1.51	11.17	11.17
Lithothrix aspergillum	1.54	11.50	3.71	1.65	10.11	21.28
Corallina pinnatifolila/ vancouveriensis	22.10	17.62	2.46	1.17	6.72	27.99
Phyllospadix torreyi	0.06	5.66	2.11	1.64	5.75	33.74
Ulva californica	7.56	11.08	1.95	1.40	5.32	39.06

Groups 2007 & 2012

Average dissimilarity = 29.52	Group 2007	Group 2012				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Total Abiotic	46.10	35.58	3.95	1.70	13.40	13.40
Lithothrix aspergillum	8.48	11.50	1.96	1.09	6.63	20.03
Phyllospadix torreyi	0.66	5.66	1.90	1.45	6.45	26.48
Ulva californica	8.18	11.08	1.65	1.73	5.58	32.06

Groups 2008 & 2012

Average dissimilarity = 34.79	Group 2008	Group 2012				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Total Abiotic	49.08	35.58	4.94	1.67	14.21	14.21
Ulva californica	1.34	11.08	3.54	2.20	10.19	24.40
Ulva intestinalis and others	6.80	0.06	2.44	1.71	7.01	31.41
Lithothrix aspergillum	11.80	11.50	2.32	1.30	6.67	38.09
Phyllospadix torreyi	0.62	5.66	1.91	1.49	5.50	43.58

Groups 2003 & 2013

Average dissimilarity = 36.53	Group 2003	Group 2013				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Lithothrix aspergillum	1.54	9.94	3.27	1.99	8.95	8.95
Total Abiotic	44.62	42.38	3.10	1.35	8.48	17.43
Corallina pinnatifolila/ vancouveriensis	22.10	19.34	2.73	1.26	7.47	24.90
Phyllospadix torreyi	0.06	5.40	2.10	1.61	5.76	30.66
Caulacanthus ustulatus	7.52	2.58	1.93	2.69	5.27	35.93

Groups 2007 & 2013

Average dissimilarity = 27.44	Group 2007	Group 2013				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Total Abiotic	46.1	42.38	2.45	1.35	8.94	8.94
Phyllospadix torreyi	0.66	5.40	1.97	1.61	7.18	16.13
Corallina pinnatifolila/ vancouveriensis	18.28	19.34	1.85	1.36	6.73	22.86
Ulva californica	8.18	3.56	1.83	2.04	6.69	29.54
Pseudolithoderma nigra	4.72	7.40	1.68	1.82	6.10	35.65
Lithothrix aspergillum	8.48	9.94	1.62	1.46	5.91	41.56

Groups 2008 & 2013

Average dissimilarity = 29.90	Group 2008	Group 2013				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Total Abiotic	49.08	42.38	3.37	1.36	11.27	11.27
Ulva intestinalis and others	6.80	0.00	2.57	1.70	8.59	19.86
Lithothrix aspergillum	11.80	9.94	2.21	1.44	7.39	27.25
Phyllospadix torreyi	0.62	5.40	1.94	1.54	6.48	33.73
Corallina pinnatifolila/ vancouveriensis	20.06	19.34	1.67	1.87	5.58	39.31

Groups 2012 & 2013

Average dissimilarity = 28.91	Group 2012	Group 2013				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Total Abiotic	35.58	42.38	3.15	1.63	10.89	10.89
Ulva californica	11.08	3.56	2.89	1.79	10.00	20.89
Lithothrix aspergillum	11.50	9.94	2.26	1.49	7.81	28.70
Caulacanthus ustulatus	6.92	2.58	1.87	1.57	6.46	35.17
Corallina pinnatifolila/ vancouveriensis	17.62	19.34	1.77	1.36	6.12	41.29

Table 6. Results of Similarities Percentage (SIMPER) tests for multivariate statistical analyses. Indicated is the dissimilarity comparison (%) between yearly sampling and the functional groups that contribute >10% of the dissimilarity. Also reported is the average percent cover ("ave abund") for those groups of taxa in each yearly comparison.

Groups 2003 & 2007						
Average dissimilarity = 18.23	Group 2003	Group 2007				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Erect Coralline	23.7	27.02	3.23	1.57	17.71	17.71
Abiotic	44.62	46.1	2.92	1.44	16	33.71
Fleshy	12.1	11.8	2.81	2.01	15.39	49.1
Filamentous-like	15.32	10.8	1.97	1.36	10.79	59.89
Groups 2003 & 2008						
Average dissimilarity = 20.34	Group 2003	Group 2008				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Erect Coralline	23.7	31.86	4.07	1.47	20.03	20.03
Abiotic	44.62	49.08	3.51	1.44	17.23	37.27
Fleshy	12.1	13.86	3.03	1.5	14.91	52.18
Filamentous-like	15.32	9.72	2.51	1.61	12.36	64.54
Groups 2007 & 2008						
Average dissimilarity = 14.29	Group 2007	Group 2008				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Erect Coralline	27.02	31.86	2.77	1.46	19.38	19.38
Abiotic	46.1	49.08	2.63	1.26	18.39	37.76
Fleshy	11.8	13.86	1.97	1.26	13.78	51.54
Filamentous-like	10.8	9.72	1.46	1.53	10.2	61.74
Groups 2003 & 2012						
Average dissimilarity = 24.34	Group 2003	Group 2012				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Abiotic	44.62	35.58	4.09	1.51	16.81	16.81
Erect Coralline	23.7	30.24	3.72	1.45	15.3	32.11
Fleshy	12.1	15.8	3.06	1.8	12.58	44.69
Blade	8.02	14.98	2.73	1.56	11.23	55.93
Filamentous-like	15.32	9.14	2.5	1.33	10.25	66.18

Groups 2007 & 2012

Average dissimilarity = 18.65	Group 2007	Group 2012				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Abiotic	46.1	35.58	3.95	1.7	21.21	21.21
Erect Coralline	27.02	30.24	2.44	1.34	13.1	34.31
Blade	9.22	14.98	2.21	1.82	11.87	46.18
Seagrass	0.66	5.66	1.9	1.45	10.21	56.39
Fleshy	11.8	15.8	1.9	1.43	10.21	66.6

Groups 2008 & 2012

Average dissimilarity = 19.92	Group 2008	Group 2012				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Abiotic	49.08	35.58	4.94	1.67	24.82	24.82
Erect Coralline	31.86	30.24	2.58	1.47	12.95	37.77
Fleshy	13.86	15.8	2.16	1.47	10.83	48.61
Blade	9.84	14.98	2.06	1.55	10.36	58.97

Groups 2003 & 2013

Average dissimilarity = 23.71	Group 2003	Group 2013				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Filamentous-like	15.32	5.16	3.96	2.27	16.69	16.69
Erect Coralline	23.7	29.34	3.71	1.47	15.67	32.36
Abiotic	44.62	42.38	3.1	1.35	13.07	45.43
Fleshy	12.1	13.86	3.02	2.41	12.74	58.17

Groups 2007 & 2013

Average dissimilarity = 16.02	Group 2007	Group 2013				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Abiotic	46.1	42.38	2.45	1.35	15.32	15.32
Erect Coralline	27.02	29.34	2.39	1.35	14.94	30.27
Filamentous-like	10.8	5.16	2.23	1.79	13.94	44.2
Seagrass	0.66	5.4	1.97	1.61	12.3	56.51

Groups 2008 & 2013

Average dissimilarity = 18.09	Group 2008	Group 2013				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Abiotic	49.08	42.38	3.37	1.36	18.62	18.62
Erect Coralline	31.86	29.34	2.67	1.43	14.74	33.36
Fleshy	13.86	13.86	1.98	1.4	10.93	44.29
Seagrass	0.62	5.4	1.94	1.54	10.7	54.99
Filamentous-like	9.72	5.16	1.87	1.19	10.32	65.31

Groups 2012 & 2013

Average dissimilarity = 18.03	Group 2012	Group 2013				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Blade	14.98	6.22	3.31	2.22	18.39	18.39
Abiotic	35.58	42.38	3.15	1.63	17.46	35.85
Erect Coralline	30.24	29.34	2.52	1.4	13.96	49.81
Filamentous-like	9.14	5.16	2	1.56	11.09	60.9

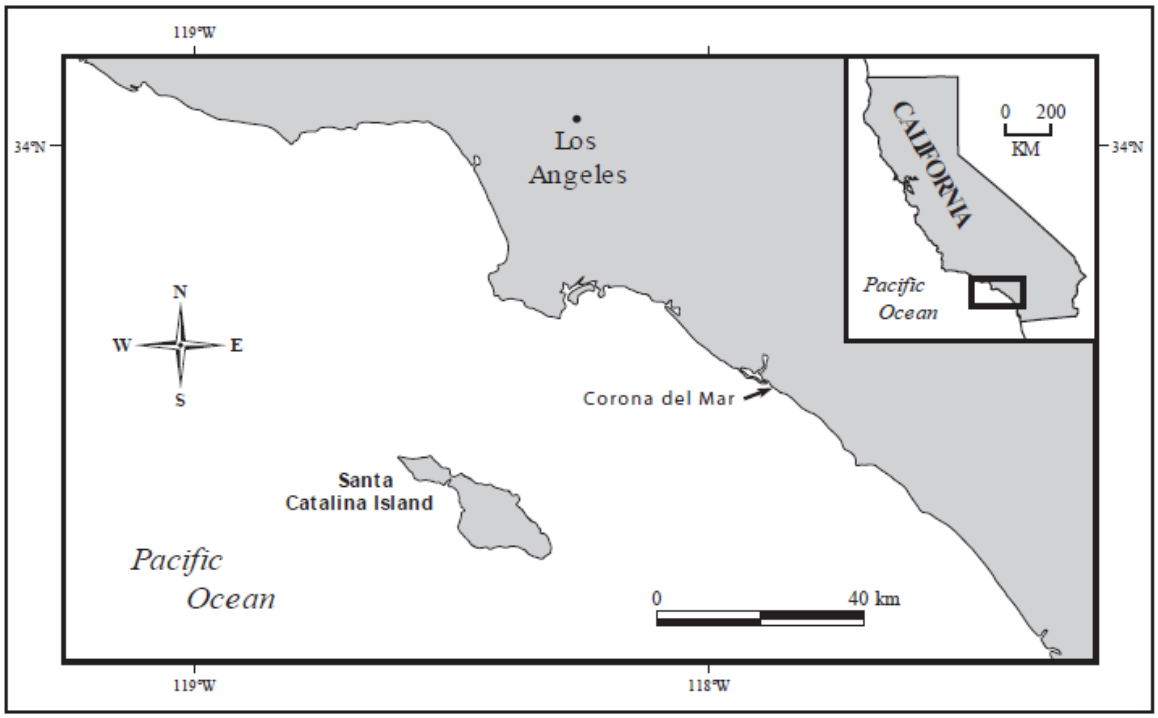

Figure 1. Map of southern California and location of Little Corona del Mar in Newport Beach, CA.

Figure 2. Five permanent transect lines established at Little Corona del Mar in Newport Beach, CA.

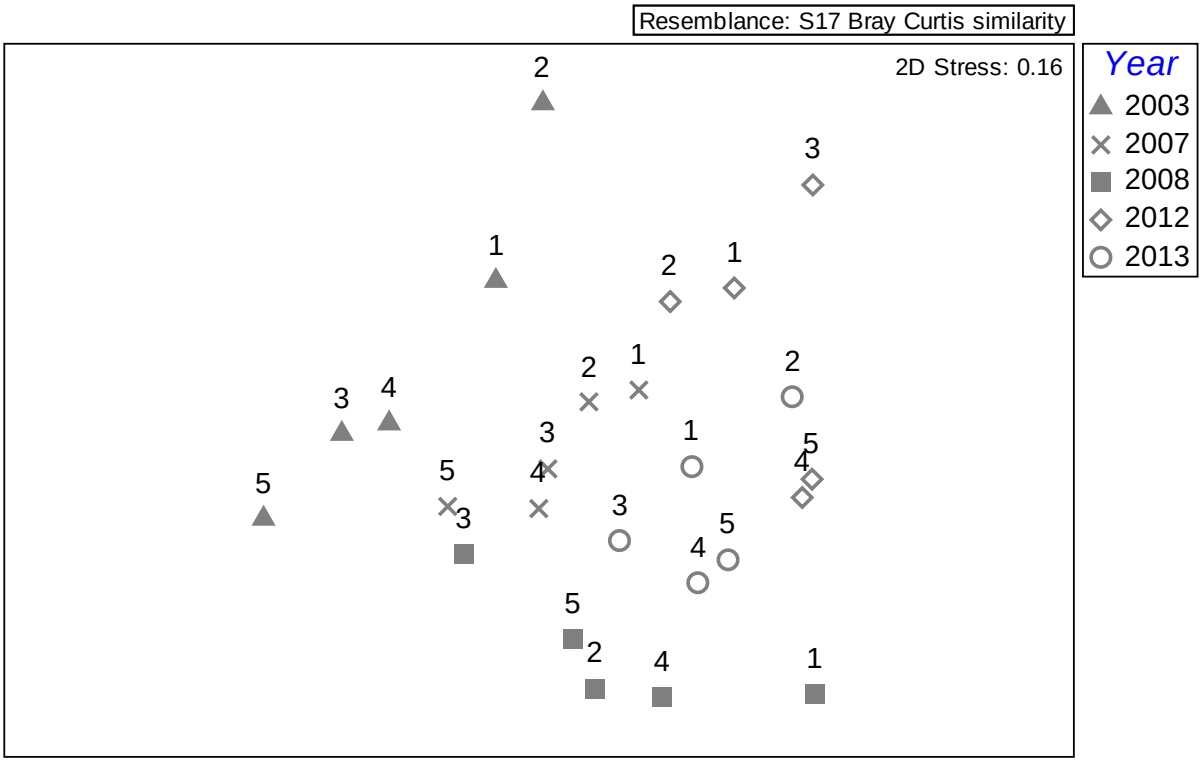

Figure 3. Multi-dimensional scaling plot of community composition using species data. Indicated are the transect lines (1 through 5) for each of the 5 sampling years. ANOSIM analysis reveals significant differences among all sampling years (Global R=0.602, p=0.001).

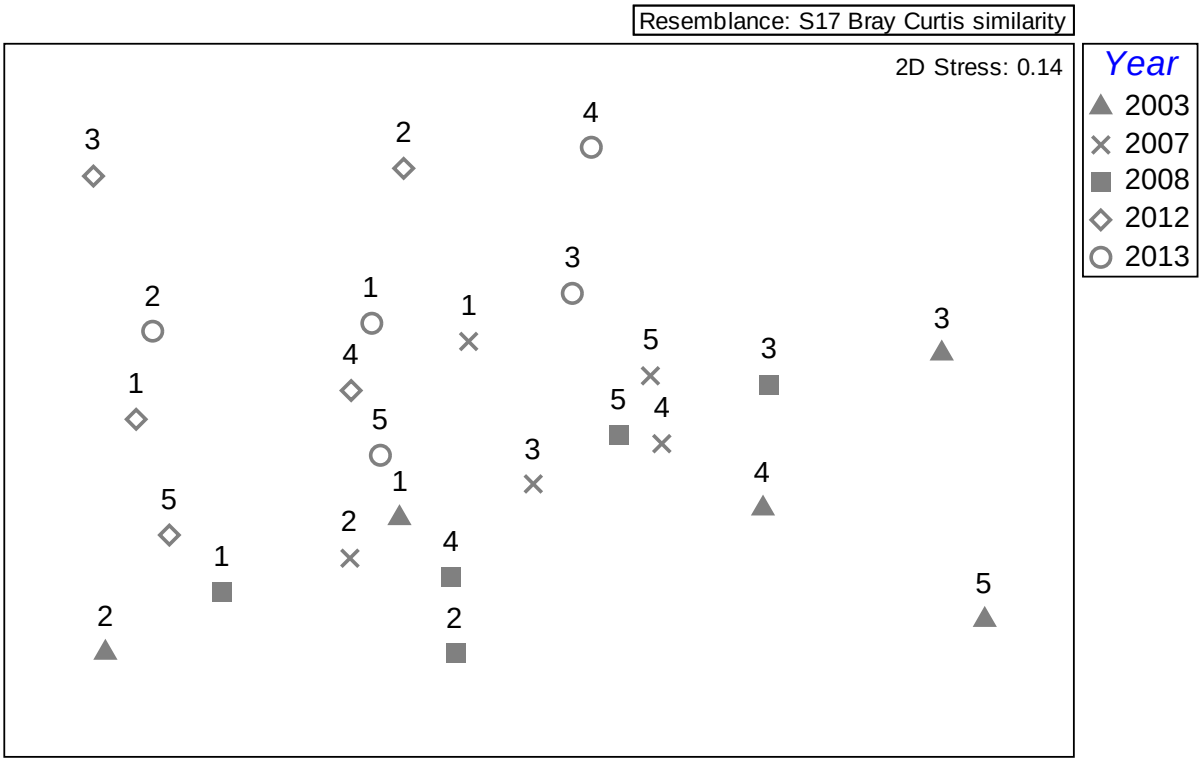

Figure 4. Multi-dimensional scaling plot of community composition using taxa groupings based on functional groups and feeding guilds. Indicated are the transect lines (1 through 5) for each of the 5 sampling years. ANOSIM analysis reveals significant differences among sampling years (Global R=0.270, p=0.003). Sampling years 2003, 2007, and 2008 group together as similar while 2012 and 2013 were similar to each other but significantly different from the first 3 years.

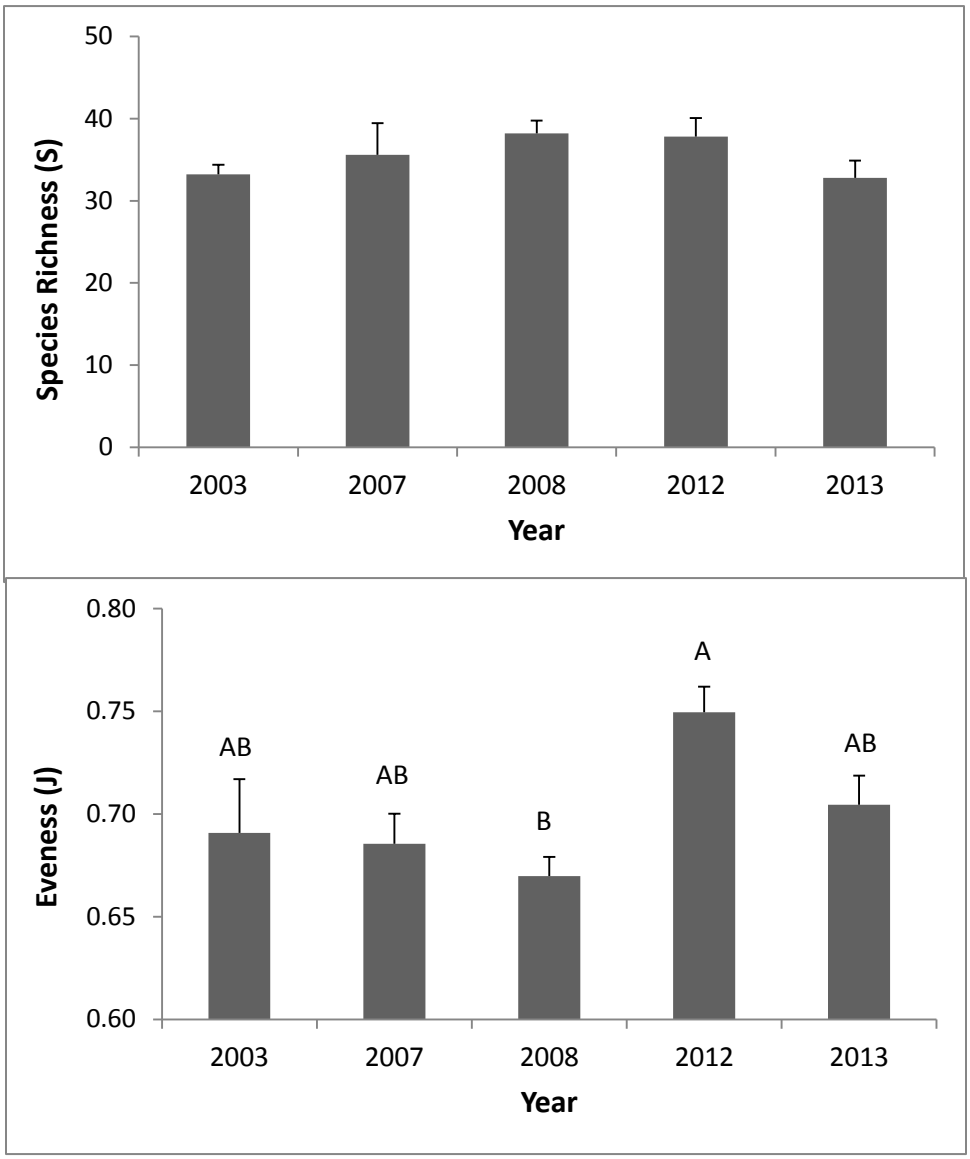

Figure 5. Mean (+/- SE) species richness (S) and Pielou's Evenness (J) for each of the five sampling years. Species richness was similar among years (ANOVA, p=0.375) while evenness varied significantly (ANOVA, p=0.027) with the letters above the bars representing significantly similar groups based on Tukey's multiple comparisons test.