Appendix A. Seven tables summarizing study site characteristics, multivariate analyses of how community structure varied with spatial/temporal scales, analyses of variance tests of spatial and temporal variation in environmental factors, variance components from univariate tests of relation between driving variables and spatio-temporal variation, RDA loadings, PERMANOVA analysis of the relation between multivariate community structure and driving variables, and path analysis.

TABLE A1. Study site names and coordinates. Abbreviated cape and site codes are shown in parentheses. Tokatee Klootchman has been referred to as "Gull Haven" in prior publications.

Cape	Site	Latitude	Longitude
Foulweather (CF)	Fogarty Creek (FC)	44.83748	-124.05922
	Boiler Bay (BB)	44.83146	-124.06053
	Manipulation Bay (MB)	44.82950	-124.06280
Perpetua (CP)	Yachats Beach (YB)	44.31926	-124.10885
	Strawberry Hill (SH)	44.24994	-124.11538
	Tokatee Klootchman (TK)	44.20456	-124.11659
Blanco (CB)	Cape Blanco North (CBN)	42.83970	-124.56510
	Cape Blanco South (CBS)	42.83440	-124.56530
	Port Orford Head (POH)	42.74289	-124.51940
	Rocky Point (RP)	42.71918	-124.46746
Mendocino (CMe)	Cape Mendocino North (CMeN)	40.34965	-124.36345
	Cape Mendocino South (CMeS)	40.34164	-124.35970
	Kibesillah Hill (KH)	39.60380	-123.79830

TABLE A2. Multivariate analysis of variance testing the effect of cape, year, cape x year, and site nested within cape on A. community structure (abundance of barnacles, mussels, understory and canopy), B. abundance of most abundant sessile invertebrate taxa, and C. abundance of most abundant macrophyte taxa in the annual surveys. NA = not applicable due to significance of factors that supersede linear contrasts.

Analysis	Response	Factors	df	Wilks' λ	F	p	Linear contrasts
A. Total community structure							
MANOVA	Community Structure (covers of barnacles, mussels, canopy, and understory)	Cape	12, 191	0.09043	23.53	**<0.0001**	NA
		Year	8, 144	0.64709	4.38	**<0.0001**	NA
		Cape x Year	24, 252	0.43217	2.86	**<0.0001**	$CF_{06,09,10} \neq CP_{06,09,10}$ $CF_{06,09,10} \neq CB_{06,09,10}$ $CF_{06,09,10} = CMe_{06,09,10}$ $CP_{06,09,10} \neq CB_{06,09,10}$ $CP_{06,09,10} \neq CMe_{06,09,10}$ $CB_{06,09} \neq CMe_{06,09}$ $CB_{10} = CMe_{10}$
		Site (Cape)	36, 272	0.14663	5.05	**<0.0001**	CF: FC $\neq$ BB FC = MB BB $\neq$ MB CP: YB $\neq$ SH YB $\neq$ TK SH $\neq$ TK CB: CBN $\neq$ CBS CBN $\neq$ POH CBN = RP CBS = POH CBS = RP POH $\neq$ RP CM: CMeN = CMeS CMeN $\neq$ KH CMeS $\neq$ KH
B. Sessile invertebrate abundance.							
MANOVA	Sessile invertebrates (*B. glandula, C. dalli, P. polymerus, B. nubilus*, mussels)	Cape	15, 196	0.04565	26.96	**<0.0001**	NA
		Year	10, 142	0.45339	6.89	**<0.0001**	NA
		Cape x year	30, 286	0.33544	2.99	**<0.0001**	$CF_{06,09,10} \neq CP_{06,09,10}$ $CF_{06,10} = CB_{06,10}$ $CF_{09} \neq CP_{09}$ $CF_{06,09,10} = CMe_{06,09,10}$

			df		F	p	
							$CP_{06,09,10} \neq CB_{06,09,10}$
							$CP_{06,09,10} \neq CMe_{06,09,10}$
							$CB_{06,10} = CMe_{06,10}$
							$CB_{09} \neq CMe_{09}$
		Site(cape)	45, 321	0.01742	10.50	**<0.0001**	CF: FC = BB
							FC = MB
							BB = MB
							CP: YB $\neq$ SH
							YB $\neq$ TK
							SH $\neq$ TK
							CB: CBN = CBS
							CBN = POH
							CBN $\neq$ RP
							CBS = POH
							CBS = RP
							POH = RP
							CM: CMeN = CMeS
							CMeN = KH
							CMeS = KH

C. Abundance of macrophytes

			df		F	p	
MANOVA	Macrophytes (*S. sessilus, P. scouleri,* coralline turfs)	Cape	9, 178	0.22231	16.89	**<0.0001**	CF $\neq$ CP
							CF $\neq$ CB
							CF $\neq$ CM
							CP $\neq$ CB
							CP $\neq$ CMe
							CB $\neq$ CMe
		Year	6, 146	0.91680	1.08	0.38	NA
		Cape x year	18, 207	0.72555	1.38	0.14	NA
		Site (cape)	27, 214	0.24272	4.94	**<0.0001**	CF: FC $\neq$ BB
							FC = MB
							BB $\neq$ MB
							CP: YB $\neq$ SH
							YB $\neq$ TK
							SH = TK
							CB: CBN $\neq$ CBS
							CBN $\neq$ POH
							CBN = RP
							CBS $\neq$ POH
							CBS $\neq$ RP
							POH $\neq$ RP
							CM: CMeN = CMeS
							CMeN = KH
							CMeS $\neq$ KH

TABLE A3. Summary of analyses of variance testing effects of cape, year, cape x year (meso-scale and temporal variation) and site nested within cape (local-scale variation) on environmental factors.

Factor	Test	Variable	F	p	df	Adj R_2	Ranking (linear constrasts)
Upwelling	2-way ANOVA	Cape	178.3	**<0.0001**	3, 370		CM>CB>CP>CV
		Year	7.26	**<0.0001**	4, 370		
		Cape x year	0.99	>0.05	12, 370	0.585	
Air Temp	Nested 3-way ANOVA	Cape	2.05	0.11	3, 426		
		Year	32.67	**<0.0001**	3, 426		2007>2009>2010>2008
		Cape x year	1.36	0.20	9, 426		
		Site[cape]	1.95	**0.043**	9, 426	0.187	
Air Temp Coefficient of Variation	Nested 3-way ANOVA	Cape	12.46	**<0.0001**	3, 426		CM=CB>CP=CF
		Year	5.58	**0.0009**	3, 426		
		Cape x year	0.74	0.67	9, 426		
		Site[cape]	8.59	**<0.0001**	9, 426	0.236	
Water Temp	Nested 3-way ANOVA	Cape	5.23	**0.0015**	3, 426		CM=CP=CF>CB
		Year	29.07	**<0.0001**	3, 426		2007>2009=2010>2008
		Cape x year	1.54	0.13	9, 426		
		Site[cape]	1.13	0.33	9, 426	0.172	
Water Temp Coefficient of Variation	Nested 3-way ANOVA	Cape	0.47	0.72	3, 426		
		Year	31.93	**<0.0001**	3, 426		2007>2008>2010>2009
		Cape x year	1.38	0.19	9, 426		

Response		Factor					
		Site[cape]	7.30	**<0.0001**	9, 426	0.300	
Nitrate + nitrite	Nested 3-way ANOVA	Cape	12.86	**<0.0001**	3, 317		CM>CB=CF>CP
		Year	16.85	**<0.0001**	2, 317		2008>2009>2010
		Cape x year	1.00	0.43	6, 317		
		Site[cape]	0.48	0.89	9, 426	0.185	
Chlorophyll-a (fluorometer)	1-way ANOVA	Cape	4.48	**0.015**	3, 19	0.322	CP=CB>CF=CM
Chlorophyll-a (bottle samples)	1-way ANOVA	Cape	18.30	**<0.0001**	3, 57	0.464	CP=CB>CF=CM
Chlorophyll-a	Nested 3-way ANOVA	Cape	30.72	**<0.0001**	3, 457		CP=CB>CF=CM
		Year	32.00	**<0.0001**	2, 457		2008>2009=2010
		Cape x year	2.68	**0.015**	6, 457		
		Site[cape]	0.19	1.39	9, 457	0.267	
Barnacle recruitment	Nested 3-way ANOVA	Cape	40.15	**<0.0001**	3, 193		CF=CP>CB>CM
		Year	12.86	**<0.0001**	2, 193		2009>2010=2008
		Cape x year	1.70	0.12	6, 193		
		Site[cape]	6.66	**<0.0001**	9, 193	0.501	
Mussel recruitment	Nested 3-way ANOVA	Cape	57.94	**<0.0001**	3, 260		CP>CF=CB>CM
		Year	0.18	0.10	3, 260		
		Cape x year	0.58	0.74	6, 260		
		Site[cape]	10.77	**<0.0001**	9, 260	0.502	

TABLE A4. Variance components (% of total variance) for responses of oceanographic, environmental, and ecological subsidy factors to spatial and temporal scales. NA = not provided by the analysis.

Response	factors	Variance components	Adj R^2	p	n
Upwelling	Cape	63.55	0.5854	<0.0001	370
	Year	3.14		<0.0001	

	Year*cape	0.00		0.99	
Air Temperature (CV)	Cape	3.70	0.2614	0.21	495
	Site(cape)	19.05		<0.0001	
	Year	3.16		0.007	
	Year*cape	0.00		0.87	
Water Temperature (CV)	Cape	0.00	0.3394	0.80	495
	Site(cape)	10.29		<0.0001	
	Year	25.28		0.0002	
	Year*cape	0.74		0.19	
Nitrate + nitrite	Cape	6.39	0.1402	0.03	442
	Site(cape)	0.00		0.63	
	Year	10.71		0.0005	
	Year*cape	0.00		0.74	
Chlorophyll-a	Cape	18.34	0.2652	0.0001	624
	Site(cape)	1.01		0.09	
	Year	6.94		0.002	
	Year*cape	2.49		0.016	
Barnacle recruitment	Cape	33.45	0.5367	NA	214
	Site(cape)	14.88		NA	
	Year	7.50		NA	
	Year*cape	1.85		NA	
Mussel recruitment	Cape	30.39	0.4524	NA	399
	Site(cape)	19.46		NA	
	Year	0.31		NA	
	Year*cape	0.00		NA	

TABLE A5. RDA loadings for partitioning of variance among factors.

Factor	RDA1	RDA2	RDA3	RDA4	RDA5	RDA6	RDA7
[chl-a]	0.557	0.216	0.618	-0.417	0.270	-0.061	0.055
NO3	-0.091	0.545	-0.340	-0.041	0.646	-0.141	-0.357
Barnacle rec	0.504	-0.116	-0.068	-0.212	-0.737	0.286	-0.150
Mussel rec	0.739	-0.270	-0.076	-0.309	-0.299	0.197	0.376
Air temp	-0.287	-0.390	-0.073	-0.161	-0.198	-0.107	-0.239
Upwelling	-0.134	0.204	-0.262	-0.160	0.510	-0.595	-0.477
Water temp	-0.158	-0.817	-0.153	0.083	-0.114	0.247	-0.328
Shelf width	0.846	-0.442	0.111	0.198	-0.186	-0.012	0.017

TABLE A6. PERMANOVA test of the effect of local-scale spatial location, temporal variation, and environmental factors on *observed* community structure (at the functional group level) as quantified in the annual community surveys. Significant p-values are shown in bold. See text for explanation of local measures of each factor for this table and those below. In all analyses, nitrate, chlorophyll-a, and recruitment rates were ln-transformed $[\ln(x + 1)]$ for analysis.

Factor	df	SS	MS	F	R^2	P value
Mean upwelling	1	0.327003	0.327003	22.36	0.0698	**0.001**
Upwelling SD	1	0.737209	0.737209	50.41	0.1573	**0.001**
Mean air T	1	0.626689	0.626689	42.86	0.1337	**0.001**
Mean water T	1	0.088281	0.088281	6.04	0.0188	**0.003**
Mean air T>25	1	0.203266	0.203266	13.90	0.0434	**0.001**
NO_3	1	0.108462	0.108462	7.42	0.0231	**0.024**
Phytoplankton	1	0.323526	0.323526	22.12	0.0690	**0.001**
Barnacle recruitment	1	0.212820	0.212820	14.55	0.0454	**0.002**

Mussel recruitment	1	0.219172	0.219172	14.99	0.0468	**0.001**
Year	3	0.783295	0.261098	17.86	0.1671	**0.001**
Cape	3	0.513955	0.171318	11.72	0.1096	**0.001**
Cape(site)	9	0.339166	0.037685	2.58	0.0724	**0.011**
Residuals	14	0.204722	0.014623		0.0437	
Total	38	4.687568			1	

TABLE A7. Path analysis summary for survey dataset (AIC = 114.8, AICc = -1003.2, model χ^2= 37, *p* value = 0.1, df = 27). *P* > 0.05 indicates that observed and modeled covariance matrices were not different and hence the model is robust.

Path Segment	Estimate	Std Error	*z* value	*p* value
$NO_3 \rightarrow$Chl-a	0.550156	0.260829	2.109	**0.0349**
Ses inv→Predators	0.487919	0.145462	3.354	**0.0008**
Chl-a→Ses inv	0.281484	0.115711	2.433	**0.0150**
Canopy→Algal Turf	0.398886	0.144747	2.756	**0.0059**
Upw→NO_3	0.693968	0.097356	7.128	**<0.0001**
Upw→Recruitment	-0.357220	0.172555	-2.070	**0.0386**
Water T→Herbivores	-0.406113	0.133021	-3.053	**0.0022**
Shelf Width→ Upw	-0.347701	0.156268	-2.225	**0.0261**
Shelf Width→NO_3	-0.284699	0.097356	-2.924	**0.0035**
Shelf Width→Recruitment	0.759960	0.141708	5.363	**<0.0001**
Shelf Width→Ses inv	0.433081	0.163782	2.644	**0.0082**
Shelf Width→Canopy	-0.37182	0.178558	-2.082	**0.0373**

Shelf Width→Chl-a	0.582265	0.169492	3.435	**0.0006**
Chl-a→Algal Turf	-0.37387	0.12047	-3.103	**0.0019**
Ses inv→Canopy	-0.45369	0.15802	-2.871	**0.0041**