

## **Final Report**

### **CHANGES IN ROCKY SUBTIDAL COMMUNITIES WITHIN A GRADIENT OF SEA OTTER PREDATION ALONG THE OLYMPIC PENINSULA COAST, WASHINGTON STATE**

Rikk G. Kvitek<sup>1</sup>, David Shull<sup>2</sup>, Don Canestro<sup>3</sup>, Ed Bowlby<sup>4</sup> and Barry Troutman<sup>4</sup>

February 17, 1988

#### **1987 Cooperative Agreement between**

**Olympic National Park,  
Washington State Department of Wildlife  
and**

**Rikk G. Kvitek**  
Zoology Dept. NJ-15  
University of Washington  
Seattle, WA 98195  
(206) 543-1649

#### **Project Officers**

##### **Olympic National Park**

Bruce Moorhead  
Olympic National Park  
600 Park Avenue  
Port Angeles, WA 98362  
(206) 452-4501

##### **Washington Dept. Wildlife**

Steve Jeffries  
Washington Dept. Wildlife  
7801 Phillips Rd.  
Tacoma, WA 98498  
(206) 964-7278

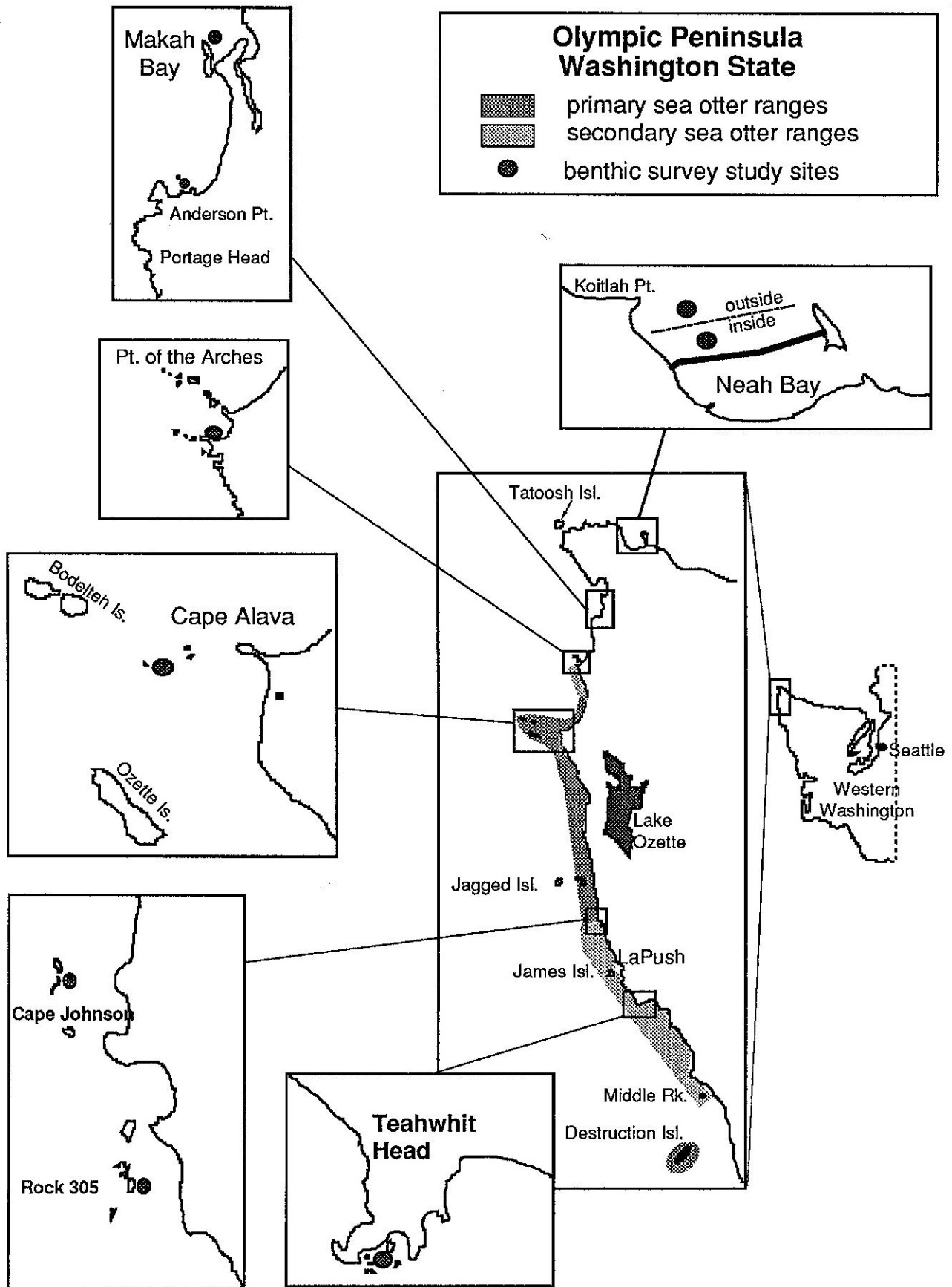
---

<sup>1</sup> Zoology Dept., NJ-15, University of Washington, Seattle, WA 98195 (206) 543-1649

<sup>2</sup> Oceanography Dept., University of Washington, Seattle, WA 98195

<sup>3</sup> Biological Sciences, University of California, Santa Barbara, CA

<sup>4</sup> Washington State Dept. Wildlife, 7801 Phillips Rd., Tacoma, WA, 98498



### Appendix

**Table 1.** Taxonomic abbreviation codes for species names listed in the appendix tables.

<b>Group</b>	<b>Code</b>	<b>Species</b>
brown algae	Ld	<i>Laminaria dentigera</i>
	Lg	<i>Laminaria groenlandica</i>
	Mi	<i>Macrocystis integrifolia</i>
	Nl	<i>Nereocystis lutkeana</i>
	Pc	<i>Pterygophora californica</i>
crabs	C sp	<i>Cancer</i> sp.
	Sa	<i>Scyra acutifrons</i>
tunicate	Sm	<i>Styela montereyensis</i>
sea stars	Di	<i>Dermasterias imbricata</i>
	Et	<i>Evasterias troschelii</i>
	Hi	<i>Henricia leviuscula</i>
	Lh	<i>Leptasteria hexactis</i>
	Ok	<i>Orthasterias koehleri</i>
	Ph	<i>Pycnopodia helianthoides</i>
	Po	<i>Pisaster ochraceus</i>
	So d	<i>Solaster dawsoni</i>
	Ss	<i>Solaster stimpsoni</i>
	Sd	<i>Strongylocentrotus droebachiensis</i>
urchins	Sf	<i>Strongylocentrotus franciscanus</i>
	Sp	<i>Strongylocentrotus purpuratus</i>
cucumbers	Cm	<i>Cucumaria miniata</i>
	Eq	<i>Eupentacta quinquesemita</i>
gastropods	Tb	<i>Tegula brunnea</i>
	Cl	<i>Calliostoma ligatum</i>
	Cf	<i>Ceratostoma foliatum</i>
	Ol	<i>Ocenebra lurida</i>
limpets	Am	<i>Acmaea mitra</i>
	Ci	<i>Collisella instabilis</i>
	Da	<i>Diodora aspera</i>
chitons	Cs	<i>Cryptochiton stellaris</i>
	MI	<i>Mopalia lignosa</i>
	Pv	<i>Placiphorella velata</i>
	Tl	<i>Tonicella lineata</i>
bivalves	Hg	<i>Hinnites giganteus</i>

### Appendix

**Table 2.** Invertebrate abundances measured along transects at Olympic Peninsula study sites (means and SD's). (N = number of square meter quadrats, ns = not sampled). See taxonomic abbreviation key for species names (appendix table 1).

		Invertebrate Species Abundances (ind/m <sup>2</sup> )											
	N	crab		tunicate	sea stars								
		Sa	C sp	Sm	Di	Et	Hi	Lh	Ok	Ph	Po	So d	Ss
Neah Bay (inside)	50												
mean		0	0	0	0.06	0	0.24	0	0.14	0.22	0.02	0	0
SD		(0.0)	(0.0)	(0.0)	(0.2)	(0.0)	(0.5)	(0.0)	(0.4)	(0.5)	(0.1)	(0.0)	(0.0)
Neah Bay (outside)	50												
mean		0	0	0	0.10	0	0.20	0	0.12	0.28	0.04	0.02	0
SD		(0.0)	(0.0)	(0.0)	(0.3)	(0.0)	(0.5)	(0.0)	(0.4)	(0.6)	(0.3)	(0.1)	(0.0)
Makah Bay	49												
mean		0	0	0.1	0	0	0.18	0.04	0	0.02	0.06	0	0
SD		(0.0)	(0.0)	(0.4)	(0.0)	(0.0)	(0.4)	(0.2)	(0.0)	(0.1)	(0.2)	(0.0)	(0.0)
Anderson Pt.	99												
mean		0	0	0.47	0.08	0.01	0.21	0.04	0	0.11	0.01	0	0
SD		(0.0)	(0.0)	(0.9)	(0.3)	(0.1)	(0.5)	(0.2)	(0.0)	(0.3)	(0.1)	(0.0)	(0.0)
Pt. of Arches	35												
mean		0	0	0	0	0	0.1	0	0	0	0	0	0
SD		(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.3)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
Cape Alava	100												
mean		0.17	0.01	0.39	0	0.16	0.35	0.56	0	0.05	0.1	0	0
SD		(0.5)	(0.1)	(0.6)	(0.0)	(0.5)	(0.7)	(1.2)	(0.0)	(0.2)	(0.4)	(0.0)	(0.0)
Cape Johnson	50												
mean		0	0	0.52	0.02	0.06	0.14	0.02	0	0.06	0	0	0.02
SD		(0.0)	(0.0)	(1.0)	(0.1)	(0.2)	(0.4)	(0.1)	(0.0)	(0.2)	(0.0)	(0.0)	(0.1)
Rock 305	50												
mean		0.02	0	1.96	0	0.08	0.36	0.1	0	0.02	0.04	0.02	0
SD		(0.1)	(0.0)	(2.3)	(0.0)	(0.3)	(0.7)	(0.6)	(0.0)	(0.1)	(0.2)	(0.1)	(0.0)
Teahwhit Head	100												
mean		0.14	0.01	0.56	0.03	0.07	0.51	0.12	0	0.01	0.13	0.01	0
SD		(0.5)	(0.1)	(0.9)	(0.2)	(0.3)	(0.9)	(0.6)	(0.0)	(0.1)	(0.4)	(0.1)	(0.0)

## Appendix

Table 2. (continued)

Invertebrate Species Abundances (ind/m<sup>2</sup>)

Site	N	urchins			cucumbers			gastropods				limpets			chitons				bivalve
		Sd	Sf	Sp	Cm	Eq	Sc	Tb	Cl	Cf	Ng	Am	Cl	Da	Cs	MI	Pv	TI	Hg
<b>Neah Bay (inside)</b>																			
mean	50	0	21.1	0	0	0	0.24				0.70	ns	ns	0.24	0.04	ns	ns	ns	0
SD		(0.0)	(9.4)	(0.0)	(0.0)	(0.0)	(0.6)				(2.2)			(0.6)	(0.2)				(0.0)
<b>Neah Bay (outside)</b>																			
mean	50	0.46	12.3	0	0	0	0.36					ns	ns	0.40	0.04	ns	ns	ns	0
SD		(0.9)	(9.7)	(0.0)	(0.0)	(0.0)	(0.7)							(0.9)	(0.2)				(0.0)
<b>Makah Bay</b>																			
mean	49	0	6.7	0.39	0.1	0	0	0.08	0.51	0	0	0.43	0.08	0.16	0.06	0.04	0	0.29	0.02
SD		(0.0)	(3.6)	(0.8)	(0.3)	(0.0)	(0.0)	(0.4)	(1.7)	(0.0)	(0.0)	(0.6)	(0.4)	(0.4)	(0.2)	(0.2)	(0.0)	(0.7)	(0.1)
<b>Anderson Pt.</b>																			
mean	99	0	3.3	0	0.27	0	0.03	0	0.18	0.03	0.08	0.06	0	0	0.02	0	0	0.04	0
SD		(0.0)	(2.6)	(0.0)	(0.6)	(0.0)	(0.2)	(0.0)	(0.7)	(0.2)	(0.3)	(0.3)	(0.0)	(0.0)	(0.1)	(0.0)	(0.0)	(0.2)	(0.0)
<b>Pt. of Arches</b>																			
mean	35	0	4.4	0	0	0	0	0	0	0	0	0	0	0	0.11	0	0	0	0
SD		(0.0)	(5.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.3)	(0.0)	(0.0)	(0.0)	(0.0)
<b>Cape Alava</b>																			
mean	100	0.04	0.02	0.43	0.93	0.06	0	0.37	3.16	0.35	0.1	0.14	0.25	0.26	0	0.19	0.01	0.39	0.03
SD		(0.3)	(0.1)	(1.8)	(1.7)	(0.2)	(0.0)	(1.4)	(4.1)	(0.7)	(0.6)	(0.4)	(1.0)	(0.6)	(0.0)	(0.4)	(0.1)	(0.6)	(0.2)
<b>Cape Johnson</b>																			
mean	50	0.02	0	0.1	0.22	0	0	0.02	0.1	0.04	0.16	0.02	0.12	0.02	0.02	0.1	0.02	0.08	0.14
SD		(0.1)	(0.0)	(0.5)	(0.8)	(0.0)	(0.0)	(0.1)	(0.4)	(0.2)	(0.4)	(0.1)	(0.4)	(0.1)	(0.1)	(0.3)	(0.1)	(0.3)	(0.8)
<b>Rock 305</b>																			
mean	50	0.04	0.1	0.34	1.06	0	0	0	0.56	0.3	0.32	0.48	0.42	0.06	0.1	0.06	0.06	0.18	0.1
SD		(0.2)	(0.3)	(1.0)	(1.8)	(0.0)	(0.0)	(0.0)	(1.4)	(0.9)	(0.8)	(1.0)	(1.4)	(0.2)	(0.3)	(0.2)	(0.2)	(0.7)	(0.4)
<b>Teahwhit Head</b>																			
mean	100	0.05	0.22	0.06	1.31	0	0	0	1.26	0.2	0.55	0.03	0.01	0.02	0.26	0.03	0.02	0.05	0.19
SD		(0.2)	(0.6)	(0.3)	(2.2)	(0.0)	(0.0)	(0.0)	(2.2)	(0.5)	(2.7)	(0.2)	(0.1)	(0.1)	(0.5)	(0.2)	(0.1)	(0.4)	(0.5)

## Appendix

**Table 4.** All species listed below were observed at least once during the subtidal survey between Teahwhit Head to the south and Makah Bay to the north. Relative abundances are based on the following rankings of encounters per dive: r = rare (< 1/dive); p = present (1-5/dive); c = common (5-50/dive); a = abundant (50-100/dive); very abundant (>100/dive).

### Faunal Species Observed and their Relative Abundances

species	relative abundance	notes
<b>Brachiopods</b>		
<i>Terebratalia transversa</i>	r	
<b>Bryozoans</b>		
<i>Aglaoephenia</i> spp.	p	
<b>Cnidarians</b>		
<b>Anthozoans</b>		
<i>Anthopleura elegantissima</i>	p	
<i>Anthopleura xanthogrammica</i>	c	
<i>Balanophyllia elegans</i>	c	
<i>Corynactis californica</i>	r	
<i>Epiactis proliferata</i>	p	
<i>Gersemia rubiformis</i>	p	
<i>Metridium senile</i>	r	
<i>Urticina crassicornis</i>	p	
<i>Urticina lofotensis</i>	r	
<b>Scyphozoans</b>		
<i>Thaumatoscyphus hexaradiatus</i>	p	
<b>Crustaceans</b>		
<i>Amphithoe</i> sp.	r	
<i>Balanus</i> sp.	p	
<i>Cancer oregonensis</i>	c	(generally found only in rock burrow holes inaccessible to sea otters)
<i>Cryptolithodes</i> spp.	r	
Hermit crabs	c	
<i>Idotea resecata</i>	r	
<i>Mimulus foliatus</i>	r	
<i>Pandalus</i> sp.	r	
<i>Scyra acutifrons</i>	p-c	
<b>Echinoderms</b>		
<b>Asteroids</b>		
<i>Dermasterias imbricata</i>	p	
<i>Evasterias troschelii</i>	c	
<i>Henricia leviuscula</i>	c	
<i>Leptasterias hexactis</i>	c	
<i>Orthasterias koehleri</i>	r	
<i>Patiria miniata</i>	r	
<i>Pisaster ochraceas</i>	p	

## Appendix

Table 4. (continued)

species	relative abundance	notes
<i>Pycnopodia helianthoides</i>	p	
<i>Solaster dawsoni</i>	r	
<i>Solaster stimpsoni</i>	p	
<b>Sea Urchins</b>		
<i>Strongylocentrotus drobachiensis</i>	p	
<i>Strongylocentrotus franciscanus</i>	r-v	
<i>Strongylocentrotus purpuratus</i>	p	(generally found only in rock burrow holes inaccessible to sea otters)
<b>Sea Cucumbers</b>		
<i>Cucumaria miniata</i>	a	
<i>Eupentacta quinquesemita</i>	p	
<i>Stichopus californicus</i>	r-c	
<b>Ophiuroids</b>	p	
<b>Hydrozoans</b>		
<i>Allepore porphyra</i>	r	
<i>Tubularia crocea</i>	p	
<b>Molluscs</b>		
<b>Gastropods</b>		
<i>Amphissa columbiana</i>	p	
<i>Calliostoma ligatum</i>	c	
<i>Ceratostoma foliatum</i>	c	
<i>Crepidula adunca</i>	p	
<i>Ocenebra lurida</i>	p	
<i>Opalia chacei</i>	p	
<i>Searlesia dira</i>	r	
<i>Tegula brunnea</i>	p	
<b>Chitons</b>		
<i>Cryptochiton stelleri</i>	p	
<i>Mopalia lignosa</i>	p-c	
<i>Placiphorella velata</i>	p	
<i>Tonicella lineata</i>	p	
<b>Limpets</b>		
<i>Acmaea mitra</i>	c	
<i>Colisella instabilis</i>	c	
<i>Diodora aspera</i>	c	
<b>Nudibranchs</b>		
<i>Anisidoris nobilis</i>	p	
<i>Antiopella barbarensis</i>	p	
<i>Archidoris montereyensis</i>	c	
<i>Archidoris odhneri</i>	p	
<i>Dirona albolineata</i>	p	
<i>Laila cockerelli</i>	p	
<i>Triopha catalinae</i>	c	
<i>Tritonia festiva</i>	p	

## Appendix

Table 4. (continued)

species	relative abundance	notes
<b>Bivalves</b>		
<i>Hinnites giganteus</i>	p	
<b>Nemerteans spp.</b>	p	
<b>Polychaetes</b>		
<i>Dodecaceria fewkesi</i>	p	
<i>Eudistylia</i> spp.	p	
<i>Myxicola infundibulum</i>	p	
<i>Phragmatopoma californica</i>	p	
<b>Sponges</b>		
<i>Tetilla arb</i>	p	
<i>Isodictya quatsinoensis</i>	p	
<b>Tunicates</b>		
<i>Styela montereyensis</i>	a	
<i>Perophora annectens</i>	p	
<i>Metanfrocampa taylori</i>	p	
<b>Fish</b>		
<i>Damalichthys vacca</i>	r	
<i>Embiotica lateralis</i>	p	
<i>Gibbonsia</i> spp.	r	
<i>Gobieosox</i> spp.	r	
<i>Hexagrammos decagrammus</i>	c	
<i>Ophiodon elongatus</i>	p	
<i>Oxylebius pictus</i>	r	
<i>Scorpaenichthys marmoratus</i>	p	
<i>Sebastes auriculatus</i>	r	
<i>S. caurinus</i>	r	
<i>S. melanops</i>	c	
<i>S. nebulosus</i>	p	



Transect spp. abundance data summary ONP Aug '87  
Species abundance (individuals/square meter) at each study site

Transect Summary sheet 87

#1112

		M brown algae						crab						tunicate stars						urchins						cucumbers						gastropods						Time	
Neck Bay (in)		Ld	Lg	Ml	Ml	Pc	Ttl	Se	Cap	Ttl	Sm	Di	Et	Hi	Lh	Ok	Ph	Pa	Se	d	Se	Ttl	Sd	Sf	Sp	Ttl	Cm	Eq	Sc	Ttl	Tb	Cl	Cf	Ac	Ttl	Am			
mean	50	ns	ns	ns	ns	ns	ns	0.00	0.00	0.00	0.00	0.06	0.00	0.24	0.00	0.14	0.22	0.02	0.00	0.00	0.68	0.00	2.14	0.00	2.14	0.00	0.00	0.00	0.24	0.24						0.70 ns			
SD								0.00	0.00	0.00	0.00	0.24	0.00	0.48	0.00	0.35	0.45	0.14	0.00	0.00	0.71	0.00	9.36	0.00	9.36	0.00	0.00	0.00	0.39	0.59						2.17			
total								0	0	0	0	3	0	12	0	7	11	1	0	0	34	0	1057	0	1057	0	0	12	12							35			
Neck Bay (out)		Ld	Lg	Ml	Ml	Pc	Ttl	Se	Cap	Ttl	Sm	Di	Et	Hi	Lh	Ok	Ph	Pa	Se	d <td>Se</td> <td>Ttl</td> <td>Sd</td> <td>Sf</td> <td>Sp</td> <td>Ttl</td> <td>Cm</td> <td>Eq</td> <td>Sc</td> <td>Ttl</td> <td>Tb</td> <td>Cl</td> <td>Cf</td> <td>Ac</td> <td>Ttl</td> <td>Am</td>	Se	Ttl	Sd	Sf	Sp	Ttl	Cm	Eq	Sc	Ttl	Tb	Cl	Cf	Ac	Ttl	Am			
mean	50	ns	ns	ns	ns	ns	ns	0.00	0.00	0.00	0.00	0.10	0.00	0.20	0.00	0.12	0.28	0.04	0.02	0.00	0.76	0.46	12.30	0.00	12.76	0.00	0.00	0.36	0.36						0.56 ns				
SD								0.00	0.00	0.00	0.00	0.30	0.00	0.45	0.00	0.39	0.57	0.28	0.14	0.00	0.80	0.91	9.86	0.00	9.93	0.00	0.00	0.66	0.66						1.07				
total								0	0	0	0	5	0	10	0	6	14	2	1	0	38	23	615	0	638	0	0	18	18						28				
Deep Bay Is.		Ld	Lg	Ml	Ml	Pc	Ttl	Se	Cap	Ttl	Sm	Di	Et	Hi	Lh	Ok	Ph	Pa	Se	d <td>Se</td> <td>Ttl</td> <td>Sd</td> <td>Sf</td> <td>Sp</td> <td>Ttl</td> <td>Cm</td> <td>Eq</td> <td>Sc</td> <td>Ttl</td> <td>Tb</td> <td>Cl</td> <td>Cf</td> <td>Ac</td> <td>Ttl</td> <td>Am</td>	Se	Ttl	Sd	Sf	Sp	Ttl	Cm	Eq	Sc	Ttl	Tb	Cl	Cf	Ac	Ttl	Am			
mean	99		1.92		0.34	0.45	2.72	0.00	0	0	0.47	0.08	0.01	0.21	0.04		0.11	0.01	0	0	0.44	0	3.333	0	3.333	0.27	0	0.03	0.3	0	0.18	0.03	0.08	0.29	0.03				
SD			10.5		0.99	2.27	11.1	0.00	0	0	0.94	0.27	0.1	0.46	0.2		0.35	0.1	0	0	0.67	0	2.611	0	2.611	0.59	0	0.17	0.61	0	0.66	0.17	0.28	0.7	0.31				
total			190		34	45	269	0.00	0	0	47	8	1	21	2		11	1	0	0	44	0	330	0	330	27	0	3	30	0	18	3	8	29	1				
Seas Rocks		Ld	Lg	Ml	Ml	Pc	Ttl	Se	Cap	Ttl	Sm	Di	Et	Hi	Lh	Ok	Ph	Pa	Se	d <td>Se</td> <td>Ttl</td> <td>Sd</td> <td>Sf</td> <td>Sp</td> <td>Ttl</td> <td>Cm</td> <td>Eq</td> <td>Sc</td> <td>Ttl</td> <td>Tb</td> <td>Cl</td> <td>Cf</td> <td>Ac</td> <td>Ttl</td> <td>Am</td>	Se	Ttl	Sd	Sf	Sp	Ttl	Cm	Eq	Sc	Ttl	Tb	Cl	Cf	Ac	Ttl	Am			
mean	49		0.1	0.92		0.16	0.04	1.22	0.00	0	0	0.1	0	0	0.18	0.04		0.02	0.06	0	0	0.31	0	6.694	0.39	7.082	0.1	0	0	0.1	0.08	0.51	0	0	0.59	0.43			
SD			0.51	4.58		0.9	0.2	5.54	0.00	0	0	0.37	0	0	0.44	0.2		0.14	0.24	0	0	0.51	0	3.63	0.84	3.894	0.31	0	0	0.31	0.45	1.68	0	0	1.72	0.61			
total			5	45		8	2	60	0.00	0	0	5	0	0	9	2		1	3	0	0	15	0	320	19	347	5	0	0	5	4	25	0	0	29	21			
Pt. of Arches		Ld	Lg	Ml	Ml	Pc	Ttl	Se	Cap	Ttl	Sm	Di	Et	Hi	Lh	Ok	Ph	Pa	Se	d <td>Se</td> <td>Ttl</td> <td>Sd</td> <td>Sf</td> <td>Sp</td> <td>Ttl</td> <td>Cm</td> <td>Eq</td> <td>Sc</td> <td>Ttl</td> <td>Tb</td> <td>Cl</td> <td>Cf</td> <td>Ac</td> <td>Ttl</td> <td>Am</td>	Se	Ttl	Sd	Sf	Sp	Ttl	Cm	Eq	Sc	Ttl	Tb	Cl	Cf	Ac	Ttl	Am			
mean	35		0.22	0.08		0.06	0	0.36	0.00	0	0	0	0	0	0.1	0		0	0	0	0	0.03	0	4.417	0	4.417	0	0	0	0	0	0	0	0	0				
SD			1.33	0.5		0.23	0	1.42	0.00	0	0	0	0	0	0.32	0		0	0	0	0	0.17	0	5.022	0	5.022	0	0	0	0	0	0	0	0	0				
total			8	3		0	2	13	0.00	0	0	0	0	0	1	0		0	0	0	0	1	0	159	0	159	0	0	0	0	0	0	0	0	0				
Alava		Ld	Lg	Ml	Ml	Pc	Ttl	Se	Cap	Ttl	Sm	Di	Et	Hi	Lh	Ok	Ph	Pa	Se	d <td>Se</td> <td>Ttl</td> <td>Sd</td> <td>Sf</td> <td>Sp</td> <td>Ttl</td> <td>Cm</td> <td>Eq</td> <td>Sc</td> <td>Ttl</td> <td>Tb</td> <td>Cl</td> <td>Cf</td> <td>Ac</td> <td>Ttl</td> <td>Am</td>	Se	Ttl	Sd	Sf	Sp	Ttl	Cm	Eq	Sc	Ttl	Tb	Cl	Cf	Ac	Ttl	Am			
mean	100		2.34	1.09	0.06	0.1	0.54	4.13	0.17	0.01	0.18	0.39	0	0.16	0.35	0.56		0.05	0.1	0	0	1.22	0.04	0.02	0.43	0.49	0.93	0.06	0	0.99	0.37	3.16	0.35	0.1	3.95	0.16			
SD			4.85	3.77	0.6	0.44	0.99	6.02	0.49	0.1	0.5	0.6	0	0.53	0.69	1.22		0.22	0.36	0	0	1.54	0.28	0.141	1.81	1.845	1.65	0.24	0	1.67	1.38	4.09	0.67	0.58	4.79	0.43			
total			234	109	6	10	54	413	17	1	18	39	0	16	35	56		5	10	0	0	122	4	2	43	49	93	6	0	99	37	313	35	10	395	16			
Cape Johnson		Ld	Lg	Ml	Ml	Pc	Ttl	Se	Cap	Ttl	Sm	Di	Et	Hi	Lh	Ok	Ph	Pa	Se	d <td>Se</td> <td>Ttl</td> <td>Sd</td> <td>Sf</td> <td>Sp</td> <td>Ttl</td> <td>Cm</td> <td>Eq</td> <td>Sc</td> <td>Ttl</td> <td>Tb</td> <td>Cl</td> <td>Cf</td> <td>Ac</td> <td>Ttl</td> <td>Am</td>	Se	Ttl	Sd	Sf	Sp	Ttl	Cm	Eq	Sc	Ttl	Tb	Cl	Cf	Ac	Ttl	Am			
mean	50		0.12	0.04	0.28	0.04	0.54	1.02	0.00	0	0	0.52	0.02	0.06	0.14	0.02		0.06	0	0	0.02	0.32	0.02	0	0.1	0.12	0.22	0	0	0.22	0.02	0.1	0.04	0.16	0.32	0.03			
SD			0.44	0.28	0.73	0.2	1.59	1.72	0.00	0	0	0.95	0.14	0.24	0.35	0.14		0.24	0	0	0.14	0.51	0.14	0	0.51	0.627	0.82	0	0	0.82	0.14	0.36	0.2	0.37	0.55	0.14			
total			6	2	14	2	27	51	0.00	0	0	26	1	3	7	1		3	0	0	1	16	1	0	5	6	11	0	0	11	1	5	2	8	16				
Rock 305		Ld	Lg	Ml	Ml	Pc	Ttl	Se	Cap	Ttl	Sm	Di	Et	Hi	Lh	Ok	Ph	Pa	Se	d <td>Se</td> <td>Ttl</td> <td>Sd</td> <td>Sf</td> <td>Sp</td> <td>Ttl</td> <td>Cm</td> <td>Eq</td> <td>Sc</td> <td>Ttl</td> <td>Tb</td> <td>Cl</td> <td>Cf</td> <td>Ac</td> <td>Ttl</td> <td>Am</td>	Se	Ttl	Sd	Sf	Sp	Ttl	Cm	Eq	Sc	Ttl	Tb	Cl	Cf	Ac	Ttl	Am			
mean	50		0.94	0.14		0.52	1.34	4.46	0.02	0	0.02	1.96	0	0.08	0.36	0.1		0.02	0.04	0.02	0	0.62	0.04	0.1	0.34	0.48	1.06	0	0	1.06	0	0.56	0.3	0.32	1.18	0.48			
SD			1.3	0.5		0.16	2.72	6.93	0.14	0	0.14	2.32	0	0.34	0.72	0.58		0.14	0.2	0.14	0	1.16	0.2	0.303	0.96	1.163	1.82	0	0	1.82	0	1.42	0.93	0.84	1.79	0.93			
total			47	7		26	67	223	1.00	0	1	96	0	4	18	5		1	2	1	0	31	2	5	17	24	53	0	0	53	0	28	15	16	59	24			
Teahwhit Head		Ld	Lg	Ml	Ml	Pc	Ttl	Se	Cap	Ttl	Sm	Di	Et	Hi	Lh	Ok	Ph	Pa	Se	d <td>Se</td> <td>Ttl</td> <td>Sd</td> <td>Sf</td> <td>Sp</td> <td>Ttl</td> <td>Cm</td> <td>Eq</td> <td>Sc</td> <td>Ttl</td> <td>Tb</td> <td>Cl</td> <td>Cf</td> <td>Ac</td> <td>Ttl</td> <td>Am</td>	Se	Ttl	Sd	Sf	Sp	Ttl	Cm	Eq	Sc	Ttl	Tb	Cl	Cf	Ac	Ttl	Am			
mean	100		2.06	0.23		0.09	2.43	4.81	0.14	0.01	0.15	0.56	0.03	0.07	0.51	0.12		0.01	0.13	0.01	0	0.88	0.05	0.22	0.06	0.33	1.31	0	0	1.31	0	1.26	0.2	0.55	2.01	0.03			
SD			3.51	0.9		0.54	5.39	5.67	0.49	0.1	0.5	0.94	0.17	0.26	0.87	0.56		0.1	0.37	0.1	0	1.27	0.22	0.613	0.28	0.753	2.21	0	0	2.21	0	2.24	0.53	2.66	3.77	0.20			
total			206	23		9	243	481	14	1	15	56	3	7	51	12		1	13	1	0	86	5	22	6	33	131	0	0	131	0	126	20	55	201	1			
		Ld	Lg	Ml	Ml	Pc	Ttl	Se	Cap	Ttl	Sm	Di	Et	Hi	Lh	Ok	Ph	Pa	Se	d <td>Se</td> <td>Ttl</td> <td>Sd</td> <td>Sf</td> <td>Sp</td> <td>Ttl</td> <td>Cm</td> <td>Eq</td> <td>Sc</td> <td>Ttl</td> <td>Tb</td> <td>Cl</td> <td>Cf</td> <td>Ac</td> <td>Ttl</td> <td>Am</td>	Se	Ttl	Sd	Sf	Sp	Ttl	Cm	Eq	Sc	Ttl	Tb	Cl	Cf	Ac	Ttl	Am			
		brown algae						crab						tunicate stars						urchins						cucumbers						gastropods						Time	

0.56  
1.07  
2.17