

# Biodiversity\_Sampling\_Final\_Group\_Submission

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#Loading in data:

Table 1: Biodiversity of invertebrates on various substrates

vertical_transect	quadrat	square	species	n	abiotic_hab	biotic_hab
1	1	1	B. glandula	9	cobble	NA
1	1	1	C. dalli	2	cobble	NA
1	1	2	NA	NA	sand	NA
1	1	3	B. glandula	2	cobble	NA
1	1	4	NA	NA	sand	NA
1	1	5	B. glandula	5	cobble	NA
1	1	5	C. dalli	10	cobble	NA
1	1	6	NA	NA	sand	NA
1	1	7	B. glandula	4	cobble	NA
1	1	8	NA	NA	cobble	NA
1	1	9	NA	NA	sand	NA
1	1	10	B. glandula	40	cobble	NA
1	1	10	C. dalli	10	cobble	NA
1	1	10	Littorina spp.	5	cobble	NA
1	2	1	NA	NA	cobble	NA
1	2	2	NA	NA	sand	NA
1	2	3	NA	NA	sand	NA
1	2	4	NA	NA	sand	NA
1	2	5	NA	NA	cobble	NA
1	2	6	NA	NA	sand	NA
1	2	7	NA	NA	sand	NA
1	2	8	B. glandula	1	cobble	NA
1	2	9	B. glandula	8	cobble	NA
1	2	9	C. dalli	4	cobble	NA
1	2	10	B. glandula	5	cobble	NA
3	3	1	B. glandula	27	cobble	upright algae
3	3	1	C. dalli	32	cobble	upright algae
3	3	1	Littorina spp.	16	cobble	upright algae
3	3	1	Littorina spp.	1	cobble	upright algae
3	3	2	B. glandula	35	cobble	crust
3	3	2	Littorina spp.	12	cobble	crust
3	3	3	B. glandula	13	cobble	NA
3	3	3	Littorina spp.	35	cobble	crust
3	3	4	B. glandula	13	cobble	NA
3	3	4	Littorina spp.	26	cobble	crust
3	3	5	B. glandula	28	cobble	upright algae, crust
3	3	5	Littorina spp.	13	cobble	upright algae, crust
3	3	6	B. glandula	22	cobble	upright algae, crust
3	3	6	Littorina spp.	10	cobble	upright algae, crust
3	3	7	B. glandula	42	cobble	upright algae, crust
3	3	7	Littorina spp.	53	cobble	upright algae, crust
3	3	8	B. glandula	2	cobble	NA
3	3	9	B. glandula	11	pebble	upright algae
3	3	9	Littorina spp.	27	pebble	upright algae
3	3	10	B. glandula	27	cobble	upright algae, crust
3	3	10	Littorina spp.	5	cobble	upright algae, crust
5	1	1	Littorina spp.	3	boulder	NA
5	1	2	Littorina spp.	20	cobble	upright_algae

vertical_transect	quadrat	square	species	n	abiotic_hab	biotic_hab
5	1	3	NA	NA	cobble	barnacles
5	1	4	Littorina spp.	20	cobble	NA
5	1	5	NA	NA	pebble	barnacles
5	1	6	NA	NA	cobble	NA
5	1	7	Littorina spp.	2	boulder	barnacles
5	1	7	Littorina spp.	1	boulder	barnacles
5	1	8	Littorina spp.	7	cobble	NA
5	1	9	NA	NA	cobble	NA
5	1	10	NA	NA	pebble	barnacles
5	2	1	Littorina spp.	30	cobble	barnacles
5	2	2	NA	NA	pebble	barnacles
5	2	3	Littorina spp.	2	cobble	barnacles
5	2	4	Littorina spp.	10	cobble	barnacles
5	2	5	NA	NA	pebble	barnacles
5	2	6	Littorina spp.	20	boulder	barnacles
5	2	7	NA	NA	pebble	barnacles
5	2	8	Littorina spp.	64	boulder	barnacles
5	2	9	Littorina spp.	13	cobble	barnacles
5	2	10	NA	NA	cobble	NA
5	3	1	NA	NA	cobble	barnacles
5	3	2	Littorina spp.	3	cobble	barnacles
5	3	3	NA	NA	cobble	barnacles
5	3	4	NA	NA	cobble	barnacles
5	3	5	NA	NA	cobble	barnacles
5	3	6	NA	NA	pebble	barnacles
5	3	7	NA	NA	pebble	barnacles
5	3	8	NA	NA	cobble	barnacles
5	3	9	NA	NA	pebble	NA
5	3	10	NA	NA	cobble	barnacles
5	4	1	NA	NA	pebble	barnacles
5	4	2	Littorina spp.	22	cobble	barnacles
5	4	3	NA	NA	cobble	barnacles
5	4	4	Littorina spp.	9	cobble	barnacles
5	4	5	Littorina spp.	3	boulder	NA
5	4	6	Littorina spp.	24	boulder	barnacles
5	4	7	NA	NA	cobble	NA
5	4	8	NA	NA	cobble	barnacles
5	4	9	Littorina spp.	10	pebble	barnacles
5	4	10	Littorina spp.	6	cobble	barnacles
4	3	1	Littorina spp.	2	cobble	NA
4	3	1	Littorina spp.	8	cobble	NA
4	3	1	B. glandula	16	cobble	NA
4	3	1	C. dalli	4	cobble	NA
4	3	2	T. funebris	15	cobble	NA
4	3	2	B. glandula	78	cobble	NA
4	3	3	T. funebris	15	cobble	NA
4	3	3	B. glandula	36	cobble	NA
4	3	4	B. glandula	79	cobble	NA
4	3	5	C. dalli	13	cobble	NA
4	3	6	T. funebris	2	cobble	NA
4	3	6	B. glandula	8	cobble	NA
4	3	7	B. glandula	48	cobble	NA

vertical_transect	quadrat	square	species	n	abiotic_hab	biotic_hab
4	3	7	<i>P. samuelis</i>	1	cobble	NA
4	3	8	<i>B. glandula</i>	16	cobble	NA
4	3	8	<i>T. funebris</i>	5	cobble	NA
4	3	9	<i>T. funebris</i>	2	cobble	NA
4	3	10	<i>B. glandula</i>	27	cobble	NA
4	3	10	<i>T. funebris</i>	13	cobble	NA
4	1	1	<i>B. glandula</i>	61	cobble	NA
4	1	1	<i>C. dalli</i>	0	cobble	NA
4	1	2	<i>B. glandula</i>	11	cobble	NA
4	1	2	<i>C. dalli</i>	46	cobble	NA
4	1	3	<i>Littorina</i> spp.	1	pebble	NA
4	1	4	<i>T. funebris</i>	1	pebble	NA
4	1	4	<i>B. glandula</i>	31	pebble	NA
4	1	4	<i>H. oregonensis</i>	1	pebble	NA
4	1	4	<i>Littorina</i> spp.	1	pebble	NA
4	1	5	<i>Littorina</i> spp.	34	pebble	NA
4	1	5	<i>T. funebris</i>	3	pebble	NA
4	1	5	<i>Littorina</i> spp.	1	pebble	NA
4	1	6	<i>H. oregonensis</i>	1	cobble	NA
4	1	6	<i>C. dalli</i>	5	cobble	NA
4	1	6	<i>T. funebris</i>	1	cobble	NA
4	1	7	<i>B. glandula</i>	32	cobble	NA
4	1	7	<i>T. funebris</i>	10	cobble	NA
4	1	8	<i>Littorina</i> spp.	1	cobble	NA
4	1	8	<i>T. funebris</i>	16	cobble	NA
4	1	9	<i>Littorina</i> spp.	1	cobble	NA
4	1	9	<i>C. dalli</i>	44	cobble	NA
4	1	9	<i>B. glandula</i>	9	cobble	NA
4	1	10	<i>B. glandula</i>	23	pebble	NA
4	1	10	<i>C. dalli</i>	5	pebble	NA
4	2	1	<i>B. glandula</i>	28	cobble	NA
4	2	1	<i>T. funebris</i>	1	cobble	NA
4	2	1	<i>Littorina</i> spp.	1	cobble	NA
4	2	2	<i>B. glandula</i>	23	cobble	NA
4	2	2	<i>T. funebris</i>	12	cobble	NA
4	2	3	<i>P. samuelis</i>	3	cobble	NA
4	2	3	<i>C. dalli</i>	13	cobble	NA
4	2	3	<i>B. glandula</i>	10	cobble	NA
4	2	4	<i>B. glandula</i>	61	cobble	NA
4	2	4	<i>T. funebris</i>	20	cobble	NA
4	2	5	<i>B. glandula</i>	13	cobble	NA
4	2	5	<i>P. samuelis</i>	1	cobble	NA
4	2	5	<i>H. oregonensis</i>	1	cobble	NA
4	2	6	<i>B. glandula</i>	31	cobble	NA
4	2	6	<i>T. funebris</i>	28	cobble	NA
4	2	6	<i>Littorina</i> spp.	2	cobble	NA
4	2	6	<i>H. oregonensis</i>	2	cobble	NA
4	2	7	<i>B. glandula</i>	48	cobble	NA
4	2	7	<i>T. funebris</i>	9	cobble	NA
4	2	8	<i>C. dalli</i>	9	cobble	NA
4	2	9	<i>P. samuelis</i>	2	cobble	NA
4	2	9	<i>H. oregonensis</i>	1	cobble	NA

vertical_transect	quadrat	square	species	n	abiotic_hab	biotic_hab
4	2	9	B. glandula	22	cobble	NA
4	2	10	T. funebris	3	cobble	NA
4	2	10	Littorina spp.	1	cobble	NA
4	2	10	B. glandula	15	cobble	NA
6	1	1	Littorina spp.	5	cobble	NA
6	1	1	C. dalli	0	cobble	NA
6	1	2	NA	NA	cobble	NA
6	1	3	NA	NA	pebble	NA
6	1	4	B. glandula	16	cobble	NA
6	1	4	C. dalli	36	cobble	NA
6	1	5	Littorina spp.	1	cobble	NA
6	1	5	C. dalli	7	cobble	NA
6	1	6	Littorina spp.	17	cobble	NA
6	1	6	B. glandula	17	cobble	NA
6	1	6	C. dalli	24	cobble	NA
6	1	6	Littorina spp.	2	cobble	NA
6	1	7	NA	NA	cobble	NA
6	1	8	Littorina spp.	2	pebble	NA
6	1	8	B. glandula	28	pebble	NA
6	1	8	C. dalli	17	pebble	NA
6	1	9	Littorina spp.	18	cobble	NA
6	1	9	B. glandula	30	cobble	NA
6	1	9	C. dalli	29	cobble	NA
6	1	10	Littorina spp.	1	cobble	NA
6	2	1	Littorina spp.	10	cobble	NA
6	2	1	B. glandula	2	cobble	NA
6	2	2	Littorina spp.	4	pebble	NA
6	2	2	B. glandula	13	pebble	NA
6	2	2	C. dalli	14	pebble	NA
6	2	3	Littorina spp.	3	cobble	NA
6	2	3	B. glandula	2	cobble	NA
6	2	4	C. dalli	3	cobble	NA
6	2	5	Littorina spp.	13	cobble	NA
6	2	5	B. glandula	5	cobble	NA
6	2	5	C. dalli	1	cobble	NA
6	2	6	C. dalli	18	cobble	NA
6	2	7	Littorina spp.	3	cobble	NA
6	2	8	NA	NA	cobble	NA
6	2	9	Littorina spp.	2	cobble	NA
6	2	9	B. glandula	2	cobble	NA
6	2	10	C. dalli	6	cobble	NA
6	3	1	Littorina spp.	31	cobble	NA
6	3	1	B. glandula	28	cobble	NA
6	3	1	C. dalli	2	cobble	NA
6	3	2	Littorina spp.	4	cobble	Mastocarpus spp.
6	3	2	B. glandula	11	cobble	Mastocarpus spp.
6	3	2	C. dalli	12	cobble	Mastocarpus spp.
6	3	3	Littorina spp.	2	boulder	NA
6	3	3	B. glandula	10	boulder	NA
6	3	3	C. dalli	27	boulder	NA
6	3	4	Littorina spp.	11	cobble	NA
6	3	4	B. glandula	2	cobble	NA

vertical_transect	quadrat	square	species	n	abiotic_hab	biotic_hab
6	3	4	C. dalli	10	cobble	NA
6	3	5	Littorina spp.	12	boulder	NA
6	3	5	B. glandula	27	boulder	NA
6	3	5	C. dalli	32	boulder	NA
6	3	5	Littorina spp.	1	boulder	NA
6	3	5	Littorina spp.	1	boulder	NA
6	3	6	Littorina spp.	3	cobble	NA
6	3	6	B. glandula	12	cobble	NA
6	3	6	C. dalli	19	cobble	NA
6	3	7	Littorina spp.	7	pebble	NA
6	3	7	B. glandula	4	pebble	NA
6	3	7	O. maculosus	1	pebble	NA
6	3	8	Littorina spp.	4	cobble	NA
6	3	8	B. glandula	7	cobble	NA
6	3	8	C. dalli	12	cobble	NA
6	3	9	Littorina spp.	5	cobble	NA
6	3	9	B. glandula	24	cobble	NA
6	3	9	C. dalli	9	cobble	NA
6	3	10	Littorina spp.	7	cobble	NA
6	3	10	B. glandula	15	cobble	NA
6	3	10	C. dalli	19	cobble	NA
2	1	1	C. dalli	25	boulder	NA
2	1	1	B. glandula	5	boulder	NA
2	1	1	Littorina spp.	19	boulder	NA
2	1	2	C. dalli	50	boulder	NA
2	1	2	B. glandula	7	boulder	NA
2	1	2	Littorina spp.	5	boulder	NA
2	1	3	B. glandula	5	pebble	NA
2	1	4	C. dalli	5	cobble	NA
2	1	4	Littorina spp.	94	cobble	barnacles
2	1	5	C. dalli	33	bedrock	NA
2	1	5	Littorina spp.	34	bedrock	NA
2	1	5	B. glandula	6	bedrock	NA
2	1	6	C. dalli	12	bedrock	NA
2	1	6	Littorina spp.	15	bedrock	NA
2	1	6	B. glandula	25	bedrock	NA
2	1	7	C. dalli	38	pebble	NA
2	1	7	Littorina spp.	9	pebble	NA
2	1	7	B. glandula	12	pebble	NA
2	1	8	C. dalli	35	boulder	NA
2	1	8	Littorina spp.	6	boulder	NA
2	1	8	B. glandula	2	boulder	NA
2	1	9	C. dalli	50	boulder	NA
2	1	9	Littorina spp.	40	boulder	NA
2	1	9	B. glandula	31	boulder	NA
2	1	10	Littorina spp.	30	boulder	barnacles
2	2	1	B. glandula	20	boulder	NA
2	2	1	Littorina spp.	1	boulder	NA
2	2	1	Littorina spp.	25	boulder	NA
2	2	2	C. dalli	22	boulder	NA
2	2	2	Littorina spp.	40	boulder	NA
2	2	2	B. glandula	30	boulder	NA

vertical_transect	quadrat	square	species	n	abiotic_hab	biotic_hab
2	2	3	NA	NA	boulder	NA
2	2	4	C. dalli	10	boulder	NA
2	2	4	Littorina spp.	1	boulder	NA
2	2	4	B. glandula	25	boulder	NA
2	2	5	C. dalli	7	boulder	NA
2	2	5	Littorina spp.	16	boulder	NA
2	2	5	B. glandula	25	boulder	NA
2	2	6	C. dalli	5	pebble	NA
2	2	6	B. glandula	12	pebble	NA
2	2	7	C. dalli	4	boulder	NA
2	2	8	B. glandula	7	boulder	NA
2	2	8	Littorina spp.	12	boulder	NA
2	2	9	B. glandula	5	cobble	NA
2	2	9	C. dalli	23	cobble	NA
2	2	10	B. glandula	2	pebble	NA
2	3	1	C. dalli	32	boulder	NA
2	3	1	Littorina spp.	30	boulder	NA
2	3	2	B. glandula	12	pebble	NA
2	3	3	B. glandula	5	pebble	NA
2	3	4	NA	0	pebble	NA
2	3	5	B. glandula	1	pebble	NA
2	3	6	C. dalli	70	boulder	NA
2	3	6	Littorina spp.	3	boulder	NA
2	3	7	B. glandula	11	pebble	NA
2	3	8	C. dalli	4	pebble	NA
2	3	8	B. glandula	3	pebble	NA
2	3	9	NA	0	pebble	NA
2	3	10	B. glandula	15	boulder	Upright.algae
2	3	10	C. dalli	10	boulder	Upright.algae
1	3	1	B. glandula	4	boulder	NA
1	3	NA	C. dalli	4	boulder	NA
1	3	2	NA	0	sand	NA
1	3	3	B. glandula	7	boulder	NA
1	3	NA	C. dalli	42	boulder	NA
1	3	4	B. glandula	47	cobble	NA
1	3	NA	C. dalli	42	cobble	NA
1	3	NA	Littorina spp.	18	cobble	NA
1	3	5	NA	NA	sand	NA
1	3	6	NA	NA	sand	NA
1	3	7	B. glandula	18	boulder	NA
1	3	NA	C. dalli	64	boulder	NA
1	3	NA	Littorina spp.	24	boulder	NA
1	3	8	B. glandula	13	boulder	NA
1	3	9	C. dalli	1	boulder	NA
1	3	10	NA	NA	sand	NA
1	4	1	B. glandula	8	boulder	NA
1	4	2	B. glandula	6	boulder	NA
1	4	3	NA	0	sand	NA
1	4	4	NA	0	sand	NA
1	4	5	NA	0	sand	NA
1	4	6	NA	0	sand	NA
1	4	7	NA	0	sand	NA

vertical_transect	quadrat	square	species	n	abiotic_hab	biotic_hab
1	4	8	B. glandula	16	cobble	NA
1	4	9	NA	0	cobble	NA
1	4	10	NA	0	sand	NA
3	1	1	B. glandula	22	cobble	NA
3	1	1	C. dalli	43	cobble	NA
3	1	1	Littorina spp.	9	cobble	B. glandula, Upright algae
3	1	2	Littorina spp.	38	cobble	B. glandula, Upright algae
3	1	2	B. glandula	26	cobble	NA
3	1	2	C. dalli	24	cobble	NA
3	1	3	B. glandula	8	pebble	NA
3	1	3	C. dalli	3	pebble	NA
3	1	3	Littorina spp.	1	pebble	NA
3	1	4	B. glandula	3	cobble	NA
3	1	4	C. dalli	11	cobble	NA
3	1	5	B. glandula	14	cobble	NA
3	1	5	Littorina spp.	16	cobble	NA
3	1	6	H. nudus	2	pebble	NA
3	1	6	B. glandula	34	pebble	NA
3	1	6	C. dalli	17	pebble	NA
3	1	6	Littorina spp.	30	pebble	NA
3	1	6	P. samuelis	1	pebble	NA
3	1	7	C. dalli	15	cobble	NA
3	1	7	B. glandula	3	cobble	NA
3	1	7	H. nudus	1	cobble	NA
3	1	8	NA	0	cobble	NA
3	1	9	Littorina spp.	25	cobble	B. glandula
3	1	9	B. glandula	20	cobble	NA
3	1	9	C. dalli	11	cobble	NA
3	1	10	H. cinctipes	1	cobble	NA
3	1	10	Littorina spp.	2	cobble	NA
3	1	10	Littorina spp.	7	cobble	NA
3	2	1	C. dalli	2	pebble	NA
3	2	1	Littorina spp.	1	pebble	NA
3	2	2	C. dalli	1	cobble	NA
3	2	2	B. glandula	2	cobble	NA
3	2	2	Littorina spp.	18	cobble	NA
3	2	3	C. dalli	70	cobble	NA
3	2	3	B. glandula	7	cobble	NA
3	2	4	Littorina spp.	8	cobble	NA
3	2	4	B. glandula	2	cobble	NA
3	2	5	Littorina spp.	1	cobble	NA
3	2	6	Littorina spp.	15	cobble	NA
3	2	6	B. glandula	25	cobble	NA
3	2	7	Littorina spp.	3	cobble	NA
3	2	7	C. dalli	2	cobble	NA
3	2	8	B. glandula	8	cobble	NA
3	2	8	C. dalli	40	boulder	NA
3	2	8	Littorina spp.	8	boulder	NA
3	2	9	Littorina spp.	1	boulder	NA
3	2	10	NA	0	cobble	NA



Table 2: Cover data

vertical_transect	quadrat	square	species	n	abiotic_hab	biotic_hab
1	1	1	B. glandula	9	cobble	NA
1	1	1	C. dalli	2	cobble	NA
1	1	2	NA	NA	sand	NA
1	1	3	B. glandula	2	cobble	NA
1	1	4	NA	NA	sand	NA
1	1	5	B. glandula	5	cobble	NA
1	1	5	C. dalli	10	cobble	NA
1	1	6	NA	NA	sand	NA
1	1	7	B. glandula	4	cobble	NA
1	1	8	NA	NA	cobble	NA
1	1	9	NA	NA	sand	NA
1	1	10	B. glandula	40	cobble	NA
1	1	10	C. dalli	10	cobble	NA
1	1	10	Littorina spp.	5	cobble	NA
1	2	1	NA	NA	cobble	NA
1	2	2	NA	NA	sand	NA
1	2	3	NA	NA	sand	NA
1	2	4	NA	NA	sand	NA
1	2	5	NA	NA	cobble	NA
1	2	6	NA	NA	sand	NA
1	2	7	NA	NA	sand	NA
1	2	8	B. glandula	1	cobble	NA
1	2	9	B. glandula	8	cobble	NA
1	2	9	C. dalli	4	cobble	NA
1	2	10	B. glandula	5	cobble	NA
3	3	1	B. glandula	27	cobble	upright algae
3	3	1	C. dalli	32	cobble	upright algae
3	3	1	Littorina spp.	16	cobble	upright algae
3	3	1	Littorina spp.	1	cobble	upright algae
3	3	2	B. glandula	35	cobble	crust
3	3	2	Littorina spp.	12	cobble	crust
3	3	3	B. glandula	13	cobble	NA
3	3	3	Littorina spp.	35	cobble	crust
3	3	4	B. glandula	13	cobble	NA
3	3	4	Littorina spp.	26	cobble	crust
3	3	5	B. glandula	28	cobble	upright algae, crust
3	3	5	Littorina spp.	13	cobble	upright algae, crust
3	3	6	B. glandula	22	cobble	upright algae, crust
3	3	6	Littorina spp.	10	cobble	upright algae, crust
3	3	7	B. glandula	42	cobble	upright algae, crust
3	3	7	Littorina spp.	53	cobble	upright algae, crust
3	3	8	B. glandula	2	cobble	NA
3	3	9	B. glandula	11	pebble	upright algae
3	3	9	Littorina spp.	27	pebble	upright algae
3	3	10	B. glandula	27	cobble	upright algae, crust
3	3	10	Littorina spp.	5	cobble	upright algae, crust
5	1	1	Littorina spp.	3	boulder	NA
5	1	2	Littorina spp.	20	cobble	upright algae
5	1	3	NA	NA	cobble	barnacles
5	1	4	Littorina spp.	20	cobble	NA
5	1	5	NA	NA	pebble	barnacles

vertical_transect	quadrat	square	species	n	abiotic_hab	biotic_hab
5	1	6	NA	NA	cobble	NA
5	1	7	Littorina spp.	2	boulder	barnacles
5	1	7	Littorina spp.	1	boulder	barnacles
5	1	8	Littorina spp.	7	cobble	NA
5	1	9	NA	NA	cobble	NA
5	1	10	NA	NA	pebble	barnacles
5	2	1	Littorina spp.	30	cobble	barnacles
5	2	2	NA	NA	pebble	barnacles
5	2	3	Littorina spp.	2	cobble	barnacles
5	2	4	Littorina spp.	10	cobble	barnacles
5	2	5	NA	NA	pebble	barnacles
5	2	6	Littorina spp.	20	boulder	barnacles
5	2	7	NA	NA	pebble	barnacles
5	2	8	Littorina spp.	64	boulder	barnacles
5	2	9	Littorina spp.	13	cobble	barnacles
5	2	10	NA	NA	cobble	NA
5	3	1	NA	NA	cobble	barnacles
5	3	2	Littorina spp.	3	cobble	barnacles
5	3	3	NA	NA	cobble	barnacles
5	3	4	NA	NA	cobble	barnacles
5	3	5	NA	NA	cobble	barnacles
5	3	6	NA	NA	pebble	barnacles
5	3	7	NA	NA	pebble	barnacles
5	3	8	NA	NA	cobble	barnacles
5	3	9	NA	NA	pebble	NA
5	3	10	NA	NA	cobble	barnacles
5	4	1	NA	NA	pebble	barnacles
5	4	2	Littorina spp.	22	cobble	barnacles
5	4	3	NA	NA	cobble	barnacles
5	4	4	Littorina spp.	9	cobble	barnacles
5	4	5	Littorina spp.	3	boulder	NA
5	4	6	Littorina spp.	24	boulder	barnacles
5	4	7	NA	NA	cobble	NA
5	4	8	NA	NA	cobble	barnacles
5	4	9	Littorina spp.	10	pebble	barnacles
5	4	10	Littorina spp.	6	cobble	barnacles
4	3	1	Littorina spp.	2	cobble	NA
4	3	1	Littorina spp.	8	cobble	NA
4	3	1	B. glandula	16	cobble	NA
4	3	1	C. dalli	4	cobble	NA
4	3	2	T. funebris	15	cobble	NA
4	3	2	B. glandula	78	cobble	NA
4	3	3	T. funebris	15	cobble	NA
4	3	3	B. glandula	36	cobble	NA
4	3	4	B. glandula	79	cobble	NA
4	3	5	C. dalli	13	cobble	NA
4	3	6	T. funebris	2	cobble	NA
4	3	6	B. glandula	8	cobble	NA
4	3	7	B. glandula	48	cobble	NA
4	3	7	P. samuelis	1	cobble	NA
4	3	8	B. glandula	16	cobble	NA
4	3	8	T. funebris	5	cobble	NA

vertical_transect	quadrat	square	species	n	abiotic_hab	biotic_hab
4	3	9	T. funebris	2	cobble	NA
4	3	10	B. glandula	27	cobble	NA
4	3	10	T. funebris	13	cobble	NA
4	1	1	B. glandula	61	cobble	NA
4	1	1	C. dalli	0	cobble	NA
4	1	2	B. glandula	11	cobble	NA
4	1	2	C. dalli	46	cobble	NA
4	1	3	Littorina spp.	1	pebble	NA
4	1	4	T. funebris	1	pebble	NA
4	1	4	B. glandula	31	pebble	NA
4	1	4	H. oregonensis	1	pebble	NA
4	1	4	Littorina spp.	1	pebble	NA
4	1	5	Littorina spp.	34	pebble	NA
4	1	5	T. funebris	3	pebble	NA
4	1	5	Littorina spp.	1	pebble	NA
4	1	6	H. oregonensis	1	cobble	NA
4	1	6	C. dalli	5	cobble	NA
4	1	6	T. funebris	1	cobble	NA
4	1	7	B. glandula	32	cobble	NA
4	1	7	T. funebris	10	cobble	NA
4	1	8	Littorina spp.	1	cobble	NA
4	1	8	T. funebris	16	cobble	NA
4	1	9	Littorina spp.	1	cobble	NA
4	1	9	C. dalli	44	cobble	NA
4	1	9	B. glandula	9	cobble	NA
4	1	10	B. glandula	23	pebble	NA
4	1	10	C. dalli	5	pebble	NA
4	2	1	B. glandula	28	cobble	NA
4	2	1	T. funebris	1	cobble	NA
4	2	1	Littorina spp.	1	cobble	NA
4	2	2	B. glandula	23	cobble	NA
4	2	2	T. funebris	12	cobble	NA
4	2	3	P. samuelis	3	cobble	NA
4	2	3	C. dalli	13	cobble	NA
4	2	3	B. glandula	10	cobble	NA
4	2	4	B. glandula	61	cobble	NA
4	2	4	T. funebris	20	cobble	NA
4	2	5	B. glandula	13	cobble	NA
4	2	5	P. samuelis	1	cobble	NA
4	2	5	H. oregonensis	1	cobble	NA
4	2	6	B. glandula	31	cobble	NA
4	2	6	T. funebris	28	cobble	NA
4	2	6	Littorina spp.	2	cobble	NA
4	2	6	H. oregonensis	2	cobble	NA
4	2	7	B. glandula	48	cobble	NA
4	2	7	T. funebris	9	cobble	NA
4	2	8	C. dalli	9	cobble	NA
4	2	9	P. samuelis	2	cobble	NA
4	2	9	H. oregonensis	1	cobble	NA
4	2	9	B. glandula	22	cobble	NA
4	2	10	T. funebris	3	cobble	NA
4	2	10	Littorina spp.	1	cobble	NA

vertical_transect	quadrat	square	species	n	abiotic_hab	biotic_hab
4	2	10	B. glandula	15	cobble	NA
6	1	1	Littorina spp.	5	cobble	NA
6	1	1	C. dalli	0	cobble	NA
6	1	2	NA	NA	cobble	NA
6	1	3	NA	NA	pebble	NA
6	1	4	B. glandula	16	cobble	NA
6	1	4	C. dalli	36	cobble	NA
6	1	5	Littorina spp.	1	cobble	NA
6	1	5	C. dalli	7	cobble	NA
6	1	6	Littorina spp.	17	cobble	NA
6	1	6	B. glandula	17	cobble	NA
6	1	6	C. dalli	24	cobble	NA
6	1	6	Littorina spp.	2	cobble	NA
6	1	7	NA	NA	cobble	NA
6	1	8	Littorina spp.	2	pebble	NA
6	1	8	B. glandula	28	pebble	NA
6	1	8	C. dalli	17	pebble	NA
6	1	9	Littorina spp.	18	cobble	NA
6	1	9	B. glandula	30	cobble	NA
6	1	9	C. dalli	29	cobble	NA
6	1	10	Littorina spp.	1	cobble	NA
6	2	1	Littorina spp.	10	cobble	NA
6	2	1	B. glandula	2	cobble	NA
6	2	2	Littorina spp.	4	pebble	NA
6	2	2	B. glandula	13	pebble	NA
6	2	2	C. dalli	14	pebble	NA
6	2	3	Littorina spp.	3	cobble	NA
6	2	3	B. glandula	2	cobble	NA
6	2	4	C. dalli	3	cobble	NA
6	2	5	Littorina spp.	13	cobble	NA
6	2	5	B. glandula	5	cobble	NA
6	2	5	C. dalli	1	cobble	NA
6	2	6	C. dalli	18	cobble	NA
6	2	7	Littorina spp.	3	cobble	NA
6	2	8	NA	NA	cobble	NA
6	2	9	Littorina spp.	2	cobble	NA
6	2	9	B. glandula	2	cobble	NA
6	2	10	C. dalli	6	cobble	NA
6	3	1	Littorina spp.	31	cobble	NA
6	3	1	B. glandula	28	cobble	NA
6	3	1	C. dalli	2	cobble	NA
6	3	2	Littorina spp.	4	cobble	Mastocarpus spp.
6	3	2	B. glandula	11	cobble	Mastocarpus spp.
6	3	2	C. dalli	12	cobble	Mastocarpus spp.
6	3	3	Littorina spp.	2	boulder	NA
6	3	3	B. glandula	10	boulder	NA
6	3	3	C. dalli	27	boulder	NA
6	3	4	Littorina spp.	11	cobble	NA
6	3	4	B. glandula	2	cobble	NA
6	3	4	C. dalli	10	cobble	NA
6	3	5	Littorina spp.	12	boulder	NA
6	3	5	B. glandula	27	boulder	NA

vertical_transect	quadrat	square	species	n	abiotic_hab	biotic_hab
6	3	5	C. dalli	32	boulder	NA
6	3	5	Littorina spp.	1	boulder	NA
6	3	5	Littorina spp.	1	boulder	NA
6	3	6	Littorina spp.	3	cobble	NA
6	3	6	B. glandula	12	cobble	NA
6	3	6	C. dalli	19	cobble	NA
6	3	7	Littorina spp.	7	pebble	NA
6	3	7	B. glandula	4	pebble	NA
6	3	7	O. maculosus	1	pebble	NA
6	3	8	Littorina spp.	4	cobble	NA
6	3	8	B. glandula	7	cobble	NA
6	3	8	C. dalli	12	cobble	NA
6	3	9	Littorina spp.	5	cobble	NA
6	3	9	B. glandula	24	cobble	NA
6	3	9	C. dalli	9	cobble	NA
6	3	10	Littorina spp.	7	cobble	NA
6	3	10	B. glandula	15	cobble	NA
6	3	10	C. dalli	19	cobble	NA
2	1	1	C. dalli	25	boulder	NA
2	1	1	B. glandula	5	boulder	NA
2	1	1	Littorina spp.	19	boulder	NA
2	1	2	C. dalli	50	boulder	NA
2	1	2	B. glandula	7	boulder	NA
2	1	2	Littorina spp.	5	boulder	NA
2	1	3	B. glandula	5	pebble	NA
2	1	4	C. dalli	5	cobble	NA
2	1	4	Littorina spp.	94	cobble	barnacles
2	1	5	C. dalli	33	bedrock	NA
2	1	5	Littorina spp.	34	bedrock	NA
2	1	5	B. glandula	6	bedrock	NA
2	1	6	C. dalli	12	bedrock	NA
2	1	6	Littorina spp.	15	bedrock	NA
2	1	6	B. glandula	25	bedrock	NA
2	1	7	C. dalli	38	pebble	NA
2	1	7	Littorina spp.	9	pebble	NA
2	1	7	B. glandula	12	pebble	NA
2	1	8	C. dalli	35	boulder	NA
2	1	8	Littorina spp.	6	boulder	NA
2	1	8	B. glandula	2	boulder	NA
2	1	9	C. dalli	50	boulder	NA
2	1	9	Littorina spp.	40	boulder	NA
2	1	9	B. glandula	31	boulder	NA
2	1	10	Littorina spp.	30	boulder	barnacles
2	2	1	B. glandula	20	boulder	NA
2	2	1	Littorina spp.	1	boulder	NA
2	2	1	Littorina spp.	25	boulder	NA
2	2	2	C. dalli	22	boulder	NA
2	2	2	Littorina spp.	40	boulder	NA
2	2	2	B. glandula	30	boulder	NA
2	2	3	NA	NA	boulder	NA
2	2	4	C. dalli	10	boulder	NA
2	2	4	Littorina spp.	1	boulder	NA

vertical_transect	quadrat	square	species	n	abiotic_hab	biotic_hab
2	2	4	B. glandula	25	boulder	NA
2	2	5	C. dalli	7	boulder	NA
2	2	5	Littorina spp.	16	boulder	NA
2	2	5	B. glandula	25	boulder	NA
2	2	6	C. dalli	5	pebble	NA
2	2	6	B. glandula	12	pebble	NA
2	2	7	C. dalli	4	boulder	NA
2	2	8	B. glandula	7	boulder	NA
2	2	8	Littorina spp.	12	boulder	NA
2	2	9	B. glandula	5	cobble	NA
2	2	9	C. dalli	23	cobble	NA
2	2	10	B. glandula	2	pebble	NA
2	3	1	C. dalli	32	boulder	NA
2	3	1	Littorina spp.	30	boulder	NA
2	3	2	B. glandula	12	pebble	NA
2	3	3	B. glandula	5	pebble	NA
2	3	4	NA	0	pebble	NA
2	3	5	B. glandula	1	pebble	NA
2	3	6	C. dalli	70	boulder	NA
2	3	6	Littorina spp.	3	boulder	NA
2	3	7	B. glandula	11	pebble	NA
2	3	8	C. dalli	4	pebble	NA
2	3	8	B. glandula	3	pebble	NA
2	3	9	NA	0	pebble	NA
2	3	10	B. glandula	15	boulder	Upright.algae
2	3	10	C. dalli	10	boulder	Upright.algae
1	3	1	B. glandula	4	boulder	NA
1	3	NA	C. dalli	4	boulder	NA
1	3	2	NA	0	sand	NA
1	3	3	B. glandula	7	boulder	NA
1	3	NA	C. dalli	42	boulder	NA
1	3	4	B. glandula	47	cobble	NA
1	3	NA	C. dalli	42	cobble	NA
1	3	NA	Littorina spp.	18	cobble	NA
1	3	5	NA	NA	sand	NA
1	3	6	NA	NA	sand	NA
1	3	7	B. glandula	18	boulder	NA
1	3	NA	C. dalli	64	boulder	NA
1	3	NA	Littorina spp.	24	boulder	NA
1	3	8	B. glandula	13	boulder	NA
1	3	9	C. dalli	1	boulder	NA
1	3	10	NA	NA	sand	NA
1	4	1	B. glandula	8	boulder	NA
1	4	2	B. glandula	6	boulder	NA
1	4	3	NA	0	sand	NA
1	4	4	NA	0	sand	NA
1	4	5	NA	0	sand	NA
1	4	6	NA	0	sand	NA
1	4	7	NA	0	sand	NA
1	4	8	B. glandula	16	cobble	NA
1	4	9	NA	0	cobble	NA
1	4	10	NA	0	sand	NA

vertical_transect	quadrat	square	species	n	abiotic_hab	biotic_hab
3	1	1	B. glandula	22	cobble	NA
3	1	1	C. dalli	43	cobble	NA
3	1	1	Littorina spp.	9	cobble	B. glandula, Upright algae
3	1	2	Littorina spp.	38	cobble	B. glandula, Upright algae
3	1	2	B. glandula	26	cobble	NA
3	1	2	C. dalli	24	cobble	NA
3	1	3	B. glandula	8	pebble	NA
3	1	3	C. dalli	3	pebble	NA
3	1	3	Littorina spp.	1	pebble	NA
3	1	4	B. glandula	3	cobble	NA
3	1	4	C. dalli	11	cobble	NA
3	1	5	B. glandula	14	cobble	NA
3	1	5	Littorina spp.	16	cobble	NA
3	1	6	H. nudus	2	pebble	NA
3	1	6	B. glandula	34	pebble	NA
3	1	6	C. dalli	17	pebble	NA
3	1	6	Littorina spp.	30	pebble	NA
3	1	6	P. samuelis	1	pebble	NA
3	1	7	C. dalli	15	cobble	NA
3	1	7	B. glandula	3	cobble	NA
3	1	7	H. nudus	1	cobble	NA
3	1	8	NA	0	cobble	NA
3	1	9	Littorina spp.	25	cobble	B. glandula
3	1	9	B. glandula	20	cobble	NA
3	1	9	C. dalli	11	cobble	NA
3	1	10	H. cinctipes	1	cobble	NA
3	1	10	Littorina spp.	2	cobble	NA
3	1	10	Littorina spp.	7	cobble	NA
3	2	1	C. dalli	2	pebble	NA
3	2	1	Littorina spp.	1	pebble	NA
3	2	2	C. dalli	1	cobble	NA
3	2	2	B. glandula	2	cobble	NA
3	2	2	Littorina spp.	18	cobble	NA
3	2	3	C. dalli	70	cobble	NA
3	2	3	B. glandula	7	cobble	NA
3	2	4	Littorina spp.	8	cobble	NA
3	2	4	B. glandula	2	cobble	NA
3	2	5	Littorina spp.	1	cobble	NA
3	2	6	Littorina spp.	15	cobble	NA
3	2	6	B. glandula	25	cobble	NA
3	2	7	Littorina spp.	3	cobble	NA
3	2	7	C. dalli	2	cobble	NA
3	2	8	B. glandula	8	cobble	NA
3	2	8	C. dalli	40	boulder	NA
3	2	8	Littorina spp.	8	boulder	NA
3	2	9	Littorina spp.	1	boulder	NA
3	2	10	NA	0	cobble	NA

Table 3: Quadrat data

vertical_transect	quadrat	square	species	n	abiotic_hab	biotic_hab
1	1	1	B. glandula	9	cobble	NA
1	1	1	C. dalli	2	cobble	NA
1	1	2	NA	NA	sand	NA
1	1	3	B. glandula	2	cobble	NA
1	1	4	NA	NA	sand	NA
1	1	5	B. glandula	5	cobble	NA
1	1	5	C. dalli	10	cobble	NA
1	1	6	NA	NA	sand	NA
1	1	7	B. glandula	4	cobble	NA
1	1	8	NA	NA	cobble	NA
1	1	9	NA	NA	sand	NA
1	1	10	B. glandula	40	cobble	NA
1	1	10	C. dalli	10	cobble	NA
1	1	10	Littorina spp.	5	cobble	NA
1	2	1	NA	NA	cobble	NA
1	2	2	NA	NA	sand	NA
1	2	3	NA	NA	sand	NA
1	2	4	NA	NA	sand	NA
1	2	5	NA	NA	cobble	NA
1	2	6	NA	NA	sand	NA
1	2	7	NA	NA	sand	NA
1	2	8	B. glandula	1	cobble	NA
1	2	9	B. glandula	8	cobble	NA
1	2	9	C. dalli	4	cobble	NA
1	2	10	B. glandula	5	cobble	NA
3	3	1	B. glandula	27	cobble	upright algae
3	3	1	C. dalli	32	cobble	upright algae
3	3	1	Littorina spp.	16	cobble	upright algae
3	3	1	Littorina spp.	1	cobble	upright algae
3	3	2	B. glandula	35	cobble	crust
3	3	2	Littorina spp.	12	cobble	crust
3	3	3	B. glandula	13	cobble	NA
3	3	3	Littorina spp.	35	cobble	crust
3	3	4	B. glandula	13	cobble	NA
3	3	4	Littorina spp.	26	cobble	crust
3	3	5	B. glandula	28	cobble	upright algae, crust
3	3	5	Littorina spp.	13	cobble	upright algae, crust
3	3	6	B. glandula	22	cobble	upright algae, crust
3	3	6	Littorina spp.	10	cobble	upright algae, crust
3	3	7	B. glandula	42	cobble	upright algae, crust
3	3	7	Littorina spp.	53	cobble	upright algae, crust
3	3	8	B. glandula	2	cobble	NA
3	3	9	B. glandula	11	pebble	upright algae
3	3	9	Littorina spp.	27	pebble	upright algae
3	3	10	B. glandula	27	cobble	upright algae, crust
3	3	10	Littorina spp.	5	cobble	upright algae, crust
5	1	1	Littorina spp.	3	boulder	NA
5	1	2	Littorina spp.	20	cobble	upright_algae
5	1	3	NA	NA	cobble	barnacles
5	1	4	Littorina spp.	20	cobble	NA



vertical_transect	quadrat	square	species	n	abiotic_hab	biotic_hab
5	1	5	NA	NA	pebble	barnacles
5	1	6	NA	NA	cobble	NA
5	1	7	Littorina spp.	2	boulder	barnacles
5	1	7	Littorina spp.	1	boulder	barnacles
5	1	8	Littorina spp.	7	cobble	NA
5	1	9	NA	NA	cobble	NA
5	1	10	NA	NA	pebble	barnacles
5	2	1	Littorina spp.	30	cobble	barnacles
5	2	2	NA	NA	pebble	barnacles
5	2	3	Littorina spp.	2	cobble	barnacles
5	2	4	Littorina spp.	10	cobble	barnacles
5	2	5	NA	NA	pebble	barnacles
5	2	6	Littorina spp.	20	boulder	barnacles
5	2	7	NA	NA	pebble	barnacles
5	2	8	Littorina spp.	64	boulder	barnacles
5	2	9	Littorina spp.	13	cobble	barnacles
5	2	10	NA	NA	cobble	NA
5	3	1	NA	NA	cobble	barnacles
5	3	2	Littorina spp.	3	cobble	barnacles
5	3	3	NA	NA	cobble	barnacles
5	3	4	NA	NA	cobble	barnacles
5	3	5	NA	NA	cobble	barnacles
5	3	6	NA	NA	pebble	barnacles
5	3	7	NA	NA	pebble	barnacles
5	3	8	NA	NA	cobble	barnacles
5	3	9	NA	NA	pebble	NA
5	3	10	NA	NA	cobble	barnacles
5	4	1	NA	NA	pebble	barnacles
5	4	2	Littorina spp.	22	cobble	barnacles
5	4	3	NA	NA	cobble	barnacles
5	4	4	Littorina spp.	9	cobble	barnacles
5	4	5	Littorina spp.	3	boulder	NA
5	4	6	Littorina spp.	24	boulder	barnacles
5	4	7	NA	NA	cobble	NA
5	4	8	NA	NA	cobble	barnacles
5	4	9	Littorina spp.	10	pebble	barnacles
5	4	10	Littorina spp.	6	cobble	barnacles
4	3	1	Littorina spp.	2	cobble	NA
4	3	1	Littorina spp.	8	cobble	NA
4	3	1	B. glandula	16	cobble	NA
4	3	1	C. dalli	4	cobble	NA
4	3	2	T. funebris	15	cobble	NA
4	3	2	B. glandula	78	cobble	NA
4	3	3	T. funebris	15	cobble	NA
4	3	3	B. glandula	36	cobble	NA
4	3	4	B. glandula	79	cobble	NA
4	3	5	C. dalli	13	cobble	NA
4	3	6	T. funebris	2	cobble	NA
4	3	6	B. glandula	8	cobble	NA
4	3	7	B. glandula	48	cobble	NA
4	3	7	P. samuelis	1	cobble	NA
4	3	8	B. glandula	16	cobble	NA

vertical_transect	quadrat	square	species	n	abiotic_hab	biotic_hab
4	3	8	T. funebris	5	cobble	NA
4	3	9	T. funebris	2	cobble	NA
4	3	10	B. glandula	27	cobble	NA
4	3	10	T. funebris	13	cobble	NA
4	1	1	B. glandula	61	cobble	NA
4	1	1	C. dalli	0	cobble	NA
4	1	2	B. glandula	11	cobble	NA
4	1	2	C. dalli	46	cobble	NA
4	1	3	Littorina spp.	1	pebble	NA
4	1	4	T. funebris	1	pebble	NA
4	1	4	B. glandula	31	pebble	NA
4	1	4	H. oregonensis	1	pebble	NA
4	1	4	Littorina spp.	1	pebble	NA
4	1	5	Littorina spp.	34	pebble	NA
4	1	5	T. funebris	3	pebble	NA
4	1	5	Littorina spp.	1	pebble	NA
4	1	6	H. oregonensis	1	cobble	NA
4	1	6	C. dalli	5	cobble	NA
4	1	6	T. funebris	1	cobble	NA
4	1	7	B. glandula	32	cobble	NA
4	1	7	T. funebris	10	cobble	NA
4	1	8	Littorina spp.	1	cobble	NA
4	1	8	T. funebris	16	cobble	NA
4	1	9	Littorina spp.	1	cobble	NA
4	1	9	C. dalli	44	cobble	NA
4	1	9	B. glandula	9	cobble	NA
4	1	10	B. glandula	23	pebble	NA
4	1	10	C. dalli	5	pebble	NA
4	2	1	B. glandula	28	cobble	NA
4	2	1	T. funebris	1	cobble	NA
4	2	1	Littorina spp.	1	cobble	NA
4	2	2	B. glandula	23	cobble	NA
4	2	2	T. funebris	12	cobble	NA
4	2	3	P. samuelis	3	cobble	NA
4	2	3	C. dalli	13	cobble	NA
4	2	3	B. glandula	10	cobble	NA
4	2	4	B. glandula	61	cobble	NA
4	2	4	T. funebris	20	cobble	NA
4	2	5	B. glandula	13	cobble	NA
4	2	5	P. samuelis	1	cobble	NA
4	2	5	H. oregonensis	1	cobble	NA
4	2	6	B. glandula	31	cobble	NA
4	2	6	T. funebris	28	cobble	NA
4	2	6	Littorina spp.	2	cobble	NA
4	2	6	H. oregonensis	2	cobble	NA
4	2	7	B. glandula	48	cobble	NA
4	2	7	T. funebris	9	cobble	NA
4	2	8	C. dalli	9	cobble	NA
4	2	9	P. samuelis	2	cobble	NA
4	2	9	H. oregonensis	1	cobble	NA
4	2	9	B. glandula	22	cobble	NA
4	2	10	T. funebris	3	cobble	NA

vertical_transect	quadrat	square	species	n	abiotic_hab	biotic_hab
4	2	10	Littorina spp.	1	cobble	NA
4	2	10	B. glandula	15	cobble	NA
6	1	1	Littorina spp.	5	cobble	NA
6	1	1	C. dalli	0	cobble	NA
6	1	2	NA	NA	cobble	NA
6	1	3	NA	NA	pebble	NA
6	1	4	B. glandula	16	cobble	NA
6	1	4	C. dalli	36	cobble	NA
6	1	5	Littorina spp.	1	cobble	NA
6	1	5	C. dalli	7	cobble	NA
6	1	6	Littorina spp.	17	cobble	NA
6	1	6	B. glandula	17	cobble	NA
6	1	6	C. dalli	24	cobble	NA
6	1	6	Littorina spp.	2	cobble	NA
6	1	7	NA	NA	cobble	NA
6	1	8	Littorina spp.	2	pebble	NA
6	1	8	B. glandula	28	pebble	NA
6	1	8	C. dalli	17	pebble	NA
6	1	9	Littorina spp.	18	cobble	NA
6	1	9	B. glandula	30	cobble	NA
6	1	9	C. dalli	29	cobble	NA
6	1	10	Littorina spp.	1	cobble	NA
6	2	1	Littorina spp.	10	cobble	NA
6	2	1	B. glandula	2	cobble	NA
6	2	2	Littorina spp.	4	pebble	NA
6	2	2	B. glandula	13	pebble	NA
6	2	2	C. dalli	14	pebble	NA
6	2	3	Littorina spp.	3	cobble	NA
6	2	3	B. glandula	2	cobble	NA
6	2	4	C. dalli	3	cobble	NA
6	2	5	Littorina spp.	13	cobble	NA
6	2	5	B. glandula	5	cobble	NA
6	2	5	C. dalli	1	cobble	NA
6	2	6	C. dalli	18	cobble	NA
6	2	7	Littorina spp.	3	cobble	NA
6	2	8	NA	NA	cobble	NA
6	2	9	Littorina spp.	2	cobble	NA
6	2	9	B. glandula	2	cobble	NA
6	2	10	C. dalli	6	cobble	NA
6	3	1	Littorina spp.	31	cobble	NA
6	3	1	B. glandula	28	cobble	NA
6	3	1	C. dalli	2	cobble	NA
6	3	2	Littorina spp.	4	cobble	Mastocarpus spp.
6	3	2	B. glandula	11	cobble	Mastocarpus spp.
6	3	2	C. dalli	12	cobble	Mastocarpus spp.
6	3	3	Littorina spp.	2	boulder	NA
6	3	3	B. glandula	10	boulder	NA
6	3	3	C. dalli	27	boulder	NA
6	3	4	Littorina spp.	11	cobble	NA
6	3	4	B. glandula	2	cobble	NA
6	3	4	C. dalli	10	cobble	NA
6	3	5	Littorina spp.	12	boulder	NA

vertical_transect	quadrat	square	species	n	abiotic_hab	biotic_hab
6	3	5	B. glandula	27	boulder	NA
6	3	5	C. dalli	32	boulder	NA
6	3	5	Littorina spp.	1	boulder	NA
6	3	5	Littorina spp.	1	boulder	NA
6	3	6	Littorina spp.	3	cobble	NA
6	3	6	B. glandula	12	cobble	NA
6	3	6	C. dalli	19	cobble	NA
6	3	7	Littorina spp.	7	pebble	NA
6	3	7	B. glandula	4	pebble	NA
6	3	7	O. maculosus	1	pebble	NA
6	3	8	Littorina spp.	4	cobble	NA
6	3	8	B. glandula	7	cobble	NA
6	3	8	C. dalli	12	cobble	NA
6	3	9	Littorina spp.	5	cobble	NA
6	3	9	B. glandula	24	cobble	NA
6	3	9	C. dalli	9	cobble	NA
6	3	10	Littorina spp.	7	cobble	NA
6	3	10	B. glandula	15	cobble	NA
6	3	10	C. dalli	19	cobble	NA
2	1	1	C. dalli	25	boulder	NA
2	1	1	B. glandula	5	boulder	NA
2	1	1	Littorina spp.	19	boulder	NA
2	1	2	C. dalli	50	boulder	NA
2	1	2	B. glandula	7	boulder	NA
2	1	2	Littorina spp.	5	boulder	NA
2	1	3	B. glandula	5	pebble	NA
2	1	4	C. dalli	5	cobble	NA
2	1	4	Littorina spp.	94	cobble	barnacles
2	1	5	C. dalli	33	bedrock	NA
2	1	5	Littorina spp.	34	bedrock	NA
2	1	5	B. glandula	6	bedrock	NA
2	1	6	C. dalli	12	bedrock	NA
2	1	6	Littorina spp.	15	bedrock	NA
2	1	6	B. glandula	25	bedrock	NA
2	1	7	C. dalli	38	pebble	NA
2	1	7	Littorina spp.	9	pebble	NA
2	1	7	B. glandula	12	pebble	NA
2	1	8	C. dalli	35	boulder	NA
2	1	8	Littorina spp.	6	boulder	NA
2	1	8	B. glandula	2	boulder	NA
2	1	9	C. dalli	50	boulder	NA
2	1	9	Littorina spp.	40	boulder	NA
2	1	9	B. glandula	31	boulder	NA
2	1	10	Littorina spp.	30	boulder	barnacles
2	2	1	B. glandula	20	boulder	NA
2	2	1	Littorina spp.	1	boulder	NA
2	2	1	Littorina spp.	25	boulder	NA
2	2	2	C. dalli	22	boulder	NA
2	2	2	Littorina spp.	40	boulder	NA
2	2	2	B. glandula	30	boulder	NA
2	2	3	NA	NA	boulder	NA
2	2	4	C. dalli	10	boulder	NA

vertical_transect	quadrat	square	species	n	abiotic_hab	biotic_hab
2	2	4	Littorina spp.	1	boulder	NA
2	2	4	B. glandula	25	boulder	NA
2	2	5	C. dalli	7	boulder	NA
2	2	5	Littorina spp.	16	boulder	NA
2	2	5	B. glandula	25	boulder	NA
2	2	6	C. dalli	5	pebble	NA
2	2	6	B. glandula	12	pebble	NA
2	2	7	C. dalli	4	boulder	NA
2	2	8	B. glandula	7	boulder	NA
2	2	8	Littorina spp.	12	boulder	NA
2	2	9	B. glandula	5	cobble	NA
2	2	9	C. dalli	23	cobble	NA
2	2	10	B. glandula	2	pebble	NA
2	3	1	C. dalli	32	boulder	NA
2	3	1	Littorina spp.	30	boulder	NA
2	3	2	B. glandula	12	pebble	NA
2	3	3	B. glandula	5	pebble	NA
2	3	4	NA	0	pebble	NA
2	3	5	B. glandula	1	pebble	NA
2	3	6	C. dalli	70	boulder	NA
2	3	6	Littorina spp.	3	boulder	NA
2	3	7	B. glandula	11	pebble	NA
2	3	8	C. dalli	4	pebble	NA
2	3	8	B. glandula	3	pebble	NA
2	3	9	NA	0	pebble	NA
2	3	10	B. glandula	15	boulder	Upright.algae
2	3	10	C. dalli	10	boulder	Upright.algae
1	3	1	B. glandula	4	boulder	NA
1	3	NA	C. dalli	4	boulder	NA
1	3	2	NA	0	sand	NA
1	3	3	B. glandula	7	boulder	NA
1	3	NA	C. dalli	42	boulder	NA
1	3	4	B. glandula	47	cobble	NA
1	3	NA	C. dalli	42	cobble	NA
1	3	NA	Littorina spp.	18	cobble	NA
1	3	5	NA	NA	sand	NA
1	3	6	NA	NA	sand	NA
1	3	7	B. glandula	18	boulder	NA
1	3	NA	C. dalli	64	boulder	NA
1	3	NA	Littorina spp.	24	boulder	NA
1	3	8	B. glandula	13	boulder	NA
1	3	9	C. dalli	1	boulder	NA
1	3	10	NA	NA	sand	NA
1	4	1	B. glandula	8	boulder	NA
1	4	2	B. glandula	6	boulder	NA
1	4	3	NA	0	sand	NA
1	4	4	NA	0	sand	NA
1	4	5	NA	0	sand	NA
1	4	6	NA	0	sand	NA
1	4	7	NA	0	sand	NA
1	4	8	B. glandula	16	cobble	NA
1	4	9	NA	0	cobble	NA

vertical_transect	quadrat	square	species	n	abiotic_hab	biotic_hab
1	4	10	NA	0	sand	NA
3	1	1	B. glandula	22	cobble	NA
3	1	1	C. dalli	43	cobble	NA
3	1	1	Littorina spp.	9	cobble	B. glandula, Upright algae
3	1	2	Littorina spp.	38	cobble	B. glandula, Upright algae
3	1	2	B. glandula	26	cobble	NA
3	1	2	C. dalli	24	cobble	NA
3	1	3	B. glandula	8	pebble	NA
3	1	3	C. dalli	3	pebble	NA
3	1	3	Littorina spp.	1	pebble	NA
3	1	4	B. glandula	3	cobble	NA
3	1	4	C. dalli	11	cobble	NA
3	1	5	B. glandula	14	cobble	NA
3	1	5	Littorina spp.	16	cobble	NA
3	1	6	H. nudus	2	pebble	NA
3	1	6	B. glandula	34	pebble	NA
3	1	6	C. dalli	17	pebble	NA
3	1	6	Littorina spp.	30	pebble	NA
3	1	6	P. samuelis	1	pebble	NA
3	1	7	C. dalli	15	cobble	NA
3	1	7	B. glandula	3	cobble	NA
3	1	7	H. nudus	1	cobble	NA
3	1	8	NA	0	cobble	NA
3	1	9	Littorina spp.	25	cobble	B. glandula
3	1	9	B. glandula	20	cobble	NA
3	1	9	C. dalli	11	cobble	NA
3	1	10	H. cinctipes	1	cobble	NA
3	1	10	Littorina spp.	2	cobble	NA
3	1	10	Littorina spp.	7	cobble	NA
3	2	1	C. dalli	2	pebble	NA
3	2	1	Littorina spp.	1	pebble	NA
3	2	2	C. dalli	1	cobble	NA
3	2	2	B. glandula	2	cobble	NA
3	2	2	Littorina spp.	18	cobble	NA
3	2	3	C. dalli	70	cobble	NA
3	2	3	B. glandula	7	cobble	NA
3	2	4	Littorina spp.	8	cobble	NA
3	2	4	B. glandula	2	cobble	NA
3	2	5	Littorina spp.	1	cobble	NA
3	2	6	Littorina spp.	15	cobble	NA
3	2	6	B. glandula	25	cobble	NA
3	2	7	Littorina spp.	3	cobble	NA
3	2	7	C. dalli	2	cobble	NA
3	2	8	B. glandula	8	cobble	NA
3	2	8	C. dalli	40	boulder	NA
3	2	8	Littorina spp.	8	boulder	NA
3	2	9	Littorina spp.	1	boulder	NA
3	2	10	NA	0	cobble	NA

#Organizing data & making new columns:

```
## vertical_transect quadrat square species n abiotic_hab biotic_hab
```

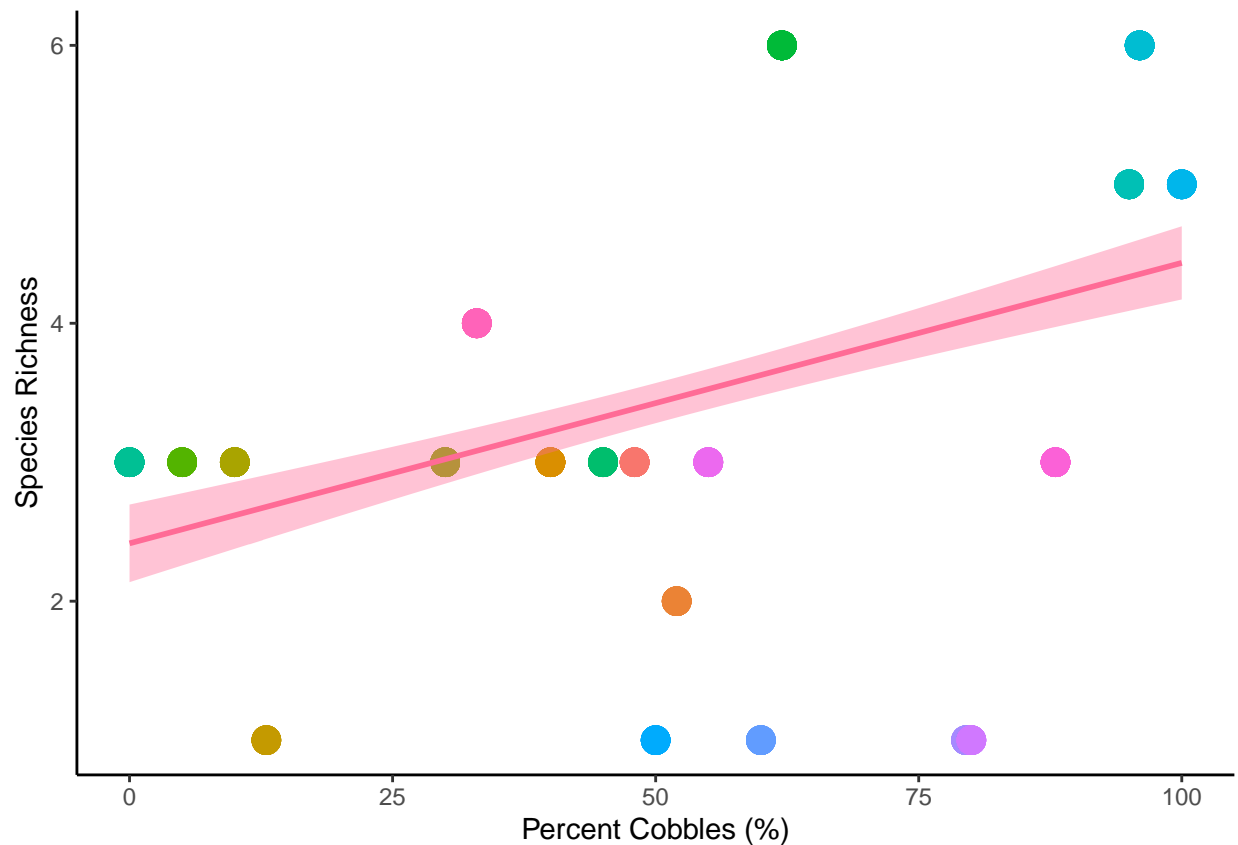
```
## 1      1      1      1 B. glandula 9      cobble      <NA>
## 2      1      1      1  C. dalli  2      cobble      <NA>
## 3      1      1      2      <NA> NA      sand        <NA>
## 4      1      1      3 B. glandula 2      cobble      <NA>
## 5      1      1      4      <NA> NA      sand        <NA>
## 6      1      1      5 B. glandula 5      cobble      <NA>
##   per_sand per_pebble per_cobble per_boulder per_bedrock per_mussel
## 1      52      0      48      0      0      0
## 2      52      0      48      0      0      0
## 3      52      0      48      0      0      0
## 4      52      0      48      0      0      0
## 5      52      0      48      0      0      0
## 6      52      0      48      0      0      0
##   per_barnacle per_upright per_crust num_snail num_crab
## 1           11      0.005      0      0      0
## 2           11      0.005      0      0      0
## 3           11      0.005      0      0      0
## 4           11      0.005      0      0      0
## 5           11      0.005      0      0      0
## 6           11      0.005      0      0      0
```

#Then we organize the final dataset by merging the above

```
figure_data = final_merged_data %>%
  mutate(transect_quad = as.factor(transect_quad))
species_rich <- ggplot(figure_data, aes(x = per_cobble, y = species_per_quad, fill = transect_quad)) +
  geom_point(aes(colour = transect_quad, size = 2)) +
  stat_smooth(method = "lm", aes(fill = "transect_quad", colour = "black")) +
  xlab("Percent Cobbles (%)") +
  ylab("Species Richness") +
  theme_classic() +
  theme(legend.position = "none")

species_rich
```

## 'geom\_smooth()' using formula 'y ~ x'



```
ggsave(here("./images/species_richness_cobble.png"), species_rich)
```

```
## Saving 6.5 x 4.5 in image
## 'geom_smooth()' using formula 'y ~ x'
```

```
species.mod <- lm(per_cobble ~ species_per_quad, data = figure_data)
summary(species.mod)
```

```
##
## Call:
## lm(formula = per_cobble ~ species_per_quad, data = figure_data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -48.029 -23.614  -3.029   27.410   49.141
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    22.2748     3.7617   5.921 7.52e-09 ***
## species_per_quad  8.5847     0.9938   8.638 < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 28.58 on 356 degrees of freedom
```



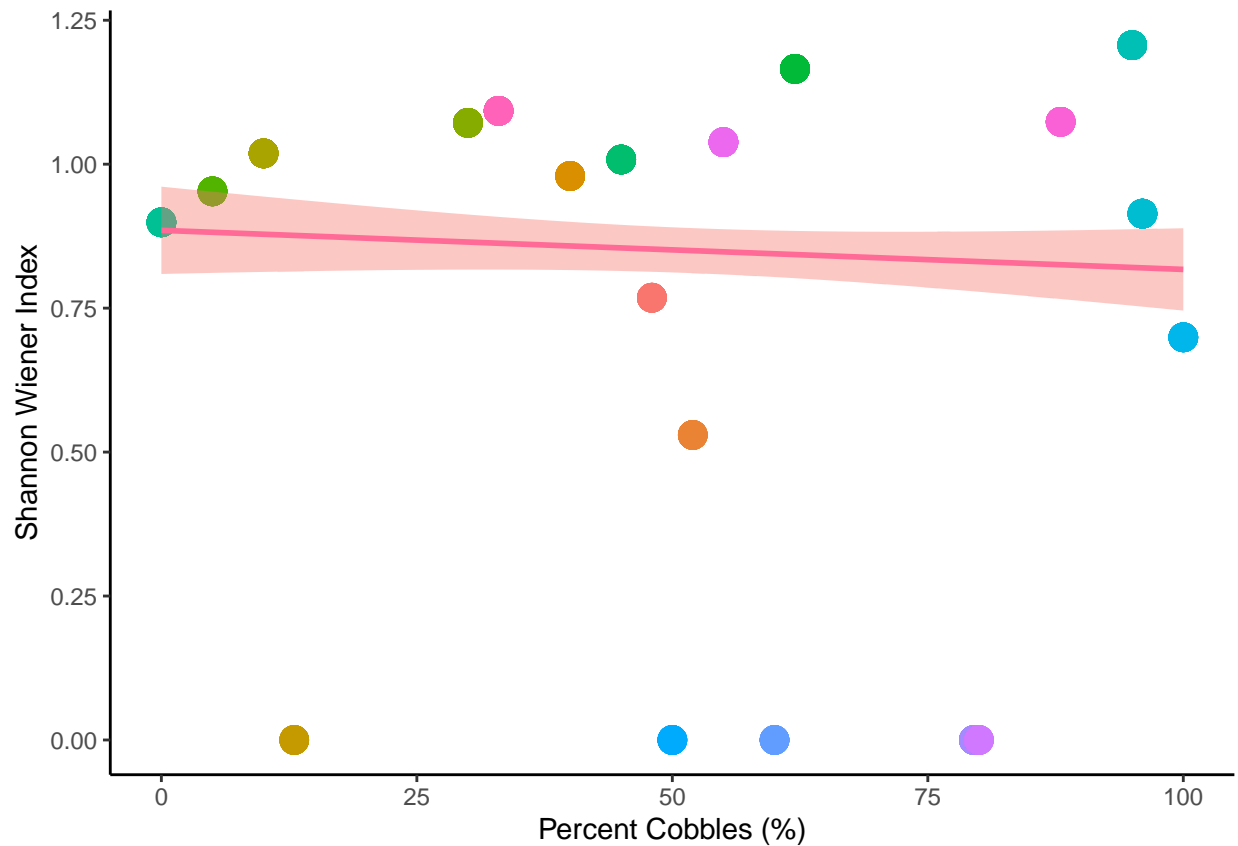
```
## Multiple R-squared:  0.1733, Adjusted R-squared:  0.171
## F-statistic: 74.61 on 1 and 356 DF,  p-value: < 2.2e-16
```

```
#p = 2e-16, significant
```

```
shannon_plot_cobble <- ggplot(figure_data, aes(x = per_cobble, y = H)) +
  geom_point(aes(colour = transect_quad, size = 2)) +
  theme_classic() +
  xlab("Percent Cobbles (%)") +
  ylab("Shannon Wiener Index") +
  stat_smooth(method = "lm", aes(fill = "transect_quad", colour = "black")) +
  theme(legend.position = "none")
```

```
shannon_plot_cobble
```

```
## 'geom_smooth()' using formula 'y ~ x'
```



```
ggsave(here("./images/shannon_plot_cobble.png"), shannon_plot_cobble)
```

```
## Saving 6.5 x 4.5 in image
## 'geom_smooth()' using formula 'y ~ x'
```

```
Hcobble.mod <- lm(per_cobble ~ H, data = figure_data)
summary(Hcobble.mod)
```

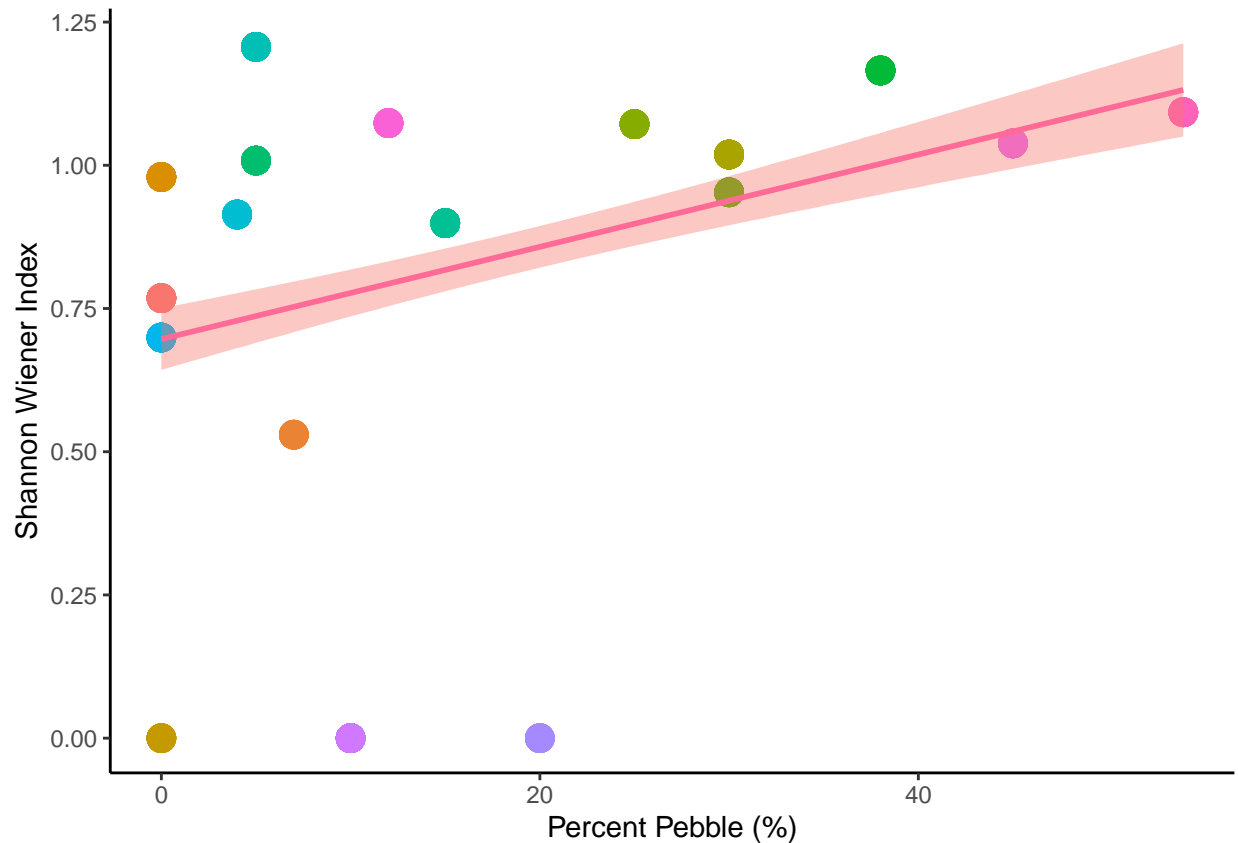
```
##
## Call:
## lm(formula = per_cobble ~ H, data = figure_data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -51.801 -20.985  -4.419   23.954   47.256
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   56.046      4.101   13.67  <2e-16 ***
## H             -4.721      4.413   -1.07    0.285
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 31.38 on 356 degrees of freedom
## Multiple R-squared:  0.003205, Adjusted R-squared:  0.0004052
## F-statistic: 1.145 on 1 and 356 DF, p-value: 0.2854
```

#p = 0.285, not significant

```
shannon_plot_pebble <- ggplot(figure_data, aes(x = per_pebble, y = H)) +
  geom_point(aes(colour = transect_quad, size = 2)) +
  theme_classic() +
  xlab("Percent Pebble (%)") +
  ylab("Shannon Wiener Index") +
  stat_smooth(method = "lm", aes(fill = "transect_quad", colour = "black")) +
  theme(legend.position = "none")
```

```
shannon_plot_pebble
```

```
## 'geom_smooth()' using formula 'y ~ x'
```



```
ggsave(here("./images/shannon_plot_pebble.png"), shannon_plot_pebble)
```

```
## Saving 6.5 x 4.5 in image
## 'geom_smooth()' using formula 'y ~ x'
```

```
Hpebble.mod <- lm(per_pebble ~ H, data = figure_data)
summary(Hpebble.mod)
```

```
##
## Call:
## lm(formula = per_pebble ~ H, data = figure_data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -21.283 -16.412   2.113  12.408  30.752
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    4.255     2.122   2.006  0.0457 *
## H              17.384     2.283   7.614 2.42e-13 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 16.24 on 356 degrees of freedom
```

```
## Multiple R-squared:  0.14, Adjusted R-squared:  0.1376  
## F-statistic: 57.97 on 1 and 356 DF,  p-value: 2.42e-13
```

```
#p-value = 2.42e-13, significant
```

## Question ## Does substrate type impact sessile invertebrate biodiversity in the intertidal zone?

Specifically, how does percent cobble cover impact species richness in each quadrat?, how does percent cobble cover impact the Shannon Wiener Index in each quadrat?, and how does percent pebble cover impact the Shannon Wiener index in each quadrat?

## Data Collection ## We sampled our data at Scott's Bay, BC using transect tapes parallel to the shoreline and quadrats that were placed haphazardly along six vertical transects. Measurements were taken during a high low tide at two different elevations across exposed and sheltered sides of the bay, and species counts and percent biotic and abiotic cover was recorded for randomly selected squares in each quadrat.

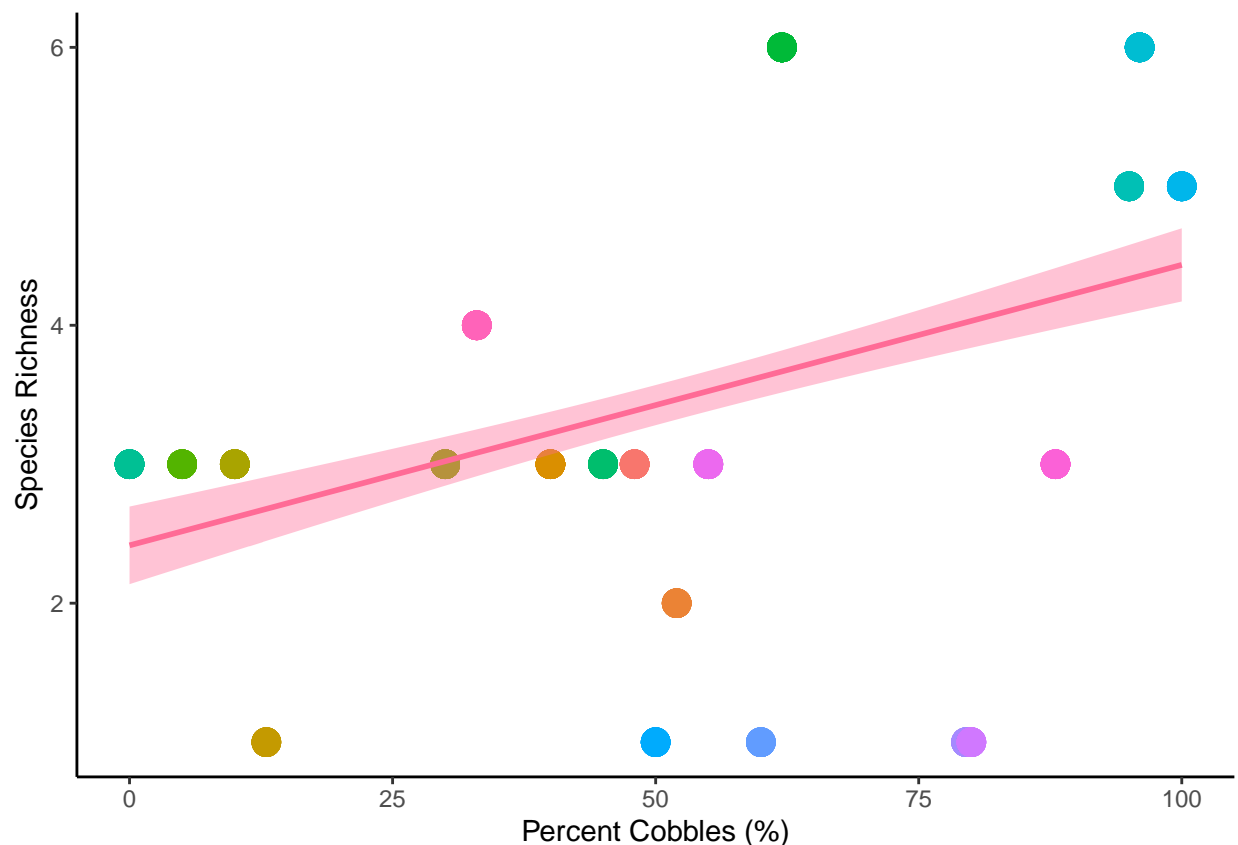
## Summary of Analysis ## We manipulated and organized our csv datasets in R studio to create a csv that included all data needed to create our figures. To answer our question we calculated species richness and Shannon Wiener Index for each quadrat, and then performed linear regression models to test the significance of our findings.

Parameters	p-value	Adjusted R-squared
Percent cobble vs Species Richness	< 2.2e-16	0.171
Percent cobble vs Shannon Wiener Index	0.2854	0.0004052
Percent pebble vs Shannon Wiener Index	2.42e-13	0.1376

## Results & Conclusions ## 0.2854 We first plotted the species richness versus percent boulder cover in each quadrat, finding that boulder cover did significantly impact species richness in a positive correlation.

```
species_rich
```

```
## 'geom_smooth()' using formula 'y ~ x'
```

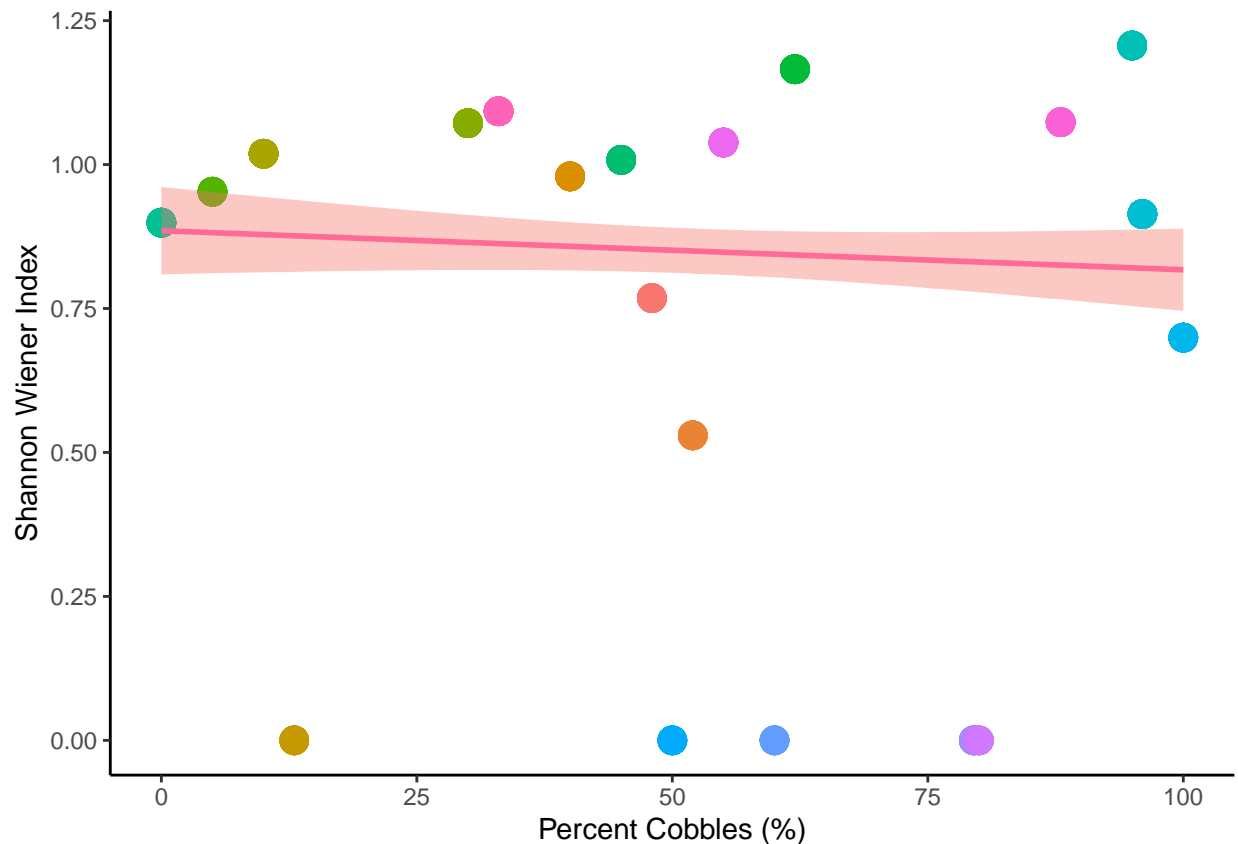


**Figure 1:** Species richness is the response variable plotted against percent cobbles, which serves as the explanatory variable. The colours represent different quadrats along our transects. The linear trendline was added and we found an adjusted  $R^2$  of 0.171 and a p-value of  $< 2.2e-16$ .

Then we plotted two figures for biodiversity (Shannon Wiener index) versus percent boulder and percent pebble cover, respectively, finding that cobble cover did not significantly impact biodiversity but pebble cover did have a significant positive correlation.

```
#for percent cobble
shannon_plot_cobble
```

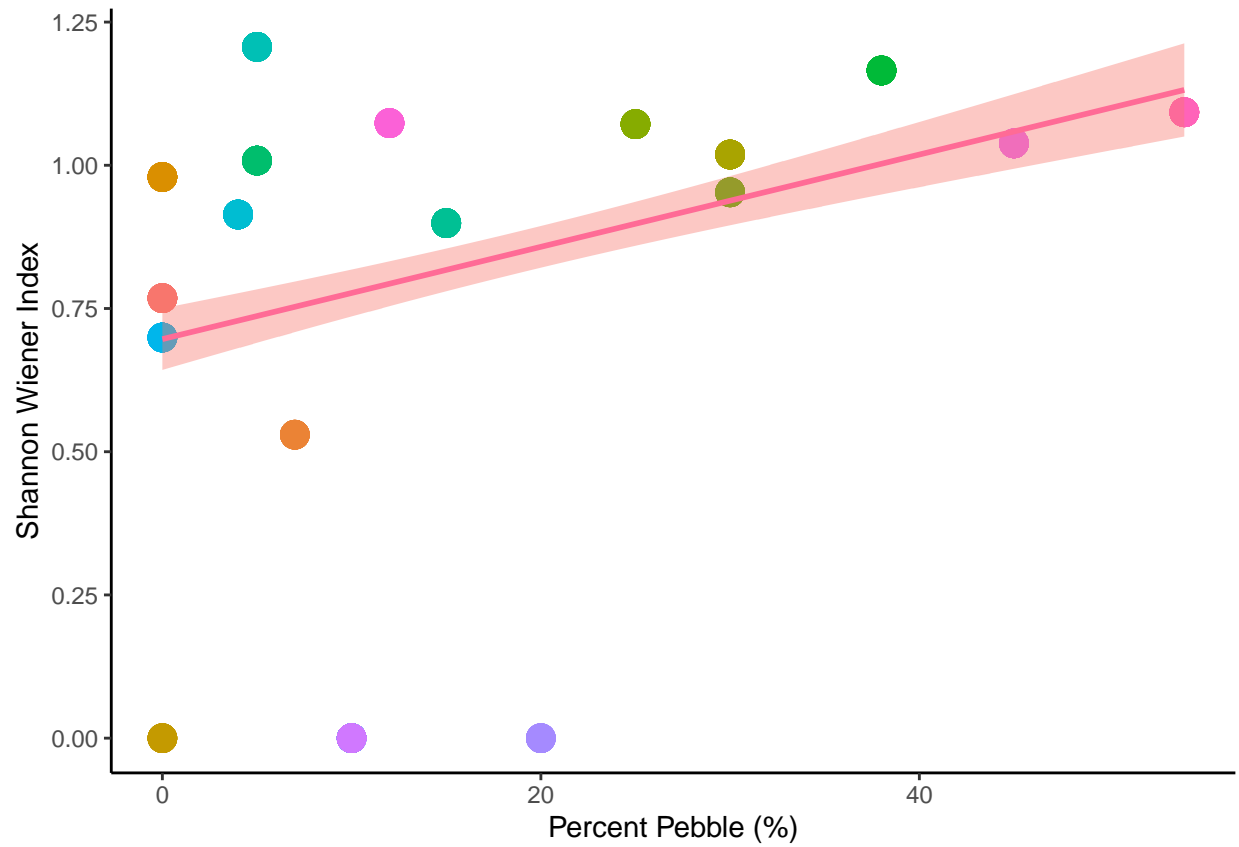
```
## 'geom_smooth()' using formula 'y ~ x'
```



**Figure 2:** The Shannon Wiener Index is the response variable plotted against percent cobbles, which serves as the explanatory variable. The colours represent different quadrats along our transects. The linear trendline was added and we found an adjusted  $R^2$  of 0.0004052 and a p-value of 0.2854.

```
#for percent pebble
shannon_plot_pebble
```

```
## 'geom_smooth()' using formula 'y ~ x'
```



**Figure 3:** The Shannon Wiener Index is the response variable plotted against percent pebble, which serves as the explanatory variable. The colours represent different quadrats along our transects. The linear trendline was added and we found an adjusted  $R^2$  of 0.1376 and a p-value of 2.42e-13.