

Pacific herring spawn events influence nearshore subtidal and intertidal species

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Supplement

Table S1. Mean $\delta^{15}\text{N} \pm \text{SE}$ and $\delta^{13}\text{C} \pm \text{SE}$ isotopic values and C:N ratios for intertidal and nearshore subtidal invertebrate and macrophyte species before (0) and after (1) the Pacific herring (*Clupea pallasii*) spawn events on beaches in Quatsino Sound, British Columbia (2011 - 2012). Control beaches are sites that did not experience herring spawn events. At each beach location, five samples were collected, with exception to *Traskorchestia spp.*, where 10 samples were collected.

Species	Beach	Year	Spawn status (before = 0, after = 1)	$\delta^{15}\text{N} \pm \text{SE}$ (‰)	$\delta^{13}\text{C} \pm \text{SE}$ (‰)	C:N ratio
<i>Phyllospadix serrulatus</i>	Control 1	2011	0	11.00 ± 0.53	-19.02 ± 0.51	11.73 ± 0.17
	Control 1	2011	1	9.96 ± 0.57	-16.05 ± 0.76	11.58 ± 0.41
	Control 2	2011	0	9.14 ± 0.45	-18.31 ± 0.46	13.86 ± 0.50
	Control 2	2011	1	8.23 ± 0.33	-15.66 ± 0.32	11.03 ± 0.31
	Spawn 1	2011	0	9.49 ± 0.50	-16.42 ± 0.68	11.66 ± 0.49
	Spawn 1	2011	1	9.37 ± 0.35	-15.52 ± 0.42	8.62 ± 0.31
	Spawn 2	2011	0	9.39 ± 0.45	-15.23 ± 0.29	11.18 ± 0.31
	Spawn 2	2011	1	10.26 ± 0.16	-14.45 ± 0.62	8.70 ± 0.06
	Spawn 3	2011	0	8.53 ± 0.54	-16.42 ± 0.59	12.15 ± 0.32
	Spawn 3	2011	1	10.08 ± 0.18	-14.38 ± 0.65	9.39 ± 0.30
	Control 1	2012	0	11.35 ± 0.80	-20.67 ± 0.50	12.09 ± 0.76
	Control 1	2012	1	8.10 ± 0.15	-17.14 ± 0.44	11.69 ± 0.25
	Spawn 1	2012	0	11.21 ± 0.47	-17.90 ± 0.39	13.86 ± 0.60
	Spawn 1	2012	1	10.67 ± 0.21	-14.79 ± 0.43	9.26 ± 0.21
	<i>Macrocystis pyrifera</i>	Control 1	2011	0	5.30 ± 0.31	-13.72 ± 0.55
Control 1		2011	1	6.04 ± 0.11	-13.57 ± 0.20	11.22 ± 0.24
Control 2		2011	0	6.63 ± 0.69	-15.32 ± 0.63	11.83 ± 1.22
Control 2		2011	1	5.98 ± 0.19	-13.14 ± 0.14	11.79 ± 0.59
Spawn 1		2011	0	4.54 ± 0.21	-14.20 ± 0.38	8.93 ± 0.34
Spawn 1		2011	1	9.48 ± 0.33	-13.48 ± 0.38	9.02 ± 0.14
Spawn 2		2011	0	-	-	-
Spawn 2		2011	1	-	-	-
Spawn 3		2011	0	4.93 ± 0.38	-15.10 ± 0.35	9.61 ± 0.36
Spawn 3		2011	1	7.77 ± 0.31	-12.77 ± 0.29	9.63 ± 0.22
Control 1		2012	0	4.59 ± 0.44	-14.88 ± 0.47	10.14 ± 0.15
Control 1		2012	1	5.83 ± 0.26	-13.72 ± 0.23	12.93 ± 0.25
Spawn 1		2012	0	4.87 ± 0.27	-16.50 ± 0.47	8.65 ± 0.14

	Spawn 1	2012	1	9.22 ± -0.37	-14.07 ± 0.27	12.89 ± 0.47
<i>Fucus</i> spp.	Control 1	2011	0	6.48 ± 0.14	-18.05 ± 0.31	11.15 ± 0.31
	Control 1	2011	1	8.57 ± 0.12	-16.25 ± 0.46	11.21 ± 0.36
	Control 2	2011	0	6.82 ± 0.22	-17.51 ± 0.22	13.04 ± 0.39
	Control 2	2011	1	7.51 ± 0.24	-15.09 ± 0.53	11.67 ± 0.24
	Spawn 1	2011	0	7.56 ± 0.10	-18.50 ± 0.35	12.47 ± 0.14
	Spawn 1	2011	1	11.20 ± 0.25	-15.87 ± 0.16	9.90 ± 0.27
	Spawn 2	2011	0	-	-	-
	Spawn 2	2011	1	-	-	-
	Spawn 3	2011	0	7.16 ± 0.15	-20.21 ± 1.22	12.93 ± 0.40
	Spawn 3	2011	1	9.80 ± 0.12	-16.08 ± 0.57	11.24 ± 0.62
	Control 1	2012	0	5.58 ± 0.29	-20.27 ± 0.39	12.17 ± 0.30
	Control 1	2012	1	7.57 ± 0.16	-16.61 ± 0.58	16.27 ± 1.02
	Spawn 1	2012	0	6.49 ± 0.12	-18.24 ± 0.38	11.07 ± 0.33
	Spawn 1	2012	1	12.03 ± 0.12	-14.79 ± 0.16	11.33 ± 0.55
<i>Callithamnion</i> spp.	Control 1	2011	0	7.75 ± 0.26	-22.44 ± 0.44	6.87 ± 0.16
	Control 1	2011	1	8.10 ± 0.23	-18.67 ± 0.35	7.12 ± 0.08
	Control 2	2011	0	7.62 ± 0.31	-21.76 ± 0.15	7.54 ± 0.07
	Control 2	2011	1	6.26 ± 0.06	-19.74 ± 0.36	7.07 ± 0.09
	Spawn 1	2011	0	8.60 ± 0.30	-21.69 ± 0.56	6.68 ± 0.16
	Spawn 1	2011	1	8.63 ± 0.16	-19.74 ± 1.03	6.86 ± 0.08
	Spawn 2	2011	0	7.39 ± 0.30	-21.75 ± 0.65	6.21 ± 0.17
	Spawn 2	2011	1	10.27 ± 0.43	-20.16 ± 1.61	6.18 ± 0.28
	Spawn 3	2011	0	6.90 ± 0.26	-21.55 ± 0.36	6.93 ± 0.14
	Spawn 3	2011	1	8.90 ± 0.08	-19.30 ± 0.25	6.79 ± 0.13
	Control 1	2012	0	6.85 ± 0.41	-23.31 ± 0.54	6.63 ± 0.13
	Control 1	2012	1	6.45 ± 0.13	-20.22 ± 0.36	8.25 ± 0.09
	Spawn 1	2012	0	7.51 ± 0.18	-22.49 ± 0.46	6.87 ± 0.10
	Spawn 1	2012	1	10.02 ± 0.16	-18.47 ± 0.93	7.47 ± 0.07
<i>Ulva lactuca</i>	Control 1	2011	0	7.27 ± 0.17	-20.23 ± 0.34	7.05 ± 0.07
	Control 1	2011	1	7.99 ± 0.08	-18.63 ± 0.20	7.32 ± 0.09
	Control 2	2011	0	-	-	-
	Control 2	2011	1	-	-	-
	Spawn 1	2011	0	-	-	-
	Spawn 1	2011	1	-	-	-
	Spawn 2	2011	0	7.31 ± 0.04	-17.30 ± 0.54	6.72 ± 0.10
	Spawn 2	2011	1	12.32 ± 0.18	-17.13 ± 0.48	6.43 ± 0.09
	Spawn 3	2011	0	-	-	-
	Spawn 3	2011	1	-	-	-
	Control 1	2012	0	7.09 ± 0.09	-19.52 ± 0.21	7.05 ± 0.11
	Control 1	2012	1	8.04 ± 0.10	-18.53 ± 0.26	10.18 ± 0.19
	Spawn 1	2012	0	7.29 ± 0.05	-19.79 ± 0.41	6.60 ± 0.03
	Spawn 1	2012	1	12.73 ± 0.23	-16.23 ± 0.33	7.02 ± 0.08
<i>Traskorchestia</i> spp.	Control 1	2011	0	10.94 ± 0.20	-12.98 ± 0.08	6.21 ± 0.10
	Control 1	2011	1	11.37 ± 0.14	-12.95 ± 0.08	5.92 ± 0.10
	Control 2	2011	0	11.20 ± 0.15	-13.11 ± 0.15	5.73 ± 0.12
	Control 2	2011	1	11.03 ± 0.10	-13.05 ± 0.11	5.52 ± 0.12
	Spawn 1	2011	0	11.95 ± 0.26	-12.40 ± 0.14	6.39 ± 0.14
	Spawn 1	2011	1	12.34 ± 0.18	-12.96 ± 0.13	6.19 ± 0.12
	Spawn 2	2011	0	11.04 ± 0.10	-12.36 ± 0.10	5.95 ± 0.08
	Spawn 2	2011	1	11.34 ± 0.24	-12.79 ± 0.14	5.62 ± 0.11
	Spawn 3	2011	0	11.57 ± 0.10	-11.68 ± 0.08	6.81 ± 0.09
	Spawn 3	2011	1	11.76 ± 0.13	-11.70 ± 0.10	6.60 ± 0.09

	Control 1	2012	0	10.56 ± 0.13	-15.28 ± 0.17	6.01 ± 0.11
	Control 1	2012	1	10.56 ± 0.07	-15.55 ± 0.13	5.49 ± 0.09
	Spawn 1	2012	0	11.56 ± 0.05	-14.45 ± 0.10	5.92 ± 0.09
	Spawn 1	2012	1	11.84 ± 0.47	-14.93 ± 0.09	5.70 ± 0.06
<i>Tectura persona</i>	Control 1	2011	0	10.21 ± 0.22	-17.25 ± 0.55	3.89 ± 0.19
	Control 1	2011	1	9.85 ± 0.18	-16.54 ± 0.29	4.47 ± 0.36
	Control 2	2011	0	9.32 ± 0.20	-15.27 ± 0.89	4.50 ± 0.21
	Control 2	2011	1	9.16 ± 0.15	-15.26 ± 0.84	4.18 ± 0.20
	Spawn 1	2011	0	11.90 ± 0.51	-15.72 ± 0.54	3.93 ± 0.11
	Spawn 1	2011	1	11.67 ± 0.18	-16.49 ± 0.17	3.85 ± 0.11
	Spawn 2	2011	0	9.66 ± 0.13	-14.60 ± 0.39	3.85 ± 0.05
	Spawn 2	2011	1	10.90 ± 0.17	-12.01 ± 1.48	4.08 ± 0.14
	Spawn 3	2011	0	10.84 ± 0.07	-18.63 ± 0.32	4.01 ± 0.19
	Spawn 3	2011	1	10.49 ± 0.19	-15.69 ± 0.48	3.86 ± 0.11
	Control 1	2012	0	9.00 ± 0.12	-17.12 ± 0.62	4.05 ± 0.09
	Control 1	2012	1	9.16 ± 0.08	-15.37 ± 0.84	4.13 ± 0.15
	Spawn 1	2012	0	11.01 ± 0.23	-15.96 ± 1.26	4.02 ± 0.13
	Spawn 1	2012	1	11.37 ± 0.26	-17.48 ± 0.49	3.91 ± 0.10
<i>Nucella lamellosa</i>	Control 1	2011	0	-	-	-
	Control 1	2011	1	-	-	-
	Control 2	2011	0	13.18 ± 0.17	-14.62 ± 0.16	3.79 ± 0.10
	Control 2	2011	1	12.27 ± 0.17	-15.54 ± 0.10	3.77 ± 0.02
	Spawn 1	2011	0	-	-	-
	Spawn 1	2011	1	-	-	-
	Spawn 2	2011	0	11.93 ± 0.15	-15.09 ± 0.06	3.85 ± 0.09
	Spawn 2	2011	1	12.22 ± 0.14	-15.28 ± 0.05	3.80 ± 0.07
	Spawn 3	2011	0	-	-	-
	Spawn 3	2011	1	-	-	-
	Control 1	2012	0	11.73 ± 0.25	-16.52 ± 0.27	4.45 ± 0.19
	Control 1	2012	1	12.00 ± 0.10	-16.32 ± 0.13	3.76 ± 0.04
	Spawn 1	2012	0	13.34 ± 0.20	-15.02 ± 0.25	4.03 ± 0.37
	Spawn 1	2012	1	12.97 ± 0.12	-15.28 ± 0.08	3.87 ± 0.06
<i>Nucella ostrina</i>	Control 1	2011	0	-	-	-
	Control 1	2011	1	-	-	-
	Control 2	2011	0	-	-	-
	Control 2	2011	1	-	-	-
	Spawn 1	2011	0	-	-	-
	Spawn 1	2011	1	-	-	-
	Spawn 2	2011	0	-	-	-
	Spawn 2	2011	1	-	-	-
	Spawn 3	2011	0	-	-	-
	Spawn 3	2011	1	-	-	-
	Control 1	2012	0	12.11 ± 0.09	-16.76 ± 0.06	3.76 ± 0.12
	Control 1	2012	1	12.10 ± 0.16	-16.69 ± 0.12	3.74 ± 0.07
	Spawn 1	2012	0	13.49 ± 0.17	-15.73 ± 0.24	4.07 ± 0.20
	Spawn 1	2012	1	13.80 ± 0.21	-15.36 ± 0.11	3.72 ± 0.05

Table S2. Results of two General Linear Mixed Models (GLMMs) to explain variation in $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ levels in macrophyte and invertebrates species collected before and after (variable = time) Pacific herring (*Clupea pallasii*) spawn events on beaches with and without spawn (variable = spawn). Shown are results of type III tests of fixed effects and estimates of covariance parameters for random effects (species, location, and year), including Wald Z statistic and corresponding significance.

Response variable	Effect	Variable	d.f.	F	Parameter estimate	SE	Wald Z	P
$\delta^{15}\text{N}$		Intercept	1,10.39	203.52	10.98	0.72		<0.001
	Fixed	Time	1,505.45	0.02	0.02	0.13		0.883
	Fixed	Spawn	1,370.33	83.77	1.58	0.17		<0.001
	Random	Species			4.62	2.19	2.10	0.035
	Random	Location			0.12	0.09	1.29	0.199
	Random	Year			0.04	0.06	0.58	0.560
	Random	Residual			1.15	0.07	16.77	<0.001
$\delta^{13}\text{C}$		Intercept	1,10.10	401.88	-15.56	0.81		<0.001
	Fixed	Time	1,491.55	52.92	1.25	0.17		<0.001
	Fixed	Spawn	1,343.11	0.01	0.03	0.23		0.914
	Random	Species			4.89	2.32	2.11	0.035
	Random	Location			0.20	0.16	1.22	0.224
	Random	Year			0.23	0.34	0.70	0.503
	Random	Residual			1.98	0.12	16.78	<0.001