



Production Characteristics and Optimization of Mitigation Mussel Culture

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Sample date	Site	Treatment	Biomass					#					
			per meter substrate (kg)	st dev	Level	p-value	Statistic	mussels per meter substrate	st dev	Level	p-value	Statistic	
October / November 2017	SKIV	30 2 m	10.1	1.1	ab	<0.01	$F_{3,20}=9.8172$	2180	273	a	0.05	$F_{3,20}=3.107$	
		30 3 m	7.3	0.6	c			1846	149	a			
		60 2 m	10.9	1.8	a			2398	463	a			
		60 3 m	8.3	1.3	bc			1931	415	a			
	DV	30 2 m	10.0	0.7		0.46	$F_{3,20}=0.8951$	1702	242		0.72	$F_{3,20}=0.4521$	
		30 3 m	9.1	1.3				1543	304				
		60 2 m	10.2	2.1				1642	341				
		60 3 m	10.2	1.0				1702	172				
	SALL	30 2 m	11.7	0.7		0.43	$t_{2,49}=-0.94$	2461	119		0.42	$t_{2,26}=-0.98$	
		60 2 m	10.6	2.0				2189	467				
	December 2017	SKIV	30 2 m	11.8	2.4	a	<0.01	$F_{3,44}=5.46$	2157	529		0.06	$F_{3,44}=2.72$
			30 3 m	9.5	2.4	ab			1811	662			
60 2 m			12.0	2.5	a	2335			416				
60 3 m			8.7	1.8	b	1786			446				
DV		30 2 m	12.1	1.6	a	<0.01	$F_{3,56}=11.27$	1623	243	a	0.03	$F_{3,56}=3.21$	
		30 3 m	8.9	1.4	b			1375	314	b			
		60 2 m	12.1	1.6	a			1567	234	ab			
		60 3 m	10.4	2.3	b			1527	319	ab			
SALL		30 2 m	12.2	0.4		0.68	$t_{2,13}=-0.48$	1866	66		0.58	$t_{2,01}=-0.66$	
		60 2 m	12.8	2.3				2290	1112				
March / April 2018		SKIV	30 2 m	9.5	3.1	a	<0.01	$F_{3,36}=8.41$	2054	449	a	<0.01	$F_{3,36}=8.07$
			30 3 m	5.3	1.4	b			1300	427	b		
	60 2 m		8.9	2.4	a	1949			389	a			
	60 3 m		6.2	2.0	b	1330			452	b			
	DV	30 2 m	10.9	2.0		0.08	$F_{3,36}=2.56$	1604	120		0.14	$F_{3,36}=2.0$	
		30 3 m	8.4	2.3				1252	113				
		60 2 m	10.8	1.8				1597	139				
		60 3 m	10.6	2.7				1527	113				
	SALL	30 2 m	10.8	1.7		0.24	$t_{3,63}=1.4$	1506	376		0.34	$t_{23,33}=1.1$	
		60 2 m	11.9	1.6				1787	232				
	November 2018	SKIV	Net 17.5	3.9	0.7	c	<0.01	$F_{2,93}=261.28$	1167	228	b	<0.01	$F_{2,93}=24.26$
			Net 25	4.9	0.9	b			1220	121	b		
30 2 m			13.5	2.7	a	2943			1277	a			
DV		Net 17.5	5.5	2.3	b	<0.01	$F_{2,39}=62.01$	1045	538	b	<0.01	$F_{2,39}=11.27$	
		Net 25	5.9	1.2	b			928	313	b			
		30 2 m	13.1	0.9	a			1703	227	a			
SALL		Net 17.5	6.0	0.8	b	0.02	$F_{4,10}=5.0$	1428	354		0.28	$F_{4,10}=1.49$	
		Net 20	7.8	0.9	ab			1380	234				
		Net 25	9.2	2.2	ab			2350	1620				
		Ladders	6.5	0.9	b			1138	109				
30 2 m		12.5	3.6	a			2183	254					

Table A.1. Biomass sampling data from the 2017 and 2018 growth cycle by potential harvest dates of belt spat collector treatments and alternative technologies. Mean mussel biomass per meter substrate (kg m^{-1}), number of mussels per meter substrate. Length of substrate of sampled grid cells on nets and ladders were scaled to a per meter basis, where Net 17.5 = 0.7 m substrate/grid cell, Net 20 = 0.8 m substrate/grid cell, Net 25 = 1.06 m substrate/grid cell, and Ladders = 1.08 m substrate/grid cell.

Sample date	Site	Treatment	Mussel					Condition				
			Shell Length (cm)	st dev	Level	p-value	Statistic	Index	st dev	Level	p-value	Statistic
October / November 2017	SKIV	30 2 m	3.84	0.47	a	<0.01	$F_{3,2396}=57.33$	7.2	1.2	0.07	$F_{3,236}=2.42$	
		30 3 m	3.52	0.49	c			6.9	1.2			
		60 2 m	3.81	0.46	a			7.4	1.5			
		60 3 m	3.66	0.37	b			6.8	1.0			
	DV	30 2 m	4.22	0.58	b	0.04	$F_{3,2396}=2.79$	6.7	1.0	b	<0.01	$F_{3,236}=19.28$
		30 3 m	4.28	0.55	ab			7.2	0.9	ab		
		60 2 m	4.32	0.6	a			7.8	0.9	a		
		60 3 m	4.28	0.58	ab			6.0	1.0	c		
	SALL	30 2 m	3.91	0.66		0.3	$t_{590.2}=-1.12$	7.1	1.0	0.64	$t_{56.3}=-0.47$	
60 2 m		3.86	0.58		7.0			0.8				
December 2017	SKIV	30 2 m	3.96	0.78	a	<0.01	$F_{3,4796}=12.56$	6.9	1.6	ab	0.04	$F_{3,476}=2.75$
		30 3 m	3.79	0.83	b			6.6	1.2	b		
		60 2 m	3.97	0.8	a			7.0	1.1	a		
		60 3 m	3.86	0.77	b			6.9	1.2	ab		
	DV	30 2 m	4.4	0.82	a	<0.01	$F_{3,5996}=15.15$	7.4	1.4	a	<0.01	$F_{3,596}=5.11$
		30 3 m	4.37	0.76	a			6.9	1.2	b		
		60 2 m	4.22	0.85	b			7.3	1.3	a		
		60 3 m	4.29	0.77	b			7.0	1.2	ab		
	SALL	30 2 m	4.46	0.71		<0.01	$t_{598}=-3.77$	6.0	0.9	0.86	$t_{57.9}=0.17$	
60 2 m		4.24	0.7		6.1			0.8				
March / April 2018	SKIV	30 2 m	4.13	0.7	ab	0.03	$F_{3,2396}=3.06$	6.1	0.9	0.86	$F_{3,236}=0.25$	
		30 3 m	4.14	0.75	ab			6.2	1.1			
		60 2 m	4.18	0.66	a			6.2	1.0			
		60 3 m	4.06	0.74	b			6.1	1.0			
	DV	30 2 m	4.37	0.66		0.5	$F_{3,2396}=0.76$	7.3	1.6	0.12	$F_{3,236}=2.0$	
		30 3 m	4.32	0.65				7.6	1.3			
		60 2 m	4.34	0.66				7.3	1.4			
		60 3 m	4.31	0.68				6.9	1.7			
	SALL	30 2 m	4.33	1.07		0.9	$t_{547.3}=-0.07$	6.5	1.6	0.50	$t_{56.5}=0.68$	
60 2 m		4.32	0.78		6.7			1.4				
November 2018	SKIV	Net 17.5	3.71	0.52	b	<0.01	$F_{2,9557}=41.93$	6.4	1.3	c	<0.01	$F_{2,957}=11.89$
		Net 25	3.88	0.5	a			6.9	1.6	b		
		30 2m	3.81	0.56	a			7.8	2.0	a		
	DV	Net 17.5	4.12	0.65	c	<0.01	$F_{2,4197}=82.45$	6.4	0.8	b	<0.01	$F_{2,417}=8.17$
		Net 25	4.33	0.72	b			6.8	1.2	a		
		30 2 m	4.58	0.69	a			7.2	1.4	a		
	SALL	Net 17.5	3.55	0.76	c	<0.01	$F_{4,1495}=33.72$	6.3	1.0	0.32	$F_{4,145}=1.19$	
		Net 20	4.05	0.76	b			6.2	0.8			
		Net 25	3.89	0.82	b			6.5	1.1			
Ladders		4.02	0.74	b	6.7			0.9				
		30 2 m	4.3	0.71	a		6.5	0.9				

Table A.2. Morphometric data from the 2017 and 2018 growth cycle by potential harvest dates of belt spat collector treatments and alternative technologies. Mussel Shell Length (cm), and Condition Index DW (mg) / SL³ (cm).

Farm	Date	Treatment	Mussel Biomass Yield per Model Farm (t)	st dev	Byssus (t)	Tissue N (t)	Tissue P (t)	Shell N (t)	Shell P (t)	Byssus N (t)	Byssus P (t)	Total N (t)	Total P (t)	N per ha (t)	P per ha (t)
SKIV	December	30 2 m	1634	333	118.9	17.13	1.73	3.94	0.02	2.75	0.02	23.81	1.77	1.27	0.09
		30 3 m	1689	432	181.9	17.71	1.79	4.07	0.03	4.20	0.03	25.99	1.84	1.39	0.10
		60 2 m	1162	245	50.9	12.18	1.23	2.80	0.02	1.18	0.01	16.16	1.26	0.86	0.07
		60 3 m	1085	229	68.7	11.38	1.15	2.62	0.02	1.59	0.01	15.58	1.18	0.83	0.06
	March/April	30 2 m	1318	428	29.1	13.02	1.29	3.93	0.02	0.67	0.00	17.63	1.32	0.94	0.07
		30 3 m	944	255	50.5	9.33	0.92	2.82	0.02	1.17	0.01	13.31	0.95	0.71	0.05
		60 2 m	870	233	23.4	8.59	0.85	2.59	0.02	0.54	0.00	11.73	0.87	0.63	0.05
		60 3 m	769	248	43.7	7.60	0.75	2.29	0.01	1.01	0.01	10.90	0.77	0.58	0.04
DV	December	30 2 m	1639	188	95.2	16.03	1.37	4.47	0.03	2.20	0.02	22.70	1.42	1.21	0.08
		30 3 m	1563	271	143.6	15.29	1.31	4.26	0.03	3.32	0.02	22.87	1.36	1.22	0.07
		60 2 m	1203	136	67.1	11.77	1.01	3.28	0.02	1.55	0.01	16.60	1.04	0.89	0.06
		60 3 m	1233	211	78.2	12.05	1.03	3.36	0.02	1.81	0.01	17.22	1.07	0.92	0.06
	March/April	30 2 m	1584	211	110.8	15.70	1.69	4.12	0.03	2.56	0.02	22.38	1.74	1.19	0.09
		30 3 m	1424	323	148.1	14.11	1.52	3.70	0.02	3.42	0.02	21.23	1.57	1.13	0.08
		60 2 m	1046	120	68.0	10.36	1.12	2.72	0.02	1.57	0.01	14.65	1.15	0.78	0.06
		60 3 m	1336	377	73.4	13.24	1.43	3.48	0.02	1.70	0.01	18.41	1.46	0.98	0.08
SALL	December	30 2 m	1694	58	114.0	16.17	1.39	4.62	0.03	2.63	0.02	23.43	1.43	1.25	0.08
		60 2 m	1059	242	88.1	10.10	0.87	2.89	0.02	2.03	0.01	15.02	0.90	0.80	0.05
	March/April	30 2 m	1505	229	65.1	15.04	1.49	4.87	0.03	1.50	0.01	21.41	1.53	1.14	0.08
		60 2 m	1161	153	92.2	11.60	1.15	3.76	0.02	2.13	0.01	17.48	1.19	0.93	0.06

Table A.3. 2017 growth cycle model farm yields (90 longlines in 18.75 ha space) with belt spat collector treatments. N and P values are calculated on the mean of farm yield

Farm	Date	Treatment	Mussel Biomass Yield per Model Farm (t)	st dev	Byssus (t)	Tissue N (t)	Tissue P (t)	Shell N (t)	Shell P (t)	Byssus N (t)	Byssus P (t)	Total N (t)	Total P (t)	N per ha (t)	P per ha (t)
SKIV	November	30 2m	1877	370	51.4	18.59	1.64	6.14	0.03	1.19	0.01	25.92	1.67	1.38	0.09
		Net 17.5	2585	487	148.6	25.60	2.25	8.45	0.04	3.43	0.02	37.49	2.32	2.00	0.12
		Net 25	2118	386	111.6	20.98	1.85	6.93	0.03	2.58	0.02	30.48	1.90	1.63	0.10
DV	November	30 2 m	1816	123	58.0	16.96	1.44	5.96	0.03	1.34	0.01	24.26	1.47	1.29	0.08
		Net 17.5	3622	1528	128.8	33.83	2.86	11.88	0.06	2.98	0.02	48.69	2.94	2.60	0.16
		Net 25	2582	532	111.9	24.12	2.04	8.47	0.04	2.58	0.02	35.17	2.10	1.88	0.11
SALL	November	30 2 m	1738	503	62.9	14.47	1.19	5.89	0.03	1.45	0.01	21.81	1.23	1.16	0.07
		Ladders	2285	306	164.2	19.02	1.57	7.75	0.04	3.79	0.03	30.56	1.63	1.63	0.09
		Net 17.5	3971	555	167.6	33.06	2.73	13.46	0.06	3.87	0.03	50.39	2.82	2.69	0.15
		Net 20	4492	529	168.8	37.40	3.08	15.23	0.07	3.90	0.03	56.52	3.18	3.01	0.17
		Net 25	3988	972	172.9	33.20	2.74	13.52	0.06	3.99	0.03	50.71	2.83	2.70	0.15

Table A.4. 2018 growth cycle model farm yields (90 longlines/ladders or 80 tubes in 18.75 ha space) with dense spacing belt spat collectors and alternative technologies. N and P values are calculated on the mean of farm yield.

Harvest	Site	N% of tissue DW	P% of tissue DW	Tissue DW yield (%)
December 2017	SKIV	9.80	0.99	10.70
	DV	9.68	0.89	10.10
	SALL	9.68	0.83	9.86
March/April 2018	SKIV	10.41	1.03	9.49
	DV	9.74	1.05	10.17
	SALL	9.19	0.91	10.87
November 2018	SKIV	8.98	0.79	11.03
	DV	9.57	0.81	9.76
	SALL	9.58	0.79	8.69

Table A.5. Nitrogen (N), phosphorus (P) content of tissues, and tissue dry weight yield (ratio of dry tissue to whole fresh mussel) by harvest date and site.