The following supplement accompanies the article

Abiotic conditions are not sufficient to predict spatial and interannual variation in abundance of *Ciona intestinalis* in Nova Scotia, Canada

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Table S1: Data extracted from Sephton et al. (2011), in which presence and relative abundance of *C. intestinalis* was monitored from 2006 – 2009 and Sephton et al. (2017) in which relative abundance was monitored through 2011 - 2013. 2014 and 2015 data are the results from the current manuscript converted to the scale used on the other two studies. The scale for percent cover categories is 0: = absent; 1: < 25% coverage; 2: 25 – 50% coverage; 3: 51 – 75% coverage; and 4; > 75% coverage. Note: comparing measurements between 2014/2015 and the earlier dates is complicated by the differing methods used, particularly the later and more variable deployment dates in the earlier studies.

Site	2006	2007	2008	2009	2011	2012	2013	2014	2015
Camp Cove	1	3	3	3	4	NA	2	4	4
Cape Canso	NA	1	NA	2	NA	NA	2	3	2
Dingwall	NA	NA	1	1	1	2	3	1	4
Falls Point	NA	NA	NA	NA	NA	4	NA	4	4
Indian Point	2	4	4	4	2	3	3	4	4
Petit-de-Grat	NA	NA	4	3	3	NA	NA	4	4
Port Bickerton	1	NA	NA	NA	NA	1	1	4	2
Ship Harbour	NA	0	NA	NA	0	1	1	2	4
Venus Cove	NA	NA	1	2	NA	NA	1	1	3
Wedgeport	1	1	1	2	NA	3	1	1	4
Yarmouth Bar	1	0	0	1	1	1	1	0	1

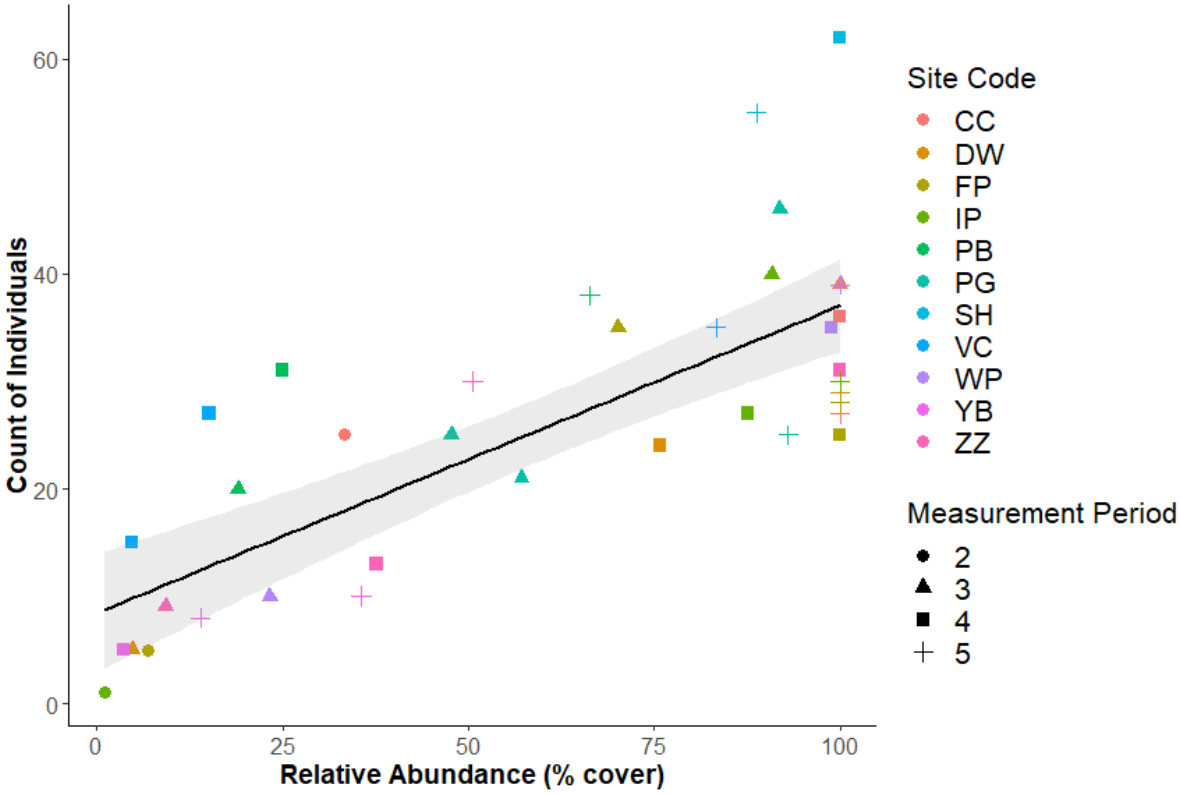

Figure S1: The relationship between the measure of relative abundance (% cover) that we used for our biotic metric of *Ciona intestinalis* on settlement plates, and the abundance of *C. intestinalis*, counts of individuals. Linear regression results verify the significant relationship between the two ($r^2 = 0.6$, $p < 0.001$). These data are from 2015 (random choice of year using coin toss) and represent a random sample of settlement plates ($n = 39$) stratified by site and measurement period. See Table 1 of manuscript for Site Codes.

Table S2: Stepwise removal of a single abiotic metric from the most correlated pair using the 2014 abiotic metrics. The pair of metrics most correlated at each step is highlighted. The light grey shaded metric was kept (Keep), while the metric shaded with dark grey was removed (Rem.) from the process. There was a selection rule to always have one metric from each variable remaining.

Variable	**Metric**	**Step 1**	**Step 2**	**Step 3**	**Step 4**	**Step 5**	**Step 6**	**Step 7**	**Step 8***	**Step 9**
Temp.	Mean	Keep		Keep				Keep	Keep	
	Minimum			Rem.						
	Maximum	Rem.								
Salinity	Mean					Keep	Keep			Keep
	Minimum						Rem.			
	Maximum					Rem.				
pH	Mean		Rem.							
	Minimum								Rem.	
	Maximum		Keep					Rem.		
Water Motion Accel.	Variance				Rem.					
	Minimum									
	Maximum				Kee p					Rem.
Pearson's r		0.92	0.91	0.9	0.89	0.83	0.75	-0.74	-0.53	-0.36

Table S3: Stepwise removal of a single abiotic variable metric from the most highly correlated pair using the 2015 abiotic data. The pair of metrics most correlated at each step is highlighted. The light grey shaded metric was kept (Keep) while the metric shaded with dark grey was removed (Rem.) from the process. There was a selection rule to always have one metric from each variable remaining. Only pairwise complete observations were used in the correlation.

Variable	**Metric**	**Step 1**	**Step 2**	**Step 3**	**Step 4**	**Step 5**	**Step 6**	**Step 7**	**Step 8**
Temp.	Mean	Keep		Keep					Keep
	Minimum			Rem.					
	Maximum	Rem.							
Salinity	Mean		Rem.						
	Minimum		Keep					Rem.	
	Maximum								
pH	Mean				Rem.				
	Minimum								
	Maximum				Keep				Rem.
Water Motion Accel.	Variance					Keep	Rem.		
	Minimum					Rem.			
	Maximum						Keep	Keep	
Pearson's r		0.95	0.93	0.93	0.9	0.9	0.86	-0.74	-0.52

Table S4: Parameter estimates, with their associated standard error (SE), for each of the species-level and site-specific model parameters from the best model in 2014 (best bottom-up (BB) and best top-down (BTD) model building methods provided the same best model). MaxPop = Maximum population size, D50 = time in days it takes for half of MaxPop occur, and Lag = the slope through the inflection point. The mean salinity (Mean Sal) abiotic metric has been centred for the analysis.

Parameter	Type	Estimate (SE)
MaxPop Intercept	Species-level	-0.48 (0.66)
MaxPop Intercept sd	Site-specific	2.08 (10.13)
MaxPop (Mean Sal – 31)	Species-level	0.65 (0.12)
D50 Intercept	Species-level	4.48 (0.01)
D50 (Avg Sal – 31)	Species-level	0.30 (0.01)
Lag Intercept	Species-level	21.26 (5.60)
Lag (Avg Sal – 31)	Species-level	-20.55 (6.29)

Table S5: Estimates (est.), with associated standard error (SE), for each of the species-level (Sp.) and site-specific (Site) model parameters from the best model, for both the bottom-up (BBU) and the top-down (BTD) model development approaches, using 2015 data. The absolute scaled effect size (ASES) (see Materials and Methods of Murphy 2016) is provided for each abiotic metric parameter. MP = Maximum population size; D50 = time in days it takes for half of MaxPop occur; Lag = the slope through the inflection point; Int = Intercept; and Int. sd = Intercept sd. Temp. = mean temperature - 14; Sal. = maximum salinity - 30; pH = minimum pH - 8; Accel. = maximum variance in acceleration.

Parameter	**Type**	**BBU est. (SE)**	**BBU ASES**	**BTD est. (SE)**	**BTD ASES**
MP Int.	Sp.	1.06 (0.28)	-	27.48 (15.97)	-
MP Int. sd	Site	0.74 (12.42)	-	2.12 (12.41)	-
MP Temp.	Sp.	-	-	-3.76 (2.33)	57.57
MP Sal.	Sp.	-0.13 (0.20)	0.69	-2.54 (2.21)	13.08
MP pH	Sp.	-	-	18.10 (13.62)	9.51
MP Accel.	Sp.	-	-	-	-
D50 Int.	Sp.	4.56 (0.07)	-	11.29 (3.62)	-
D50 Int. sd	Site	0.20 (12.42)	-	-	-
D50 Temp.	Sp.	-	-	-0.92 (0.54)	14.07
D50 Sal.	Sp.	0.17 (0.07)	0.88	-0.31 (0.48)	1.57
D50 pH	Sp.	-	-	5.03 (3.18)	2.64
D50 Accel.	Sp.	-	-	-674.31 (236.48)	5.07
Lag Int.	Sp.	14.88 (3.48)	-	3.64 (0.51)	-
Lag Temp.	Sp.	-	-	-0.10 (0.06)	1.47
Lag Sal.	Sp.	-2.77 (2.51)	14.22	-0.01 (0.10)	0.07
Lag pH	Sp.	52.64 (16.95)	27.64	-1.90 (1.18)	1.00
Lag Accel.	Sp.	6352.57 (3766.51)	47.80	1901.05 (1182.88)	14.30

LITERATURE CITED

Murphy KJ (2016) Nonlinear mixed-effects modelling of Ciona intestinalis population growth, dependent upon abiotic conditions. MSc thesis, St. Francis Xavier University, Nova Scotia, Canada