Table 13. Performance statistics for the two versions of the selected model (NumTaxaIBI vs. PctTaxaIBI). Coefficient of variation (CV) equals the ratio of the standard deviation to the mean, based on reference sites. Lower values are more desirable as they indicate less variability.

Dataset	NumTaxaIBI*			PctTaxaIBI		
	DE	*Z*-score	CV	DE	*Z*-score	CV
MA/SNEP 300-count	100.0	2.87	0.18	97.6	2.96	0.16
MA/SNEP 200-count	97.6	2.69	0.19	97.6	2.74	0.17
MA/SNEP 100-count	97.6	2.45	0.21	97.6	2.50	0.19
SNEP only, 300-count	100.0	2.45	0.21	95.65	2.72	0.18
SNEP only, 200-count	100.0	2.30	0.23	100.0	2.48	0.19
SNEP only, 100-count	100.0	2.22	0.23	100.0	2.40	0.20

* the scoring formulae for the two richness metrics in the NumTaxaIBI would need to be adjusted based on subsample size (Block et al. 2020) therefore PctTaxaIBI was ultimately selected

5.4 Final index selection and performance

The team of MassDEP and RI DEM biologists used the following empirical and logical criteria to select their final index:

- Relatively high index DE and *Z*-scores
- Index metrics representing as many metric categories as practical
- Not including redundant metrics
- Performs well at different subsample sizes (tested 100-, 200-, and 300-count versions)
- Inclusion of individual metrics having the following characteristics:
    - High overall DE
    - Response mechanisms that were plausible and ecologically important
    - Straightforward metric calculations

The component metrics in the SNEP low gradient, multihabitat IBI are listed in Table 14, along with performance statistics and scoring formulae. The metrics have comprehensible mechanisms of response to increasing environmental stress, as described in Appendix F. The percent tolerant taxa metric (pt_tv_toler) is strongly correlated with percent non-insect taxa (pt_NonIns) (rho=0.80), percent POET taxa (pt_POET) (rho=-0.75), and percent semi-voltine taxa (pt_volt_semi) (rho=-0.66) (Table 15); however, the workgroup did not think that these metric were fundamentally redundant with one another but instead evaluated unique components of the macroinvertebrate community. The IBI discriminates well between reference and stressed samples, as shown in Figure 11.

Index scores do not always match the disturbance categories. For example, a tributary of the Wading River east of Attleboro (TAU-W2910) is a reference sites with a low index score. This is a sub-reference site with a small watershed (5.0 km^2). There is no immediate explanation for the high percentages of non-insects and tolerant taxa in this sample, so it might take additional investigation to associate site conditions with the index score. On the Moshassuck River near Providence, there are two highly stressed sites with very different index scores. The upper site, LO-Worst-P1, has an unusually high IBI score of 67.9 and the lower site, LO-Worst-R1, has an index score of 32.6, as expected for a highly stressed site. Because of possible confusion of the contributing watershed (downstream of an impoundment of the Blackstone River Canal), it is possible that the watershed delineation was incorrect and that the upstream site with the better IBI score is actually only moderately stressed. In this case, the incongruent index score might indicate that the disturbance

category was incorrect as the biology indicates.

Table 14. Metrics in the low gradient IBI, with scoring formulae, DE values, and trend. This index was chosen for both the SNEP and MassDEP low gradient projects.

Metric Name	Category	5th	95th	Scoring formula	DE	Trend
% OET individuals (pi_OET)	COMP	3	49	100*Metric/49	78.3	Dec.
% Predator taxa (pt_ffg_pred)	FFG	9	32	100*Metric/32	69.6	Dec.
% Non-insect taxa (pt_NonIns)	RICH	4	46	100*(46-Metric)/42	95.7	Inc.
% POET taxa (pt_POET)	RICH	9	40	100*Metric/40	78.3	Dec.
% Tolerant taxa (pt_tv_toler)	TOLER	3	36	100*(36-Metric)/33	100.0	Inc.
% Semivoltine taxa (pt_volt_semi)	VOLT	0	12	100*Metric/12	87.0	Dec.

5^{th}: 5^{th} percentile of all sample metrics; 95^{th}: 95^{th} percentile of all sample metrics
Scoring Formula: Replace "metric" with the sample metric value for calculation of an index
Trend: Decreasing (Dec.) or increasing (Inc.) trend with increasing stress

Table 15. Correlation coefficients (Spearman rank rho) for the IBI input metrics, based on the SNEP dataset.

	pi_OET	pt_ffg_pred	pt_NonIns	pt_POET	pt_tv_toler	pt_volt_semi
pi_OET	1					
pt_ffg_pred	0.03	1				
pt_NonIns	-0.44	-0.09	1			
pt_POET	0.70	0.11	-0.73	1		
pt_tv_toler	-0.57	-0.24	0.80	-0.75	1	
pt_volt_semi	0.43	0.11	-0.64	0.64	-0.66	1

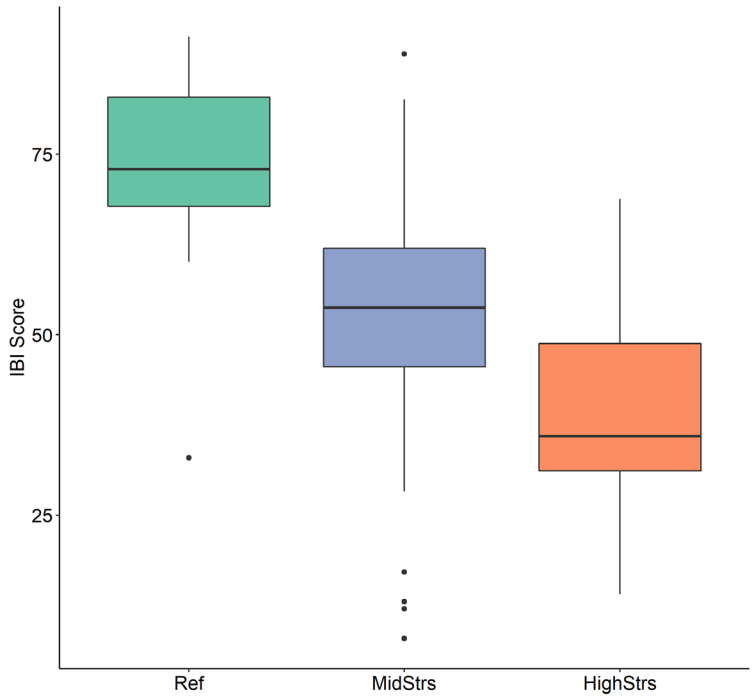

Figure 11. Distribution of SNEP IBI scores across disturbance categories, reference (Ref), intermediate (MidStrs), and stressed (HighStrs).