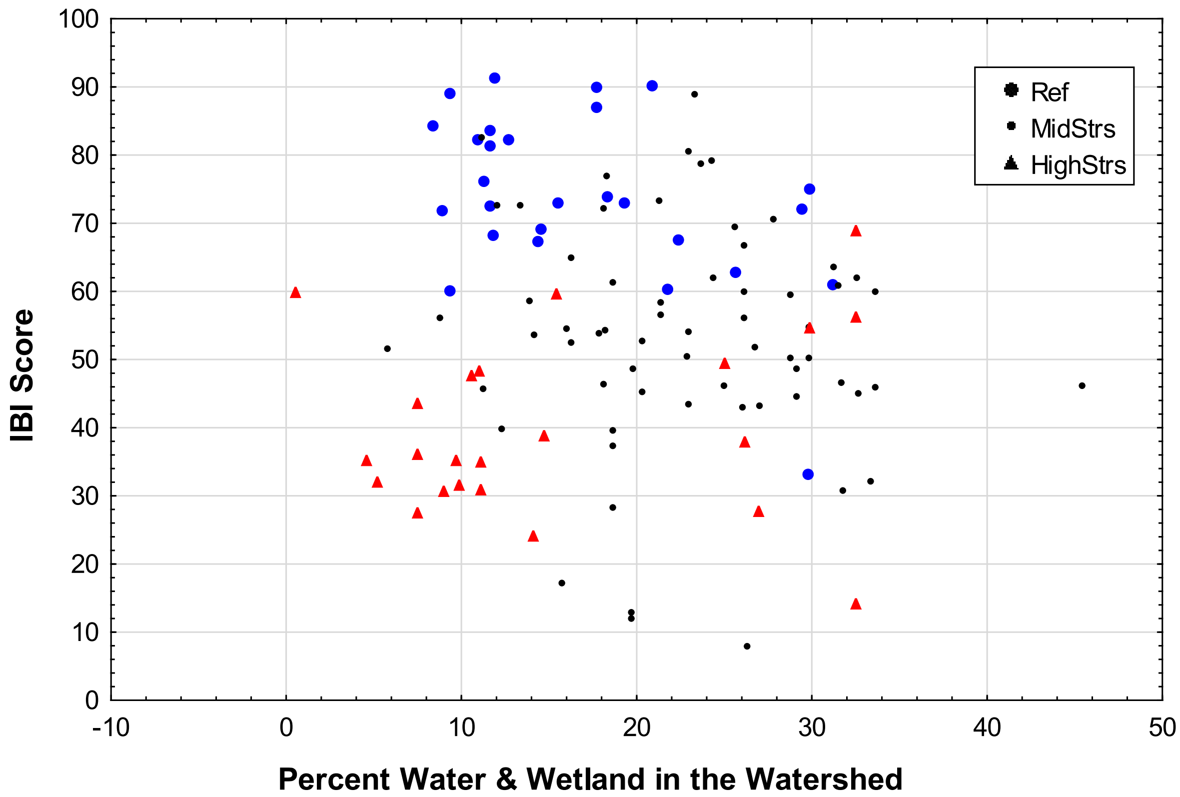

Figure 26. Percent water and wetland in the watershed in relation to IBI scores, marked by disturbance category.

6 Exploration of assessment thresholds

Once site classes are established and indices are calibrated, some entities establish thresholds for numeric biocriteria. We used multiple analyses to identify possible thresholds associating ranges of index values with biological condition categories. However, before identifying thresholds, we found that revisions to the taxa traits were needed, and this changed the index scores when compared to index scores calculated on the calibration traits. The shift in index scores was acknowledged and incorporated into this analysis of thresholds.

Explanation of Trait Changes and Index Adjustments

The data used for index calibration was based on taxa traits that were available at the time of the analysis and using metric scoring formulae based on the 300-count data. Taxa lists are not static and should be updated with new and better information as it becomes available, as it did over the project timeline. As the project progressed, the taxa traits were updated based on conferences with MassDEP biologists (Bob Nuzzo and Allyson Yarra) and the contract taxonomist (Mike Cole). The metric scoring formulae were based on distribution statistics first in the calibration data and then in the combination of calibration data and virtually subsampled data. Changes in traits and scoring formulae resulted in changes in metric and index scores between the original calibration data and the metric and index values in Attachment C.

The taxa traits that were changed over time included tolerance values and voltinism traits. In most cases, missing values were completed based on new information or association with similar taxa with existing traits. There were no changes in tolerance values, only additions of new values. For example, *Physa* (Mollusca) first had no tolerance value and then the value was added (8, tolerant). For voltinism traits, an important change was applied to Elmid beetles. Per feedback from Mike Cole, we assigned all Elmids to the 'semi-voltine' category (vs. previously, Elmid taxa were assigned to a mix of categories (blank, uni-voltine, semi-voltine). Revised taxa traits are tabulated in Attachment B. The trait revisions resulted in higher percentages of semi-voltine taxa in the revised metric calculations compared to the calibrated metrics. When the original scoring formula was applied to the pt_volt_semi metric, there were many high scores and many scores of 100 because of the increased number of recognized semi-voltine taxa.

The 5th and 95th percentiles of metrics based on 300-count data were used in calibration. As the project evolved to consider application with 100-count and 200-count data, the scoring formulae were changed to include the percentiles of those data also (as an average value for the three data sets). The changes to the scoring formulae were minor and were not expected to substantially affect metric and index scores.

The overall effect of the changes in metric traits and scoring were an upward shift in index values (Figure 27). The regression line for the calibration and revised index scores has a slope of almost 1 (0.99), indicating that the adjustment is applicable along the whole index gradient. The revised index is 4.9 points higher than the calibration index, in general. This shift should be accounted for when applying the index. Threshold development proceeded using index scores calculated from the revised taxa traits and the scoring formulae in Table 14.

Reference Distribution Statistics

The reference condition (RC) approach is the most commonly used method to derive biological thresholds (e.g., Yoder and Rankin 1995, DeShon 1995, Barbour et al. 1996, Roth et al. 1997). With the RC approach, IBI scores are calculated from a reference site dataset, and then a percentile of the IBI scores, such as the 25th or 10th, is chosen to represent the RC.

The low gradient, multihabitat SNEP IBI was developed using reference condition concepts to identify sites with relative degrees of disturbance due to human activities. The reference and highly stressed conditions for low gradient sites were defined using quantitative criteria of measures of stressors and stressor sources. The absolute degree of disturbance is undefined, though there are relatively fewer stressors in the reference condition compared to intermediate and high-stress conditions.

Distribution statistics in reference sites and all sites can inform possible thresholds, allowing assessment of sites that are similar to reference. These reference sites have few stressors and a biological condition representing a somewhat natural standard. Any index value above the minimum of reference index values might be a reference site. However, given that the reference sites were defined with relative, not absolute, stressor criteria and that there is variability in biological conditions, it is likely that the minimum value is not representative of acceptable reference conditions. Rather, the minimum reference index value probably should not be recognized as an acceptable natural standard. In contrast, a threshold set at the median of index values would discount half of the reference sites, which would suggest that the reference sites were poorly defined and the reference condition has substantial errors.

Thresholds based on a lower percentile of reference index scores describe points on the index scale above which conditions represent predominantly natural community types and below which biological conditions are departing from the core natural standard and might be impacted, erroneously designated reference sites, or simple errors due to biological and site variability. The 10th - 25th percentiles of reference index values are common thresholds used in bioassessments. One of these percentiles could be selected as a threshold for assessing low gradient biological conditions