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Calibration and validation of the AZTI's Marine Biotic Index (AMBI) for Southern California marine bays

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ABSTRACT

Benthic indices are useful indicators of sediment condition, but many indices are difficult to employ because they require large calibration datasets. The AZTI's Marine Biotic Index (AMBI) requires minimal local calibration, but it was developed in Europe and the validity of its extension to distant regions is unclear. Here we compare its performance in Southern California's marine bays with that of the Benthic Response Index (BRI), a locally derived data-intensive index. AMBI was calibrated in four ways: (1) using the original AMBI species' classifications developed in Europe; (2) augmenting the original classifications with closely related taxa, following AMBI guidelines; (3) using local expertise to independently classify taxa; and (4) revision of the local expert classifications by European developers of the index. These approaches were applied to a 685 sample data set and assessed relative to the BRI by comparing samples' classification from best to worst and by evaluating the level of agreement in assigning samples into four condition categories. The AMBI was validated against environmental proxies of disturbance and expert judgement, using consensus agreement about sample condition developed by nine benthic ecologists. The first AMBI approach did not work well, as only 24% of the 928 taxa were on the original AMBI species list, resulting in only 11% of the samples meeting the required 20% of classified individuals for AMBI application. The other approaches classified substantially more taxa, allowing application to 75–98% of the samples. Both of these approaches were significantly correlated with the BRI, though the correlations were lower than between the AMBI runs. None of the AMBI approaches, though, compared well with either the BRI or the validation data when placing samples into perturbation categories, with the AMBI having a greater central tendency. AMBI categorized less than 5% of the samples as reference compared to almost one-third of the samples by the experts or BRI, and substantially underestimating the number of severely affected samples. Species most responsible for disagreements between BRI and AMBI approaches were identified. Four modifications to enhance AMBI performance were identified: (1) incorporate local expertise in assigning ecological classifications, (2) use transformed abundance weighting to reduce the effect of dominant species, (3) calibrate the categorization scaling using expert judgement, and (4) use the AMBI in combination with other measures, such as the M-AMBI. The success of these modifications is specific to this study, but they are likely to enhance AMBI's performance worldwide.