

Coastal Benthic Communities

Benthic communities are largely composed of macroinvertebrates, such as annelids, mollusks, and crustaceans. These organisms inhabit the bottom substrates of estuaries and play a vital role in maintaining sediment and water quality. They also are an important food source for bottom-feeding fish, invertebrates, and birds. Communities of benthic organisms are important indicators of environmental stress because they are particularly sensitive to pollutant exposure (Holland et al., 1987). This sensitivity arises from the close relationship between benthic organisms and sediments—which can accumulate environmental contaminants over time—and the fact that these organisms are relatively immobile, which means they receive prolonged exposure to contaminants in their immediate habitat (Sanders et al., 1980; Nixon et al., 1986).

This indicator is based on regional multi-metric benthic community indices that reflect overall species diversity in coastal areas throughout the contiguous United States (adjusted for salinity, if necessary) and the presence of pollution-tolerant and pollution-sensitive species (e.g., Engle and Summers, 1999; Hale and Heltshe, 2008; Paul et al., 2001; Van Dolah et al., 1999). The benthic community condition at each sample site is given a high score if the index exceeds a particular threshold (e.g., has high diversity or populations of many pollution-sensitive species, as well as a low proportion of pollution-tolerant species), a low score if it falls below the threshold conditions, and a moderate score if it falls within the threshold range. The exact structure of the index and the threshold values vary from one ecoregion to another, but comparisons between predicted and observed scores based on expert judgment are used to ensure that the classifications of sites from one region to another are consistent (U.S. EPA, 2012a). Data were collected using probabilistic survey design, so the results from the sampling sites provide unbiased estimates of the distribution of index scores in coastal areas throughout each region.

The data for this indicator are from probabilistic surveys conducted as part of EPA's National Coastal Assessment (NCA) and presented in EPA's fourth National Coastal Condition Report (U.S. EPA, 2012a). The survey was designed to provide a national picture of coastal benthic community condition by sampling sites in coastal waters throughout the contiguous 48 states, as well as Puerto Rico, Guam, and the U.S. Virgin Islands. Different regions were sampled during different years between 1999 and 2006. Data are sufficient to show differences in benthic community condition over time for four regions (Northeast Coast, Southeast Coast, Gulf Coast, and West Coast).

What the Data Show

The Southeast Coast, West Coast, and Guam had the highest benthic community scores, with high condition covering 77 to 90 percent of coastal area during the time periods sampled (Exhibit 1). The Northeast Coast, Gulf Coast, and Puerto Rico had the largest proportion of coastal area rated low (ranging from 10 to 34 percent). Note, however, that 52 percent of the Gulf Coast had missing benthic data during the 2005–2006 time period; this was, in part, due to difficulties in obtaining samples after the 2005 hurricanes (U.S. EPA, 2012a). The Northeast Coast and West Coast benthic community index scores remained relatively stable over time, while scores varied somewhat in the Southeast Coast and Gulf Coast regions. The percent area with low benthic condition decreased fairly steadily from 2000 to 2006 in the Southeast Coast. EPA's fourth National Coastal Condition Report concluded that the national benthic index score has steadily increased over time (U.S. EPA, 2012a).

Limitations

- Data are unavailable to assess benthic community condition in Alaska, Hawaii, and American Samoa.
- Multi-metric benthic indices were not available for the West Coast, Puerto Rico, Guam, and the U.S. Virgin Islands. The assessment of benthic community condition in these regions is based on a ratio of observed to expected species richness or diversity.
- Sample collection is limited to a 9- to 12-week period during the summer. Further, because benthic communities can be strongly influenced by episodic events, trawling, or climate perturbations, this indicator may not reflect the full range of conditions that occur at each sampling location throughout this time period.

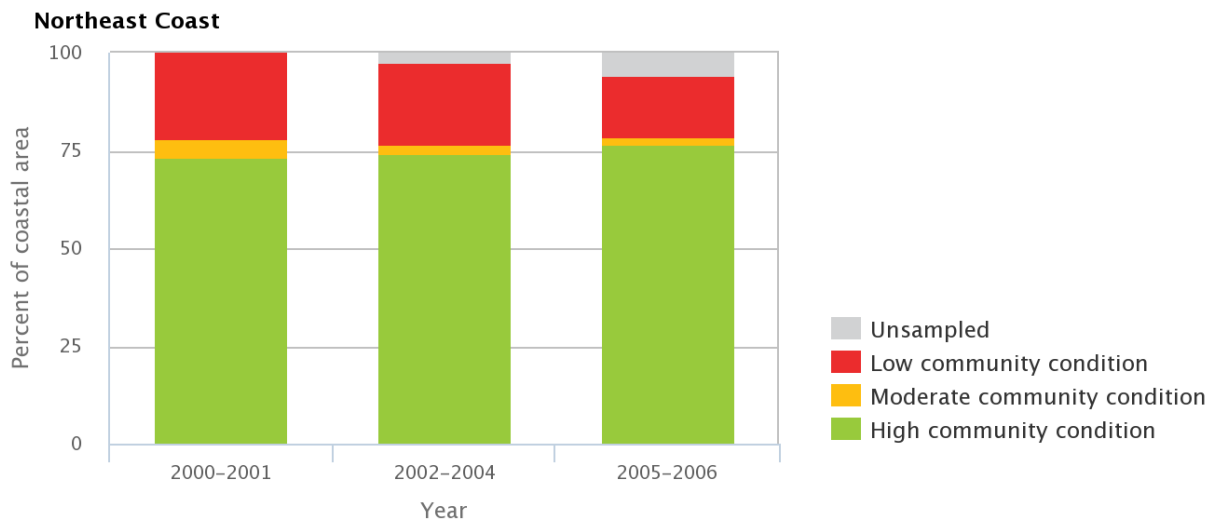
Data Sources

This indicator is based on an analysis published in EPA's fourth National Coastal Condition Report (U.S. EPA, 2012a). The NCA data are housed in the National Coastal Database (U.S. EPA, 2012b) (<https://www.epa.gov/national-aquatic-resource-surveys/data-national-aquatic-resource-surveys>).

References

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Exhibit 1. Coastal benthic communities index for the U.S. by ecoregion, 1999-2006



Coverage: Coastal waters of the United States. Data are not available for Alaska, Hawaii, and American Samoa.

See text for definitions of categories.

Analysis shows that these trends are not statistically significant. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: U.S. EPA, 2012a

Visit <https://www.epa.gov/roe> to see the full exhibit.