

Report on the Environment <https://www.epa.gov/report-environment>

Fish Faunal Intactness

Intactness, the extent to which ecological communities have retained their historical composition, is a critical aspect of the biological balance of the nation's ecological systems (NRC, 2000). It is of particular importance in freshwater systems that are impacted by pollution, habitat alteration, fisheries management, and invasive species.

This indicator tracks the intactness of the native freshwater fish fauna in each of the nation's major watersheds by comparing the current faunal composition of those watersheds with their historical composition. The indicator specifically measures the reduction in native species diversity in each 6-digit U.S. Geological Survey hydrologic unit code (HUC) cataloguing unit in the 48 contiguous states. Intactness is expressed as a percent based on the formula:

$$\text{reduction in diversity} = 1 - (\# \text{ of current native species} \div \# \text{ of historical native species})$$

The native species diversity indicator proposed by the National Research Council (NRC, 2000) compared expected native species diversity (projected from species-area-curve models) with observed diversity. This "Fish Faunal Intactness" indicator makes use of empirical, rather than modeled, data sets and focuses on a well-known group of organisms with a fairly strong historical record.

Reductions in watershed diversity may be due either to the overall extinction of a species (16 U.S. freshwater fish species are known to be extinct and another two species are known only from historical records and may be extinct) or, more commonly, to the extirpation of a species from selected watersheds. In the case of regional extirpations, opportunities may exist for restoring a species to watersheds in its historical range.

The fish distributional data underlying this indicator were gathered by NatureServe, a nonprofit research organization, and are derived from a number of sources, including species occurrence data from state Natural Heritage Programs, a broad array of relevant scientific literature (e.g., fish faunas), and expert review in nearly every state. Within NatureServe's database, any native species with a recorded observation before 1970 is considered part of the historical (baseline) faunal composition of a given watershed. A species is classified as "current" if there is evidence that it is still present in the watershed—for example, a recent observation. Conversely, if a species has not been observed in a given watershed for many years, experts may deem it to be no longer present. The underlying data include distributions for 874 native freshwater fish species across small watersheds (8-digit HUC). For this indicator, data were pooled and reported by larger 6-digit HUCs to reduce potential errors of omission in the smaller watersheds.

What the Data Show

Watersheds covering about a quarter (27 percent) of the area of the contiguous U.S. appear to have fish faunas that are fully intact, retaining the entire complement of fish species that were present before 1970 (Exhibits 1 and 2). Watersheds covering about one-fifth (21 percent) of the area, however, have lost 10 percent or more of their native fish species. Reductions in diversity are

especially severe in the Southwest (e.g., the lower Colorado River watershed), with four major watersheds having lost at least half of their native fish species.

Some watersheds are naturally more species-rich than others, and for those with greater historical diversity, even a small percentage reduction may mean the loss of numerous species in absolute terms. Although the greatest diversity of fish species is found in the Southeast, the greatest reduction in numbers has occurred in portions of the Midwest and the Great Lakes, where several watersheds have lost more than 20 species (Exhibits 3 and 4). In contrast, southwestern HUCs have all lost 10 or fewer species, but because these watersheds historically supported fewer species, on a percentage basis their fish faunas are regarded as less intact.

Limitations

- The incomplete historical record for freshwater fish distributions and inconsistent inventory records for contemporary fish distributions are sources of uncertainty.
- Although NatureServe has attempted to compile the most complete distributional information possible for these species at the 8-digit HUC level, these data are dynamic; new records frequently are added and existing records are revised as new information is received and as taxonomic changes occur.

Data Sources

This indicator presents a summary of data available from the NatureServe Explorer database (NatureServe, 2015) (<https://explorer.natureserve.org/>). The identity and status (current vs. historical) of all native fish species recorded in each 8-digit HUC are available from this database, along with species-by-species distribution maps at the 8-digit HUC level. Analyses based on these data have previously been reported in Master et al. (1998, 2003) and Stein et al. (2000).

References

Master, L., A. Olivero, P. Hernandez, and M. Anderson. 2003. Using small watershed fish, mussel, and crayfish historical and current presence data to describe aquatic biogeography and inform its conservation. Abstract #PO67. Society for Conservation Biology Annual Meeting, Duluth, Minnesota.

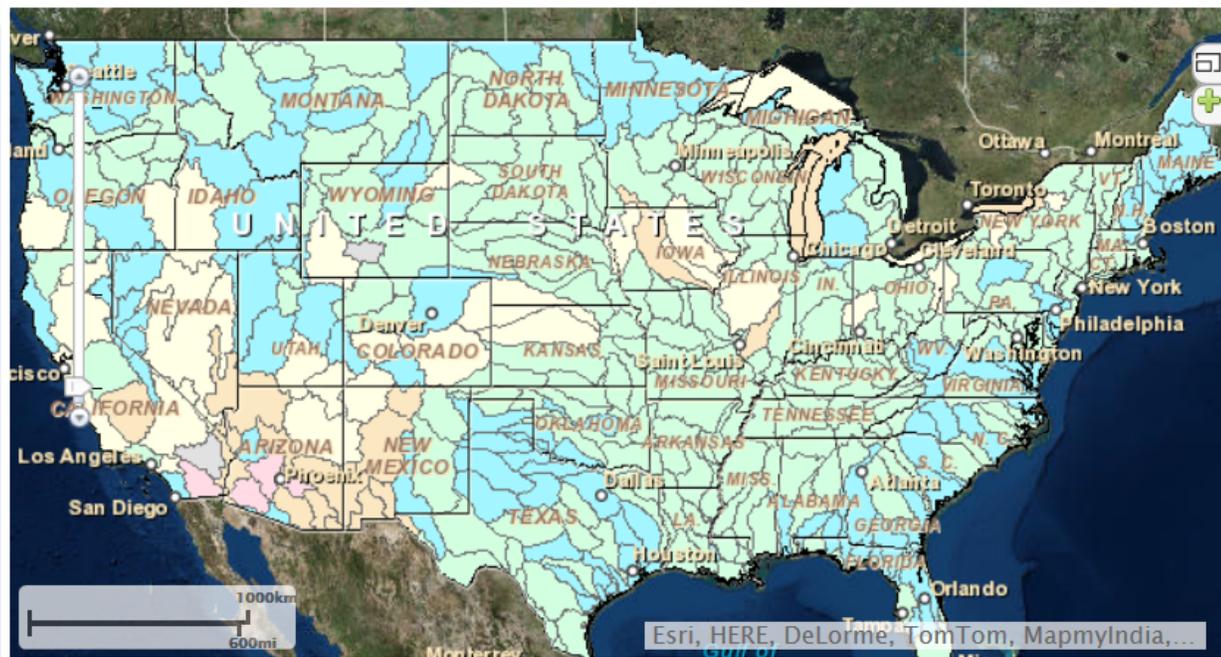
Master, L.L, S.R. Flack, and B.A. Stein. 1998. Rivers of life: Critical watersheds for protecting freshwater biodiversity. Arlington, VA: The Nature Conservancy. <http://www.natureserve.org/biodiversity-science/publications/rivers-life-critical-watersheds-protecting-freshwater-biodiversity>.

NatureServe. 2015. NatureServe explorer. Accessed 2015. <http://explorer.natureserve.org>.

NRC (National Research Council). 2000. Ecological indicators for the nation. Washington, DC: National Academies Press. <http://www.nap.edu/read/9720/chapter/1>.

Stein, B.A., L.S. Kutner, and J.S. Adams. 2000. Precious heritage: The status of biodiversity in the United States. New York, NY: Oxford University Press. <http://www.natureserve.org/biodiversity-science/publications/precious-heritage-status-biodiversity-united-states>.

Exhibit 1. Percent reduction in native fish species diversity in the contiguous U.S. from historical levels to 2014



Opacity: [Click here to toggle legend](#)

Percent reduction in fish species :

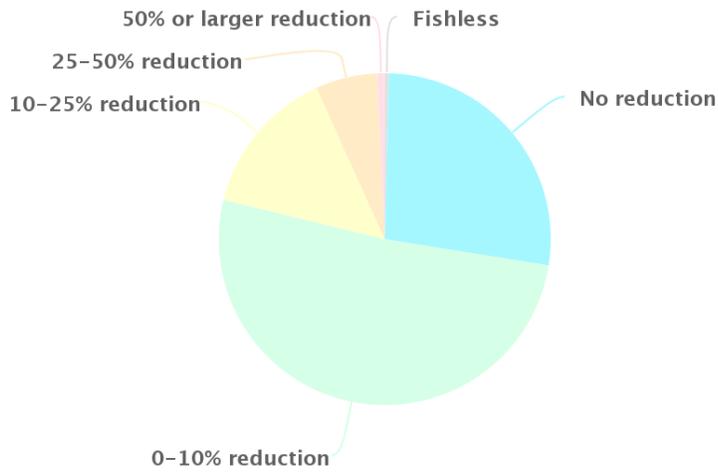
- Fishless
- 0%
- >0% to <10%
- 10 to <25%
- 25 to <50%
- >= 50%

Data are displayed by 6-digit hydrologic unit code (HUC-6) watershed. Percent reduction is based on the number of native species determined to be present as of 2014, compared with historical numbers documented prior to 1970. A species is considered "present" if there is at least one record of its presence in any 8-digit HUC within the 6-digit HUC.

Information on the statistical significance of the trends in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: NatureServe, 2015

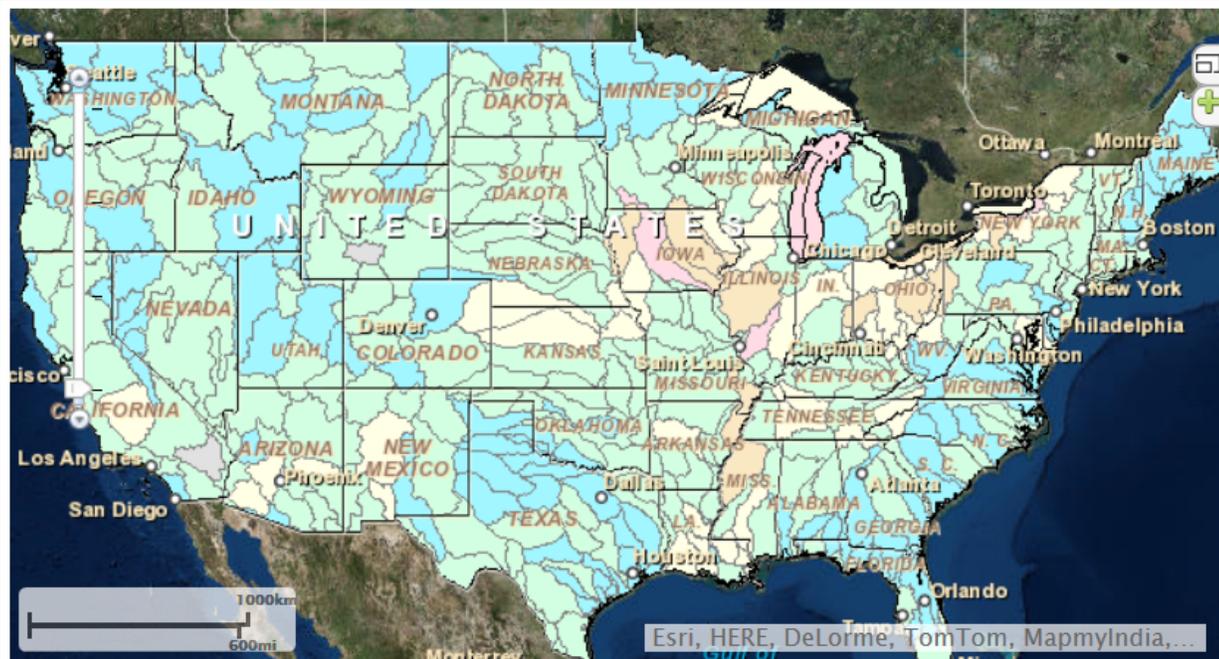
Exhibit 2. Percent reduction in native fish species diversity in the contiguous U.S. from historical levels to 2014, by percentage of area



Information on the statistical significance of the trends in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: NatureServe, 2015

Exhibit 3. Reduction in native fish species diversity in the contiguous U.S. from historical levels to 2014



Opacity: [Click here to toggle legend](#)

Number of species lost:

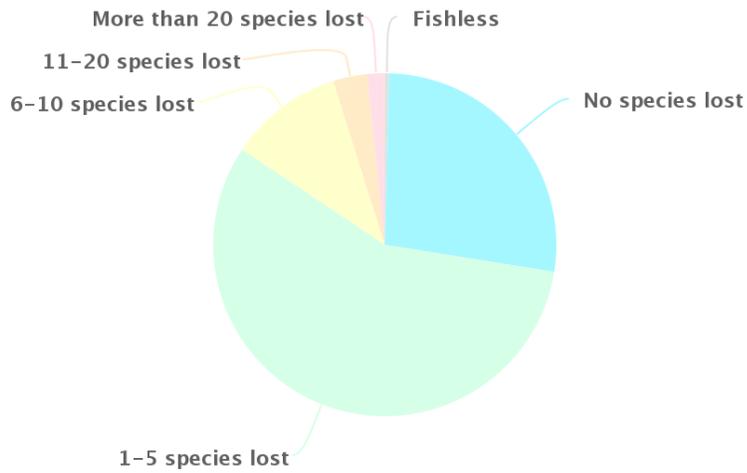
- Fishless
- 0
- 1 - 5
- 6 - 10
- 11 - 20
- >20

Data are displayed by 6-digit hydrologic unit code (HUC-6) watershed. Reduction is based on the number of native species determined to be present as of 2014, compared with historical numbers documented prior to 1970. A species is considered "present" if there is at least one record of its presence in any 8-digit HUC within the 6-digit HUC.

Information on the statistical significance of the trends in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: NatureServe, 2015

Exhibit 4. Reduction in native fish species diversity in the contiguous U.S. from historical levels to 2014, by percentage of area



Information on the statistical significance of the trends in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: NatureServe, 2015