

# MATERIALS AND METHODS

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We compiled information for this update from many different sources, including data and specimen collections held by government agencies, colleges and universities, and private individuals. All told, we considered information from about 3500 locations on 1200 Wisconsin streams, rivers, and lakes sampled from 1981 through 1999. For new distribution records we relied on published literature, the Master Fish File, and voucher specimens or photographs deposited in the fish collection of the University of Wisconsin Zoological Museum (UWZM) in Madison or the WDNR Research Center in Monona. A portable sea lamprey assessment trap (Schuldt and Heinrich 1982) operated below the DePere Dam on the Lower Fox River (Brown County) from 1979 to the present provided especially useful information on exotic species and trends in fish abundance (Cochran 1994, Cochran and Hesse 1994, Cochran and Marks 1995), although it was relatively inefficient at collecting large, deep-bodied species. We accepted unpublished records without specimens or photographs if they had been observed by one of the authors or by a biologist that we judged competent to identify Wisconsin fishes.

We have used common and scientific names from the most recent American Fisheries Society list of fish names (Robins et al. 1991a, 1991b, Kendall 1997), and we have indicated where these names differ from those in Becker (1983). The American Fisheries Society list will be updated soon and will probably include name changes for several Wisconsin species to match the nomenclature proposed by Mayden et al. (1992), so we list these alternative names in parentheses.

We defined three categories of Wisconsin fishes. Native species are those that had established populations in the state prior to European

settlement in the early 1800s. Most of these fishes are able to complete their whole life cycle in Wisconsin waters, but two, American eel (*Anguilla rostrata*) and skipjack herring (*Alosa chrysochloris*), spend only part of their lives in Wisconsin and spawn outside the state (Becker 1983). Non-native species were not present prior to European settlement and entered Wisconsin because of human activities subsequent to settlement, either through intentional or accidental introductions or through modifications of waterways that allowed them to bypass natural barriers. An example of the latter is the construction of the Welland Canal, which circumvented the barrier at Niagara Falls and permitted the invasion of the sea lamprey (*Petromyzon marinus*) and alewife (*Alosa pseudoharengus*) from Lake Ontario into the upper Great Lakes. We split non-native species into two categories: "established species," with one or more self-sustaining populations in the state as of 1999, and "transient species," which are not self-sustaining in the state. Some transient non-natives, such as the rainbow sharkminnow (*Epalzeorhynchus frenatum*) or striped bass (*Morone saxatilis*), are known only from a single individual; others, such as the grass carp (*Ctenopharyngodon idella*) or Atlantic salmon (*Salmo salar*), are represented by several records because they have been regularly stocked in Wisconsin or nearby states.

The following species accounts are divided into the three categories of native, established non-native, and transient non-native fishes. Species are listed by category and then alphabetically by scientific name within family, with families ordered taxonomically according to Robins et al. (1991a). Note that this taxonomic order differs from that of Becker (1983), reflecting an improved understanding of phylogenetic relationships.

Each species account includes a brief update of the current status of each species treated in Becker (1983), emphasizing any significant new information since then on taxonomy, distribution, and abundance. For status we used a five-level classification: secure – highly unlikely to disappear from the state within the foreseeable future; special concern – probably secure, but with either evidence of recent declines or uncertainty about trends in distribution or abundance; threatened – likely to become endangered in the foreseeable future; endangered – continued existence as a viable component of the Wisconsin biota in jeopardy; extirpated – no records from the state over at least the last 20 years. Threatened and endangered species have been legally designated by Wisconsin state law, whereas special concern species are listed informally by the WDNR.

Each species account also defines current abundance as either common – consistently captured in large numbers when the appropriate sampling technique is used in the right habitat; occasional – captured sporadically, usually not in large numbers; or uncommon – taken infrequently and always in small numbers. We also briefly summarize current distribution patterns. See figure 1 for a map of many of the rivers and lakes mentioned in the text.

For those native and established non-native species newly confirmed in the state since Becker (1983), the species account is more detailed, including a photograph, distribution map, discussion of identifying features and taxonomic status, and information (if available) on reproduction, growth, feeding, population dynamics, interactions with other species, and management issues.