

### Methods and Criteria Used To Identify Critical Habitat

As required by section 4(b)(2) of the Act and its implementing regulations (50 CFR 424.12), this final rule is based on the best scientific information available concerning the species' present and historical range, habitat, biology, and threats. In preparing this rule, we reviewed and summarized the current information available on the Gulf sturgeon, including the physical and biological features that are essential for the conservation of the species (see "Primary Constituent Elements" section), and identified the areas containing these features. The information used includes known locations; our own site-specific species and habitat information; State-wide Geographic Information System (GIS) coverages (e.g., land ownership, bathymetry (the measurement of depths of water in oceans, seas, and lakes), and estuarine substrates); the final listing rule for the Gulf sturgeon; recent biological surveys and reports; peer-reviewed literature; our recovery plan; discussions and recommendations from Gulf sturgeon experts; and information received during Gulf sturgeon recovery meetings. The Gulf Sturgeon Recovery/Management Plan (FWS *et al.*, 1995) contains valuable biological information, and it is cited throughout this document. However, the state of our knowledge regarding Gulf sturgeon biology and distribution has changed markedly since publication of the recovery plan for this species. The recovery criteria put forth in this recovery plan were deemed preliminary and may now warrant revision in light of new information. As a result of recent research and survey efforts directed towards this species, substantial portions of the biological information presented in the recovery plan are now dated or obsolete. Thus, although the recovery plan is a valuable source of information, it is not the final authority on the natural history and distribution of this species.

In the past, we had assumed, based on the information available at the time, that unoccupied habitat would be necessary for the recovery of the Gulf sturgeon. Since approval of the recovery plan in 1995 and our 1998 not prudent finding, we have collected new biological information on this species. We have analyzed what is necessary for the conservation of the Gulf sturgeon, as described above, and based on the best scientific information available at this time, we have determined that unoccupied habitat is not essential to the conservation of the Gulf sturgeon.

### Determining the Scale of the Final Designation

We first evaluated the Gulf sturgeon in the context of its current distribution throughout the historic range to determine what portion of the range must be included to ensure conservation of the species. We considered several factors in this evaluation—(1) maintaining overall genetic integrity and natural rates of inter-river genetic exchange, thereby minimizing the potential for inbreeding, (2) retaining potentially important selective pressure at the margins of the species' range by protecting the eastern- and western-most subpopulations, (3) decreasing the extinction risk of a subpopulation by protecting adjacent subpopulations that can provide a rescue effect, if needed, (4) avoiding the potential for subpopulation extirpation from environmental catastrophes, and (5) protecting sufficient habitat to support conservation of the species.

The historic range of the Gulf sturgeon included nine major rivers and several smaller rivers from the Mississippi River, Louisiana, to the Suwannee River, Florida, and in marine waters of the Central and Eastern Gulf of Mexico, south to Tampa Bay (Wooley and Crateau, 1985; and FWS *et al.*, 1995). Seven of these major river systems continue to support reproducing subpopulations. These include (from west to east)—the Pearl, Pascagoula, Escambia, Yellow/Blackwater, Choctawhatchee, Apalachicola, and Suwannee Rivers.

The Gulf Sturgeon Recovery/Management Plan (FWS *et al.*, 1995) noted the importance of identifying and maintaining genetic integrity and diversity during restoration efforts on Gulf sturgeon. A severe loss of genetic variability may lead to a decline in the fitness of a species (Soulé, 1987). Evidence suggests that peripheral subpopulations are often genetically and morphologically divergent from central subpopulations (Lesica and Allendorf, 1995). Distinct traits found in peripheral subpopulations may be crucial to the species, allowing adaptation in the face of environmental change (Lesica and Allendorf, 1995; and Allendorf *et al.*, 1997). In light of these considerations, we determined that the inclusion of stocks or subpopulations from both the eastern and the western margins of the current range were necessary to protect the potential evolutionary importance of those subpopulations (Scudder, 1989; Lesica and Allendorf, 1995; and Young and Harig, 2001).

While telemetry data indicate that Gulf sturgeon from one genetically

distinct drainage occasionally enter another river and also mix during the winter months in estuarine and marine habitats, a genetic analysis of tissue samples concluded that Gulf sturgeon exhibit strong natal river fidelity, with stocks exchanging less than one mature female per generation on the average (Waldman and Wirgin, 1998). These low gene flow estimates strongly suggest that natural recolonization of extirpated subpopulations of Gulf sturgeon would proceed slowly (Waldman and Wirgin, 1998). Semi-isolated subpopulations are more vulnerable to the effects of demographic and environmental population fluctuations (Forney and Gilpin, 1989; and Wahlberg *et al.*, 1996).

Gene flow estimates are usually higher between adjacent stocks, suggesting that migrants from semi-isolated subpopulations are exchanged primarily with neighboring subpopulations (Waldman and Wirgin, 1998). The loss of any intermediate subpopulations by a single environmental catastrophe could seriously limit a species' recovery (Kautz and Cox, 2001; and Young and Harig, 2001). In light of this, we determined that it is necessary to designate as critical habitat rivers used by subpopulations evenly spaced between the western- and eastern-most limits of the current range. To ensure conservation of the species, subpopulations must be geographically located so that they can serve as sources of sturgeon emigration, albeit at a slow rate (Waldman and Wirgin, 1998), to adjacent rivers and so that they can provide a rescue effect if an adjacent subpopulation is extirpated (Brown and Kodric-Brown, 1977; Hanski and Gyllenberg, 1993; and Young and Harig, 2001).

Designating critical habitat for only a few subpopulation units, or for units not spaced in a manner that allows genetic exchange with other subpopulations, could increase the vulnerability of the species due to isolation of subpopulations. Protection of a single, isolated, minimally viable population risks the extirpation or extinction of a species as a result of harsh environmental conditions, catastrophic events, or genetic deterioration over several generations (Kautz and Cox, 2001). To reduce the risk of extinction through these processes, it is important to establish multiple protected subpopulations across the landscape (Soulé and Simberloff, 1986; and Wiens, 1996).

Because of these considerations, we reached the conclusion that this designation should include critical habitat units within the major river