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Science Brief for Resource Managers

A Landscape Approach for Fisheries Database Compilation and Predictive Modeling

Description

A strong data foundation is needed to support science-based decisions for fisheries management at a watershed level. To assist in comprehensive watershed-scale planning, the Arizona Game and Fish Department (AGFD) is developing a fisheries data management system by compiling and formatting several hundred thousand fish survey and stocking records, and linking them to an existing Geographic Information System (GIS) national spatial framework (National Hydrography Dataset). This allows the system to also be used in watersheds shared with neighboring states, creating a seamless layer that goes beyond state boundaries.

In addition to integrating a variety of fisheries data and models into a single watershed-scale system, the AGFD has also created landscape-scale species distribution models (SDMs) for the 35 fish species listed as the Species of Greatest Conservation Need in the state's Wildlife Action Plan. This data also benefits neighboring states like New Mexico and Utah, helping resource managers in those states create similar models for shared species of interest.

Arizona's landscape-scale SDMs are also being used in other projects, most notably the Western Association of Fish and Wildlife Agencies' Crucial Habitat Assessment Tool (CHAT). West-wide, CHAT ensures wildlife values are better incorporated into land use planning by developing policies and tools to help identify and conserve crucial wildlife habitat and corridors throughout the region.



Humpback Chub (courtesy AGFD)

The primary objectives of this project were to:

- Compile and georeference Arizona watershed fish observation data into a robust, centralized database integrated within a GIS and documented with metadata.
- Use the database to help forecast the spread of non-native species under current and future climate conditions.
- Use the data with priority algorithm software to identify high priority areas for conservation or restoration to focus species' management efforts.
- Supplement data available to existing GIS-based projects like CHAT and other regional partnerships.

This study helps achieve goals identified by the Desert LCC partnership, including:

- Project changes in the distribution and populations of fishes.
- Project changes in distribution of invasive aquatic species.
- Project changes to endangered species habitat distribution.

Management Implications

Freshwater fishes are among the most imperiled biodiversity groups in the North American deserts of the Desert LCC, and include 67 native fish species of conservation concern. Historically, 36 species of native fish were found in varied habitats within Arizona ranging from small springs to raging flood waters of the lower Colorado River. One native fish species has become extinct, 20 are federally listed under the Endangered Species Act, and 34 are recognized as Species of Greatest Conservation Need under Arizona's State Wildlife Action Plan. Aquatic habitat loss and alteration through irrigation diversions, dams, and groundwater pumping creates challenges for both sport and native fish management not only in Arizona, but throughout the entire arid Southwest U.S.

One of the challenges to effective science-based decision-making in Arizona is the lack of high quality, accessible data that is updated over the long-term. This project compiles data from existing observation records and reports into a database that will continually be updated by AGFD as surveys are completed. The resulting data will be supplemented with georeferenced information about habitat condition, flow regime, human land-use, and dams/diversions operations that are highly predictive of fish distribution and community composition.

The information collected establishes a baseline by which managers can assess the impacts of water use, biological invasions, and climate change on fisheries resources in Arizona, and can help explain and predict the impacts of water use and climate change on Southwestern aquatic species. Projected species distributions can also help identify landscape-level areas that may have increased significance in the future for conservation and restoration.

This project creates a tool to help resource managers prioritize critical conservation needs by developing models that will project the impacts of increased water use, warming waters, or other potential future threats on aquatic resources. The information can also be used to answer management, planning and research questions related to risks and stressors associated with development impacts and other ecological changes.

Future Direction

This project established a foundation on which future modeling efforts can be developed and refined. Site specific modeling (like Species Distribution Models) can be used to provide valuable information at the landscape-level, and help identify areas for conservation. However, developing data output products such as Species Distribution Models is very time and resource intensive. This project demonstrates AGFD's expertise in developing and vetting over 200 such models which can further support neighboring states' efforts in creating SDMs for their own species of concern.

The results of this effort will also benefit many existing programs and agencies. The datasets can be incorporated into CHAT, a GIS-based, publicly available, web user interface to access wildlife and habitat data and assess potential impacts to populations from land-use activities, natural disturbances, or ecological change.

The 20+ members of the Desert Fish Habitat Partnership can also use the data in their efforts to conserve aquatic habitat throughout the arid West for desert fishes.

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Progress to Date

This study is complete. More information can be found at <https://www.sciencebase.gov/catalog/item/532343ace4b0f19aef5a48cb>.