

FAUNAZ

ARIZONA'S ARCHAEOFAUNAL INDEX

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For many years, zooarchaeologists have recognized the utility of archaeofaunal data to modern challenges, including informing wildlife management, environmental conservation, and habitat rehabilitation decisions (Lauwerier and Plug 2004; Lyman 1996, 2006; Lyman and Cannon 2004; Martin and Szuter 1999). Increasingly, conservation biologists and managers turn to archaeologists and environmental historians for information on past species ranges, communities, and habitats (Meine 1999). Despite this mutual interest, and given that archaeologists struggle with the dissemination of research results and primary data within our own professional community, the difficulties of reaching audiences and users beyond our disciplinary boundaries are great.

Open-access web-based applications are an important part of the new frontier of knowledge-sharing in the digital world, and provide the best opportunities for interdisciplinary and interprofessional communication and dissemination of research data. In 2004, Pavao-Zuckerman, with colleagues Charles Adams and Rich Lange of the Arizona State Museum, received funding from the Arizona Game and Fish Department¹ to build a GIS-linked database of zooarchaeological remains from the state of Arizona that could be used to inform modern habitat reconstruction and conservation decisions. The primary result of this project was the creation of "FaunAZ: Arizona's Archaeofaunal Index" (<http://faunaz.asu.edu>) (Figure 1).

The original goal of the grant project was to create a stand-alone GIS-linked database that could be used by wildlife managers, biologists, and others to inform modern wildlife conservation issues. Because of concerns about the security of archaeological site locality information, the initial plans for FaunAZ did not include a web component. As the project developed, however, it became clear that the instant and open-access that only a web-based application can provide was critical if the data was to reach our intended audience.

Moving toward a web-based and open-access application was only possible with cooperation and collaboration with AZSITE: Arizona's Cultural Resource Inventory (<http://azsite.arizona.edu>), and the Arizona Archaeological Records Office. AZSITE already maintains an on-line fee-for-service GIS-linked state archaeological records database that has for many years been a model for other state archaeological records offices. Collaboration with AZSITE permitted the piggybacking of FaunAZ onto the existing AZSITE structure and application. As a result of this arrangement, the project avoided significant duplication of effort in terms of populating a new database with site records and locality information that already exist in AZSITE. Working with AZSITE, however, required permission from, and collaboration with, the AZSITE Board, the AZSITE decision-making body. This was particularly the case given the sensitive nature of AZSITE data. As a result of this consultation, certain restrictions on data access and site locality information were built into the FaunAZ web application.

By working with AZSITE and the AZSITE Board, we constructed FaunAZ to be accessible to archaeologists, the target community of wildlife managers, as well as the general public free-of-charge, and without compromising sensitive archaeological data such as site locality information. FaunAZ can be accessed by anyone with an internet connection without special arrangements or permissions.

FaunAZ: Arizona's Archaeofaunal Index

FaunAZ includes all vertebrate zooarchaeological remains from all archaeological sites reported in AZSITE within the state of Arizona, exclusive of tribal lands. To date, FaunAZ includes nearly 7,000 records of zooarchaeological remains from over 600 sites in Arizona. In addition to lists of vertebrate species recovered, FaunAZ includes, when available, bone counts (reported as the number of identified specimens, or NISP). The database is searchable by scientific and common name, site name and number, as well as by time

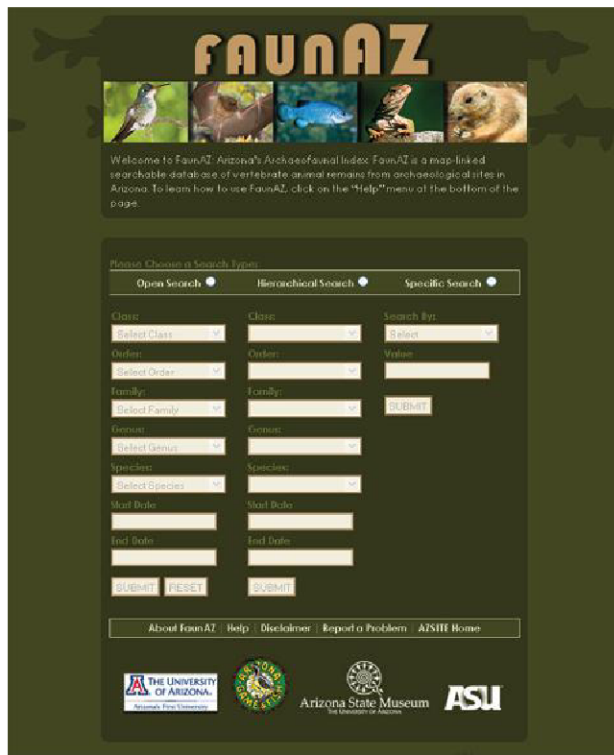


Figure 1: Screen capture of FaunAZ: Arizona's Archaeofaunal Index, website query.

period. FaunAZ also provides citations for the original reports and publications from which the data was collected.

While archaeological site locality and attribute information was already available within AZSITE, the addition of faunal remains required creating a new back-end SQL server database that integrates the FaunAZ “extension”² with the existing AZSITE relational database (Figure 2). Relational databases such as FaunAZ are capable of modeling a wide variety of analytical approaches. Since taxonomic designations are hierarchical, a relational model for all legal taxonomic designations was built using five tables that list legal values for each hierarchical taxonomic level (Class, Order, Family, Genus, Species). Four additional tables list all legal combinations of taxonomic values (Class to Order, Order to Family, Family to Genus, Genus to Species). A manager front-end entry module permits only the project manager (Pavao-Zuckerman) to enter new valid taxonomic relationships into the FaunAZ extension (Figure 3). Site-specific data are given in an additional seven field table in which one field is site number, five fields refer back to lists of legal values for each level in the taxonomic hierarchy, and an additional field records NISP (Figure 4).

The majority of zooarchaeological data from the state is pub-

lished in cultural resource management reports. Populating the FaunAZ database, therefore, required accessing the original hard-copy archaeological reports. Fortunately, the Arizona State Museum serves as the archaeological repository for the state of Arizona, and curates all CRM project reports associated with the Museum's repository collections. The archaeological records office also maintains reports submitted to that office as part of the state's archaeological permitting procedures. A small army of graduate students³ entered data from these reports (and other publications, including theses and dissertations), including taxonomic identification and bone count, using a back-end data entry module designed specifically for FaunAZ with the goal of minimizing data entry errors. Using object-oriented programming, a series of commands limit the taxonomic designations available to the data entry staff based on their most recent input. Via a series of nested, exclusive, drop-down menus (Figure 4), the scientific Class must be chosen first, and then the user is presented with a menu including only taxonomic Orders that belong within that Class, then Families within that Order, and etc., down to the taxonomic level of species.

As mentioned above, working with AZSITE necessitated additional security measures. As much of the intended audience are not archaeologists, it was decided that sensitive archaeological data would not be given in FaunAZ. Spatial data is provided only down to the USGS 7.5' map quad and only nonlocational information relating to faunal remains is available through FaunAZ. Future development will allow the user to bore down to the section level (1 square mile). Users must subscribe to AZSITE to access more detailed information about individual sites and locality information.

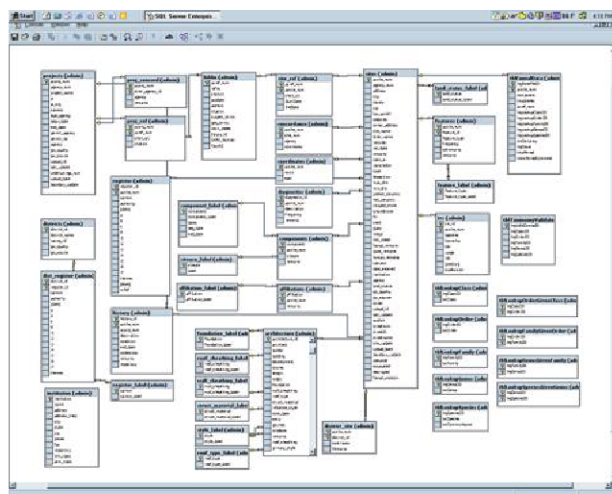


Figure 2. Back-end SQL server integration of FaunAZ with AZSITE: Arizona's Cultural Resource Inventory, the state site files database.

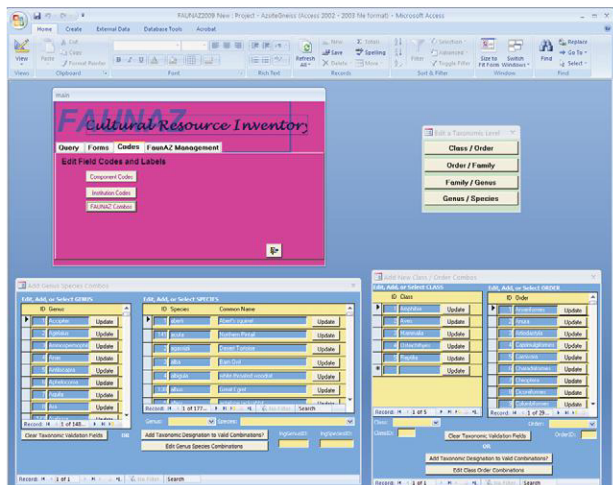


Figure 3. In the project manager front-end, valid relationships between Class/Order, Order/Family, Family/Genus, and Genus/Species are established, and new taxonomic designations are added.

Limitations and Challenges

Given the scope of the project (nearly 1,800 sites with faunal remains recorded as present), it was not possible to confirm the accuracy of the faunal data reported in FaunAZ. The accuracy of zooarchaeological analysis is influenced by the skill and training of the individual researchers who contributed the original data, but no attempt was made to confirm the taxonomic identifications made by this large community of faunal analysts.

The goal of the project was to be comprehensive within state geographical boundaries exclusive of tribal lands, but this was far more idealistic than realistic. A surprising number of archaeological sites, particularly those investigated before the formation of a statewide archaeological records office, are not currently recorded in AZSITE. We relied on institutional memories, and referrals from faunal analysts statewide, to track down faunal assemblages not reported in AZSITE. As a result of our efforts, many new sites were also added to the main AZSITE application. We continue to receive (and welcome) input from users who know of unpublished faunal reports that are currently missing from our database.

Taxonomic Limitations

Given time and funding constraints, we were only able to include vertebrate (mammals, birds, herpetiles, and fish) remains in the FaunAZ database. No invertebrate remains are included, although the project could be extended to include invertebrate remain with additional funding. The database also only includes archaeological remains—

paleontological or other remains not associated with past human activities were not included in FaunAZ.

The vagaries of changing taxonomic designations were also problematic for FaunAZ. Many older reports of zooarchaeological materials use taxonomic designations that are no longer valid. The preferred taxonomy used in FaunAZ is that employed in ITIS, the Integrated Taxonomic Information System (<http://www.itis.gov>). However, for the convenience of users, FaunAZ also recognizes commonly used, but currently invalid, synonymous scientific designations. ITIS was also used as the source for accepted common names.

Diverse Audience

Because FaunAZ was intended to be used by non-archaeologists, it was important to explain the limitations of archaeological data to an untrained audience. We use a disclaimer statement on the FaunAZ website to inform users about several key issues, including the movement of exotic species by humans long distances in the past, and the site discovery bias that is inherent in interpreting data collected primarily through cultural resource management activities. We urge users that, before these data are employed in policy or practical applications, they should consult with archaeologists who can help distinguish human effects from natural species occurrences.

Final Thoughts

In addition to building the FaunAZ database and search interface, one goal of the grant project was to demonstrate the utility of zooarchaeological data to conservation biology and management decisions. Our case study was the Homol'ovi cluster, a community of Ancestral Puebloan villages located on or near the Little Colorado River in northern Arizona. Faunal remains from these communities are indicative of extensive riparian and wetland habitats that

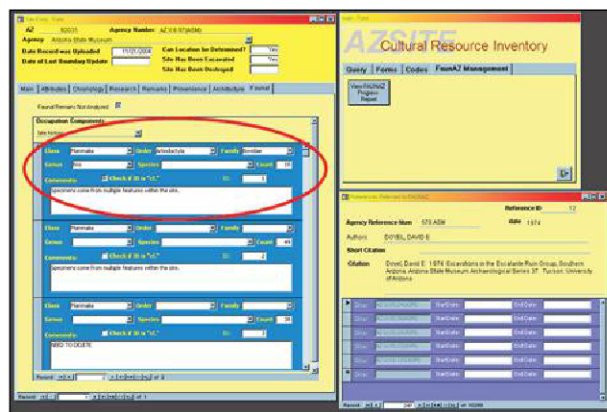


Figure 4. FaunAZ data entry interface. Drop-down menus prevent erroneous taxonomic affiliations and misspellings.

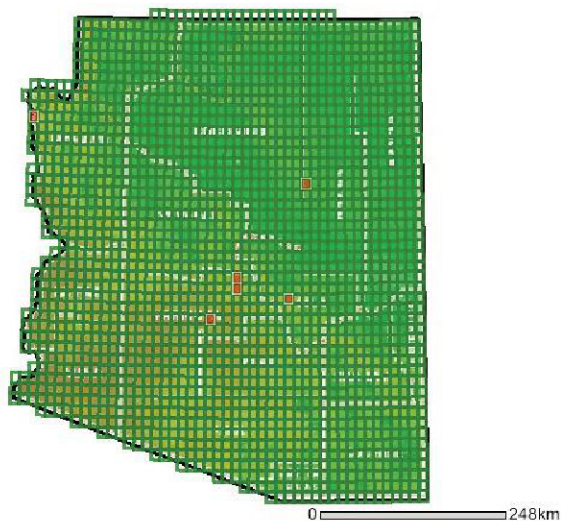


Figure 5. Recovery of razorback sucker (*Xyrauchen texanus*) zooarchaeological remains as recorded in FaunAZ.

were home to a number of wetland species that are no longer found in the region, including beaver (*Castor canadensis*) and muskrat (*Ondatra zibethicus*). FaunAZ also demonstrates that several endangered or threatened native fishes, including the razorback sucker (*Xyrauchen texanus*), Colorado pikeminnow (*Ptychocheilus lucius*), Gila chub (*Gila robusta*), humpback chub (*Gila cypha*), and bonytail chub (*Gila elegans*), were extant in the Little Colorado River during the occupation of the Hono'ovi pueblos (Figure 5). Prior to the publication of FaunAZ, it was not known that the Little Colorado River provided appropriate habitat for these fish species. These data suggest that, following planned Arizona Game and Fish habitat restoration efforts, many of these endangered and threatened native fish species could be reintroduced into the Little Colorado River drainage system.

While FaunAZ is similar to other web-based GIS-linked databases, such as Faunmap (<http://www.museum.state.il.us/research/faunmap/>), no other GIS-linked database includes *all* vertebrate remains from archaeological sites in a single state. In addition to providing information for wildlife managers and biologists, FaunAZ also serves as a central clearing house for archaeofaunal research in Arizona. The database includes full citations for data reported in FaunAZ and serves as a valuable research tool for zooarchaeologists.

Importantly, FaunAZ is also serving as a model for public access to archaeological research, a particularly important goal given that the vast majority of archaeological research is supported by public funding. As an extension of the collaboration between FaunAZ and the AZSITE Consortium, the

Arizona Archaeological Records Office recently went live with AZSITE Public (<http://azsitepublic.asu.edu/>), a free “public” version of AZSITE that, like FaunAZ, protects sensitive site locality and other archaeological information while providing public access to archaeological research results.

The success of the FaunAZ project hinged on collaboration and consultation with individuals who brought a diversity of skill sets and interests to the table. Throughout the project we relied on archaeologists, wildlife managers, AZSITE Board members, experts on computer programming and database design, GIS consultants, and web designers. The project took a great deal of time, and funding, but it is, fundamentally, a system that could easily be replicated and, more importantly, improved upon in other regions in the service of the dissemination of archaeological research.

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Notes

1. AZGF Heritage Fund Grant #I05009, awarded to B. Pavao-Zuckerman, R. Lange, and E.C. Adams, Arizona State Museum, University of Arizona.
2. The back-end SQL server FaunAZ database, integration with AZSITE, back-end user entry module, and front-end manager entry module were built by John F. Chamblee with input from Rick Karl, John T. Murphy, and Zhongxiang Xia.
3. Including Ashley Blythe, Dan Broockmann, Elisabeth Cutright-Smith, Melanie Dedecker, Kacy Hollenback, Lauren Jelinek, Lauren Milligan, Meredith Reifschneider, Chris Roos, and AJ Vonarx.