

ASSESSMENT OF AQUATIC INVASIVE SPECIES IN NATIONAL PARK WATERS

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A report on a Cooperative Project between the
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Introduction

Along with habitat alteration and climate change, invasive species are one of the most serious threats to ecosystems managed by the National Park Service. According to the public NPS web site, “The spread of invasive species is recognized as one of the major factors contributing to ecosystem change and instability throughout the world. ... Invasive species are changing the iconic landscapes of our National Parks” (<http://www.nature.nps.gov/biology/invasivespecies/>). The threats posed by invasive species are not confined to terrestrial landscapes, but are also causing severe ecological and economic disturbances to aquatic and marine ecosystems. The taxa that are involved in these invasions include aquatic plants, insects, crustaceans, mollusks, fish, reptiles, and amphibians. Anecdotal and scientific evidence about the extent and impacts of aquatic and marine invasive species abounds. While there is abundant evidence testifying to the seriousness of marine and aquatic invasive species in NPS waters, there is no comprehensive service-wide assessment of the issue, and no risk assessment to identify the most pressing threats and impacts. Assessment, risk analysis, and mitigation strategies for marine and aquatic invasive species lag behind those for terrestrial invasives because marine and aquatic environments are less visible and more difficult to study than terrestrial environments. This information for aquatic and marine environments is needed in order to develop realistic management strategies for detection of, protection from, and mitigation of aquatic invasive species, and for restoration of disturbed habitats.

Objective

The objective of this project is to ensure that there is a systematic, comprehensive database and assessment that documents the current state of knowledge of the extent of aquatic invasive species in national park waters.

Approach

One of the first tasks associated with this project was the establishment of communications between the NPS and other organizations interested in aquatic invasive species. During the course of the project, contacts were made with the following organizations with the aim of forging collaborations related to the occurrence of aquatic invasive species:

1. The U.S. Geological Survey, Non-indigenous Aquatic Species Database program, headed by Pam Fuller in Gainesville, Florida. This interaction is described in more detail below.
2. Colorado State University, Natural Resources Ecology Laboratory, including Tom Stohlgren and Jim Graham, who helped with assessing the occurrence of certain species, reviewing the overall approach, and making the results available on the web.
3. The Nature Conservancy’s Invasive Species Program, and its associated efforts on mapping marine and freshwater ecoregions, headed by Jennifer Molnar.

The main effort of the project focused on assessing the occurrence of aquatic invasive species in national park waters using existing data. The primary source of data for the effort was the USGS Non-indigenous Aquatic Species Database (<http://nas.er.usgs.gov/>), which contains records from numerous organizations of the occurrence of freshwater and marine non-indigenous aquatic species (NAS) from all major biological taxa. The records are geographically referenced by latitude and longitude, as well as by state and 8-digit hydrologic unit code (HUC8).

A request for a customized retrieval was made to the USGS, for all the records of NAS in HUC8 watersheds containing all or part of a national park with significant aquatic resources to manage. The lists of parks and HUC8s were available from NPS files. The USGS responded by sending a spreadsheet containing 9,156 entries representing the requested records. Some of the entries were duplicates, which was reasonable since multiple park units may occur in the same HUC8. In all the spreadsheet entries represented 2,965 records of 361 species in or near 129 national parks.

The geo-referenced records in the spreadsheet were incorporated into a GIS map coverage at the NPS Natural Resources Program Center. Two subsets of the data were sorted out of the main database: (1) records from within the boundaries of a national park, and (2) records from within half a mile of a national park. The map coverage differentiates among these data subsets by plotting points with different color codes, and by the locations where the points are plotted with respect to park boundaries. A geographic verification process was established to check the plotted locations, and a few dozen points were identified that had errors in location information. These errors were found to be correctable through the use of other location information contained in the record. The location corrections were made as needed, and the corrected records were shared with the USGS.

The map was prepared for viewing by users within and outside the NPS, and a data viewing guide was written. By using the free downloadable software, "ArcGIS Explorer", users can adjust the map to any scale from continental to local, view the data points representing the locations of records, and click on a point to retrieve tabular data about the records.

Results

As mentioned above, the retrieval from the USGS NAS database contained 2,965 records of 361 species in or near 129 national parks. The spreadsheet, with summary graphs, is included in Appendix A to this report. The most frequently reported NAS in park waters is *Dreissena polymorpha* (zebra mussel), with 120 records, followed by the *Corbicula fluminea* (Asian clam), with 109 records, and *Cyprinus carpio* (common carp) with 99 records. The top 25 species, by frequency of occurrence, are listed in figure 1.

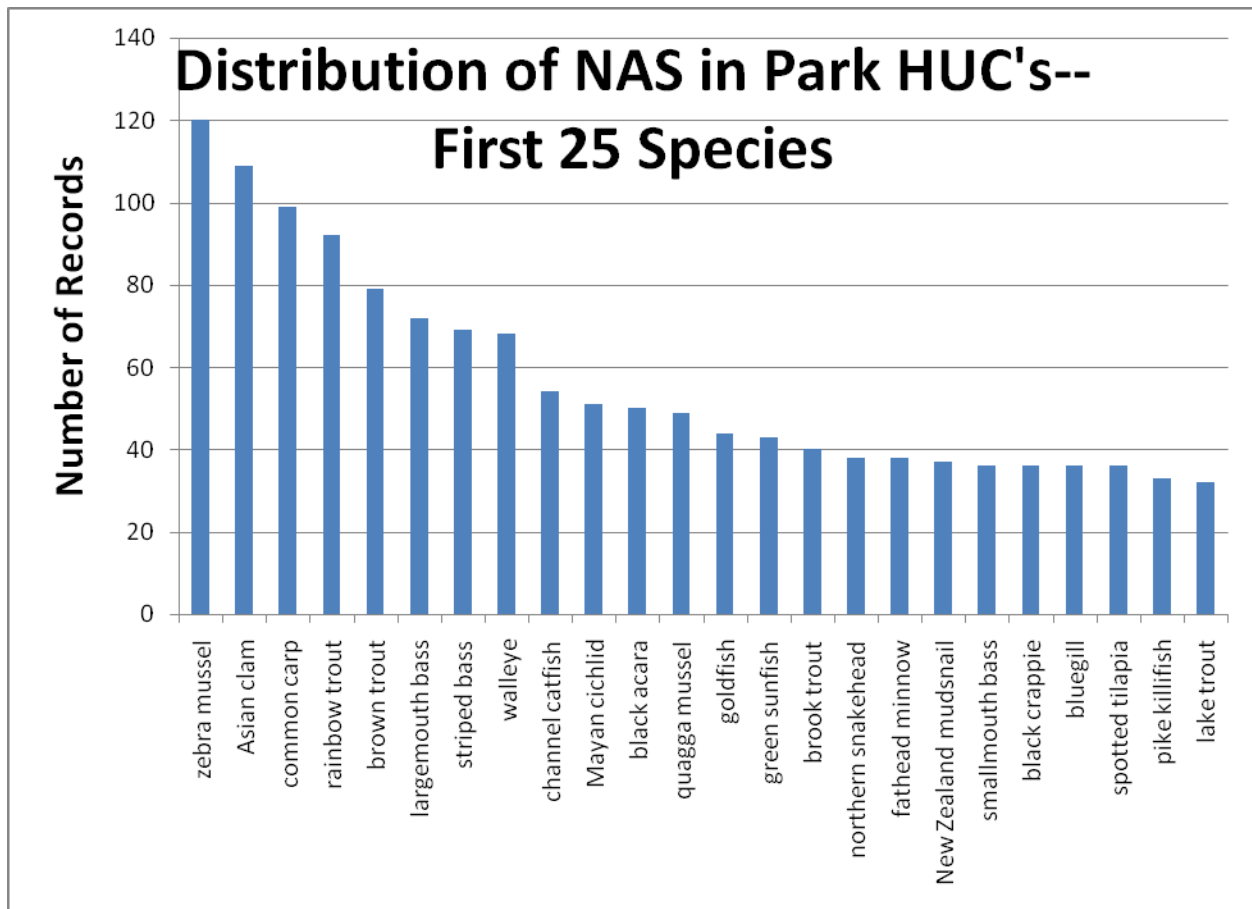


Figure 1.—Frequency distribution of the top 25 non-indigenous aquatic species in NPS waters.

For graphs of the second, third, and fourth groups of 25 species, please see the “spp_graph” tabs in the Excel workbook in Appendix A. Not surprisingly, the list includes well-known aquatic invasive species such as the quagga mussel, the northern snakehead, the New Zealand mudsnail, purple loosestrife, the Burmese python, the sea lamprey, the walking catfish, hydrilla, nutria, water hyacinth, and the Asian swamp eel. Also on the list are numerous salmonid species that have been intentionally released as game fish in waters where they are not native, and many common aquarium fish that have been intentionally or unintentionally released into the wild.

The two parks with the greatest number of records for their HUC8 watersheds encompass reservoirs on the lower Colorado River: Lake Mead National Recreation Area with 740 records, followed by Glen Canyon National Recreation Area with 590. Next come two parks in southern Florida, Big Cypress National Preserve with 439 records, and Everglades National Park with 381. Parks in the National Capitol area are well represented on the list, owing to many records from the Potomac River and tributaries, as are other western reservoirs and a number of coastal parks. The top 25 parks by number of records are listed in figure 2.

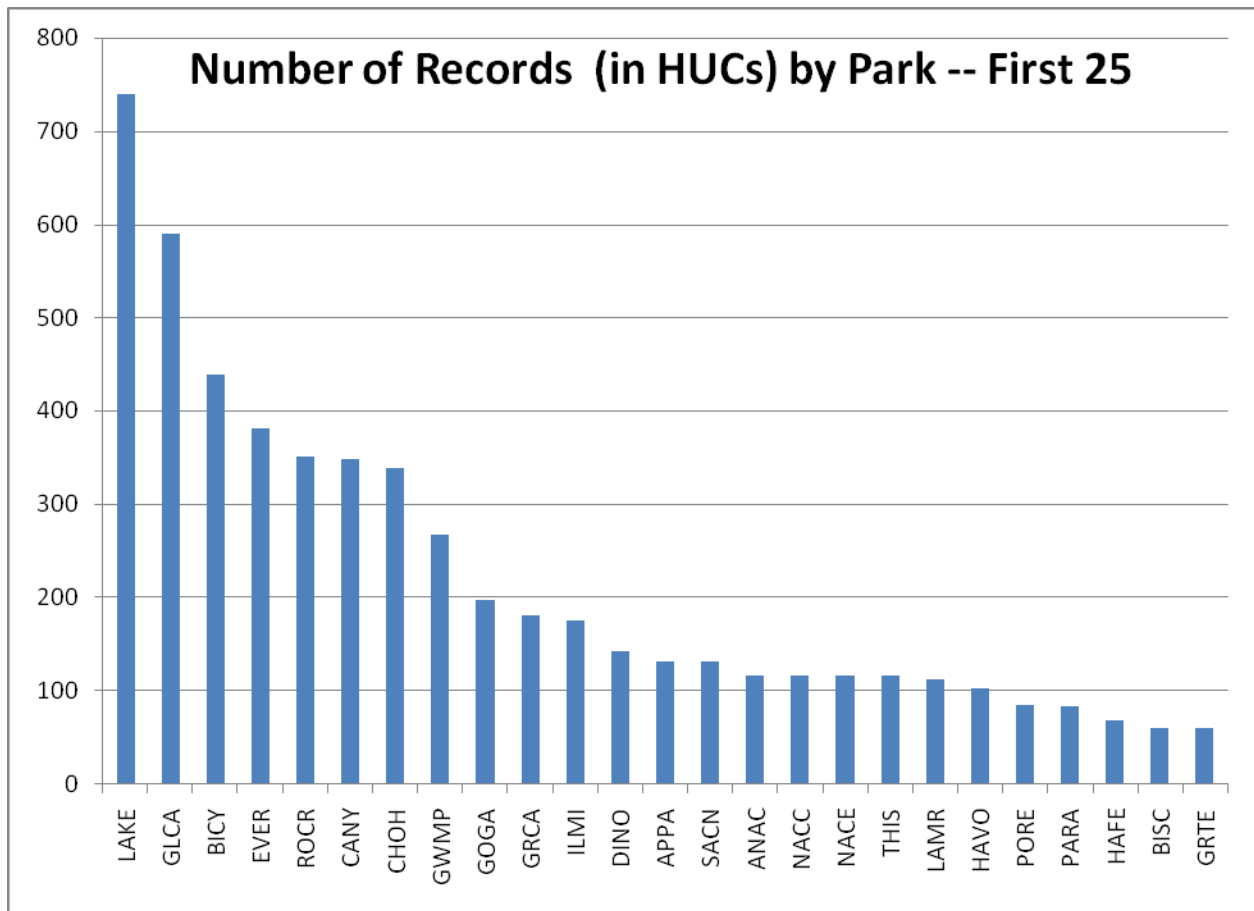


Figure 2.—Frequency distribution of the top 25 parks, by number of records of NAS.

For graphs of the second, third, and fourth groups of 25 parks by number of records, please see the “park_graph” tabs in the workbook in Appendix A.

The order of listing for the parks changes slightly when they are listed according to number of non-indigenous species observed in the HUC8 watershed containing the park. This list ignores repeated observations of the same species in a given park. The park with the greatest number of NAS is Golden Gate National Recreation Area with 72 species, followed by Lake Mead National Recreation Area with 67, and Chesapeake and Ohio Canal National Historical Park with 59. The top 25 parks by species are listed in figure 3.

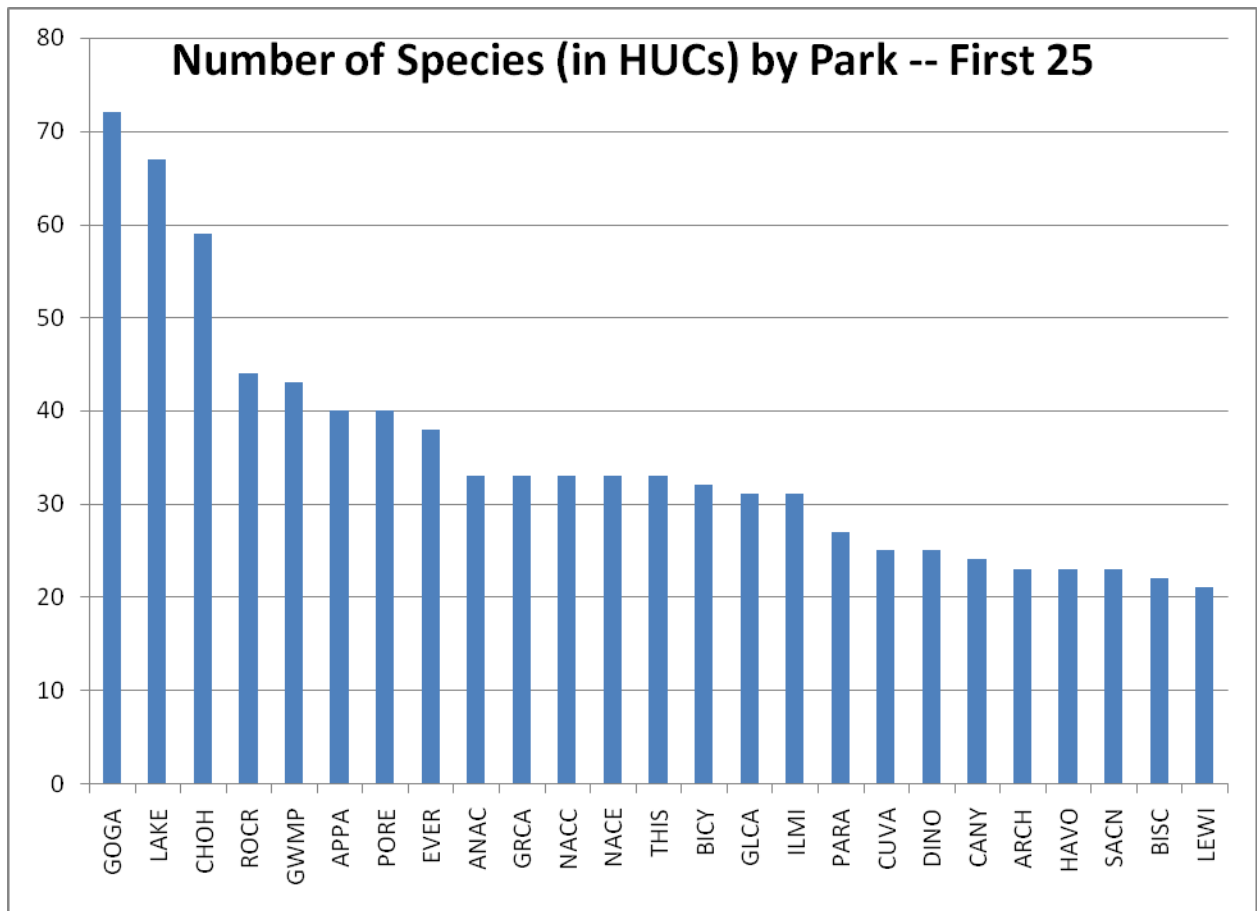


Figure 3.—Top 25 parks by species.

For graphs of the second, third, and fourth 25 parks in this series, please see the “park_graph_spp” tabs in the workbook in Appendix A.

A sample image of a portion of the interactive map of NAS in park waters is included in figure 4.

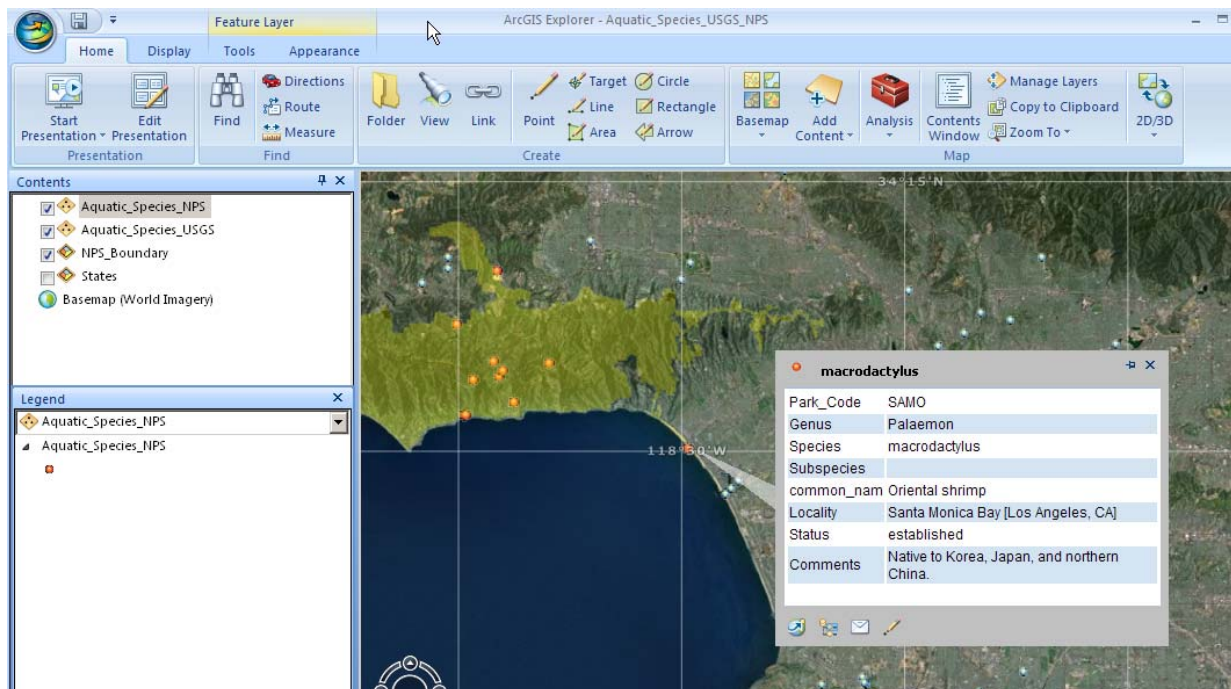


Figure 4.—Image of a portion of the interactive map of NAS in park waters. This frame is from southern California and shows Santa Monica Mountains National Recreation Area.

The viewing guide is included as Appendix B. For access to the interactive map, please contact the author at glenn_patterson@partner.nps.gov.

Recommendations for Additional Actions

The following additional actions are recommended as follow-up to this project:

1. Invite NPS field offices including regions, parks, and Inventory and Monitoring networks, to view the map and make any needed corrections or additions.
2. Address the degree of invasiveness posed by certain species in certain parks. Some species are native in some areas and invasive in others, so this must be done on a park-specific basis.
3. Share the data with the interested public via the CSU NREL web site, International Biological Information System.
4. Share the results with policy and budget offices in NPS.