Case Study

Finding Value *in* Pre-existing Data Sets

Ecological effects of raven populations in the Joshua Tree National Park

by William I. Boarman & Sharon J. Coe

U.S. Geological Survey, Western Ecological Center and Department of Biology, University of California, Riverside

RESOURCE MANAGERS AT JOSHUA TREE NATIONAL PARK, in southeastern California, are concerned about their new neighbor—Eagle Mountain Landfill. This large solid-waste landfill has been sited immediately adjacent to the park and is expected to receive up to 20,000 tons of household garbage per day. Park managers' misgivings about the landfill include its the potential to be used by common ravens (*Corvus corax*) as a food source, subsequently promoting an increase in raven populations in and around the park. Ravens are a natural component of the avifauna in the park, but their populations have grown substantially in recent years along with the proliferation of human activities. Landfill operators from other areas have observed ravens eating organic material along the active face of landfills, readily extracting food covered by as much as 15 centimeters of dirt.

The real concern is not the ravens themselves but the desert tortoise (*Gopherus agassizii*), a federally listed threatened species in California, Nevada, Utah, and northwest Arizona. In desert areas, juvenile desert tortoises are known to fall prey to ravens, and increases in raven densities have been implicated as one cause of desert tortoise decline. Clearly, the new landfill was not welcome in the neighborhood.

Because the park managers were faced with the imminent licensing of the landfill, they sought to address key management questions. What is the population status of ravens in and around the park? How has the population changed during recent decades? How will the landfill affect raven populations in the area?

As a first step to developing and implementing a monitoring program, managers at Joshua Tree National Park asked us to evaluate raven distribution and relative abundance. They suggested we use information from studies they had already initiated. What we learned in the process was not only about ravens but also the value of using pre-existing data sets. What initially seemed like weak data for evaluating raven distribution and abundance ultimately gave us considerable insight into their occurrence in the park, at relatively low cost.

Pre-existing data sets tend to be ignored by both managers and scientists. Managers may be unaware of what data exists and where to find it. Scientists often consider these sources irrelevant to their biological questions and are reluctant to use data that may not have been rigorously collected, may not be amenable to statistical analysis, or have not been published in peer-reviewed scientific outlets. These are the unwanted "ugly ducklings" of data sets. Yet they should not be snubbed. Although they may not be substance for contributions to the more prestigious peer-reviewed journals or for dissertations, they can often be applied to management questions at hand.

Furthermore, collecting and analyzing data can be costly and time consuming. Managers often do not have sufficient time or funding to address all issues with long-term, statistically rigorous studies. Evaluating pre-existing data can sometimes augment, or in some cases replace, data collection efforts. Such data is particularly useful for answering questions about major changes in species abundance and distribution or gross changes in habitat use. For example, inventories can be used when historical information is needed before implementing additional surveys. Also, when working on a poorly studied or rare species, local anecdotal knowledge can provide surprising and valuable insight. However, if the data exists, it is applicable to any plant or animal species or community, These reservoirs of data may be found in the form of agency or academic surveys, volunteer counts, museum records, or wildlife observer species lists. These data sources are probably available for any identifiable land management unit that has a history of visits by scientists, natural historians, or the public.

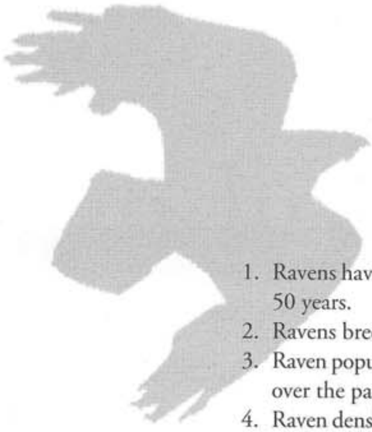
TABLE 1.

Data source	Information provided
Sighting surveys sightings along a designated transect either on foot, in road vehicles or helicopter	• distribution and abundance estimates • relative densities within surveyed area
Incidental sightings lists of species, numbers and location collected by agency staff and visitors to the park	• distribution estimates • breeding information by nest sighting
Museum specimens samples of skin and eggs	• historical distribution in specific areas
Anecdotal historical records written reports by naturalists	• changes in occurrence over time

During our data hunt, we tracked down information from diverse sources spanning about 50 years. Most of these studies were unpublished. For example, we found U.S. Geological Survey (USGS) Breeding Bird Surveys (BBS), National Audubon Society Christmas Bird Counts (CBC), museum records, unpublished park reports, and field notes from knowledgeable local bird enthusiasts. Most of our data were collected by volunteers and agency staff who participated in count-programs, by researchers during sighting surveys, or as anecdotal historical records. Most of the thirteen data sources we considered (published and unpublished) were recorded within the park, but we also considered observations from around the park. The earliest record we found for what is now park land was a published observation in 1935, although records of raven occurrence in the region dated back as far as 1893. Among the museum collections were specimens (eggs and skins) from the early 1900s. Some of the early observations for areas near the park describe raven sightings "about every day usually in pairs" and "common at all times everywhere, nesting on cliffs in the mountains."

This historical perspective gave us an indication of raven densities in the region before contemporary levels of human occupancy. Also, comparisons with fairly recent sighting data helped us evaluate why ravens currently occupy sites where they may have been absent earlier. Table 1 summarizes the type of data we used in our evaluation of raven populations.

Although none of the data sets provided a comprehensive assessment of common raven distribution or density in the park for any given time period, when used together they revealed trends in distribution and occurrence. The results thus provided a valuable baseline from which changes in raven populations could be traced and compared and further monitoring programs could be established. As far as answering our original management questions and understanding the ecological effects of raven populations in the Joshua Tree National Park, the conclusions we drew were:



1. Ravens have occurred in the park for almost 50 years.
2. Ravens breed in the park.
3. Raven populations in the park have increased over the past 50 years.
4. Raven density might be positively correlated with human density.
5. Raven density is lower in regions without roads.
6. Landfills in Southern California deserts are the largest concentration areas for ravens.
7. The number of ravens at landfills near the park seem to be associated with the type and frequency of garbage burial methods rather than with the size of the landfill or amount of garbage.

We submitted our conclusions to the park managers who will incorporate the findings into the design of an extensive raven monitoring program. While some tortoise populations remain stable, others are still declining. Further studies to evaluate the status of the desert tortoise are planned. The Eagle Mountain Landfill is expected to begin operation within the next couple of years, by which time a raven-monitoring program should be up and running. The landfill operators will monitor raven numbers at the site and adopt control measures, such as covering the garbage with a minimum of 15 centimeters of dirt at the end of each day. If the raven population increases, further control measures will have to be implemented.

As valuable as these data sets were, they were not without problems. We learned from our experience that it behooves managers to interpret pre-existing data sets with caution. Characteristics such as lack of standardized and consistent methods as well as unreliable observer reports make these data unsuitable for anything but conservative and often tentative conclusions. We recommend being wary of comparing incompatible data sets. For example, in the National Audubon Society CBC, observers counted birds within a 15-mile diameter during a 12-hour period, whereas in the USGS North American BBS, observers counted the number of birds at stops every half mile along a 24.5-mile route.

Similarly, it is also important to watch for over- or under-estimating abundance. If, for example, a survey is carried out in an area particularly attractive to ravens, abundance estimates for the whole region may be overestimated. Likewise, when surveys occur only once a year, as with the BBS, the weather conditions on a particular day could influence the survey results. Sometimes the survey design itself can introduce bias; for example, when surveys occur strictly along roads, the effect of roads on bird dispersal can bias the data.

In some cases, we needed to manipulate the data. For example, when school children took part in the park's Adopt-A-Raven survey, some observers deviated from the survey protocol, and it was necessary to make allowances for this in the data interpretation. Despite one's best efforts to be cautious and to judiciously manipulate data, there are nevertheless times when it is necessary to discard dubious data sets.

Our use of pre-existing data sets that could easily have been ignored as non-statistical or non-scientific provided historical and temporal information that would have been absent had we used only contemporary baseline surveys. We found that some of our questions were answered partially or entirely in the evaluation of data collected by others. Even anecdotal and incidental sightings contributed to our long-term look at raven distribution throughout the park and its surrounds. We discovered several sites where ravens often are reported, sites that could become focal points for future monitoring efforts. The BBS and Adopt-a-Raven transect data can be used as baselines for comparing future trends, if similar methods are adopted for monitoring raven populations. Finally, we identified several people with a wealth of experience and knowledge regarding raven populations in the park. ❧

For more Information:

Boarman,W.I. 1993. When a native predator becomes a pest: A case study. In Majumdar *et al.* (eds.) *Conservation & Resource Management.* Pennsylvania Academy of Sciences, Easton, PA.

Root, T. 1988. *Atlas of wintering North American birds: An analysis of Christmas bird count data.* The University of Chicago Press, Chicago IL.

Breeding Bird Survey and Christmas Bird Count long-term data sets can be downloaded from the web:(BBS) *http://www.mp2pwrc.usgs.gov/bbs/retrieval/*; (CBC) *http://birdsource.cornell.edu/*