METHODOLOGICAL CHALLENGES TO ESTIMATING RECREATION USE OVER A LARGE GEOGRAPHICAL AREA: A CASE STUDY OF 35 TVA RESERVOIRS

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Abstract

The Tennessee Valley Authority (TVA) initiated a study to estimate the changes in aggregate recreation use and associated changes in recreation expenditures within the TVA region for 35 of the reservoirs impacted by proposed changes in system operations. The data needed to develop recreational use estimates, user profiles, and economic impacts for this Programmatic EIS were collected using primary data collection on reservoirs and tailwaters.

This paper focuses on the methodological challenges of collecting data in an efficient and cost-effective manner over a large geographic area from four main user groups: public water access site users, commercial operators providing tours or rental watercraft, patrons of commercial operators, and shoreline property owners. The four main methodological challenges discussed in this paper are: (1) stratification of a system of 35 reservoirs and 29 tailwaters; (2) sample design; (3) survey design; and (4) data collection for public access site users and commercial patrons.

1.0 Introduction

The Tennessee Valley Authority (TVA) operates 49 reservoirs on the Tennessee River System, which extends across seven states. Thirty-five of the reservoirs are impacted by TVA's reservoir operations policy, which guides the daily operations of the Tennessee River System (TVA 2004). In 2001, TVA initiated its Reservoir Operations Study (ROS) to identify whether changes in system operations would produce greater public value. The ROS analyzed a number of different alternative operating policies to estimate the impacts of those policies on various resources, including recreation. To support the resulting Programmatic Environmental Impact Statement, data were needed to estimate existing recreational use occurring at its projects, and the changes in recreation use and associated changes in recreation expenditures within the TVA region from the proposed changes in system operations. Primary data collection for the study was conducted with four main user groups: public water access site users, commercial operators providing tours or rental watercraft, patrons of commercial operators, and shoreline property owners.

Conducting primary data collection in an efficient, cost-effective manner over a large geographical area is a challenging task. The study area was spread across two time zones, and the study team across three time zones. Methodological challenges fell into four main categories: (1) stratification of a system of 35 reservoirs and 29 tailwaters; (2) sample design; (3) survey design; and (4) data collection for the public access site users and commercial patrons. The challenges associated with the primary data collection, and the resulting implications for future research of this type are discussed in this research paper.

To provide background for the methodological issues, the data collection efforts used for each of the four user groups are briefly described below.

2.0 Primary Data Collection

The data needed to develop recreational use estimates, user profiles and economic impacts were collected using primary data collection on reservoirs and tailwaters. Data collection methods included contact (intercept) surveys, mail surveys, and advance and follow-up telephone surveys.

2.1 Public Water Access Site Users

Contact surveys were administered at a representative sample of public access sites at sampled reservoirs/ tailwaters to collect data on recreational users (by

recreational activity) and provide a basis for estimating total recreation use by activity for each reservoir and tailwater area. In addition to counting everyone entering and exiting the site on the sampled data collection day, interviewers intercepted recreationists to collect trip-specific items, such as age, income, group size, primary activity, length of stay, and trip expenditures. Public water access site users were also asked to indicate how their recreational use would change under different reservoir operating conditions.

Sampling and data collection for recreational use at public access sites were conducted using a roving access site survey method (also known as the Bus Route Method) as described in Pollock et al. (1994). For each sampled reservoir and tailwater, all water-based public access sites were mapped and sampled with the assistance of TVA staff based on their level of anticipated use.

The data collection at public access sites was conducted between May 19 and October 19, 2002. Specific data collection days were selected to represent two seasons, summer and fall. Data collection days were also selected to represent three different day types: weekdays, weekends, and holiday weekends. A total of 15 data collection days were selected for Pickwick, Chatuge, Chickmauga, Melton Hill, Kentucky, Guntersville, Norris and Tellico reservoirs. A total of 10 data collection days were selected for Blue Ridge, Cherokee, Douglas, Hiwassee, and South Holston because these reservoirs were assumed to have lower recreational use levels. Contact surveys were completed with 4,644 persons at the sampled reservoirs, or 67 percent of those approached by the interviewers and asked to complete the survey.

2.2 Commercial Operators

This survey was mailed to commercial operators to estimate use levels for recreationists who access the water via marinas, outfitters, and other commercial operations. The type of data collected included recreational use data (number of trips for each activity by month and reservoir/tailwater), as well as perceptions on how the demand for their services would change under different operating conditions.

Prior to the survey mailing, an initial telephone contact was attempted with each of the commercial operators to inform them of the upcoming mail survey. A survey was than mailed to all 198 commercial operators operating on the 13 selected reservoirs, and reminder telephone calls were made to those commercial operators who had not yet responded. A total of 107 (or 56%) commercial outfitters returned a completed survey.

2.3 Patrons of Commercial Operators

Contact surveys were administered at a representative sample of commercial operations to collect data on recreational users (by recreational activity) and provide a basis for estimating total recreation use by activity for each reservoir and tailwater area. The information collected was identical to that collected in the survey of public water access site users. Completed surveys were obtained from 618 commercial patrons.

2.4 Shoreline Property Owners

A survey was mailed to a census of property owners (identified by dock permits) on the sampled reservoirs to collect data on recreation use (by activity and reservoir/tailwater), user characteristics, and potential changes in use under different operating alternatives. This survey was designed to complement the contact survey by providing comparable data on recreationists who generally access reservoir waters from their homes instead of using public access sites. Completed surveys were received from 2,220 shoreline property owners (or 73% of those mailed a survey).

3.0 Methodological Challenges

The methodological challenges associated with the primary data collection discussed above fell into four main categories: (1) stratification of a system of 35 reservoirs and 29 tailwaters; (2) sample design; (3) survey design; and (4) data collection for the public access site users.

3.1 Stratification of a System of 35 Reservoirs and 29 Tailwaters

Because it was not cost-effective or logistically feasible to collect data at all TVA reservoirs/tailwaters during the study period, the research team needed to identify a sample of reservoirs/tailwaters that would be

representative of the reservoirs/tailwaters impacted by system operations. The development of sampling strata proved challenging in that it needed to recognize the unique traits of each reservoir and associated tailwater in the TVA system, while being general enough to allow for stratification.

Prior to selecting a sample of representative reservoirs, the study team met with TVA staff to classify all reservoirs/tailwaters by type of dam (mainstem, tributary, and run-of-river), type of area (urban, rural, remote), and estimated level of recreational use (high, medium, and low). This type of stratification ensured that each type of dam, area, and level of recreational use were represented within the 13 (of 35) reservoirs and 6 (of 29) tailwaters selected.

To expand the recreational use estimates to the remaining 22 reservoirs and 23 tailwaters where recreational use data were not collected, the following procedures were used:

1. Sampled and unsampled reservoirs were matched on the basis of reservoir type (urban, rural, and remote) and estimated usage level (high, medium, low).
2. Sampled and unsampled tailwaters were matched on the basis of total usage level (high, medium, low).
3. An average total recreation user day (combined estimates of user days from public access site, commercial operations and shoreline property owners) per shoreline mile was calculated for each of the 13 sampled reservoirs. An estimate of the recreation user days per shoreline mile factor was obtained for each of the sampling strata for reservoirs noted above. The total recreation user days per shoreline mile factor was then applied to the total shoreline miles for each of the 22 unsampled reservoirs, based on its classification in the sampling strata to estimate total recreation user days for each of the unsampled reservoirs.
4. Average total recreational user days for each sampling strata for tailwaters noted above was estimated using data collected from the 6 sampled tailwaters. These averages were then used to estimate usage for the unsampled tailwaters in each stratum.
5. Average total recreation user days per shoreline mile were applied to unsampled reservoirs and tailwaters.

This method of extrapolating use allowed the study team a means of matching up reservoirs/tailwaters and accounting for the sometimes significant differences in the size of reservoirs.

3.2 Sample Design

Different sampling methods were required for each population of recreational users and commercial operators. Because of this and the different data collection methods used for each group, use estimates were developed for each population separately, and then summed to estimate total recreational use of TVA reservoirs and tailwaters. Resulting estimates of use were extrapolated to unsampled seasons and reservoirs to provide and estimate of total recreational use for the Tennessee River System.

Because of the many different sources of data, in addition to the different sample designs, survey methodology, and the number of completed questionnaires for each of the survey data sources, there is no statistical procedure available to calculate confidence intervals for the total recreation use estimates for the individual reservoirs or for the TVA system.

3.2.1 Public Water Access Site Users

An inventory of the public access sites available at each sampled reservoir/tailwater was required in order to create the sampling plan for the contact survey. Regional TVA staff that was knowledgeable about the recreation sites at projects within their region was canvassed to compile a comprehensive census of public recreation sites on the sampled reservoirs/tailwaters. TVA staff also assisted in assigning a preliminary estimate of use for each site (high, medium, low, unknown) prior to developing the sample plan for the roving access site survey method, which aided the team in selecting appropriate individual recreation sites for the contact survey as well as in estimating the level of interviewer effort that would be required at each location.

For 11 of the 13 reservoirs, the study team grouped sampled public access sites into one to four data collection routes. A data collection route consisted of three to six relatively contiguous access sites, so that all access sites on the route could be covered on each data collection day. Because of the large number of access sites on two reservoirs, a proportion of access sites were sampled to represent low, medium, and high use sites and the results were extrapolated to the unsampled sites.

An interviewing team (1 or 2 persons) was assigned to a specified data collection route on each data collection day. The interviewing team was responsible for conducting the data collection at each site on that data collection route, with specific starting and stopping times for each of the access sites on the route. The starting point for a data collection route was randomly selected for all access sites on that route for each day. The route direction was also randomly selected for each day.

Specific data collection days were randomly sampled to represent summer and fall. Data collection days were also selected to represent weekdays, weekends, and holiday weekends. A total of 15 data collection days were selected for Pickwick, Chatuge, Chickmauga, Melton Hill, Kentucky, Guntersville, Norris and Tellico reservoirs. A total of 10 data collection days were selected for Blue Ridge, Cherokee, Douglas, Hiwassee, and South Holston because these reservoirs were assumed to have lower recreational use levels. Estimates of use for the spring and winter seasons were obtained from self-reported survey data.

3.2.2 Commercial Operators

The study team worked with knowledgeable TVA staff to identify commercial operations that provided recreation access to reservoirs. The study team and TVA staff identified a list of 198 active commercial operators for the 13 selected reservoirs and tailwaters, and assigned a preliminary estimate of use to each operator (high, medium, low). An initial telephone contact was attempted with each of these operators to inform them of the upcoming mail survey. The study team also used this contact to obtain permission to conduct on-site interviews with commercial patrons at some of the sites.

3.2.4 Shoreline Property Owners

TVA maintains a database of permits issued to property owners for shoreline modifications, including new structures, alterations to structures, and property transfers issued for land- and water-based development on TVA-owned residential access shoreland and flowage easement shoreland. Referred to as 26a permits, the permits are issued by TVA's regional offices, and individual records were retained within each regional. Generally, the database contained records of permits issued within the past 5 years, contained some apparent commercial listings, contained numerous duplications of addresses due to multiple permits being issued to individual residences (for some reservoirs), and excluded residents living in multi-family buildings where the permit is not in their individual name. TVA staff familiar with the study area and the permit database advised that "most" residential shoreline properties have some sort of structure or development for which a 26a permit is necessary, and that new or transfer permits are applied for regularly and that most residences would have likely applied for a permit within the last 5 years (since 1997).

Alternatives to the 26a database were considered but rejected—these included purchasing a sample from a survey research sample vendor, assembling a sample from property assessor's offices, and hand sampling from individual regional offices' hard copy files of 26a permits. Each of these alternatives had issues related to coverage, time intensity, and/or cost.

Despite its limitations, the study team judged the 26a database to be the best available database of shoreline property owners' addresses needed to provide broad coverage for purposes of implementing the survey in support of obtaining information for the system-wide programmatic EIS. Two important assumptions were made about this database: (1) Shoreline residential permit holders are the same as other shoreline residents with no permits; and (2) Shoreline residential permit holders in the usable database are the same as shoreline residential permit holders who are not included in the database.

All unique records with a valid residential mailing address were included in the sample frame. All records for the

sampled reservoirs/tailwaters (3,393) were included in the sample of shoreline property owners.

3.3 Survey Design

Survey design was challenging because surveys needed to vary not only by user group, but also by reservoir since the individual drawdown schedules of the sampled reservoirs varied.

3.3.1 User Group

The contact survey of public access site users and commercial patrons collected information on:

- Recreational activities
- Length of current trip
- Trip expenditures
- Total number of trips per month to the sampled reservoir/tailwater
- How visitation was likely to change if water levels changed

The commercial operator survey collected information on:

- Number of watercraft launched by month and average party size
- Number of campsites available, occupancy rate, average party size
- Number of watercraft rentals by month, average party size
- Number of people using fishing and guide services by month
- Number of people using whitewater rafting guided trips by month

The design of the property owner mail survey was challenging as it needed to recognize year round residents, summer residents and weekend residents. The shoreline property owner survey collected information on:

- Household size
- Number of days each month use each sampled reservoir
- Types of recreational use
- How visitation was likely to change if water levels changed
- Suggestions for improvements

3.3.2 Individual Drawdown Schedule of Sampled Reservoirs

For the different user groups, the surveys needed to also vary by reservoir to account for different proposed drawdown schedules. For each of the four users groups, there were three different scenarios for changes in operating schedule. This resulted in a total of 12 survey versions.

The survey asked how their recreational use at the sampled reservoir would change if the drawdown levels changed. It also asked how their recreation use of other reservoirs would change if the drawdown level at the sampled reservoir changed (speaks to site substitution).

3.4 Data Collection for the Public Access Site Users and Commercial Patrons

The study team needed to identify, hire and deploy over 50 people to conduct the contact surveys with public access site users and commercial patrons over a 7-month period. Interviewers were obtained from a variety of sources, and included college students, TVA volunteers and temporary workers. These interviewers were deployed across five different states and two different time zones on the sampled data collection days.

The challenges in identifying and retaining this group of people were many, including:

- Lack of interest among the interviewers in being assigned to certain locations
- Number of required working hours per day was too long for some
- Seven-month length of the data collection period was too long for some (e.g., college students)
- Lack of flexibility in schedule of sampled days
- Physical demands of data collection were to much for some (e.g., senior citizens)
- Inability of some to understand the high level of quality control required for the data collection

4.0 Implications for Future Research

This challenging project offered some lessons for future studies of this type, including the following:

- It is imperative to have a dedicated staff person from the client who is knowledgeable about the different reservoirs/tailwaters as well as the

other staff who can be called upon to assist with compiling the census of public and commercial sites. Compiling these censuses without these knowledgeable staff would have entailed several person-months.

- Existing databases may or may not be complete or have sufficient information. Once again, it is critical to have staff that is knowledgeable about how the database was compiled in order to be able to evaluate its strengths and weaknesses as a sample source or a source of information.

- The amount of time and resources needed to assemble a team of interviewers who can work across a large geographic area for a long period of time should not be underestimated. A significant amount of resources are needed to recruit, train and oversee the work of interviewers. Universities and temporary agencies proved to be a good source for interviewers. Given the irregularity of the data collection over a long period of time, and the need to work on holidays and weekends, interviewers should be well-compensated for their work and supervisors should be assigned to implement quality control checks throughout the data collection period.

- Given the number of variations to the survey instruments across the various user groups, survey versions need to be clearly marked on the instruments.

- Surveying public water access site users at a large number of sites is a very time-intensive (thus, expensive) task. If additional funds had been available, additional days would have been sampled during the summer and fall. This number of sample days actually used resulted in large confidence intervals. If resources allow, additional days should be sampled for the access site surveys to reduce the size of the confidence levels, especially if data are needed by type of day (weekend, weekday, and holiday) as well as time of year.

5.0 Citations

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