

BIMS – THE BEAR REPORTING NETWORK FOR THE NATIONAL PARK SERVICE¹

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Abstract: The U.S. National Park Service employs a nationwide computer network to make reports of bear-related events available to managers in parks, regional, and national offices simultaneously. This is the Bear Information Management System, BIMS. It is operated by managers and technicians through use of interactive programs. A flexible structure enables each park to store data in up to 91 information categories, using a reporting form tailored for field use. Through database management programs, managers retrieve specific records or analyze large volumes of data to carry out effective day-to-day management and to plan for future needs. System support at the national level and commitment by the user parks to complete, accurate data reporting are essential for reliable operation.

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The value of information on bears has increased as the use of bear habitat in the United States for resource exploitation and recreation has increased (Martinka 1972). Designation of the grizzly bear (*Ursus arctos*) as a threatened species in the 48 contiguous states (Endangered Species Act, 1973) focused public attention on effective protection of bear populations. Managers who examined historic records to evaluate bear management programs often found scant reliable data. Custodians of bear data have begun to use systems analysis and database management techniques to make bear records complete and accessible to many users. The United States National Park Service now handles grizzly bear and black bear (*Ursus americanus*) reports from 7 parks on a nationwide computer network. This network employs FORTRAN programs and a commercially marketed database management system. This is the Bear Information Management System of the National Park Service, BIMS.

BIMS was developed in Yosemite and Glacier National Parks during 1978 and 1979. Funding was provided by the Natural Resources Management Division and the Data Systems Division of the U.S. National Park Service. The Natural Resources Management Division currently provides

program maintenance, training for users, and further development.

HISTORY

National parks began monitoring bear-related "incidents" (injuries and property damages) and control actions in the 1930's. During the 1960's, managers and research scientists began to record bear sightings in addition to incidents and control actions (Martinka 1972). In the early 1970's, some parks began to record bear data on forms that would allow computer analysis (Harms 1980). The Border Grizzly Project (BGP) of Missoula, Montana, and Glacier National Park (GNP) developed several FORTRAN programs for analyzing bear data in 1976 (Joslin and Kapler 1980). The programs allowed users to select and list records at a terminal. The interagency application of this system required extensive commitments of personnel and money. When these resources were not available, the National Park Service developed a smaller computerized bear information system for use in Glacier National Park in 1977.

The 1977 GNP system contained only 16 information categories, known as "fields." The first 15 were for specific data, such as date, time, coordinates of location, and bear species; the 16th was for supplemental narrative. During the summer of 1977, more than 600 bear-related events were recorded on the GNP system. Every day during the summer, a list of recent sightings and incidents was printed by the computer and sent to visitor information centers and management offices. At the end of the season, summary tables and complete lists of the data were printed.

¹ Financial support for this project was provided by the National Park Service. Documentation can be requested from the United States Department of the Interior, National Park Service, Biological Resources Division, Washington, D.C. 20240.

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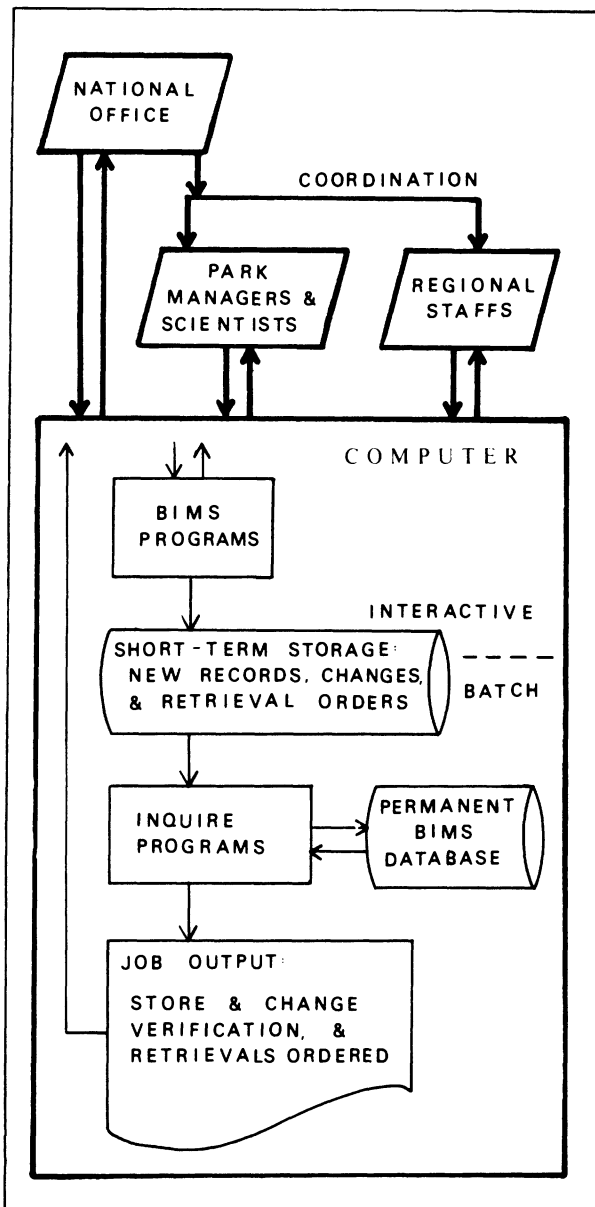


Fig. 1. Operating structure for BIMS. The national office provides database protection and assistance with user needs. Park and regional personnel operate computer programs using terminals in their offices. BIMS programs translate user instructions into INQUIRE commands and place them in short-term storage. Then a batch job carries out these commands—storing or revising permanent data and preparing lists or summaries of data. Job output, retrieved by the user, contains verification of all additions and changes to the database and lists the results from database searches.

In October 1977, representatives from the Washington office of the National Park Service, 3 regional offices, and 6 parks with bear management programs met to discuss the use of computers for bear information processing. Managers

at the regional and national levels needed immediate access to complete records from the parks to provide accurate, timely information to the public. Managers in the parks found their bear records too numerous and complex for manual analysis. Participants at this meeting agreed that a Park Service-wide computerized bear information system would serve park, regional, and Washington data needs. This system was to be similar in scope and flexibility to the BGP-GNP system of 1976, but coordinated and supported by the National Park Service's Washington office. This was the initial planning meeting for BIMS.

OBJECTIVES

BIMS enables parks to establish a database of bear reports and maintain their information on a daily basis. Data summaries available from the system are used by park managers to more effectively protect bears and park visitors. Similar reports enable regional and national offices to use the same data for answering public information needs. Specific objectives of the system are:

1. To provide a concise, complete record of bear information for use in management and research programs at park, regional, and national levels.
2. To allow for bear records to be linked with other computer-accessible park data.
3. To use data storage and retrieval programs that can be operated by technicians with minimal training in computer use.
4. To allow for modifications and additions to the system without extensive revision of existing programs.
5. To allow for storing large numbers of historic records.
6. To provide documentation for users and system maintenance.

SYSTEM OPERATING ENVIRONMENT

BIMS operates on a computer with nationwide access, Boeing Computer Services (BCS) in McLean, Virginia (Fig. 1). The National Park Service uses BCS to process other resource-related data such as records of backcountry use and pesticide use. These data can be linked with BIMS. User assistance and system maintenance

are provided by a central office in Washington, D.C.

To store and retrieve bear data, BIMS uses a database management system called INQUIRE. INQUIRE is a series of data management and retrieval programs marketed by InfoData, Inc., Falls Church, Virginia. Statistical analysis, not available through INQUIRE commands, can be carried out by using statistical analysis packages.

Because most BIMS operators have had little or no experience in computer use, complete interactive operation, in which the computer queries the user for specific instructions and responds immediately to user commands, would be ideal. Interactive operation allows for user errors to be detected by the program and corrected at once, and permits users to refine their commands using information already retrieved. The alternative to interactive operation is batch processing, in which the user prepares a list of commands for the computer to carry out, submits this list for processing in what is known as a "batch job," and then obtains answers to all commands in a single output list. Efficient batch processing requires more meticulous preparation than interactive work, but is less expensive on most computer systems. BIMS employs a combination of interactive and batch processing in order to use both operator and computer time as efficiently as possible.

An interactive program checks the data typed in by the user. Errors are pointed out immediately for correction; acceptable data are placed in short-term storage (Fig. 1). Through the same program, the user "orders" data retrievals—lists, tables, or graphs. The program points out ambiguities in commands and asks for corrections. Thus the user guides the computer to prepare INQUIRE retrieval commands and place them in short-term storage with new data. Finally, the user submits all data and retrieval requests in short-term storage for batch processing. This is the step in which new records are permanently stored, old records revised according to user commands, and the database searched to answer user requests. A batch job is completed either immediately or overnight, depending on user-specified priority, which governs cost. Job output includes verification of all data storage and corrections; lists, tables, or graphs ordered by the user; and a summary of job costs.

Table 1. Organization of BIMS information.^a

Logical category	Field group	Storage format ^b	General contents
Time & place	REPORTID	F, N	Date, time, coordinates
	LOCATION	V	Place name & description
Bear(s)	DESCRIPT	F, R	Age, weight, sex Tags, tattoo numbers Narrative description
	IDENTIFS	F, R	
	MARKINGS	V	
Event	HAPPENED	F, N	Details of event
	HANDLING	F, R	
	INCIDENT	F, R	
	FOLLOWUP	F, N	
	COMMENTS	V	

^a Complete list of field groups and member fields is in system documentation for BIMS (J.E. Kapler, unpubl. rep., Natl. Park Serv., Data Syst. and Nat. Resour. Manage. Div., Washington, D.C., 1979b).

^b Storage format abbreviations used in the table are: F, fixed-length data fields; N, non-repeatable field group; R, repeatable field group; V, variable-length field.

All BIMS operations are directed by interactive commands, but the majority of actual data processing is carried out in batch jobs. Thus, BIMS mimics interactive operation without paying all the costs of this convenience.

DATA STRUCTURE

BIMS contains 91 data fields, which are grouped into 3 logical subject-matter categories: time and place, bear description, and event details (Table 1). Each logical category is subdivided to accommodate different properties; the time and place category, for instance, contains fields for specific numeric and coded data, and also a field for supplemental narrative. Each bear report contains a single time and place, so the REPORTID field group is designated nonrepeatable. Since a single report can contain descriptions of several bears, the field groups for bear description, DESCRIPT and IDENTIFS, are repeatable.

Several BIMS fields are specific to an event. Injuries and property values, for instance, are recorded only when an incident occurs; handling methods and drug dosages are recorded only when a bear is captured and handled. To accommodate these data fields, BIMS reports are classified as: (1) observations, (2) incidents, or (3) control actions. Retrieval programs refer to the event type to interpret event-specific fields (Table 2).

Table 2. BIMS data fields for specific events. Content of 4 BIMS field groups is interpreted by programs according to the type of event recorded.^a

Field group name	Event type		
	Observation	Incident	Control action
HAPPENED	Observer type	Main cause	Relocation site
	Bear distance	Legal action	Area management
	Bear activity	Incident cost	Action cost
HANDLING		Object damaged	Handling method
		Property value	Dosage
		Food presence	Time
INCIDENT		Person injured	Justification
FOLLOWUP		Court action	Return distance

^a For complete documentation, see Kapler (1979b).

BIMS uses two types of records to cross-reference related events: dossier and relocation-site. The dossier contains all tag numbers, names, and other unique identifiers associated with a bear; it is used to retrieve all reports in which a specific bear was identified. Relocation-site records describe park locations used for releasing translocated bears. The computer uses a relocation-site record to describe a given site and to locate all reports of the site's use.

Nineteen of the 91 data fields available to BIMS users are required by the national office from all participating parks: park, year, month, and day; record type, case-incident report number, area type, and bear species; nature of incident, type of person affected or injured, related law enforcement action, estimated value of property damaged, and presence of food; nature of management action, related area management, and method used for handling a bear; resolution of law enforcement action, fine collected, and amount lost in tort claim. A participating park may add any of the 72 optional fields to the 19 required ones in designing its database.

Each user park designs its own reporting form with assistance from the system support staff in Washington. All coded items are listed on the form, so that code books are not needed. A file called the user profile links the park's unique form with the Service-wide database (Fig. 2). The profile enables the BIMS input program to validate numeric fields, assign default values, and translate input to the database format. The profile can be revised if park managers revise their form.

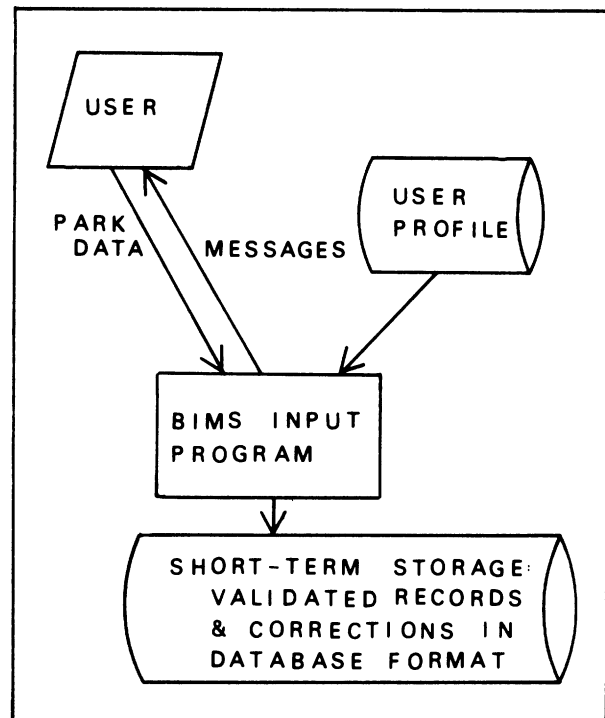


Fig. 2. User profile. When a park user enters data, the BIMS input program refers to that user's profile to check data validity, reformats it to conform to the format of the Servicewide database, and adds default values. The resulting records are placed in short-term storage until processed in a batch job and added to the permanent database (Fig. 1).

BIMS COMMANDS

BIMS users direct every system operation by typing a command to a terminal, transmitting it by telephone to the computer, and receiving an immediate response. When the computer receives a BIMS command, it identifies the user and allocates capabilities at a user level—park, general, or system support. Authorization to alter and add to park data is given only to users at the park level. A park user has 5 commands that can alter the database: STORE, CHANGE, ERASE, DATAQUAL, and ARCHIVE.

BIMS retrieval commands are available to users at all levels—park, regional, and system support. Any user can read data from any BIMS park, but participants in the system agree to acknowledge use of another park's data. Retrieval capabilities include 12 commands for routine retrievals and 2 that can be adapted to answer specific data needs. More than 40 data lists, tables, and graphs are available. Commands for obtaining these and sample output are available in the

BIMS user manual (J.E. Kapler, unpubl. rep., Natl. Park Serv., Data Syst. and Nat. Resour. Manage. Div., Washington, D.C., 1979a). Special data searches have been made to answer specific management questions, such as the impact of a proposed trail on grizzly bears, bear activity patterns in the vicinity of a problem campground, and evaluation of a specific bear family group (McArthur 1979a). Research scientists in the parks have used BIMS data to analyze trends in bear behavior and incidents (McArthur 1979b, 1983, Keay and VanWagtendonk 1983).

The BIMS support staff in Washington, D.C., is in charge of system maintenance and user training. This office controls passwords that protect BIMS files against alteration by unauthorized users, provides for restoring the system in case of operating problems, and provides documentation and training.

CONCLUSION

BIMS was implemented in 6 national parks in May 1978: Glacier, Great Smoky Mountains, Sequoia and Kings Canyon, Shenandoah, Yellowstone, and Yosemite. The system was revised and documented during the following winter and was implemented in a 7th park, Denali, in June 1979. The system now contains more than 5000 records, from as early as 1967. Some reports from Waterton Lakes National Park, Canada, are stored on the system.

BIMS is in transition from the development phase into routine operation as a National Park Service management tool. Further development may occur in response to changing bear management problems and information needs. A database structure with tested, operable programs provides only the beginning of effective information use. To maintain BIMS as an effective part of bear management programs, the user parks must provide timely, accurate data and the system support staff must respond readily to changing park needs.

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