Computer Use in Freshwater Fisheries Management

Richard D. Clark, Donald L. Garling, and Robert T. Lackey*

*Department of Fisheries and Wildlife
Oregon State University
Corvallis, Oregon 97331

Robert.Lackey@oregonstate.edu
(541) 737-0569

COMPUTER USE IN FRESHWATER FISHERIES MANAGEMENT

Richard D. Clark, Jr., Donald L. Garling, Jr., and Robert T. Lackey

ABSTRACT

A brief questionnaire was sent to chiefs of the 50 freshwater fisheries management agencies in the United States to determine how they currently use computers and how they plan to use or perceive the need to use computers in the near future. Currently, the leading use of computers is in automated mail or creel surveys, followed by biostatistical calculations and data storage and retrieval. Eight fisheries agencies reported using computerized resource allocation or ecosystem models, while three agencies reported not using computers for any reason. Two agencies predicted their computer needs over the next 5 years would remain about the same as the present, 40 agencies predicted their needs would probably increase, and five states planned great expansions of their use of computers.

Donald L. Garling, Jr.   **Robert T. Lackey**

Few technological developments have affected twentieth century society as much as the ready availability of high-speed digital, analog, and hybrid computers. Computer usage has permeated nearly all phases of modern technologically oriented society, and although it is difficult to distinguish cause from effect, computers have been either heralded as servants of man or damned as heartless masters. Whatever conclusion one draws, the inescapable fact is that computers are integral to contemporary society.

The Computer Age, as some are inclined to describe the present period in North America, has resulted in harnessing a tremendous and relatively inexpensive analytical capability for man's use. This situation appears inherently desirable, but it has not been without cost, both real and imagined. There are reasons why universities offer courses such as Computers and Society, Man and the Computer, Computers and the Modern World, and Socio-Technological Problems. Part or all of the potential benefit from technological advance is lost if potential users are unable or unwilling to use the tool.

Freshwater fisheries managers, either directly or indirectly, have been influenced by the availability of high speed computers. In September 1976, we mailed a brief survey questionnaire from Virginia Polytechnic Institute and State University to chiefs of the 50 freshwater fisheries management agencies in the United States. The questionnaire was designed to determine how and if these agencies currently use computers and how they plan to use or perceive the need to use computers in the near future.

Freshwater fisheries management agencies in 47 states responded to our questionnaire. The first survey question asked chiefs to indicate how their agency currently uses computers. A list of general computer uses and a category ("other") for specifying a use not listed were provided. Most of the more specific uses listed as "other" were judged to fit into the general categories listed and are reported as such in the results.

Currently the leading use of computers by freshwater fisheries management agencies is in automated mail or creel surveys. Computers are also used for bio-statistical calculations and automated data storage and retrieval by more than half the agencies. Resource allocation and ecosystem modeling are presently being used by eight fisheries agencies. Three agencies reported that they do not use computers for any reason (Table 1).

The second and third survey questions were designed to provide information about *availability* of computers to the agencies and their personnel. In answer to the second question, "Do fisheries biologists in your agency have direct access to a computer facility?" 17 fisheries agencies indicated "yes," 27 indicated "no," and 3 gave no response.

The third question asked what percent of the agency's com-

THE AUTHORS: **Richard D. Clark, Jr.,** is a Fisheries Research Biologist with the Michigan Department of Natural Resources in Ann Arbor, Michigan. **Donald Garling** is an Assistant Professor of Fisheries Sciene at VPI & SU, Blacksburg, Virginia. He received a B.S. from the University of Dayton, an M.S. from Eastern Kentucky University, and a Ph.D. from Mississippi State University. His major research interests are the effects of environmental parameters on the biochemical and physiological functions of aquatic organisms as they relate to fisheries management strategies. **Robert T. Lackey,** Professor at VPI & SU, Blacksburg, Virginia, is a former Canadian. He holds a B.S. in fisheries and wildlife from Humboldt State University, an M.S. in Zoology from the University of Maine, and a Doctorate in fisheries and wildlife science from Colorado State University. (Picture of Clark unavailable at press time.)

Table 1. Current computer usage by state freshwater fisheries management agencies.

Type of computer use	Number of agencies giving positive response
Mail or creel surveys	31
Bio-statistical calculations	29
Biological/management data storage and retrieval	28
Resource allocation or ecosystem models	8
Do *not* use computers for any reason	3

puter work is contracted to universities, private industry, or other state agencies. Ten fisheries agencies reported they did all of their own computer work, 12 reported contracting 1% to 25% of their work, 1 reported contracting 26% to 50% of its work, 1 reported contracting 51% to 75% of its work, and 19 reported contracting 76% to 100% of their work.

The last two survey questions addressed *future* computer applications and needs of the agencies. Five choices were provided as answers to the fourth question: "How do you think the computer needs of your agency will change in the next five years?" Table 2 summarizes responses to this question. None of the agencies indicated its computer needs would decrease; in fact, a large majority projected increased needs and use (Table 2). Three groups resulted: Group 1 predicted their computer needs over the next 5 years will remain about the same at the present (2 states); Group 2 predicted their computer needs will probably increase in the next 5 years (40 states); and Group 3 plan great expansions of their use of computers in the next 5 years (5 states).

Table 2. Anticipated changes in computer needs of state freshwater fisheries management agencies in the next 5 years.

Answer	Number of agencies
We will try to use computers as *little* as possible	0
Our computer needs will probably *decrease*	0
Our computer needs will remain about the *same* as the present	2
Our computer needs will probably *increase*	40
We plan a *great expansion* of our current use of computers	5

The fifth question asked the respondents to list some of the more important reasons for their answer concerning future computer needs. The answers to question #5 were organized by splitting the states into the three groups based on answers to question #4 (Table 2). Group 1 did not answer the question. Groups 2 and 3 gave a wide variety of reasons for predicting expanded computer needs and usage. These answers were placed in five categories: (1) data storage, retrieval, and analysis; (2) survey, inventory, and classification systems; (3) modeling and planning systems; (4) financial or personnel limitations; and (5) miscellaneous answers. Tables 3 and 4 summarize the answers from Groups 2 and 3, respectively. The only obvious difference in the answers between these two

Table 3. Reasons given by freshwater fisheries agencies for predicting their computer needs would increase in the next 5 years.

Reason	Number of agencies
Category I	
Data Storage, Retrieval, and Analysis	
We need rapid data storage and retrieval capabilities.	21
We need the capability for more thorough data analysis using meaningful statistical techniques, so that more data can be assimilated for management purposes.	8
We wish to free our personnel from tedious manual calculations.	3
Category II	
Survey, Inventory, and Classification Systems	
We plan to increase creel and/or mail surveys.	12
We plan a quantitative aquatic habitat inventory and/or classification.	4
Category III	
Modeling and Planning Systems	
Our computer needs will increase because of increased emphasis on work effectiveness with a shrinking budget.	1
We plan to expand (or begin) our use of computer implemented modeling and/or planning systems.	6
We plan to use computer techniques to improve the management of our fish culture and stocking program.	2
Category IV	
Financial or Personnel Limitations	
Computer programmers and fisheries managers do not communicate well, but hopefully, they will in the future.	1
There is potential for increased computer use, but full realization of this use will be inhibited by:	
(1) Availability of consulting services	1
(2) Personnel limitations	2
(3) The high cost of using computers	2
Category V	
Miscellaneous	
Our increase in computer use is a result of newly acquired knowledge of computer potential by our staff.	3
We have recently added or plan to add new personnel with computer expertise.	2
Our computer use will increase when and/or if certain proposed studies or purchases of facilities are approved.	5
We will probably increase our use of computers because computer systems are becoming more popular.	1
General expansion of our agency's programs requires expansion of computer use.	1

groups was in the financial or personnel limitations category. States planning great expansions of computer use (Group 3) did not list any answers of this nature. Apparently, they have overcome such limitations or they would not plan to expand.

Freshwater fisheries management agencies that are currently making substantial use of computers are listed in Table 5. The list consists of (1) agencies presently using computers for the four major uses in Table 1; and (2) agencies presently using computers for three of the four uses in Table 1 and also indicating they plan to increase their computer use to include the remaining area of application. We encourage agencies that are making substantial use of computers to take the responsibility for documenting their successes and failures in computer applications. Hopefully, they can provide some much needed benefit/cost information for computer applications in fisheries management. Such documentation would accelerate progress in assigning computers their proper and effective role in fisheries management.

Table 4. Reasons given by freshwater fisheries agencies for planning great expansions of their use of computers over the next 5 years.

Reason	Number of agencies
Category I	
Data Storage, Retrieval, and Analysis	
We need to expand data storage and retrieval capabilities.	3
We need the capability for more thorough data analysis using more meaningful statistical techniques, so that more data can be assimilated for management purposes.	2
Category II	
Survey, Inventory, and Classification Systems	
We plan to increase creel and/or mail surveys.	2
Category III	
Modeling and Planning Systems	
We plan to expand (or begin) our use of computer implemented modeling and/or planning systems.	2
We plan to use computer techniques to improve the efficiency and effectiveness of our fish culture and stocking program.	1
We plan to undertake a systems management approach to fisheries resource management.	1
Category IV	
Agency or Professional Limitations	
(No answers in this category were listed by these states.)	
Category V	
Miscellaneous	
We have just acquired a computer.	1
We plan to expand our facilities to make them more accessible to field personnel.	1

Table 5. States with freshwater fisheries management agencies currently making substantial use of computers (X indicates current use; 0 indicates planned use).

State	Data storage and retrieval	Bio-statistical calcu-lations	Mail or creel surveys	Model-ing
Alaska	X	X	X	X
California	X	X	X	X
Oregon	X	X	X	X
Texas	X	X	X	X
Washington	X	X	X	X
Colorado	X	X	X	0
Maine	X	X	X	0
Missouri	X	X	X	0
Montana	X	X	X	0
New York	X	X	X	0
Oklahoma	X	X	0	X

Current or planned use of computers

Our survey shows computers are playing an important role in freshwater fisheries management and computer use will continue to increase in the near future. Current applications of computers by freshwater fisheries agencies can best be described as those of a calculating and bookkeeping device. Activities that involve assimilation of data for management planning and decision-making appear to be major applications of the near future.