An In-House Method of Teaching SAS ® to Fisheries Biologists

Teresa Wilson, Clemson University, SC
Jeffrey Foltz, Clemson University, SC

ABSTRACT

Four SAS programming workshops were developed in-house to meet the needs of the freshwater fisheries biologists in the South Carolina Department of Natural Resources. The instructor (primary author) designed the courses and created workbooks with examples and exercises relevant to fisheries research and management. Overall response from the participants indicated that the hands-on approach to learn SAS programming was beneficial.

INTRODUCTION

In the late 1980s, the Freshwater Fisheries Section (FWF) of the South Carolina Wildlife and Marine Resources Department initiated a statistics and computer cooperative (COOP) with the Department of Aquaculture, Fisheries and Wildlife (AFW) at Clemson University. The Department of Experimental Statistics at Clemson University was a partner in the COOP and provides statistical expertise. The expressed goals were:

1) access to statistical consultation
2) assistance in programming and computer management
3) source of PC expertise
4) work toward long-term goal of using the SAS system in ongoing fisheries/environmental responsibilities
5) point of contact in university community.

The FWF biologists wanted to meet their data analysis needs without depending on an outside source to run analyses. With the affordability of personal computers (PCs) this was a viable possibility. Because of the flexibility and power of the SAS system, recently hired biologists' graduate training with the SAS system, and the expertise of university staff with mainframe SAS system, the COOP selected the PC version of the SAS system as the data analysis package.

Since the biologists wanted to obtain a working knowledge of SAS programming, we decided two to three day workshops would be the most effective means of training. We decided to design the workshops in-house because of the uncertainty in an outside source in fully understanding the special needs of the biologists. Workshops were then developed based on the needs and desires of the biologists. The initial workshops used version 6.04 of SAS. A fourth workshop was developed using SAS 6.08 for Windows.

The objective of this paper is to review the in-house designing and teaching of SAS programming workshops to fisheries biologists.

MATERIALS AND METHODS

The primary author, an AFW staff fisheries biologists who also serves as the SAS Consultant for the COOP site license, was responsible for designing and teaching the workshops. At the time of the first workshop the instructor had 4+ years programming experience with the SAS system on the mainframe and one year on the PC.

For all workshops, the class was limited to one participant per PC (15 biologists) to allow constant hands-on experience. For the first workshop, programming capabilities of the participants ranged from none to intermediate. However, the SAS programming skills of most of the participants were very limited. All knew how to negotiate and use SAS commands and execute programs written by others.

The instructor designed workbooks for each workshop with examples relevant to the fisheries field. Exercises were included throughout the workbook. Programs and data were developed using fisheries problems similar to those encountered in their jobs.

A course schedule was distributed at the beginning of each workshop. An overhead projector and chalkboard were also used. Solutions to the exercises were shown on overhead transparencies after the participants had had sufficient time to complete the exercises. Participants were encouraged to ask questions at anytime during the workshop.

The first workshop was titled the *Basics of SAS*. Figure 1 shows the Table of Contents of this workshop. Because this was an entry level class, most of the advance features were not discussed. Total time for instruction and questions for each subsection ranged from 30-45 minutes. The participants were then allowed time for writing SAS code for the subsection. The code was then entered into the Program Editor and submitted by each participant. Data files (ASCII or dBASE III Plus) were previously created by the instructor. The time for writing, typing and debugging the programs ranged from 30-60 minutes, depending on the difficulty of the subject matter and skills of the participants. Although the instructor was available for assistance, the participants were encouraged to determine cause of programming errors and possible solutions.

The second workshop titled *SAS Statistics Useful to Fisheries Biologists* was (Figure 2) given at the request of the FWF biologists a year later. This workshop used the same format as the previous workshop. A workbook with exercises was developed using situations that the biologists could encounter int their daily work. This workshop focused on writing SAS code for these procedures, and how to read and interpret the output. The instructor stressed that a statistician should be consulted for experimental design before using the procedures to assure that all assumptions are met. Because of the complexity of these statistical procedures, more time was allotted for instruction, discussion, and hands-on programming. At the end of each day, a faculty member from the Experimental Statistics Department came in for a one-hour question and answer period.

The third programming workshop, *More Basics of SAS*, was given a year later. This workshop discussed (1) advanced features in several of the procedures from previous workshops, (2) character, special and numeric functions, (3) more effective ways of using some data statements, and (4) DO statements. Two additional procedures, PROC FORMAT and PROC TABULATE, were covered. Participants were then allowed time for writing SAS code after discussion of each subsection. The code was then entered into the Program Editor and submitted by each participant. Data files (dBASE III Plus) were previously created by the instructor. The time for writing, typing and debugging the programs ranged from 30-60 minutes.

The fourth workshop, *SAS for Windows*, introduced the SAS windows menu, how to negotiate in SAS for Windows and new options available that would be of benefit to the biologists. This workbook combined the previous three workbooks into one workbook and was updated to include information specifically for SAS for Windows. Time was provided for participants to ask general or specific questions relating to the SAS system.

After each workshop, participants were asked to complete a course evaluation.

RESULTS AND CONCLUSIONS

Overall response from the participants indicated the hands-on approach to learn SAS programming was beneficial. Most participants thought the pace of each workshop was appropriate.

Since the instructor has designed the workshop for a very focused user group, there was great interest in whether the workbooks were useful and clear. Almost all participants stated that the workbooks would definitely be used as a reference in their labs/offices. Most indicated the workbook exercises were clear.

At the second and third workshops, the instructor saw evidence that the participants programming skills had increased since the first workshop. The instructor stressed to the participants to spend as much time as possible programming and exploring the SAS system.

ACKNOWLEDGEMENTS

Teresa Wilson, Clemson University, Dept AFW, G08 Lehotsky Hall, Clemson, SC 29634-0362
864.656.3063   twlsn@clemson.edu

Figure 1.

Basics of SAS

Introduction

Data- where does it come from & how does one
        access it?
        SAS data sets
        dBASE files
        ASCII files
        DIF files

Data-how to manipulate it
        SAS Operators
        Creating new variables
        Informats and formats
        Missing values
        SAS statements
        Proc Sort
        Proc Print

Data-how to use statistical procedures
        Proc Freq
        Proc Means
        Proc Univariate

Figure 2.

Fisheries Statistics

Proc REG

Proc ANOVA

Proc GLM

Figure 3.

More Basics of SAS

Data Manipulation and Functions

Additional Data Statements
        Do/Array
        Retain
        Attrib

Simple Macros

Procedures
        Proc Format
        Proc Tabulate

Creating ASCII files from SAS data sets