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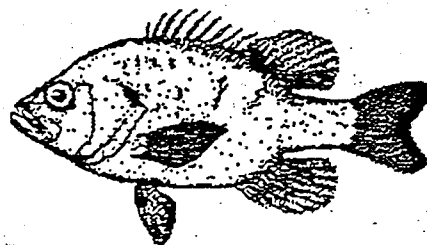
**MANUAL FOR FISH POPULATION SURVEYS  
(DOC PACKAGE) FOR THE DISTRICT  
FISHERIES ANALYSIS SYSTEM (FAS)**

**Center for Aquatic Ecology**

**Peter B. Bayley, Douglas J. Austen, and Stephen T. Sobaski**

October 1990

**Aquatic Ecology Technical Report 90/9**







Illinois Natural History Survey  
Aquatic Biology Section Special Technical Report 90/9

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FOR THE DISTRICT FISHERIES ANALYSIS SYSTEM (FAS)**

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October 1990

## SUMMARY OF PROJECT

Data Base Management and Analysis of Fisheries in Illinois (Project F-69-R(1-3)) is a continuation of F-46-R with significant additions. A statewide system of creel surveys was implemented and resulted in 52 annual, daytime creels and 13 nighttime creels being completed on impoundments ranging from 13 to 18,900 acres. A highly stratified random design produced 95% confidence limits of  $\pm 10-30\%$  of mean total harvest and  $\pm 5-15\%$  of total angling effort for most of the daytime creel surveys. Comprehensive software packages were developed for statistical analyses of creel surveys and incorporation of creel data into the State Fisheries Analysis System data base.

The Final report is divided into four Aquatic Ecology Technical Reports 90/9 through 90/12. The 'Manual for Fish Population Surveys (DOC9 package) for the District Fisheries Analysis System (FAS)' (90/9) updates the package of data entry and analysis at the District level, which has so far provided data from 231 state-managed impoundments that occupy 14 Mbytes on the statewide data base. The 'Creel Survey Manual for the District Fisheries Analysis System (FAS)' (90/10) is a major update on the package for statistical analysis and reporting of creels. 'The State Fisheries Analysis System (State FAS)' (90/11) describes the layout and function of the fish population survey and creel data components of the statewide data base, the procedure for uploading creel summary data, and output programs. Finally, 'The Fisheries Analysis System (FAS): Creel Survey and Lake Analyses' (90/12) contains an analysis of precision of creel surveys, a study that predicts numbers of active anglers from car lot counts by season and lake type, an analysis of the diurnal variation of anglers by season to correct for bias in fishing intensity estimates, and an update on the lake documentation program.

This technical report is part of the final report of Project F-69-R (1-3), Data Base Management and Analysis of Fisheries in Impoundments, which was conducted under a memorandum of understanding between the Illinois Department of Conservation and the Board of Trustees of the University of Illinois. The actual work was performed by the Illinois Natural History Survey, a division of the Department of Energy and Natural Resources. The project was supported through Federal Aid in Sport Fish Restoration (Dingell-Johnson) by the U.S. Fish and Wildlife Service, the Illinois Department of Conservation, and the Illinois Natural History Survey. The form, content, and data interpretation are the responsibility of the University of Illinois and the Illinois Natural History Survey, and not that of the Illinois Department of Conservation.

## **PREFACE**

This manual has been written as a guide to the District Fisheries Analysis System (DISTRICT FAS). It is an update of Aquatic Biology Technical Report 87/11 that includes operation of new hardware. Significant changes include the new hardware and associated software that uses 800K 3.5-in. drives and the 1 MByte Ramfactor for increased speed and capacity. There is an option for english units for data entry and a full list of permissible species and group codes. We urge you to read these instructions before and while using the program. Further details and some techniques for increasing efficiency can be found in the General Manager™ manual, but you will not need most of that information to perform the tasks of data entry and analysis.

## **ACKNOWLEDGMENTS**

Bob Illyes, John Gleichman, and Mark Thompson helped develop much of the programming for the DISTRICT FAS. We also express our appreciation to Illinois Department of Conservation district managers who made many constructive comments. Beverley Hubert is thanked for her redactional work.

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## Chapter 1. Introduction

This chapter describes the Ramfactor/3.5-in. disk system that improves capacity and performance of the Apple //e computer. The original system developed under F-46-R can still be used with current software, but at a much reduced performance for larger data sets. The original system is described in Appendix G.

### Materials Required

#### Hardware:

Apple //e Computer with monochrome monitor,  
plus 1-Meg RAMFACTOR™ with RAMCHARGER™ battery backup (optional)  
1-4 3.5-in. disk drives (1 controller for every two drives needed),  
2 5.25-in. disk drives (plus 1 controller),  
C.Itoh Prowriter (8510 series) printer  
Graphicard (or Grappler+) interface  
An accelerator is optional but recommended  
A heavy duty power supply is recommended and may be necessary when an accelerator is added

#### Software:

FAS Ramfactor loader for DOC9 (all on a 3.5-in. disk) containing:  
General Manager™ (PC Manager, Inc., 64 E. Ashley Ave., P.O. Box 567,  
Driggs, ID 83422-0567),  
DATA ENTRY:DOC9  
TABULAR OUTPUT programs  
FORTH GRAPHICS containing ISYS FORTH™ (Illyes Systems, P.O. Box 2516,  
Station A, Champaign, IL 61820; (217)359-6039)  
Diversi-DOS™ (optional) (DSR, Inc., 34880 Bunker Hill, Farmington, MI  
48018-2728)

**Start Up** (If Ramfactor is already loaded with programs, go to 2.)

1. Put 3.5" DOC9 Ramfactor Loader disk in drive (leave 5.25" Drive 1 empty).
2. Turn Apple //e on. If the 5.25-in. drive continues to spin you have an earlier machine. In this case press CTRL-RESET and the Applesoft prompt appears on the screen. Then press PR#5 <RETURN> to boot 3.5" disk if you are loading programs into Ramfactor. Otherwise, press PR#7 <RETURN> to boot Ramfactor and go to 8.
3. A menu appears allowing the following choices to load to Ramfactor\*:
  - (1) GM with inverse labels
  - (2) GM without inverse labels
  - (3) DOC9 Output programs w/ CPUE.
  - (4) DOC9 Output programs w/ CPUE SUMMARY.
  - (5) DOC9 Data entry programs
  - (6) Backup this Ramfactor Loader 3.5" disk  
(this option overwrites all Ramfactor contents)
  - (7) Exit to Ramfactor

The General Manager (GM) Master program (choice (1) or (2)) is always loaded in ramdrive 2, while choice (3), (4), or (5) will load working programs in ramdrive 1 of Ramfactor.

4. Press (1) or (2) <RETURN>, depending on your machine. (If the GM master is already loaded in the Ramfactor, this is unnecessary).

5. Press (3) or (4) <RETURN> as desired.

6. Press (7) <RETURN>, then <RETURN> again to boot Ramfactor. The Ramfactor Menu will appear.

7. If you wish to do any disk work with GM data, such as copying data from disk to Ramfactor, press 1. (GM DISK UTILITIES menu will appear). To exit the UTILITIES menu select option 1 and continue with step 9.

8. Press 5., 6., or 7. in the Ramfactor Menu to select the current location of your GM data base. The current selection is indicated by an inverse sign on the right side.

9. Press 4. in the Ramfactor Menu to boot GM, then follow the instructions in Chapter 2, if you loaded (5) {DOC9 Data entry programs}, or Chapters 4 or 5, if you loaded (3) {Output programs with CPUE} or (4) {Output programs with CPUE SUMMARY}.

Figure 1 describes the novel features of the hardware and where programs and data reside. The conceptual relationship between software components of the package have not changed, and are described in Chapter 3. The role of DOC9 in the Fisheries Analysis System is described in Bayley and Austen (1989).

## Chapter 2. Data Entry

There are two parts to data entry. So-called permanent data entry is entered manually using GM methods described in 2.1. Section 2.1 also explains some basic principles of the data base. The bulk of the data is entered using a special program (Section 2.2) which is designed to reduce error frequency.

### 2.1 Permanent Data Entry

This section appears to be long and complicated, but includes many of the operational features of General Manager which are useful for checking and correcting data. Also, the whole process does not have to be repeated for every new data base. A template of 'permanent' data can be saved and edited when starting a new lake, or continuing with an old lake on a new 3.5-in. data disk.

Be sure that the CAPS LOCK key is depressed, which insures that all typed letters are in upper case and makes the data base screens and output easier to read.

Three terms are used to describe the data base components: *fields*, and In your data base, DOC9, there are 9 *screens* (Figure 2). Each screen contains the template for a specific arrangement of data. For example, screen 2 contains information on the lake such as its name, maximum depth, acreage, *etc.* Within each screen are several fields. A *field* is the title for a specific piece of information. In screen 2, the fields are lake, season code, station number, county, acreage, *etc.* A *record* is the actual data that you enter for all the fields of a screen. For screen 2, this would be the lake name, number of acres, *etc.* A screen can have one record as in screen 1, or it can have thousands of records, such as screen 8 where each individual fish weight and length is one record.

DOC9 is a hierarchical data base, which can be compared to a family tree (Figure 2). Each record within a screen is linked to a record in the screen above. For example, screen 2 is linked to screen 1 and screen 3 is linked to screen 2. When a record is a screen lower in the hierarchy, it is a *child* of a particular *parent* record. That *parent* record is also a *child* unless it is screen 1. For example, every record in screen 3 must be a child of a record in screen 2, each of which must be a child of a record in screen 1. Each *parent* record *can have more than one child* record *but not vice versa*. Therefore, a record in screen 1 can produce a number of records in screen 2, which can in turn produce a considerable number of records in screen 3.

Each of your data bases or *files* will normally only have one record in screen 1 to identify yourself and your district. You should set up a separate data base (*i.e.*, start a new disk) for each impoundment, unless there is a group of ponds with limited data.

Data for the *permanent* records in the first three screens (Figures 2 and 3) in the DOC9 data base need only be entered once, so a specialized user program is not necessary. Instead we use the *standard data entry mode* as explained in the General Manager Manual (Chapter 5, p. 35).

Before entering data the first time, you must *format* your data disk, as explained in Appendix A. Do not format a data disk which has data on it unless you want to erase that data. Then proceed as follows.

1. Boot GM by pressing 4. in the Ramfactor menu. You may then select ACCESS DATA BASE from the GM Master Menu. Then select DATA ENTRY. Any of the nine data base screens may now be accessed.

2. Select the first screen, DISTRICT-1, from the Data Entry Menu. Always read the information at the bottom. It should say ENTER DATA, not ENTER CRITERIA. The layout you see on the monitor is the *screen* (in this case, screen 1; Figure 3). Each item is a *field*.

Enter your data followed by a <RETURN> to proceed to the next field. If you have nothing to enter just press <RETURN>. The data you have entered in screen 1 is a *record* that you will write onto your formatted data disk in Drive 2. However, to produce the appropriate record linkage, the criteria for the *key field* must be entered for each screen; these keys are listed in Figure 3. In screen 1, the key fields are Region and District. Key fields contain the information which uniquely identifies the parent record.

When you have finished entering data in the fields, press the "closed apple key" to the right of the space bar to save the data (<⌘> has been programmed to be equivalent to <CTRL-G>). It doesn't matter where the cursor is. As Drive 2 lights up, this record is being *written* to your data base file on the diskette in that drive.

3. Now you will want to enter a record in screen 2, which is a child of the one you just wrote. To *quit* from the data entry mode in screen 1, press <␣> or <CTRL-Q>. Then select screen 2, *i.e.*, LAKE-STATION-SEASON-2, from the Data Entry Menu. For an explanation of the other control functions that are displayed at the bottom of each screen, refer to the General Manager manual.

You are now shown screen 1, DISTRICT-1. Because General Manager needs to know under which parent record you wish to write your screen 2 record it is asking for selection criteria to find that record. Enter the values for the region and district that you just saved under screen 1. Notice that an equals sign precedes these entries. To move to screen 2 press <⌘>. If the key criteria have been incorrectly entered, the parent record will not be found and an error message will be displayed. In the case of screen 1, only one record should ever exist, so entering selection criteria is unnecessary. You can simply press <⌘> and screen 2 will appear with ENTER DATA near bottom of the monitor. If multiple screen 1's exist, there is a problem. You should erase the extra screen 1's, enter Region and District, the key criteria, into this screen to access the correct parentage for screen 2.

4. Enter data in screen 2 as before. You may not have all the information required, but you must enter at least the first three fields (key criteria). We recommend using the lake title as well as county, acreage, and class (fields 4, 5, and 6) from the list produced by the Springfield office. It is advisable to enter information in upper case.

SEASON CODE contains two numbers, the first is 1, 2, or 3 depending on whether the sampling trip was in the spring, summer, or fall, respectively. The second number refers to the number of the sample trip in that season; it is normally 1, unless you have made more than one trip in the same season to the same lake and station. If you try to press <RETURN> after the entry of only one number, the screen will show the message FIXED LENGTH FIELD and prompt you to re-enter both numbers.

For the purposes of data organization and consequently field data collection, STATION refers to an area of the lake in which it is planned to take one set of limnological or *water* measurements (screen 4), and in which predetermined SAMPLES with particular gear (screen 3) are taken regularly during that season. Therefore, every lake will have at least one station, with >1 station

they are numbered 1, 2, *etc.*, for each lake. Up to 10 stations per lake are possible (counting station 0). Your station designation will not affect the way you select samples for data output.

5. After pressing <␣> and <RETURN> (to save this record), you may enter another record for screen 2, such as another station for the same lake and season. Remember, every lake-season-station combination needs a record in screen 2, even if it is a small lake with one station, sampled once in a year. If you don't wish to enter any more data, press <␣> to return to the Data Entry Menu.

6. To enter data in a record in screen 3 (Figure 3) as a child of a record you have entered in screen 2, select screen 3, SAMPLE-PERMANENT-3 and press <RETURN>. You now have to work your way down to 3 via the proper parentage. As before, screen 1 appears first. If the two key criteria are proper for the correct parentage, press <␣>; if not, correct and press <␣>. Screen 2 will appear; enter the proper values for lake, season, and station. As before, notice that an "equals" (=) sign precedes the entries. If these three key criteria are correct in screen 2, press <␣> and screen 3 will appear with the cursor on SAMPLE CODE.

Your lake may have a long name and the parent record will not be found unless the criteria is exact. A fast alternative is to use a criteria other than the equal sign. For example, if the lake is the only one beginning with "D" on your disk, you can enter /D to instruct General Manager to look for a lake whose first letter is "D."

When all three criteria are entered, press <␣>. If the record in screen 2 is found that corresponds to the criteria, screen 3 will appear ready for new data entry. The first three fields are output from the parent record in screen 2 to confirm your selection.

9. Enter data into screen 3 as in previous screens. Again, you may not have all the permanent sample site information (it will take us some time to collect it all). It is important to define the SAMPLE CODE, beginning with a capital letter corresponding to the gear (see Table 1 for gear codes), followed by a number to distinguish this sample site from another in the same station (*e.g.*, E1). Up to 9 sites are allowed for a given station and gear type (you could add a tenth using zero, E0).

The sample code location must be described using landmarks or names that can be identified on a map. Save these data (press <␣>) as before, and enter additional sample codes for the same parent record. All sampled areas must have records in screen 3 even if all the fields cannot be filled initially.

In lakes with more than one station, you will typically have more than one sample site with the same sample code (*e.g.*, E1, G1). Although the data base will not confuse these data, it is convenient to refer to each sample site by preceding it with the station number (*e.g.*, 1-E1, 2-E1, 3-E1) so that each site is unique for that lake. Output formats follow this convention. Don't worry, if the same sample code is accidentally typed in twice; the computer will respond with a DUPLICATE RECORD message.

This completes permanent data entry. We do not recommend using this manual method for entry of new records in the remaining screens 4 through 9. Our special data entry program (Section 2.2) is more convenient and contains more error checking.

Table 1. Single-letter codes for sampling gears.

---

|   |  |
|---|--|
| E | Electrofishing (AC boat-mounted)   |
| N | Night electrofishing (AC boat-mounted)   |
| G | Gillnet, 125-ft long standard fleet (5 panels of 1.5-, 2-, 3-, 4-, and 5-in. stretched mesh) |
| L | 250-ft gillnet (twice repeating meshes as above)   |
| M | Minnow seine   |
| D | Drag seine   |
| T | Trap net (0.5-in. bar mesh)  |
| I | Trap net (1-in. bar mesh)  |
| H | Hoop net   |
| F | Fyke net   |
| R | Trammel net  |
| B | Basket trap  |
| C | Cove rotenone  |
| O | Otter trawl  |
| P | Primacord  |
| A | Draining   |
| K | Back-pack shocker (Smith-Root VII, pulsed DC)  |
| W | 30-ft AC electric seine  |

---

Press <C> and <RETURN> a few times to work your way back to the General Master Master Menu. If you are not planning to proceed immediately to field sheet data entry, **back up your data** on a new disk (see Appendix A) before turning the computer off.

## 2.2 Data Entry from Field Data Sheets

Separate your field sheets for a particular impoundment by station. Then within each *stack* the 'Station and Sample' sheet should precede the 'Frequency- Length/Weight' data sheets (see Appendix B). Each *set* now contains the information necessary to enter records for screens 4 through 9 in the data base (Figures 2, 4, 5) for each station in turn. This procedure would be extremely tedious and error-prone using the standard General Manager data entry method described previously. Imagine every 10-mm length group requiring a separate record entry in screen 7 and one for every fish with a length/weight measurement in screen 8.

Because a reliable data base is very important, considerable time was spent developing a program for direct entry from field data sheets. The District Biologist may enter data quickly and at the same time check and edit entries before saving the data. We do not recommend that data entry be immediately delegated to a secretary. Correct data entry saves a lot of headaches later, and the experience with General Manager and DOC9 is important in understanding how outputs have been developed so that incorrect entries can be traced and you can play a part in future enhancements.

Once started, the data entry program is largely self-instructing. You may proceed from the end of the Start Up procedure described previously or from the Main Menu in General Manager (start at step 2).

1. Check that your DATA ENTRY:DOC9 programs are in Ramfactor by the title on the Ramfactor menu. Select the appropriate medium (5. or 7.) where your data is to be accessed (if it is in Ramfactor you are taking risks). Boot GM by pressing 4.
2. Select UTILITIES and then RUN USER PROGRAM from the Utilities Menu.
3. Select DOC9 from the Blank Forms Menu (*i.e.*, your data base structure), then select DATA ENTRY PROGRAM from the User Program list. This will load a menu program that gives you several options for data entry.
4. The menu on your monitor should appear as follows:

#### DATA ENTRY PROGRAMS

(WITH ENGLISH ENTRY OPTIONS)

1. DATA ENTRY: DOC9
2. DATA ENTRY WITH AGES
3. AGE DATA ONLY ('CRITERIA' USED)
4. SELECT CRITERIA
5. RETURN TO GENERAL MANAGER
6. RUN GM DISK UTILITIES
7. EXIT TO BASIC
8. EXIT TO RAMFACTOR MENU

Data entry can be accomplished in several ways, depending on how you collected age data. If you used envelope codes and are entering data before you have aged the scales or otoliths, you should use option 1, DATA ENTRY:DOC9. This program allows entry of all field data and expects the user to input envelope codes for fish that had scales or otoliths taken for aging. Later, when the fish are aged, data are entered using the option AGE DATA ONLY.

If the fish have been aged and you want to enter everything at once, use option 2, DATA ENTRY WITH AGES. This program is similar to DATA ENTRY: DOC9, except that it allows you to enter ages simultaneously with lengths and weights. This program circumvents the entry of envelope codes. It still needs envelope codes to properly complete the data base, but it is done automatically after the user provides a starting value. See Step 9 below for the advantages of using envelope codes.

Both DATA ENTRY: DOC9 and DATA ENTRY WITH AGES are run in the same manner by selecting the number of the one you wish to run. A title screen will appear and you continue by pressing <RETURN>

SELECT INPUT UNITS FOR FISH DATA will ask you to select metric (mm and grams) or english (tenths of inch or pounds) depending on the units you recorded for fish data. The data is stored internally in metric, so the english inputs are converted before writing to the data base.

5. A partial list of species codes is presented. You can use any of the standard species codes for Illinois fish (Appendix H), but typically only a few *common* fish species exist in a set of lakes. This list is designed to increase data-base integrity by checking your spelling of common ones and questioning entries that are not on this list. You can add species to the list and they will be effective while the computer is on (these changes are not permanent). If permanent changes appropriate for your District are required, we can change your copy of the program accordingly. Once you are in

the program, you can still enter species codes that are not on the list. You will simply be questioned about your entry and asked if the code is correct.

6. To exit from the species list and continue, type 0 and <RETURN>. The computer will then prompt you to CHOOSE A REGION, which allows you to establish the correct parentage for your data entry. After selecting the proper code, press <RETURN>. In the next few screens, you will be asked to select DISTRICT-NUMBER, LAKE, SEASON CODE, and STATION-NUMBER. The Main Menu will appear with the following options:

RESTART PROGRAM  
NORMAL ENTRY FROM STATION/SAMPLE DATA  
DIRECT ENTRY OF L. OR L/WT DATA  
CHANGE STATION-NUMBER  
EXIT PROGRAM

7. To continue data entry, select NORMAL ENTRY FROM STATION/SAMPLE DATA from the Main Menu and then NORMAL ENTRY STARTING WITH SCREEN 4 from the Station/Sample Data Menu. Once the data entry into screen 4 has been completed and the data saved, entry into screen 5 DEPTH PROFILE is possible. This screen may be bypassed if the data set is not available by pressing <RETURN> (the default value was N). In this case, there will be only one record in screen 5--the surface water temperature measurement (Figure 4).

Screen 6 will be automatically accessed next. There will be one record in screen 6 for every SAMPLE CODE entered in screen 3 (Figure 4). If you attempt to enter a sample code into screen 6 that has not been previously entered in screen 3, the computer will warn you of this fact and prompt you to enter another. Screen 6 may also be accessed from the Station/Sample Data Menu, bypassing screens 4 and 5. If entering screen 6 directly, you will be prompted to enter YEAR before the screen appears. If a duplicate sample code is entered, the computer will tell you. At this point, you may enter another STATION-NUMBER or EXIT to the Main Menu.

In the lower half of screen 6 data can be entered for subsamples from an electrofishing run. For example, crappie may only have been collected for 33% of the run. The species or group code for fish that were subsampled must be entered, plus the percentage of time that they were sampled. Permissible Group Codes are listed under Groups Codes (1) at the end of Appendix H. Three group codes, including one for shad, are allowed in a sample (= one screen 6 record). For the crappie example, you would enter CRP, 33 (%), under screen 6 meaning that for 33% of the run all crappie observed were picked while for the remaining 67% no crappie were picked up. We do not recommend subsampling unless absolutely necessary.

Once data in screen 6 have been entered and saved, you can enter data from your 'Frequency-Length/Weight' sheets for that station into screens 7, 8, and 9 (Figure 5) without having to go through the menus.

8. **Length and weight data entry.** If you are not proceeding from screen 6 but have recently started up the program, select DIRECT ENTRY OF L. OR L/WT DATA from the Main Menu. After responding correctly to prompts to determine parentage, you can select L. FREQ. DATA FOR SCREEN 7, DIRECT ENTRY OF LENGTH/WEIGHT DATA, or DIRECT ENTRY OF ODD DATA TO SCREENS 7, 8.

There are different options for entering length frequencies and weights. There is no single, correct way to enter the data, but simply more convenient ways depending on the quantity and length range of data for the species in each sample. However, you must be aware of the following.



When entering length/weight data for a previously defined species, it only goes into screen 8 (see step 9 below). These fish are not automatically recorded as length frequency in screen 7, which would take time and create excessive *dead records* (what is left when a record is updated or deleted; they are automatically avoided but take up space and increase search times; see Appendix C). Therefore all fish must be included in the length frequencies entered in screen 7.

The exception is when entering *odd* data (see DIRECT ENTRY OF ODD DATA FOR SCREENS 7, 8 on the menu). This is for miscellaneous fish listed on the data sheets for which it is inconvenient to have length frequencies. When saving *odd* fish, a frequency of one for the cm length group is automatically saved in screen 7 (you are notified) and added to a previous length frequency (if present) before saving the length/weight data in screen 8. If there is a zero or null weight entered (you may have odd fish lengths without weights), no record in screen 8 is saved unless an envelope code was entered (see below).

**9. Age data.** Two methods are available for handling age data: (1) envelope codes and (2) ages only, no envelope codes. This section describes option 1. Option 2 is easily handled by running the program DATA ENTRY WITH AGES and envelope codes are effectively bypassed. *Envelope codes* were included in the system because collecting and labelling scale or otolith samples and manual entry of the data are tedious tasks. Therefore, the following method was devised.

Before going to the field on a sampling trip, the biologist pre-numbers scale envelopes with a one- to three-digit number that uniquely identifies each envelope. When a fish to be aged is collected, the biologist writes the number of the envelope on the data sheet along with the length and weight of that fish. No additional data need be recorded on the envelope, although adding the species code aids in sorting. This procedure saves valuable field time, because lengths, weights, and species codes only have to be written once on the field data sheet.

If the fish have not been aged, you should input the length, weight, and envelope code under the length, weight, age portion of DATA ENTRY:DOC9. Later, when the fish are aged, use AGE DATA ONLY to automatically retrieve the lengths and weights and allow you to save the age data for the appropriate individual fish. There are separate fields for ages based on scales and otoliths.

The program AGE DATA ONLY resides on the DATA ENTRY:DOC9 disk. Before running this program, you must create a proper criteria file using the criteria selection program (also located on the DATA ENTRY:DOC9 disk). Two options exist in the AGE DATA ONLY program. The first is that the computer automatically retrieves un-aged records from Screen 9 and puts them on the screen for you to enter the ages. This method is fast and easy to use, but the order in which the computer retrieves the records may not be the same as that of the information on your raw age-data sheets.

The second option allows you to enter the envelope codes for which you want to enter age data. The computer then retrieves the Screen 9 records in that order. This method is slower but may be more convenient, because you do not have to "hunt" for your raw data.

During entry of length/weight data, including the *odd* data mode, you are given the opportunity to enter the envelope code or press <RETURN> to bypass it. When the data are saved, only those entries that have an envelope code will result in a record in Screen 9. These records initially have a blank for the actual age.

**10. Data entry errors.** Most logical errors have been trapped and are explained in the program. For example, you are not allowed to save duplicate records in Screens 4 and 6. However, there is a limit to how much *intelligence* that can be programmed into a computer.

You may get to the point of data entry and realize that you don't want to enter data there. Follow the instructions on the monitor for saving the data before entering any data (*e.g.*, <RETURN> or <0> <RETURN>). Even though a message suggests the contrary, Drive 2 will not light up, indicating that a record was not saved. If you had actually entered data that you did not want to save, clear it using the indicated editing commands.

Any frequencies of zero in screen 7 or lengths and weights of zero in screen 8 will not be used by the output programs.

If you know or suspect that an incorrect entry was saved, exit the program from the Main Menu, which will put you into General Manager. Then use BROWSE/UPDATE to locate and correct the entry. Note that if separate entries of length frequencies for the same length groups-species-sample were made, they will have been automatically summed.

Before you delete a record, you must remember that all *child* records will also be deleted. Refer to Figure 2 to determine if a child screen exists; if necessary, check for child records by using *nested browse* (Chapter 4, General Manager manual). If you make a mistake, retrieve the information from your back-up disk.

11. When you have finished a data entry session, even if you have not finished the pile of data sheets, *back up* your work before turning the computer off (see Appendix A). First exit the data entry program by getting to the Main Menu and selecting 8. (EXIT TO RAMFACTOR MENU). Then follow the instructions in Appendix A.

## Chapter 3. Data Output

Retrieval and output of data in a useful form from the General Manager DOC9 data base has received a great deal of attention in the design of FAS. The General Manager interface commands allow programs to access data much faster than their generalized, but restricted, REPORTING program. All tabular output is handled by BASIC interface programs which are run in the General Manager environment.

For graphic outputs and the age table, we have implemented the FORTH language that is fast, economical in its memory use, has a nine significant-place accuracy, and employs double high resolution graphics. Data files collected with an interface program described below are optionally stored in the top 43-K of RAM memory in the Ramfactor memory. This is still called Auxiliary Memory for convenience. When using ISYS FORTH™, you can quickly access these files, or their equivalents (stored as DOS 3.3 files).

### File Manipulation

The tabular and graphical outputs consist of a series of programs that are linked together by several different files (Figure 6). To produce a table or graph, the user simply selects the appropriate criteria (*i.e.*, region, district, lake, season) and then moves through the programs to produce the output desired.

The file management system (Figure 7) is, in most cases, operated automatically within the program but it can also be manipulated by the user to enhance efficiency. Two files that are generally updated automatically are CRITERIA and CONDITION. CRITERIA contains the selection criteria that you have chosen when running the criteria selection program (*i.e.*, region, district, lake, season), *a* and *b* parameters for length-weight relationships, and length group choices. This file is created anytime that you go through the CRITERIA SELECTION program. The program also allows you to update the CRITERIA file on any program disk. It is necessary that criteria be selected for any of the programs to work properly. The file CONDITION contains all of the stock and quality sizes for proportional stock densities and the standard weight formulas for relative weights. This file can be edited whenever you select species by typing <III> (three capital I's).

Two types of files are used to actually hold and manipulate data. These are the RAW LENGTH FREQUENCY files (RLF) and the LENGTH WEIGHT AGE files (LWA). RLF files consist of a series of frequencies corresponding to length groups (0-130 cm). LWA files are simply the length, weight, and age of individual fishes. Both RLF and LWA files can be stored in auxiliary memory or saved on a disk. Figures 6 and 7 illustrate use of these files.

You can access auxiliary memory files or their equivalent disk files from Forth graphics. It is easy to change from the General Manager environment to that of ISYS FORTH and vice versa using the output program menu in the uploaded working programs or the Ramfactor menu itself. All environments use the Diversi-DOS system (or DOS 3.3) installed in your Ramfactor upload disk.

Currently LWA files can be saved as DOS 3.3 files in the form readable by the SPS Statistical Package (public domain from G. J. Buyhoff *et al.*, School of Forestry and Wildlife Resources, Virginia Polytechnic Institute and State University, Blacksburg, VA 24041). This optional package

can also manipulate files so that, for example, data from different years can be combined, analyzed, and compared.

The best way to become familiar with the output programs is to use the system while referring to the manual. The output programs do not change the General Manager data base in any way.

## Chapter 4. Tabular Output Programs

Programs are accessed from General Manager by selecting UTILITIES and USER PROGRAM. General types of tabular output are:

1. Species summary table
2. Length-frequency and condition index table
3. Stock index table
4. Catch per unit effort (CPUE) tables
5. Age table (obtained from FORTH package: see Chapter 5)

Formulae used in these tables are explained in Appendix D. All tables can be previewed before being printed. Metric and english units are given in all outputs.

Before tables can be prepared, criteria must be selected and stored in the reference file CRITERIA using the program CRITERIA SELECTION from the menu. Any combination of samples and species can be selected for a given lake and sampling trip. If you wish to have a complete list of species, you may enter ALL as a single entry when species codes are requested, then run L-FREQ/CONDITION, which will find each species in turn and write them in the file CRITERIA. The ALL species designation can *only* be used in the L-FREQ/CONDITION program. Use of ALL in other programs will result in a return to the program selection menu, which allows you to return to the CRITERIA SELECTION PROGRAM to choose the species desired. If you choose ALL and then L-FREQ/CONDITION, the program will automatically find every species in your data base and, if you choose, will update CRITERIA with the species codes.

The species summary and length frequency/condition index tables are included in the program L-FREQ/CONDITION. The L-FREQ/CONDITION program has many functions:

1. Length frequencies and condition indices by species
2. Species summary table
3. Updating CRITERIA for CPUE program (*a* and *b* parameters and length groups)
4. Saving files to auxiliary memory for later retrieval

L-FREQ/CONDITION includes facilities to save length-frequency (RLF) and length-weight-age (LWA) files in auxiliary memory, to calculate the *a* and *b* parameters of the length-weight allometric equation (using the geometric mean regression of Ricker (1973)), and optionally to store these and any length intervals chosen in the reference file CRITERIA. L-FREQ/CONDITION is largely self-explanatory. If the ALL species selection is chosen the program will allow you to produce output for every species in the data base (it also gives you the option of skipping the species and moving on to the next one). In its present form, each time L-FREQ/CONDITION is run, the file CRITERIA is optionally updated with additional information for each species. Each time L-FREQ/CONDITION is loaded and run, the auxiliary memory is cleared of any previously stored files.

The STOCK INDEX TABLE can calculate for each species: proportional stock density (PSD), young to adult ratio (YAR), up to three relative stock density (RSD) calculations, or four calculations of stock indices using the length categorization system (Gabelhouse 1984). Stock and quality sizes are provided in the reference file CONDITION and are automatically read into the program. These can, however, be altered if desired or entered and permanently saved for species

not on the list. There is a new version of the Stock Index Table in the FAS-CREEL package that can incorporate length frequencies from creel data and DOC9 in the same table.

The data required to run the Stock Index Tables program are the length-frequencies of the fish chosen. These can either be manually read from the data base by General Manager or they may be picked up as RLF auxiliary memory files saved from a previous run of the program L-FREQ/CONDITION. The latter is much faster because it avoids accessing the data base again.

The Catch Per Unit Effort (CPUE) program is a series of three tables that give a comprehensive output of data on catch and effort. Catch can be expressed in numbers or weight, with both metric and english units shown on all tables. Units of effort will continue to be controversial until we find out more about what affects catchability. Units given in these tables were chosen on the basis of standard Illinois Department of Conservation sampling guidelines. Electrofishing is reported in catch per hour, nets (such as gill nets and trammel nets) are in catch per net-night, and seines are given in catch per haul.

The CPUE program uses length-frequency arrays to calculate catches. To transform lengths to weights it requires the allometric parameters  $a$  and  $b$  derived from the length-weight regression. These can be calculated in the L-FREQ/ CONDITION program and stored in CRITERIA. Alternatively, the CRITERIA file is automatically given the  $a$  and  $b$  parameters used in the LeCren condition factor calculations (located in the file CONDITION) whenever you select a species in CRITERIA SELECTION. Obviously it is better to calculate your own  $a$  and  $b$  parameters for the lake you are working on rather than using the standard LeCren parameters. Therefore we suggest that, before you run CPUE, run L-FREQ/ CONDITION to calculate and save proper  $a$  and  $b$  parameters.

When a print out is requested, a table name or number (which can be any label less than 20 characters long) is requested so that the table can be identified in a report. All tables allow considerable user interaction and are extremely easy to use. All that you need to know is how you want to analyze and presort the data.

## Start Up

If not already in General Manager environment, proceed as follows.

1. Follow start-up directions in Chapter 1, uploading (3) Output programs with CPUE or (4) Output programs with CPUE SUMMARY. The only difference between these packages is that the shorter CPUE SUMMARY replaces CPUE.
2. Select UTILITIES and then RUN USER PROGRAM from the Utilities Menu.
3. Select DOC9 from the Blank Forms Menu (*i.e.*, your data base structure), then select output from the User Program list. This will load a menu program that gives you several options for data entry.

4. The menus on your monitor should appear as follows for the CPUE option:

#### OUTPUT PROGRAMS: RAMFACTOR

1. SELECT CRITERIA
2. L-FREQ/ CONDITION
3. STOCK INDEX TABLE
4. CPUE
5. FORTH (GRAPHICS + AGE TABLE)
6. SEE OTHER CHOICES

After pressing 6. you get:

#### UTILITIES ON RAMFACTOR

1. TRANSFER AUX=>DOS
2. CHECK AUX.MEMORY
3. RETURN TO GENERAL MANAGER
4. RUN GM DISK UTILITIES
5. EXIT TO BASIC
6. EXIT TO RAMFACTOR MENU
7. SEE OTHER CHOICES

The CPUE SUMMARY version is the same except that CPUE SUMMARY is substituted for CPUE.

#### Creating a Table

As with the DOC9 data input program, the user must select criteria (region, district, lake, *etc.*) so that the computer *knows* where to collect the data. These selections are made by menus. All options are listed on the screen and the user moves the arrow to the one that is wanted and presses <RETURN>. The selection can be changed by pressing <RETURN> again. More than one or any combination can be selected by placing the arrow next to the line desired and pressing <RETURN>. The selected value will be shown in inverse (black on white) type so you will know which ones have been chosen. See Appendix E for dip switch settings for the printer.

1. Choose SELECT CRITERIA, which will allow you to choose the data that you will analyze. This program will also write the CRITERIA file to your disk. If you chose criteria during your last session that you want to use again, you can skip this step because the criteria are saved on disk. However, each time you run through criteria selection the old CRITERIA file is erased and the new one is saved.
2. Select desired criteria (*i.e.*, region, district, lake, sample codes). Any combination of stations and sample codes can be selected. Note that the sample codes are listed by station. If you have selected several stations for the data analysis, you will have to choose the sample codes desired at each station. When the table is created, all sample codes chosen for each station selected will be used in the calculations. Remember that you can change your mind by simply placing the arrow next to the previously selected item and press <RETURN> to *de-select* the choice.
3. There are three options when selecting species. The first option is to enter the three letter species code for those species for which output is desired. If the code has already been entered once, it will be rejected. If the code is not listed in the CONDITION file (viewed by typing <III> under species selection) (I for species Index), the code will be accepted but the computer will give you a message that it is not in the condition file; therefore, the species has no stock and quality sizes, relative

weight, or LeCren condition parameters. You may use species codes not listed in CONDITION, but condition indices cannot be printed; you will also need to input stock and quality sizes for these species in the STOCK INDEX program.

The second option, selected by <III>, allows you to see the file CONDITION. You are presented with a menu for editing the parameters that determine standards used in condition indices and the calculation of the proportional stock index (present parameters are listed in Appendix F). You may (a) list the parameters presently stored in the text file CONDITION on your Tabular Output disk, (b) change parameters for a species, or (c) add parameters for a new species. Changes in CONDITION are recorded on the disk with the option to save onto other disks.

The third option is to enter ALL rather than a species code, for use in L-FREQ/CONDITION.

4. When all desired species have been entered, type QQQ to end the species selection process. The CRITERIA file will be updated and saved. You are now ready to create a table.

### Length-frequency/Condition Index Table

Load L-FREQ/CONDITION from the Program Selection Menu. The title screen is shown along with the contents of the CRITERIA file which you previously created. You have three options from which to choose:

1. L-FREQ/CONDITION TABLES, AUX. MEM.  
FILE STORAGE, CRITERIA UPDATE,  
SUMMARY TABLE - ALL OPTIONAL.
2. AUTOMATIC SAVING OF ALL RLF AND  
LWA FILES TO AUXILIARY MEMORY  
WITH OPTIONAL SUMMARY TABLE.
3. SUMMARY TABLE ONLY.

The first choice produces L-FREQ tables for all of the species that you have chosen in criteria selection. You will then be given the option of saving files to auxiliary memory for later use in graphics. You can also update the criteria file with *a* and *b* parameters and length group choices for use in CPUE tables. Option 2 allows you to store RLF and LWA files in auxiliary memory and optionally update the criteria file with *a* and *b* parameters automatically. Option 2 bypasses production of L-FREQ tables but produces the species summary table. The third option produces the species summary table only; files are not saved to auxiliary memory and no criteria updating is done. Option 3 is the fastest way to produce the species summary table. Options 2 and 3 are self explanatory when they are chosen. Option 1 is run as follows:

Option 2: This produces RLF and LWA files for all species selected and saves these files to auxiliary memory. In addition, you are given the option of updating the CRITERIA file with the *a* and *b* parameters calculated during this process. For storage of auxiliary memory files you will be asked to give a header name for the files; it should be some unique identifier, such as the lake name. The program will then add the species name and either LWA or RLF to the file name resulting in something such as RLF LMB.CLINTON. Files are saved to auxiliary memory in order of species found. If the auxiliary memory runs out of space for file storage, you will be given a message telling you which species was the last one entered, which will be incomplete. Finally you are given the option of printing the species summary table calculated for the species selected.



Option 3: This option simply collects length-frequency information for all species and samples selected in criteria selection. No files are saved and there are no CRITERIA file updates. Once this option is selected, the program runs without any user input and produces the species summary table. This is a relatively quick program because it only accesses screen 7 data.

1. The first species in the CRITERIA file is selected and you are asked if you want to see the data. The species can be skipped by answering N. Accepting the default (Y) allows the program to search the data base and gather the length-frequency data for the species and criteria that were chosen. You are then asked if you want length/weight/age data to be collected. If these data are in the data base and you want to produce condition indices, calculate  $a$  and  $b$  parameters for the CPUE tables and save data to auxiliary memory; choose the default Y. For graphics, it is necessary to have the computer retrieve these data from the DOC9 data base.

2. After data are gathered, a summary screen is produced showing species, sample size, length range, and  $a$  and  $b$  parameters. A menu of options is included on the lower half of the screen. You now have the option of saving files into auxiliary memory.

3. Saving RLF and LWA files is accomplished by choosing the appropriate menu option. When chosen, the program will ask for a file name. It can be any name up to 30 characters in length containing any character (including spaces and punctuation marks) except the comma. For example, a length-frequency file of largemouth bass from Lake Shelbyville might be named LMB.SHELBY. The name is then automatically prefixed by RLF if it is a length-frequency file or LWA if it is a length/weight/age file. The file is stored in auxiliary memory as RLF LMB.SHELBY or LWA LMB.SHELBY, respectively, and can be called up by that name in later parts of the output programs. Each time the L-FREQ/ CONDITION program is run from the beginning all files in auxiliary memory are cleared.

4. Select either PREPARE L-FREQ/CONDITION TABLE to produce the table or GO TO CRITERIA MENU to skip production of the table and move to the other programs.

5. If you choose to produce a table, you will be asked to select size categories. Categories available are

(a) Tabulate by each centimeter group--gives values for each individual centimeter group from smallest fish to largest and is useful for developing length-frequency distributions or a general overview of data.

(b) Choose even length intervals--creates a length-frequency/condition table with equal length group intervals as defined by the user. For example, choosing 5 centimeter groups will result in data groups of 0-4.9 cm, 5.0-9.9 cm, 10.0-14.9 cm, etc.

(c) Choose your own groups--allows input of up to 22 length groups of any size. The groups you save here will be used later in the CPUE programs

(only selections (b) and (c) are valid for use in the CPUE program and a maximum of 15 groups are allowed in CPUE).

6. Select output device: printer or screen.

7. After viewing the table type <CTRL-P> to print a hard copy, press <SPACE BAR> to change length groups, or press <RETURN> to move on.

8. You will be asked to update CRITERIA (if desired) with your length group choices and  $a$  and  $b$  parameters before moving to the next species. Although it is recommended that you save these  $a$

and *b* parameters and length groups for the CPUE tables, it is not required because the CPUE program allows you to input your own values.

9. When all species have been processed or if you choose to exit you will have the option to see the SPECIES SUMMARY table. This table is previewed and printed in the same manner as above.

At this point, you may wish to proceed to graphics to check your length-weight data for *outliers* and use length-frequency/age plots to select appropriate length ranges for the CPUE tables.

### **Stock Density Table (PSD, RSD, YAR, Length Categorization)**

1. Load STOCK INDEX TABLE program from the Program Selection Menu.

2. You are now given two options in running the STOCK INDEX programs:

Option 1. Traditional YAR/PSD/RSD values--produces standard output of YAR, PSD, and RSD values as proposed by Anderson (1976, 1980).

Option 2. Length categorization--produces tables of stock indices using the length categorization system of Gabelhouse (1984).

Option 1 works as follows:

3. After you have chosen Option 1, you are asked to select your data source. You may either:

(a) load data from auxiliary memory if the file was stored there (the fastest way) or

(b) have the program search the data base. If you choose to read from auxiliary memory, a new menu appears with four commands and shows the first RLF file in auxiliary memory (only RLF files are used in STOCK INDEX TABLE so only those are shown). To see more files, press <RETURN>. To read the current file, press <R>. To return to the top of the list of auxiliary files, press <->. To quit, press <Q>. Once the file is read you will have to give it the correct species code.

4. Select Stock Index Values. Stock and quality sizes for most common species have been written into the CONDITION file (see Appendix F). The user must input YAR size and any RSD sizes that are desired (these must be integers--whole numbers, no decimals). The user can also change PSD sizes if needed, but this is not recommended as the values are those published by Anderson and are generally accepted nationwide.

5. You will now be sent back to the first screen, giving you the option of calculating stock indices for another species, producing tabular output, or exiting from the program. If you want another species simply choose it from auxiliary memory or from your CRITERIA file (Option 2).

6. To get a printout, choose TABLE OUTPUT. Select output method (printer or screen). If you choose PRINTER, be sure your printer is on. If SCREEN is chosen, you will have the option of getting a printout after the table is pre-viewed.

7. Select the next option from the Table Selection Menu.

Option 2. If you chose the length categorization option, you will have the opportunity to calculate stock indices as proposed by Gabelhouse (1984). Gabelhouse's categories of *preferred*, *memorable*, and *trophy* are simply the number of fish in a certain length range divided by the

number of stock size fish. This is a two-step process. First you must select what categories you want calculated (e.g., Quality to Preferred) and then you must assign lengths to each category.

1. Choose the categories for which you want output. The length categories can be thought of as an RSD for a specific length interval. For example, an RSD from Quality to Preferred gives you the proportion of fish in the quality size category. In this case, under RSD 1, you would enter from Q to Q. You are asked to put in the one-letter code for stock, quality, preferred, memorable, and trophy for the categories for which you want calculations. You may ask for up to four calculations or do only one. Later you will be given the chance to set up the centimeter sizes for each of these groups.

2. Choose the species from the data menu as in Step 3 above.

3. Now enter the centimeter lengths for each of the categories for which you want output (stock, quality, *etc.*). The values for stock and quality are read from condition and are the standard values. These can be changed. You must enter your own values for preferred, memorable, and trophy. These must be entered as integers (whole numbers).

4. As above, to get printout simply choose TABLE OUTPUT.

### Catch Per Unit Effort Tables

1. To produce CPUE tables it is recommended that the user have a CRITERIA file completed with length groups and *a* and *b* parameters as is produced by the L-FREQ CONDITION program.

2. The CPUE program reads the CRITERIA file and will, for each species, give you the option of using the *a* and *b* parameters and length groups from CRITERIA or inputting your own values. No more than 15 length groups can be used. If more than 15 groups are saved in CRITERIA and the CPUE program is run, an error message will occur and you will be sent back to the program selection menu. If you accept 1-cm length groups for a species with a length range of more than 15 cm, an error message will occur and the program will terminate. We don't expect any need to analyze more than 15 length groups at any one time. If you choose to ignore the length groups in CRITERIA, the CPUE program will allow you to select any length groups in a fashion similar to that in L-FREQ CONDITION.

3. The CPUE tables are run, for the most part, automatically. Once the user has selected CPUE from the main output programs menu, the program is loaded and runs. A user may skip species and may request the weight portion of the table not be calculated and printed. If the user chooses not to produce the weight portion of the table (by pressing <CTRL-S>) he will forfeit production of weight portions of the subsequent tables during the current run.

4. Each table is first shown in numerical form (catch in numbers) and second in the weight form (catch in kilograms and pounds). In the first table, CPUE is given with number of fish in the sample below the CPUE value. In the second and third tables, mean CPUE is given, number of samples with that gear is given in square brackets, and 95% confidence intervals are given below each value. The second table gives the weights in both kilograms (above) and pounds (below). The third table, the final summary table, gives the length range in centimeters (curly brackets) and inches (parentheses).

5. Print-outs of tables are made by pressing <CTRL-P>.

6. Select the next option from the Table Selection Menu.

## Final CPUE Summary Table

On the other working programs option, CPUE SUMMARY only produces the final summary table. This version requires the same input as the complete version described above but it does not print the first and second tables.

## Transfer AUX=>DOS Program

This program writes selected files from auxiliary memory to a DOS 3.3-formatted disk in Drive 2. There are several ways to format a DOS disk.

1. Exit from General Manager, return to the Ramfactor Menu and select EXIT. Put a bootable, 5.25-in. Apple DOC 3.3 disk in Drive 1 and enter PR#6 <RETURN>. Then put the disk you want formatted in the same drive. Type <INIT TEST,D1> (in this case, TEST is a dummy name for a file; any other name can be used) and press <RETURN>. The drive will then be active for about 1 minute while the computer is formatting the disk. When the cursor re-appears type <DELETE TEST,D1> and press <RETURN>. Now the disk is formatted and ready for your transfer of files. Enter PR#7 to return to the Ramfactor Menu; you will be returned to the General Manager system without having lost any files.

2. If you are starting with the system off. Place your Apple DOS 3.3 System Master disk in Drive 1. Turn on the computer. Once the program is loaded put your blank disk in Drive 1. Type <INIT TEST,D1>, let the system format the disk, then type <DELETE TEST,D1>, and the disk will be ready for use.

3. It is convenient to save a blank formatted disk and use a fast copy program, such as DIVERSI-COPY™, to create others. This also applies to General Manager 5.25-in data disks.

To run TRANSFER AUX=>DOS:

1. Choose TRANSFER AUX=>DOS from the Program Selection Menu.

2. Once the program is loaded and you pass through the title screen, you are asked, DO YOU WANT ALL AUXILIARY MEMORY FILES AUTOMATICALLY SAVED? This option allows you to save every file in auxiliary memory to disk quickly and with no interruptions. If you choose this option by answering yes, you are then asked to give a general name for the files (*i.e.*, Shelbyville). Each auxiliary memory file is then saved as either RLF or LWA, then the species code and finally given the general name you entered (*i.e.*, RLF LWA.SHELBYVILLE). Files are saved automatically and you are given a message when complete.

3. If you choose not to save files automatically, you are presented with options allowing you to see the files in auxiliary memory (by pressing <RETURN>), saving a file to disk (pressing <S>), or quitting (<Q>). If you choose to save a particular file to disk, you will be asked if that is the correct file and then given a chance to alter the name under which it is saved.

4. Exit from the program by selecting <Q>.

Raw length-frequency files (RLF) are saved *as is*. Length/weight/age (LWA) files are saved in SPS format (as three files, postfixed by either an M, L, or N). The M file is the LWA file accessed by FORTH (which also can read the RLF file).

## Chapter 5. FORTH Package: Graphics and Age Table

Graphical and some tabular output from the DOC9 data base is produced by using the ISYS FORTH™ disk and the routines saved on that disk. The programming is in a language called FORTH (as opposed to languages such as BASIC and FORTRAN). The advantages of FORTH are speed, compactness and its interactive nature. Options presently available are

1. Length-frequency histogram--shows number of fish in each of the specified length groups (from 1- to 5-cm per group).
2. Condition-factor graph--calculates either  $W_r$  or  $K_n$  and its 95% confidence interval for each length group specified. These values are then plotted with length on the x-axis and condition factor on the y-axis.
3. Length-Weight regression--plots length on x-axis and weight on y-axis with both scales being logarithmic.
4. Individual length at age--plots the length of individual fish against their respective ages. Age is on the x-axis with length on the y-axis.
5. Mean length at age--plots mean length of age classes based on the interpretation of the user (see the command GROUP for further information).
6. Age table--mean length, length range and mean weight at age.

### General Information about FORTH

The ISYS FORTH system may be entered via two different paths. The first is accessed directly from the Ramfactor Menu. Also menus within GM interface programs allow you to transfer quickly to FORTH.

Prior to attempting graphic output, data files must be stored in at least one of the two possible places--in the auxiliary memory (saved to auxiliary memory in the L-FREQ CONDITION program) or on disk (using the TRANSFER AUX=>DOS program). The two forms of files are Raw Length Frequency files (RLF) and Length/Weight/Age files (LWA). If RLF or LWA files have been saved in auxiliary memory from General Manager and the computer has not been switched off, these files can be accessed rapidly. Alternatively, their equivalents as DOS files can be read from a data disk in Drive 2.

The dip switch settings on your printer are important for graphics; see Appendix D.

FORTH commands (*words*) that produce graphs generally fit into two categories--those that create graphs and those that read data or modify graphs. A current list of FORTH commands that read data and modify graphs, with examples, follows. *All commands are followed by <RETURN> to execute.* Several FORTH commands may be entered on one line before pressing <RETURN>. The commands are read from left to right and acted upon in that order. There must be a space between each command.

## Commands that Use Data Saved in Auxiliary Memory

Auxiliary memory may be thought of as a stack of file folders. The first file saved to auxiliary memory is placed on the top of the stack, the next file is placed below it, *etc.* To transfer a file from auxiliary memory to the main memory of the computer you must first be positioned at that file (*e.g.*, you can't read the bottom file if you're at the top of the stack). Once positioned at the particular file, simply *read* it from auxiliary memory; it is automatically transferred to the main memory of the computer for processing into a graph. The two types of files, RLF and LWA, are stored in different locations in the computer. Therefore, you can read and work with both types of files at the same time. For example, you can start a session by reading in a RLF and a LWA file, produce a histogram with the RLF file and immediately use the LWA file to put ages onto it without having to read it in again. Commands for doing this follow:

**TOP**--the command TOP will bring you to the top or beginning of the auxiliary memory. To see what the name of the file is, you must use the next command, SEE.

**SEE**--lets you view the file heading at your present position in auxiliary memory. Pressing the return key again allows you to view the next file in memory. Once you have viewed all the file headings, the word END will appear. You must type in TOP and SEE commands to view the files again. You may combine the commands on one line <TOP SEE>.

**LWA or RLF**--these commands, in addition to being the acronyms for the two file types, will read or load the current RLF or LWA file you are viewing (from auxiliary memory) into FORTH mode. Simply position yourself at the file you want to read in by using TOP and SEE commands then type either LWA or RLF depending on the type of file and press <RETURN>. RLF and LWA files need to be read in only once while you are working with that particular pair for a species. The two files are stored separately and are only lost when you read in another file of that type.

### Loading Data Stored on a DOS 3.3 Disk

Once you are in FORTH mode, you may easily load RLF and LWA files that have been saved on disk. As with General Manager, the data disk is always placed in Drive 1. Typing CATALOG will show the files you have saved on the disk. To read in a file from the disk, type in the title of that file (*e.g.*, RLF LMB.SHELBY). The first part of the file name (RLF or LWA) not only acts to distinguish the two types of files, but when typed into the computer, it also tells the machine to *read* a file from disk and transfer it to the main memory. Note that LWA files saved on disk are in three forms with the three being distinguished by being postfixed by either an L, M, or an N. The file that you need for graphics is postfixed by an M. The other two letters are used for statistical processing using SPS. Once the file is read in, you are ready to construct graphics. No TOP, SEE, or READ commands are used.

**RLF**--followed by the remainder of the file name loads a Raw Length Frequency file from the disk (*e.g.*, RLF BLG.DAWSON). The space after the prefix, or between any FORTH words is important. Note that this is different from the command to read in files from auxiliary memory. To read in auxiliary memory files, simply type LWA or RLF and nothing else. To read files from disk you need to type LWA or RLF and then the rest of the file name (*e.g.*, RLF BLG.DAWSON).

**LWA**--followed by the remainder of the file name loads a length/weight/age file from disk (*e.g.*, LWA WAE.RENDM, note the postfixed M). These first two commands, unlike others, should not have any other words following them before you press <RETURN> to execute.

## Commands That Modify Graphs or Are Otherwise Useful

**HIGH**--the command **HIGH** preceded by a number adjusts the height of any graph (e.g., <200 HIGH> makes the y-axis extend to 200 units). You must enter numbers as integers (i.e., without decimals).

**WIDE**--the command **WIDE** preceded by a number adjusts the width of any graph. (e.g., 50 WIDE for a length-frequency histogram makes it 50 cm wide). Enter numbers without decimals. You may combine commands **HIGH** and **WIDE** into one statement (e.g., <200 HIGH 50 WIDE>).

**FIGURE**--allows you to enter your own title or label for a histogram, up to the width of the screen. For example: type in **FIGURE** followed by your own text for a histogram. (e.g., <FIGURE 1. LMB in Lake Glendale, fall 1985>). This caption will then be printed out on the printer with the graph.

**PRINT**--sends the current graphics image to the printer. The use of **PRINT** in conjunction with a group name will print an age table (see below).

**ALL**--shows all the current graphics that will be printed, including titles that the computer will assign to each histogram and any other text that you may have entered by using the **FIGURE** command.

**MIX**--allows you to retain graph titles output by the computer, as well as entering your own additional text. For example, once you have created a histogram, type <MIX>, press <RETURN>; type <FIGURE>, followed by any text you wish to enter, and press <RETURN>. Enter the <ALL> command. The screen shows the output title as well as your own text entry just as it would appear when printed. No cursor appears on the screen but you may still obtain a print out by using the **PRINT** command.

**TEXT**--will clear the screen. In this mode, you may change the parameters of your histogram. All graphics commands may be used in the **TEXT** mode.

**QUIT**--exits from **ISYS FORTH**, with options to return to General Manager or turn the computer off.

**AGE**--plots individual age data over respective lengths in either the length-frequency histogram or a condition-factor plot. You must read in an **LWA** file before using the **AGE** command. For example, create a histogram using a **RLF** file, read in an **LWA** file, then use the **AGE** command. The ages will appear at the top of the screen over the length groups. The number shown is the age of the fish and each number represents an individual fish. Therefore, if a column has one 2 and two 3's there is one fish of age 2 and two fish of age 3 in that particular length group.

**GROUP**--allows the user to create length groups of any size (such as those of various age classes) and then plot condition factors with these groups or produce the Age/Mean-Length graph. The command **GROUP** followed by any name that you choose, identifies a length group file. For example, if you create a group name by using the command <GROUP LMB1> you will have a grouping file called **LMB1**. You cannot use the three letter species codes for group names. The program will interpret these as a command to produce condition factors, which is not what you want at this point. To operate **GROUP**:

1. Designate a group name (*e.g.*, GROUP TEST),
2. Read in an RLF file,
3. Type in your title (*e.g.*, <TEST>) and the group screen will appear,
4. Enter the age for grouping to start and minimum and maximum lengths for any group (in mm).

Group files may be used in AGE/ML, WR, and KN. Up to five such files may be constructed and stored. To clear all groups from memory, use the command EMPTY.

TICS--allows you to alter the number of tick marks that have numbers (the default is 5). For example, <2 TICS> <RETURN> will produce cm and inch values on every other tick mark. <1 TICS> <RETURN> will produce values on every tick mark. Changing the scale of subsequent graphs will often require a readjustment using TICS unless the default of 5 is used. TICS does not work on log scales used in the L/WT plot.

BOX--selects specific data points from a L/WT plot. Plot as usual with L/WT. If you determine that at approximately 15 cm and 150 g there is a "bad" data point (outlier), position a box on the screen by entering <10 150 BOX> <RETURN>, which places a box on the screen with the lower left coordinates corresponding to 10 cm and 150 g. Use the arrow keys to move the box until you enclose the point(s) you want to identify. Press <P> (not followed by a <RETURN>) and the exact values corresponding to the point(s) are printed on the screen. If more than one length-weight value corresponds to the point, they will be printed out. Without pressing <RETURN>, you can move the box with the arrow keys to identify other outliers, followed by <P>. To exit, press <RETURN>.

If you want to print the data on the printer, before entering the BOX command, enter <1 PR#> <RETURN>. Keyboard input and text output will be sent to the printer. Redirect output to the monitor by entering <0 PR#> <RETURN>.

*This process does not alter any data*, either in the auxiliary memory or in an internal FORTH file. Rather it identifies outliers precisely so that you can use BROWSE/UPDATE and search for the actual values in Screen 8; then values may be corrected or deleted.

## Creating Graphs

L/WT--produces the length-weight regression plot. To produce this plot:

1. Read in an LWA file,
2. Type <L/WT>.

This allows you to identify *outliers* (data points that may be erroneous); they can be later erased or corrected in the General Manager data base. If data appears to be missing from this graph be sure to check the width and height values because they may not be appropriately set for the data you are analyzing.

HISTO--produces the length-frequency histogram. This graph is constructed from an RLF file saved in auxiliary memory or on a disk. To obtain a histogram:

1. Read in an RLF file,
2. Type the command <HISTO>.

Ages may also be plotted above their corresponding centimeter groups. To do this, follow the instructions above under AGE. Histograms are plotted by centimeter groups with the default



being groups of 1 cm. You may also plot histograms in groups of up to 5 cm by using the following commands.

ONE HISTO--plots a length-frequency histogram from the current data file (which should be an RLF file) in 1-cm intervals. One-cm groups is the default but using ONE HISTO would be necessary to return to 1-cm groups after setting groups to different sizes.

TWO HISTO--same as previous command, but in 2-cm intervals.

THREE HISTO--same as previous command, but in 3-cm intervals.

FOUR HISTO--same as above, but in 4-cm intervals.

FIVE HISTO--same as above, but in 5-cm groups.

WR--Relative Weight Histogram. To construct a relative weight histogram:

1. Read in an LWA file,
2. Enter your species code followed by the command WR (*e.g.*, <LMB WR>). This tells the computer to find the WR parameters for species LMB, calculate the relative weight values, and show the resulting graph.

The mean WR value is shown by the horizontal line above the centimeter group and the 95% confidence is given by the vertical dots. You may also use any of the grouping commands for producing WR graphs (*i.e.*, THREE LMB WR). To use the GROUP command, simply run through the grouping procedure or recall previously defined groups (by typing its group name) before producing the WR graph. To use the ONE, TWO, ..., FIVE commands, simply type the word before you enter WR (*e.g.*, <THREE LMB WR>).

Ages may also be printed on the graph by using the AGE command listed above.

KN--LeCren's condition factor may be used in a similar manner to WR above.

AGE/L--Individual Length at Age Graph. To construct a graph:

1. Read in an LWA file,
2. Use the command AGE/L.

AGE/ML--Mean Length at Age. To construct this graph:

1. Follow instructions under the GROUP command,
2. Read in an RLF file,
3. Then use the command AGE/ML.

To construct an age table:

1. Read in RLF and LWA files,
2. Follow procedures under GROUP,
3. Print age table by typing PRINT and the group name (*e.g.*, <PRINT TEST>).
4. The *a* and *b* parameters for converting length to weight are shown followed by the request ENTER TABLE/LAKE/SEASON/SPECIES, to which you might respond <9/SHELBYVILLE/FALL/BLUEGILL>.
5. The table is output directly to the printer.

After completing graphics operations if you are returning to normal printing operations (such as tabular output), you should switch the printer off and back on to clear its memory of special commands used in graphics.

## Appendix A. Back ups and Organization of Data Disks

You should *always* back up your data after finishing a data entry session. We do not recommend entering data into Ramfactor. However, Ramfactor is used to assist in making back ups. Every 3.5-in. data disk should have a back-up on another disk.

Press **1.** from the Ramfactor menu to run GM DISK UTILITIES. Select **4.** to copy 3.5-in. disk data to the Ramfactor. Then select **5.** to copy Ramfactor to the 3.5-in. back-up disk. If the disk is not formatted it will be. There is an option to write or change an internal identifier (such as lake, year, and last date that data was entered) from option **2.** This will be displayed every time a 3.5-in. data disk is accessed by GM DISK UTILITIES. There is also an option, **8.,** to format single 5.25-in. disks for small data sets which is more convenient than the original method described in Appendix G. Option **9.** is for selecting different types of GM data bases. You need not be concerned with this option.

Make a habit of backing up your data before terminating each session. Remember to clearly label all disks, and write *back-up* to distinguish those copies from *originals*. Store disks away from sources of electromagnetic waves, such as the monitor or disk drives. Not following this advice causes heartbreaks sooner or later.

**Appendix B. Data Sheets**

**STATION AND SAMPLE DATA**

Body of Water \_\_\_\_\_ County \_\_\_\_\_ Station # \_\_\_\_\_ Date \_\_\_\_\_ Time of Records\* \_\_\_\_\_ Air Temp. \_\_\_\_\_ of Page \_\_\_\_\_

|                 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| Depth (ft)      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Water Temp. (C) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Oxygen (ppm)    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| pH              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Total Alc. \_\_\_\_\_ Conductivity \_\_\_\_\_ Secchi (ft) \_\_\_\_\_ Water level, +/- spillway level in ft. \_\_\_\_\_ Boatman name \_\_\_\_\_ Front Dipper name \_\_\_\_\_

| Sample Code † | Date Fished Mo/Day | Time* |     | % of zone fished | % time/max. TL for: |    |      |    |      |    |      |    | Weed Cover (%) | Comments (unusual conditions affecting sample) |
|---------------|--------------------|-------|-----|------------------|---------------------|----|------|----|------|----|------|----|----------------|--|
|               |                    | Begin | End |                  | SHD                 |    | % TL |    | % TL |    | % TL |    |                |  |
|               |                    |       |     |                  | %                   | TL | %    | TL | %    | TL | %    | TL |                |  |
|               |                    |       |     |                  |                     |    |      |    |      |    |      |    |                |  |
|               |                    |       |     |                  |                     |    |      |    |      |    |      |    |                |  |
|               |                    |       |     |                  |                     |    |      |    |      |    |      |    |                |  |
|               |                    |       |     |                  |                     |    |      |    |      |    |      |    |                |  |
|               |                    |       |     |                  |                     |    |      |    |      |    |      |    |                |  |
|               |                    |       |     |                  |                     |    |      |    |      |    |      |    |                |  |
|               |                    |       |     |                  |                     |    |      |    |      |    |      |    |                |  |
|               |                    |       |     |                  |                     |    |      |    |      |    |      |    |                |  |
|               |                    |       |     |                  |                     |    |      |    |      |    |      |    |                |  |
|               |                    |       |     |                  |                     |    |      |    |      |    |      |    |                |  |
|               |                    |       |     |                  |                     |    |      |    |      |    |      |    |                |  |
|               |                    |       |     |                  |                     |    |      |    |      |    |      |    |                |  |
|               |                    |       |     |                  |                     |    |      |    |      |    |      |    |                |  |
|               |                    |       |     |                  |                     |    |      |    |      |    |      |    |                |  |
|               |                    |       |     |                  |                     |    |      |    |      |    |      |    |                |  |
|               |                    |       |     |                  |                     |    |      |    |      |    |      |    |                |  |
|               |                    |       |     |                  |                     |    |      |    |      |    |      |    |                |  |
|               |                    |       |     |                  |                     |    |      |    |      |    |      |    |                |  |
|               |                    |       |     |                  |                     |    |      |    |      |    |      |    |                |  |
|               |                    |       |     |                  |                     |    |      |    |      |    |      |    |                |  |
|               |                    |       |     |                  |                     |    |      |    |      |    |      |    |                |  |
|               |                    |       |     |                  |                     |    |      |    |      |    |      |    |                |  |
|               |                    |       |     |                  |                     |    |      |    |      |    |      |    |                |  |

† refers to specific area sampled by a particular gear; must correspond to the Sample Code in Screen 3 in the data base.

\* 24h clock

**LENGTH FREQUENCY—LENGTH/WEIGHT DATA**

Body of Water \_\_\_\_\_ Date \_\_\_\_\_ Station \_\_\_\_\_ Sample Code \_\_\_\_\_ Gear \_\_\_\_\_ of Page \_\_\_\_\_

LENGTH FREQUENCY BY CM (fill in 10's of cm) Species: \_\_\_\_\_

|    |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |    |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|----|--|--|--|--|--|--|--|--|--|--|----|--|--|--|--|--|--|--|--|--|----|----|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| 00 |  |  |  |  |  |  |  |  |  |  | 00 |  |  |  |  |  |  |  |  |  | 00 |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10 |  |  |  |  |  |  |  |  |  |  | 10 |  |  |  |  |  |  |  |  |  |    | 10 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 20 |  |  |  |  |  |  |  |  |  |  | 20 |  |  |  |  |  |  |  |  |  |    | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  |  |  |  |  | 30 |  |  |  |  |  |  |  |  |  |    | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 40 |  |  |  |  |  |  |  |  |  |  | 40 |  |  |  |  |  |  |  |  |  |    | 40 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 50 |  |  |  |  |  |  |  |  |  |  | 50 |  |  |  |  |  |  |  |  |  |    | 50 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  | 60 |  |  |  |  |  |  |  |  |  |    | 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 70 |  |  |  |  |  |  |  |  |  |  | 70 |  |  |  |  |  |  |  |  |  |    | 70 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 80 |  |  |  |  |  |  |  |  |  |  | 80 |  |  |  |  |  |  |  |  |  |    | 80 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 90 |  |  |  |  |  |  |  |  |  |  | 90 |  |  |  |  |  |  |  |  |  |    | 90 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 00 |  |  |  |  |  |  |  |  |  |  | 00 |  |  |  |  |  |  |  |  |  |    | 00 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10 |  |  |  |  |  |  |  |  |  |  | 10 |  |  |  |  |  |  |  |  |  |    | 10 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 20 |  |  |  |  |  |  |  |  |  |  | 20 |  |  |  |  |  |  |  |  |  |    | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  |  |  |  |  | 30 |  |  |  |  |  |  |  |  |  |    | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 40 |  |  |  |  |  |  |  |  |  |  | 40 |  |  |  |  |  |  |  |  |  |    | 40 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 50 |  |  |  |  |  |  |  |  |  |  | 50 |  |  |  |  |  |  |  |  |  |    | 50 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  | 60 |  |  |  |  |  |  |  |  |  |    | 60 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 70 |  |  |  |  |  |  |  |  |  |  | 70 |  |  |  |  |  |  |  |  |  |    | 70 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 80 |  |  |  |  |  |  |  |  |  |  | 80 |  |  |  |  |  |  |  |  |  |    | 80 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 90 |  |  |  |  |  |  |  |  |  |  | 90 |  |  |  |  |  |  |  |  |  |    | 90 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

**LENGTH BY WEIGHT DATA (Hash all lengths above before entering here)**

| TL (mm) | Wt (g) | Age Code | TL (mm) | Wt (g) | Age Code | TL (mm) | Wt (g) | Age Code | TL (mm) | Wt (g) | Age Code |
|---------|--------|----------|---------|--------|----------|---------|--------|----------|---------|--------|----------|
|         |        |          |         |        |          |         |        |          |         |        |          |
|         |        |          |         |        |          |         |        |          |         |        |          |
|         |        |          |         |        |          |         |        |          |         |        |          |
|         |        |          |         |        |          |         |        |          |         |        |          |
|         |        |          |         |        |          |         |        |          |         |        |          |
|         |        |          |         |        |          |         |        |          |         |        |          |
|         |        |          |         |        |          |         |        |          |         |        |          |
|         |        |          |         |        |          |         |        |          |         |        |          |
|         |        |          |         |        |          |         |        |          |         |        |          |
|         |        |          |         |        |          |         |        |          |         |        |          |
|         |        |          |         |        |          |         |        |          |         |        |          |
|         |        |          |         |        |          |         |        |          |         |        |          |
|         |        |          |         |        |          |         |        |          |         |        |          |
|         |        |          |         |        |          |         |        |          |         |        |          |
|         |        |          |         |        |          |         |        |          |         |        |          |
|         |        |          |         |        |          |         |        |          |         |        |          |
|         |        |          |         |        |          |         |        |          |         |        |          |
|         |        |          |         |        |          |         |        |          |         |        |          |
|         |        |          |         |        |          |         |        |          |         |        |          |
|         |        |          |         |        |          |         |        |          |         |        |          |

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## Appendix C. Reorganizing Data Bases (using 5.35-in. drives with original Apple //e system)

Sometimes, you may have corrected a number of errors that fill up the disk with excessive *dead records*. Selecting DATA BASE STATISTICS from the UTILITIES menu will tell you how many and how full the disk is (effective capacity is about 135,000 bytes).

Dead records slow operations and increase the likelihood of having to put the data base on more than one disk. *Reorganizing* is needed (p. 107-109, General Manager manual). This procedure rewrites the data base onto a new disk with another volume number. The following describes how to return the same volume number (generally volume 1) to avoid confusion by having to change the Blank-forms starting volume number for those disks.

1. Select REORGANIZE DATA BASE from the Data Base Utility Menu (not the Master Menu as misprinted on p. 107 of the General Manager manual).
2. Accept blank-forms DOC9 and default starting volume 1, and select RUN (no criteria are being selected).
3. Follow Steps 8 to 10 on p. 108 in the General Manager manual, accepting all defaults.
4. Insert a new (= scratch) disk in Drive 1, on which the reorganized data base will be written as volume 2; follow steps 11 to 13, using <F> to format if it is not already volume 2. REORGANIZE can take a long time. When complete, return working program disk to Drive 1 and press <RETURN> once.
5. Do not press <RETURN> to update the starting volume on the blank-forms (when you are prompted to UPDATE STARTVOL). Instead, quit by pressing <C> to avoid this.
6. Select BACKUP/RESTORE DATA BASE from UTILITIES.
7. You must now copy the reorganized data base on your scratch disk (volume 2) to another disk as volume 1. You might as well use the original data disk (volume 1) to avoid relabelling. Since it is already in Drive 2, leave it there; but remember to define the scratch disk (volume 2) as the *original*, which you must put into Drive 1 when prompted. Therefore, *do not accept the default values* for Drive and Volume for *original* and *duplicate* disks. This procedure is opposite of the normal back-up routine in Appendix A.
8. Your reorganized data base is now on the original disk as volume 1. You can keep your scratch disk as volume 2 for future REORGANIZE's.
9. Using Appendix A instructions, back up your reorganized volume 1 data base onto your original back-up disk.

## Appendix D. Formulae for Indices

1. Proportional Stock Density(PSD) is calculated following Anderson (1976):

$$\text{PSD} = (\text{number of quality size fish}/\text{number of stock size fish}) \times 100$$

Both quality and stock size are defined by Anderson and incorporated into the program. The user has the option of changing any value.

2. Young to Adult Ratio (YAR) is also following Anderson (1976):

$$\text{YAR} = \text{number of young-of-the-year}/\text{number of adults}$$

Sizes for young-of-the-year have been defined and adult size is considered to be the same as quality size.

3. Relative Stock Density (RSD) is defined by Anderson (1976) as:

$$\text{RSD} = (\text{quantity of fish in size category}/\text{number of stock size fish}) \times 100$$

4. Relative Weight ( $W_r$ ) was proposed by Wege and Anderson (1978) as an alternative to traditional condition indices.

$$W_r = (W \times 100)/W_s$$

where  $W$  = weight of fish,  $W_s$  = standard weight, and  $W_r$  = relative weight. Standard weight  $a$  and  $b$  coefficients are incorporated into the program (from Anderson 1980). The user, however, can change these values.

5. LeCren's (1951) Condition Factor ( $K_n$ ) is:

$$K_n = \text{weight of fish}/\text{standard weight}$$

Standard weight for  $W_r$  and  $K_n$  are both estimated from parameters  $a$  and  $b$  from the allometric equation:  $\log(W) = \log(a) + b \cdot \log(L)$ , where  $W$  is in grams and  $L$  in millimeters. Therefore, the only difference between  $W_r$  and  $K_n$ , apart from one being multiplied by 100, is due to chosen values of  $a$  and  $b$ . Parameters for  $K_n$  are provisional until we assemble your data and obtain statewide averages for non-stunted populations. When we have done this,  $K_n$  will be more relevant to fish populations in the state and will include more species.

## Appendix E. Dip Switch Settings (For C.Itoh Printers and Graphicard Interfaces)

These settings are critical for the double-hires graphics output from Forth and are consistent for any C.Itoh 8510 series parallel printer.

|     | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----|---|---|---|---|---|---|---|---|
| SW1 | O | C | O | C | C | C | C | O |
| SW2 | O | O | O | O | O | C | O | O |

O = Open, C = Closed

After printing graphics the printer should be switched off and on again to clear it of internal instructions before printing tables or other material.

Graphicard switch settings when connected to C. Itoh Prowriter:

| 1   | 2  | 3  | 4  | 5 | 6 |
|-----|----|----|----|---|---|
| OFF | ON | ON | ON | * | * |

\*these switches not important



## Appendix F. Parameters for Stock Indices and Condition

Stock size, quality size, and parameters for standard weight for  $W_r$  and LeCren coefficient of condition ( $Kn$ ) (found in file CONDITION).  $a$  and  $b$  are parameters in the length-weight relation:  $\log(W) = \log(a) + b \cdot \log(L)$ , where  $W$  is in grams and  $L$  in millimeters. The  $Kn$  parameters were taken from Carlander (1977). Updated parameters from Illinois impoundments are derived in Chapter 2 of Aquatic Biology Technical Report 87/14.

| Species code | Stock size |    | Quality size |    | Relative weight |       | LeCren's KN |       |
|--------------|------------|----|--------------|----|-----------------|-------|-------------|-------|
|              | cm         | in | cm           | in | $a$             | $b$   | $a$         | $b$   |
| LMB          | 20         | 8  | 30           | 12 | 4.831E-6        | 3.191 | 8.241E-6    | 3.103 |
| SMB          | 18         | 7  | 28           | 1  | 1.039E-5        | 3.055 | -           | -     |
| BLG          | 8          | 3  | 15           | 6  | 4.227E-6        | 3.316 | 5.176E-6    | 3.219 |
| GSF          | -          | -  | -            | -  | -               | -     | 5.248E-6    | 3.219 |
| WHC          | 13         | 5  | 20           | 8  | 7.907E-6        | 3.112 | 5.395E-6    | 3.194 |
| BLC          | 13         | 5  | 20           | 8  | 1.219E-5        | 3.052 | 9.204E-6    | 3.096 |
| RSF          | 13         | 5  | 18           | 7  | -               | -     | 4.742E-6    | 3.258 |
| WAE          | 25         | 10 | 38           | 15 | -               | -     | -           | -     |
| YEP          | 13         | 5  | 20           | 8  | -               | -     | -           | -     |
| WHB          | 15         | 6  | 23           | 9  | -               | -     | -           | -     |
| YLB          | 13         | 5  | 20           | 8  | -               | -     | -           | -     |
| CAP          | 28         | 11 | 41           | 16 | -               | -     | -           | -     |
| GZS          | 18         | 7  | 28           | 11 | 4.207E-6        | 3.170 | 8.128E-6    | 3.034 |
| CCF          | 28         | 11 | 41           | 16 | 2.244E-6        | 3.243 | 4.121E-6    | 3.407 |
| FCF          | 28         | 11 | 41           | 16 | -               | -     | -           | -     |
| BLB          | 13         | 5  | 20           | 8  | -               | -     | 3.600E-6    | 3.130 |
| YEB          | 13         | 5  | 20           | 8  | -               | -     | -           | -     |
| FRD          | 20         | 8  | 30           | 12 | -               | -     | -           | -     |

## Appendix G. Procedures with Minimum Apple //e Hardware (only recommended for small data sets occupying two 140k floppy disks or less)

### Materials Required

Apple //e Computer with monochrome monitor and 2 140K floppy disk drives plus C.Itoh Prowriter (8510 series) printer and Graphicard (or Grappler+) interface  
General Manager™ master diskette (PC Manager, Inc., 64 E. Ashley Ave., P.O. Box 567, Driggs, ID 83422-0567)  
DATA ENTRY:DOC9 diskette (Working Program/BLANK-FORMS.DOC9)  
TABULAR OUTPUT diskettes (Working Program/BLANK-FORMS.DOC9)  
ISYS FORTH™ graphics program (Illyes Systems, P.O. Box 2516, Station A, Champaign, IL 61820; 217/359-6039)  
Diversi-DOS™ Pre-boot (optional) (DSR, Inc., 34880 Bunker Hill, Farmington, MI 48018-2728)

### Start Up

1. Put pre-boot (Diversi-DOS) disk in Drive 1 (left hand drive or lower drive) and close lid on drive.
2. Switch on power to all units using the single switch on the System Saver. This is called *booting* a program, which is *loaded* into the computer's memory from part of the diskette. The red light indicates that the disk drive is being used. Whenever a red light is on, disks should not be inserted or removed, keys should not be pressed, or the power turned off.
3. Replace pre-boot disk with General Manager master diskette in Drive 1 and select <G> (< and > enclose keys to press). Make sure the CAPS LOCK key is depressed as only a capital "G" will work.
4. The question on the monitor DO YOU WANT 40 COL? (Y/N) is followed by an inverse Y, or *default*. If you want a 40-column display, press <RETURN>. The 40-column display is recommended for easier reading and error checking. After pressing <RETURN>, the Data Base Master Menu will appear.
5. Remove the General Manager master diskette and return it to its protective sleeve. (*Please* read Appendix F, p.157 in the General Manager Manual, for diskette care). The master is not needed as long as General Manager is being used and you don't turn the computer off.

### Formatting data disks

Before entering data the first time, you must *format* your data disk, as explained in steps 1 and 2 below. Do not format a data disk which has data on it unless you want to erase that data.

1. Put your DATA ENTRY.DOC9 diskette in Drive 1 and your blank disk for a new data base in Drive 2. Movement between screen options requires using the arrow keys ( $\neq \emptyset$  "Æ) on the lower right of your keyboard.
2. Select ACCESS DATA BASE from the Master Menu using the arrow keys and then press <RETURN>. The computer will prompt you to press <RETURN> again to continue. The Blank Forms Catalog Selection Menu will then appear on the screen with three options. For now, select DOC9 BLANK FORMS.

If this is your first time performing this step, an error message will appear because the data disk was not yet formatted. Exit by pressing <CTRL-Q> (press the key labelled CONTROL and Q simultaneously) or the "open apple" key to the left of the space bar (<⌘>). The next question regarding volume number can be ignored by answering with another <CTRL-Q>. You will then be returned to the Master Menu. This step of accessing the data base before you actually have one is necessary because of a bug in General Manager. It can be skipped for future data disk formatting if you already have accessed the data base during the work session. Select UTILITIES on the Master Menu (use arrow keys, then press <RETURN>). Select FORMAT DATA DISK on the Utilities Menu. General Manager now needs to know which blank forms you are using, in this case DOC9.

Continue by following the instructions on the monitor and accepting volume 1 by pressing <RETURN>. You are then given a warning that the disk in Slot 6, Drive 2 will be erased. Make sure that the disk in Drive 2 is the proper one to be formatted and press <RETURN>. Drive 2 will then 'whirr' and 'tick' as it formats the disk. Follow instructions to return to the Master Menu; then select ACCESS DATA BASE. Respond to the query if DOC9 is wanted with a <RETURN>.

The volume numbers that you were just asked about are used by General Manager to order disks in the data base. The first disk is always given volume number 1. If the data base extends to a second disk, it would be formatted as volume 2, *etc.* We do not recommend that you use more than one 5.25-in disk (1 140k volume) for a data base. Therefore this would be appropriate for only a few, small lakes, or when you are starting up on a new lake. For most lakes, the data should be copied onto a 3.5-in. disk (see main text).

## Back ups and Organization of 5.25-in. Data Disks

You should *always* back up your data after finishing a data entry session. Select UTILITIES from the Master Menu, then select BACKUP/RESTORE DATA BASE from the Utilities Menu. Follow instructions from the monitor and from Chapter 13 (p. 105-106) in the General Manager manual if necessary. Don't anticipate the instructions by putting your back-up disk in Drive 1 until it actually asks you to insert it. You do not need to format a data disk prior to this operation, just press <F> instead of <RETURN> for a new disk. Subsequent "back ups" on the same disk do not require reformatting every time and are very fast.

For ease of organization of your disks, we recommend using the reverse side of a data disk for storage of other data. This can be done by using an appropriate clipper<sup>1</sup> to *clip out* a *write protect notch* on the left edge of the disk. You can then store data on both sides of the diskette. Each data

---

<sup>1</sup>By *clipper* we mean a 0.25-in. diameter hole puncher obtainable from most stationers. It is used to clip a semicircle in the disk holder at the same distance from the top as the existing one, so that you can use the other side of the disk by turning it over before inserting it in the drive.

disk must have a back-up copy on a separate data disk. However, if a data-base pertaining to a single trip exceeds the capacity of one disk, you must use a separate disk for the continuation of volume 2 (you cannot use the reverse side of volume 1). The program instructs you in this procedure. Therefore, you could store your original data on side A of a disk and put a copy of data from some other lake on the reverse side of that disk.

Remember to clearly label all disks, and write *back-up* to distinguish those copies from *originals*. Also refer to the Disk Use and Care Checklist in Appendix F of the General Manager manual. Not following this advice causes heartbreaks sooner or later.

If you wish to continue using the computer after backing up data, you need to re-boot the General Manager Master Disk or another program you are using. As with formatting new disks described above, a General Manager bug prevents you from backing up data just after switching on; you need to go to Data Base Access Menu first. Therefore, make a habit of backing up your data before terminating each session.

**Appendix H. Species and hybrid codes allowed for FAS data bases  
(originally compiled by Gary Lutterbie, additions by INHS  
staff)**

| FAS CODE | COMMON NAME            |
|----------|------------------------|
| ABL      | AMERICAN BROOK LAMPREY |
| ALE      | ALEWIFE                |
| ALG      | ALLIGATOR GAR          |
| ALS      | ALABAMA SHAD           |
| AME      | AMERICAN EEL           |
|          |                        |
| BAD      | BANDED DARTER          |
| BAK      | BANDED KILLIFISH       |
| BAM      | BRASSY MINNOW          |
| BAS      | BANDED SCULPIN         |
| BBD      | BLUEBREAST DARTER      |
| BCF      | BLUE CATFISH           |
| BCS      | BLACKCHIN SHINER       |
| BGB      | BIGMOUTH BUFFALO       |
| BGC      | BIGEYE CHUB            |
| BGS      | BIGEYE SHINER          |
| BHC      | BIGHEAD CARP           |
| BHS      | BLUEHEAD SHINER        |
| BKB      | BLACK BUFFALO          |
| BKC      | BLACKFIN CISCO         |
| BKD      | BLACKNOSE DACE         |
| BKS      | BROOK STICKLEBACK      |
| BKT      | BROOK TROUT            |
| BLB      | BLACK BULLHEAD         |
| BLC      | BLACK CRAPPIE          |
| BLD      | BLACKSIDE DARTER       |
| BLG      | BLUEGILL               |
| BLO      | BLOATER                |
| BLR      | BLACK REDHORSE         |
| BLS      | BLUNTNOSE MINNOW       |
| BLT      | BLACKSTRIPE TOPMINNOW  |
| BMS      | BIGMOUTH SHINER        |
| BNS      | BLACKNOSE SHINER       |
| BOW      | BOWFIN                 |
| BPS      | BANDED PYGMY SUNFISH   |
| BRB      | BROWN BULLHEAD         |
| BRM      | BRINDLED MADTOM        |
| BRS      | BROOK SILVERSIDE       |
| BRT      | BROWN TROUT            |
| BSF      | BANTAM SUNFISH         |
| BST      | BLACKSPOTTED TOPMINNOW |
| BTS      | BLACKTAIL SHINER       |
| BUB      | BURBOT                 |
| BUD      | BLUNTNOSE DARTER       |
| BUM      | BULLHEAD MINNOW        |
| BUS      | BLUE SUCKER            |

| FAS CODE | COMMON NAME         |
|----------|---------------------|
| CAP      | CARP                |
| CCF      | CHANNEL CATFISH     |
| CCS      | CREEK CHUBSUCKER    |
| CEM      | CENTRAL MUDMINNOW   |
| CHL      | CHESTNUT LAMPREY    |
| CHO      | COHO SALMON         |
| CMS      | COMMON SHINER       |
| COS      | CENTRAL STONEROLLER |
| CRC      | CREEK CHUB          |
| CRD      | CRYSTAL DARTER      |
| CSC      | CISCO               |
| CYD      | CYPRESS DARTER      |
| CYM      | CYPRESS MINNOW      |
| DUD      | DUSKY DARTER        |
| EMS      | EMERALD SHINER      |
| ESD      | EASTERN SAND DARTER |
| FAD      | FANTAIL DARTER      |
| FCF      | FLATHEAD CATFISH    |
| FCS      | FALL CHINOOK SALMON |
| FHM      | FATHEAD MINNOW      |
| FLC      | FLATHEAD CHUB       |
| FLR      | FLIER               |
| FOS      | FOURHORN SCULPIN    |
| FRD      | FRESHWATER DRUM     |
| FRM      | FRECKLED MADTOM     |
| GHS      | GHOST SHINER        |
| GLD      | GILT DARTER         |
| GOF      | GOLDFISH            |
| GOL      | GOLDEYE             |
| GOR      | GOLDEN REDHORSE     |
| GOS      | GOLDEN SHINER       |
| GRC      | GRASS CARP          |
| GRD      | GREENSIDE DARTER    |
| GRP      | GRASS PICKEREL      |
| GRR      | GREATER REDHORSE    |
| GSF      | GREEN SUNFISH       |
| GVC      | GRAVEL CHUB         |
| GZS      | GIZZARD SHAD        |
| HAD      | HARLEQUIN DARTER    |
| HFC      | HIGHFIN CARPSUCKER  |
| HOC      | HORNYHEAD CHUB      |
| INS      | INLAND SILVERSIDES  |
| JOD      | JOHNNY DARTER       |
| LAC      | LAKE CHUB           |
| LAS      | LAKE STURGEON       |

| FAS CODE | COMMON NAME            |
|----------|------------------------|
| LAT      | LAKE TROUT             |
| LAW      | LAKE WHITEFISH         |
| LBL      | LEAST BROOK LAMPREY    |
| LCS      | LAKE CHUBSUCKER        |
| LED      | LEAST DARTER           |
| LGD      | LONGNOSE DACE          |
| LMB      | LARGEMOUTH BASS        |
| LNS      | LONGNOSE SUCKER        |
| LOG      | LONGNOSE GAR           |
| LOP      | LOGPERCH               |
| LOS      | LONGEAR SUNFISH        |
| LSS      | LARGESCALE STONEROLLER |
| MMS      | MIMIC SHINER           |
| MOF      | MOSQUITOFISH           |
| MOM      | MOUNTAIN MADTOM        |
| MOO      | MOONEYE                |
| MSS      | MISSISSIPPI SILVERSIDE |
| MTS      | MOTTLED SCULPIN        |
| MUD      | MUD DARTER             |
| MUE      | MUSKELLUNGE            |
| NBL      | NORTHERN BROOK LAMPREY |
| NHS      | NORTHERN HOG SUCKER    |
| NOM      | NORTHERN MADTOM        |
| NOP      | NORTHERN PIKE          |
| NOS      | NORTHERN STUDFISH      |
| NSS      | NINESPINE STICKLEBACK  |
| ORD      | ORANGETHROAT DARTER    |
| ORS      | ORANGESPOTTED SUNFISH  |
| OWD      | IOWA DARTER            |
| OZM      | OZARK MINNOW           |
| PAH      | PADDLEFISH             |
| PAS      | PALLID STURGEON        |
| PLM      | PLAINS MINNOW          |
| PLS      | PALLID SHINER          |
| PRP      | PIRATE PERCH           |
| PUD      | PUMPKINSEED            |
| PUM      | PUGNOSE MINNOW         |
| PUS      | PUGNOSE SHINER         |
| RAD      | RAINBOW DARTER         |
| RAS      | RAINBOW SMELT          |
| RBS      | RIBBON SHINER          |
| RBT      | RAINBOW TROUT          |
| RCS      | IRONCOLOR SHINER       |
| RDS      | REDFIN SHINER          |
| RES      | RED SHINER             |
| ROB      | ROCK BASS              |
| ROS      | ROSEFIN SHINER         |

| FAS CODE | COMMON NAME            |
|----------|------------------------|
| ROW      | ROUND WHITEFISH        |
| RRC      | RIVER CHUB             |
| RSF      | REDEAR SUNFISH         |
| RUD      | RUDD                   |
| RVC      | RIVER CARPSUCKER       |
| RVD      | RIVER DARTER           |
| RVR      | RIVER REDHORSE         |
| RVS      | RIVER SHINER           |
| RYS      | ROSYFACE SHINER        |
|          |                        |
| SAB      | SMALLMOUTH BUFFALO     |
| SAR      | SAUGER                 |
| SAS      | SAND SHINER            |
| SCS      | SPRING CHINOOK SALMON  |
| SDS      | SPOTTED SUCKER         |
| SEL      | SEA LAMPREY            |
| SES      | STEELCOLOR SHINER      |
| SFS      | SPOTFIN SHINER         |
| SGC      | STURGEON CHUB          |
| SGD      | STARGAZER DARTER       |
| SHD      | SLENDERHEAD DARTER     |
| SHG      | SHORTNOSE GAR          |
| SHR      | SHORTHEAD REDHORSE     |
| SHS      | SHOVELNOSE STURGEON    |
| SHT      | STARHEAD TOPMINNOW     |
| SJM      | SILVERJAW MINNOW       |
| SKC      | SICKLEFIN CHUB         |
| SKH      | SKIPJACK HERRING       |
| SLD      | SLOUGH DARTER          |
| SLM      | SLENDER MADTOM         |
| SLS      | SLIMY SCULPIN          |
| SMB      | SMALLMOUTH BASS        |
| SNC      | SPRING CAVEFISH        |
| SOS      | SPOONHEAD SCULPIN      |
| SPB      | SPOTTED BASS           |
| SPC      | SPECKLED CHUB          |
| SPD      | SPOTTAIL DARTER        |
| SPG      | SPOTTED GAR            |
| SPS      | SPOTTAIL SHINER        |
| SRD      | SOUTHERN REDBELLY DACE |
| SSF      | SPOTTED SUNFISH        |
| STB      | STRIPED BASS           |
| STC      | STONECAT               |
| STD      | STRIPETAILED DARTER    |
| STS      | STRIPED SHINER         |
| SUM      | SUCKERMOUTH MINNOW     |
| SVC      | SILVER CHUB            |
| SVL      | SILVER LAMPREY         |
| SVM      | SILVERY MINNOW         |
| SVR      | SILVER REDHORSE        |
| SVS      | SILVERBAND SHINER      |



| FAS CODE | COMMON NAME            |
|----------|------------------------|
| TGC      | TRIPLOID GRASS CARP    |
| TGM      | TIGER MUSKIE           |
| THS      | THREADFIN SHAD         |
| TPM      | TADPOLE MADTOM         |
| TRP      | TROUT-PERCH            |
| ULL      | QUILLBACK              |
| WAE      | WALLEYE                |
| WAM      | WARMOUTH               |
| WCF      | WHITE CATFISH          |
| WES      | WEED SHINER            |
| WHB      | WHITE BASS             |
| WHC      | WHITE CRAPPIE          |
| WHS      | WHITE SUCKER           |
| WSD      | WESTERN SAND DARTER    |
| WSM      | WESTERN SILVERY MINNOW |
| YEB      | YELLOW BULLHEAD        |
| YEP      | YELLOW PERCH           |
| YLB      | YELLOW BASS            |

#### HYBRID SPECIES CODES:

##### Sunfish hybrids:

|     |                                  |
|-----|----------------------------------|
| BGH | BLUEGILL X GREEN SUNFISH         |
| BOH | BLUEGILL x ORANGESPOTTED SUNFISH |
| BRH | BLUEGILL X REDEAR SUNFISH        |
| BWH | BLACK X WHITE CRAPPIE            |
| GWH | GREEN SUNFISH X WARMOUTH         |
| LBH | LONGEAR SUNFISH X BLUEGILL       |
| LGH | LONGEAR SUNFISH x GREEN SUNFISH  |
| MMH | LARGEMOUTH X SMALLMOUTH BASS     |
| PBH | PUMPKINSEED x BLUEGILL           |
| PGH | PUMPKINSEED X GREEN SUNFISH      |
| RGH | REDEAR SUNFISH X GREEN SUNFISH   |
| RLH | REDEAR SUNFISH X LONGEAR SUNFISH |
| RWH | REDEAR SUNFISH X WARMOUTH        |
| SFH | HYBRID SUNFISH SP.               |
| WBH | WARMOUTH X BLUEGILL              |

Other species hybrids:

|     |                                  |
|-----|----------------------------------|
| BSH | BLACKSIDE X SLENDERHEAD DARTER   |
| CGH | CARP X GOLDFISH                  |
| GBH | GRASS X BIGHEAD CARP             |
| HSH | HORNEYHEAD CHUB X STRIPED SHINER |
| RSH | RED SHINER X SPOTFIN SHINER      |
| RUH | REDFIN SHINER X NOTROPIS SP.     |
| SBH | HYBRID STRIPED BASS              |
| WSH | SAUGEYE (WALLEYE X SAUGER)       |

## Appendix I. Group Codes

(1) Group codes allowed in DOC9 Screen 6 for subsampling:

|     |  |
|-----|--|
| CRP | CRAPPIE SPP.                             |
| MIN | ALL MINNOW SPP. EXCEPT CARP              |
| SHA | SHAD SPP.                                |
| SUN | ALL SUNFISH SPP. EXCEPT BASS AND CRAPPIE |

(2) Group codes allowed in CREEL Screen 7 for Species Sought:

|     |  |
|-----|--|
| BSS | BLACK BASS SPP. (includes LMB, SMB, SPB and MMH)                         |
| CAT | CATFISH SPP. EXCEPT BULLHEADS  |
| CRP | CRAPPIE SPP.   |
| MOR | STRIPED BASS (includes SBH, STB, WHB and YLB)                            |
| MUS | TIGER MUSKIE/MUSKELLUNGE   |
| SUN | ALL SUNFISH SPP. EXCEPT BASS & CRP                                       |
| ANY | ANY GROUP NOT CORRESPONDING TO THE PREVIOUS 6 GROUPS OR ANY SPECIES CODE |

(3) Group codes allowed in CREEL COMP. TRIP/SUPP/L.FREQ Output Program as taxa for Fish/Completed Trip and Length Frequency outputs:

|     |  |
|-----|--|
| BSS | BLACK BASS SPP.  |
| CRP | CRAPPIE SPP.   |
| LEP | BLUEGILL, REDEAR SUNFISH and BLUEGILL X REDEAR SUNFISH |
| MUS | TIGER MUSKIE/MUSKELLUNGE                               |

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Figure 1. FAS Hardware and locations of software and data.

Figure 2. Hierarchical structure of DOC9.

Figure 3. First three screens containing permanent data for DOC9.

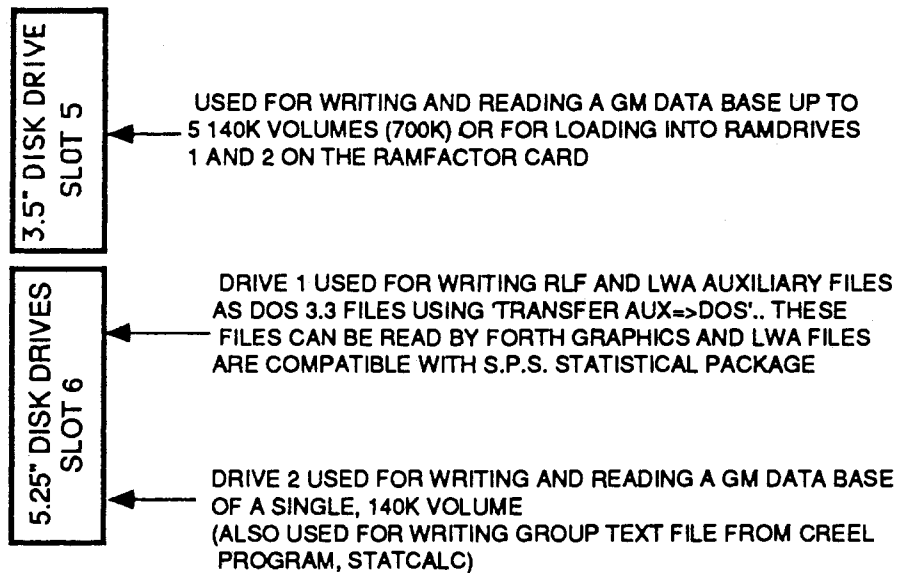
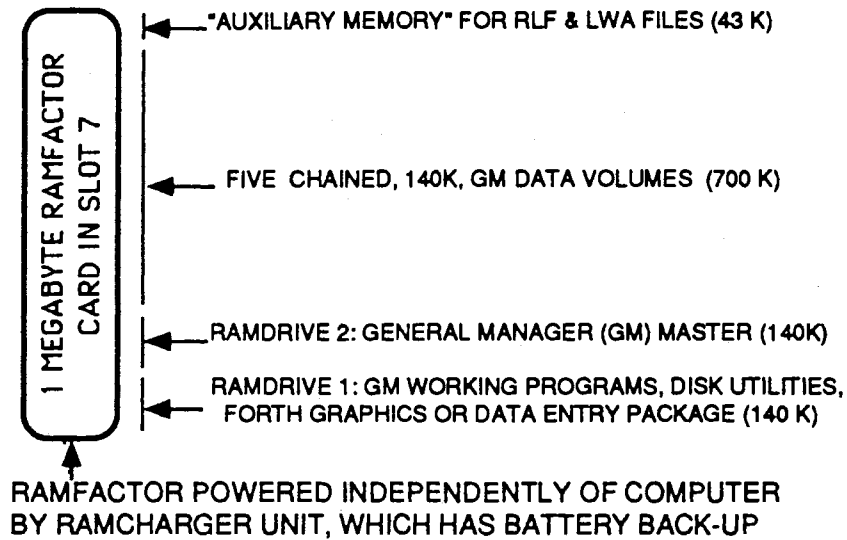
Figure 4. Screens 4, 5, and 6 of DOC9.

Figure 5. Screens 7, 8 , and 9 of DOC9.

Figure 6. In DOC9, tabular and graphical outputs consist of a series of programs that are linked together by several different files.

Figure 7. The file management system of DOC9.





**FIGURE 1. New Apple //e hardware modifications and software locations for Fisheries Analysis System (District FAS)**

(APPLE //e CPU, MONITOR, 64K 80 COL CARD, ACCELERATOR NOT SHOWN)

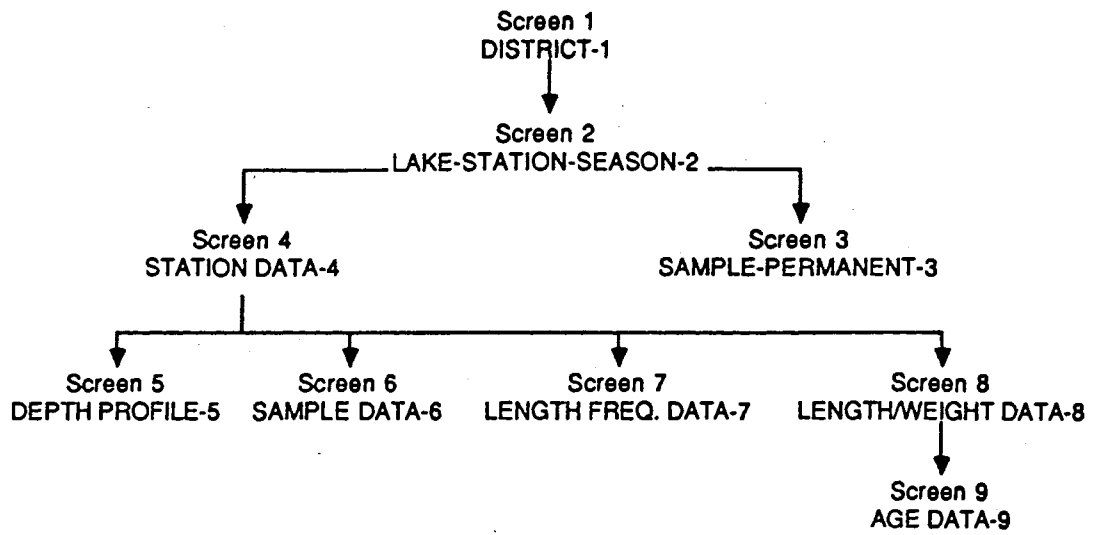


Figure 2. Hierarchical structure of DOC9.

DOC9

SCREEN 1: DISTRICT-1  
 SCREEN 2: LAKE-STATION-SEASON-2

DUPLICATES ARE FIRST  
 BOOT SCREEN  
 KEYS ARE: REGION (ASC)  
 DISTRICT (ASC)  
 COMBINED KEY LENGTH: 3  
 1 DISTRICT-1 RECORD  
 10 SCREEN FIELDS

| FLD# | NAME                                  | TYPE | REFR | LEN |
|------|---------------------------------------|------|------|-----|
| 1    | REGION                                | F    |      | 1   |
| 2    | DISTRICT                              | F    |      | 2   |
| 3    | DIST.BIOLOGIST                        | V    |      | 21  |
| 4    | REPLACEMENT NAME                      | F    |      | 21  |
| 5    | DATE OF REPLACEMENT                   | F    |      | 6   |
| 6    | YEARS OF DATA: FROM 19[ ]             | F    |      | 2   |
| 7    | TO 19[ ]                              | F    |      | 2   |
| 8    | DEPTHS/DISTANCES IN (FT) OR (METRIC)? | F    |      | 2   |
| 9    | COMMENTS                              | V    |      | 31  |
| 10   | COMMENTS                              | V    |      | 39  |

APPROXIMATE RECORD LENGTH IS 127

TYPE = (F)ixed, (V)ariable, or automatic (O)utput  
 REFR = (S)creen reference field no.  
 LEN = length of field

DOC9

SCREEN 2: LAKE-STATION-SEASON-2

DUPLICATES ARE FIRST  
 PARENT: DISTRICT-1  
 KEYS ARE: LAKE (ASC)  
 SEASON CODE (ASC)  
 STATION NO. (ASC)  
 COMBINED KEY LENGTH: 33  
 10 LAKE-STATION-SEASON-2 RECORDS FOR EACH DISTRICT-1 RECORD  
 15 SCREEN FIELDS

| FLD# | NAME                          | TYPE | REFR | LEN | NUM |
|------|-------------------------------|------|------|-----|-----|
| 1    | LAKE                          | V    |      | 30  |     |
| 2    | SEASON CODE                   | F..  |      | 2   |     |
| 3    | STATION NO.                   | F    |      | 1   |     |
| 4    | COUNTY                        | F    |      | 3   |     |
| 5    | ACREAGE                       | V    |      | 6   | 1   |
| 6    | CLASS (PU, ST, RE, PR)        | F    |      | 2   |     |
| 7    | MAX. DEPTH (FT)               | V    |      | 2   | 0   |
| 8    | AVE. DEPTH (FT)               | V    |      | 4   | 0   |
| 9    | SHORELINE LENGTH (FT)         | V    |      | 7   | 0   |
| 10   | COMMENTS                      | V    |      | 31  |     |
| 11   | COMMENTS                      | V    |      | 39  |     |
| 12   | STATION LOCATION              | V    |      | 31  |     |
| 13   | STATION SHORELINE LENGTH (FT) | V    |      | 39  |     |
| 14   | COMMENTS                      | V    |      | 6   | 0   |
| 15   | COMMENTS                      | V    |      | 31  |     |

APPROXIMATE RECORD LENGTH IS 236

DOC9

SCREEN 3: SAMPLE-PERMANENT-3

DUPLICATES ARE FIRST  
 PARENT: LAKE-STATION-SEASON-2  
 KEYS ARE: SAMPLE CODE (1ST LET (ASC)  
 COMBINED KEY LENGTH: 2  
 4 SAMPLE-PERMANENT-3 RECORDS FOR EACH LAKE-STATION-SEASON-2 RECORD  
 13 SCREEN FIELDS

| FLD# | NAME                                    | TYPE | REFR | LEN | NUM |
|------|---|------|------|-----|-----|
| 1    | LAKE                                    | O    | S2.1 | 30  |     |
| 2    | SEASON CODE                             | O    | S2.2 | 2   |     |
| 3    | STATION NO.                             | O    | S2.3 | 1   |     |
| 4    | SAMPLE CODE (1ST LET - GEAR, 2ND - #)   | F    |      | 2   |     |
| 5    | LOCATION                                | V    |      | 31  |     |
| 6    | SHORELINE LENGTH (FT)                   | V    |      | 39  |     |
| 7    | MEAN DIST. OFFSHORE                     | V    |      | 5   | 0   |
| 8    | MEAN DIST. OFFSHORE AT 5-FT DEPTH (FT)  | V    |      | 2   | 0   |
| 9    | MEAN DIST. OFFSHORE AT 10-FT DEPTH (FT) | V    |      | 3   | 0   |
| 10   | HARD COVER (TRUNKS, BRUSH); RATE 0 TO 3 | F    |      | 1   |     |
| 11   | % OF SHORE RIP-RAP                      | V    |      | 3   | 0   |
| 12   | COMMENTS                                | V    |      | 31  |     |
| 13   | COMMENTS                                | V    |      | 39  |     |

APPROXIMATE RECORD LENGTH IS 156

Figure 3. First three screens containing permanent data for DOC9.

DOC9  
 SCREEN 4: STATION DATA-4  
 SCREEN 5: DEPTH PROFILE-5  
 SCREEN 6: SAMPLE DATA-6

DUPLICATES ARE FIRST  
 PARENT: LAKE-STATION-SEASON-2  
 KEYS ARE: YEAR (ASC)  
 COMBINED KEY LENGTH: 2  
 2 STATION DATA-4 RECORDS  
 FOR EACH LAKE-STATION-SEASON-2 RECORD  
 14 SCREEN FIELDS

DUPLICATES ARE FIRST  
 PARENT: STATION DATA-4  
 KEYS ARE: DEPTH (FT) (ASC)  
 COMBINED KEY LENGTH: 4  
 15 DEPTH PROFILE-5 RECORDS FOR EACH STATION DATA-4  
 RECORD  
 9 SCREEN FIELDS

DUPLICATES ARE FIRST  
 PARENT: STATION DATA-4  
 KEYS ARE: SAMPLE CODE (ASC)  
 COMBINED KEY LENGTH: 2  
 4 SAMPLE DATA-6 RECORDS FOR EACH STATION DATA-4  
 RECORD  
 24 SCREEN FIELDS

| FLD# | NAME                | TYPE | REFR | LEN | NUM | FLD# | NAME           | TYPE | REFR | LEN | NUM | FLD# | NAME                  | TYPE | REFR | LEN | NUM |
|------|---------------------|------|------|-----|-----|------|----------------|------|------|-----|-----|------|-----------------------|------|------|-----|-----|
| 1    | LAKE                | O    | S2.1 | 30  |     | 1    | LAKE           | O    | S2.1 | 30  |     | 1    | LAKE                  | O    | S2.1 | 30  | 0   |
| 2    | SEASON CODE         | O    | S2.2 | 2   |     | 2    | SEASON CODE    | O    | S2.2 | 2   |     | 2    | SEASON CODE           | O    | S2.2 | 2   | 0   |
| 3    | STATION NO.         | O    | S2.3 | 1   |     | 3    | STATION NO.    | O    | S2.3 | 1   |     | 3    | STATION NO.           | O    | S2.3 | 1   | 0   |
| 4    | MONTH/DATE          | F    | S4.4 | 4   |     | 4    | MONTH/DATE     | O    | S4.4 | 4   |     | 4    | YEAR                  | O    | S4.5 | 2   | 0   |
| 5    | YEAR                | F    | S4.5 | 2   |     | 5    | YEAR           | O    | S4.5 | 2   |     | 5    | SAMPLE CODE           | F    |      | 2   | 0   |
| 6    | TIME OF RECORDING   | F    |      | 4   |     | 6    | DEPTH (FT)     | V    |      | 4   | 1   | 6    | MO/DAY FISHED         | F    |      | 4   | 0   |
| 7    | AIR TEMP (C)        | V    |      | 4   | 1   | 7    | WATER TEMP (C) | V    |      | 4   | 1   | 7    | BEGAN AT (24 H)       | F    |      | 4   | 0   |
| 8    | TOTAL ALC           | V    |      | 4   | 0   | 8    | OXYGEN (PPM)   | V    |      | 4   | 1   | 8    | ENDED AT (24 H)       | F    |      | 4   | 0   |
| 9    | CONDUCTIVITY        | V    |      | 5   | 0   | 9    | PH             | V    |      | 4   | 1   | 9    | GEAR SET FOR >24 H?   | F    |      | 1   | 0   |
| 10   | SECCHI (FT)         | V    |      | 4   | 1   |      |                |      |      |     |     | 10   | % SHORELENGTH COVERED | V    |      | 3   | 0   |
| 11   | WATER LEVEL (FT)    | V    |      | 4   | 1   |      |                |      |      |     |     | 11   | WEED COVER            | V    |      | 3   | 0   |
| 12   | PLUMINUS NORMAL     | V    |      | 12  |     |      |                |      |      |     |     | 12   | % RUN TIME: SHA       | V    |      | 2   | 0   |
| 13   | BOATMAN'S NAME      | V    |      | 12  |     |      |                |      |      |     |     | 13   | MAX. TL SUBSAMPLED    | V    |      | 2   | 0   |
| 14   | FRONT DIPPER'S NAME | V    |      | 30  |     |      |                |      |      |     |     | 14   | % RUN TIME:           | F    |      | 3   | 0   |
|      | COMMENTS            | V    |      | 30  |     |      |                |      |      |     |     | 15   | % RUN TIME:           | V    |      | 2   | 0   |
|      |                     |      |      |     |     |      |                |      |      |     |     | 16   | MAX. TL SUBSAMPLED    | V    |      | 2   | 0   |
|      |                     |      |      |     |     |      |                |      |      |     |     | 17   | % RUN TIME:           | F    |      | 3   | 0   |
|      |                     |      |      |     |     |      |                |      |      |     |     | 18   | % RUN TIME:           | V    |      | 2   | 0   |
|      |                     |      |      |     |     |      |                |      |      |     |     | 19   | MAX. TL SUBSAMPLED    | V    |      | 2   | 0   |
|      |                     |      |      |     |     |      |                |      |      |     |     | 20   | % RUN TIME:           | F    |      | 3   | 0   |
|      |                     |      |      |     |     |      |                |      |      |     |     | 21   | % RUN TIME:           | V    |      | 2   | 0   |
|      |                     |      |      |     |     |      |                |      |      |     |     | 22   | MAX. TL SUBSAMPLED    | V    |      | 2   | 0   |
|      |                     |      |      |     |     |      |                |      |      |     |     | 23   | COMMENTS              | V    |      | 31  | 0   |
|      |                     |      |      |     |     |      |                |      |      |     |     | 24   |                       | V    |      | 39  | 0   |

APPROXIMATE RECORD LENGTH IS 85  
 APPROXIMATE RECORD LENGTH IS 16  
 APPROXIMATE RECORD LENGTH IS 116

TYPE = (F)ixed, (V)ariable, or automatic (O)utput  
 REFR = (S)creen reference field no.  
 LEN = length of field  
 NUM = number of decimal places for numerical variables

Figure 4. Screens 4, 5, and 6 of DOC9.

|  |                           |      |      |     |     |      |                   |      |      |     |     |
|--|---------------------------|------|------|-----|-----|------|-------------------|------|------|-----|-----|
| DOC9   |                           |      |      |     |     |      |                   |      |      |     |     |
| SCREEN 7: LENGTH-FREQ. DATA-7  |                           |      |      |     |     |      |                   |      |      |     |     |
| DUPLICATES ARE FIRST<br>PARENT: STATION DATA-4<br>KEYS ARE: SAMPLE CODE (ASC)<br>SPECIES (ASC)<br>TOTAL LENGTH (10 MM D) (ASC)<br>COMBINED KEY LENGTH: 8<br>150 LENGTH-FREQ. DATA-7 RECORDS FOR EACH STATION<br>DATA-4 RECORD<br>8 SCREEN FIELDS |                           |      |      |     |     |      |                   |      |      |     |     |
| FLD#   | NAME                      | TYPE | REFR | LEN | NUM | FLD# | NAME              | TYPE | REFR | LEN | NUM |
| 1  | LAKE                      | O    | S2.1 | 30  | 0   | 1    | LAKE              | O    | S2.1 | 30  | 0   |
| 2  | SEASON CODE               | O    | S2.2 | 2   | 0   | 2    | SEASON CODE       | O    | S2.2 | 2   | 0   |
| 3  | STATION NO.               | O    | S2.3 | 1   | 0   | 3    | STATION NO.       | O    | S2.3 | 1   | 0   |
| 4  | SAMPLE CODE               | F    | S4.5 | 2   | 0   | 4    | SAMPLE CODE       | F    | S4.5 | 2   | 0   |
| 5  | YEAR                      | O    | S4.5 | 2   | 0   | 5    | YEAR              | O    | S4.5 | 2   | 0   |
| 6  | SPECIES                   | F    |      | 3   | 0   | 6    | SPECIES           | F    |      | 3   | 0   |
| 7  | TOTAL LENGTH (10 MM DOWN) | V    |      | 3   | 0   | 7    | TOTAL LENGTH (MM) | V    |      | 3   | 0   |
| 8  | FREQUENCY                 | V    |      | 3   | 0   | 8    | WEIGHT (G)        | V    |      | 3   | 0   |
| APPROXIMATE RECORD LENGTH IS 11  |                           |      |      |     |     |      |                   |      |      |     |     |
| TYPE = (F)ixed, (V)ariable, or automatic (O)utput<br>REFR = (S)creen reference field no.<br>LEN = length of field<br>NUM = number of decimal places for numerical variables  |                           |      |      |     |     |      |                   |      |      |     |     |

DOC9  
SCREEN 8: LENGTHWEIGHT DATA-8

DUPLICATES ARE FIRST  
PARENT: STATION DATA-4  
KEYS ARE: SAMPLE CODE (ASC)  
SPECIES (ASC)  
TOTAL LENGTH (10 MM) (ASC)  
COMBINED KEY LENGTH: 8  
2000 LENGTHWEIGHT DATA-8 RECORDS FOR EACH  
STATION DATA-4 RECORD  
8 SCREEN FIELDS

|  |                   |      |      |     |     |      |                   |      |      |     |     |
|--|-------------------|------|------|-----|-----|------|-------------------|------|------|-----|-----|
| DOC9   |                   |      |      |     |     |      |                   |      |      |     |     |
| SCREEN 9: AGE DATA-9   |                   |      |      |     |     |      |                   |      |      |     |     |
| DUPLICATES ARE FIRST<br>PARENT: LENGTHWEIGHT DATA-8<br>KEYS ARE: ENVELOPE CODE (ASC)<br>COMBINED KEY LENGTH: 3<br>1 AGE DATA-9 RECORD FOR EACH LENGTHWEIGHT DATA-8<br>RECORD<br>10 SCREEN FIELDS |                   |      |      |     |     |      |                   |      |      |     |     |
| FLD#   | NAME              | TYPE | REFR | LEN | NUM | FLD# | NAME              | TYPE | REFR | LEN | NUM |
| 1  | LAKE              | O    | S2.1 | 30  | 0   | 1    | LAKE              | O    | S2.1 | 30  | 0   |
| 2  | SEASON CODE       | O    | S2.2 | 2   | 0   | 2    | SEASON CODE       | O    | S2.2 | 2   | 0   |
| 3  | STATION NO.       | O    | S2.3 | 1   | 0   | 3    | STATION NO.       | O    | S2.3 | 1   | 0   |
| 4  | SAMPLE CODE       | F    | S4.5 | 2   | 0   | 4    | SAMPLE CODE       | F    | S4.5 | 2   | 0   |
| 5  | YEAR              | O    | S4.5 | 2   | 0   | 5    | YEAR              | O    | S4.5 | 2   | 0   |
| 6  | SPECIES           | F    |      | 3   | 0   | 6    | SPECIES           | F    |      | 3   | 0   |
| 7  | TOTAL LENGTH (MM) | V    |      | 5   | 0   | 7    | TOTAL LENGTH (MM) | V    |      | 5   | 0   |
| 8  | ENVELOPE CODE     | V    |      | 5   | 0   | 8    | ENVELOPE CODE     | V    |      | 5   | 0   |
| 9  | AGE (SCALE)       | V    |      | 2   | 0   | 9    | AGE (SCALE)       | V    |      | 2   | 0   |
| 10   | AGE (OTOLITH)     | V    |      | 2   | 0   | 10   | AGE (OTOLITH)     | V    |      | 2   | 0   |
| APPROXIMATE RECORD LENGTH IS 7   |                   |      |      |     |     |      |                   |      |      |     |     |

Figure 5. Screens 7, 8, and 9 of DOC9.

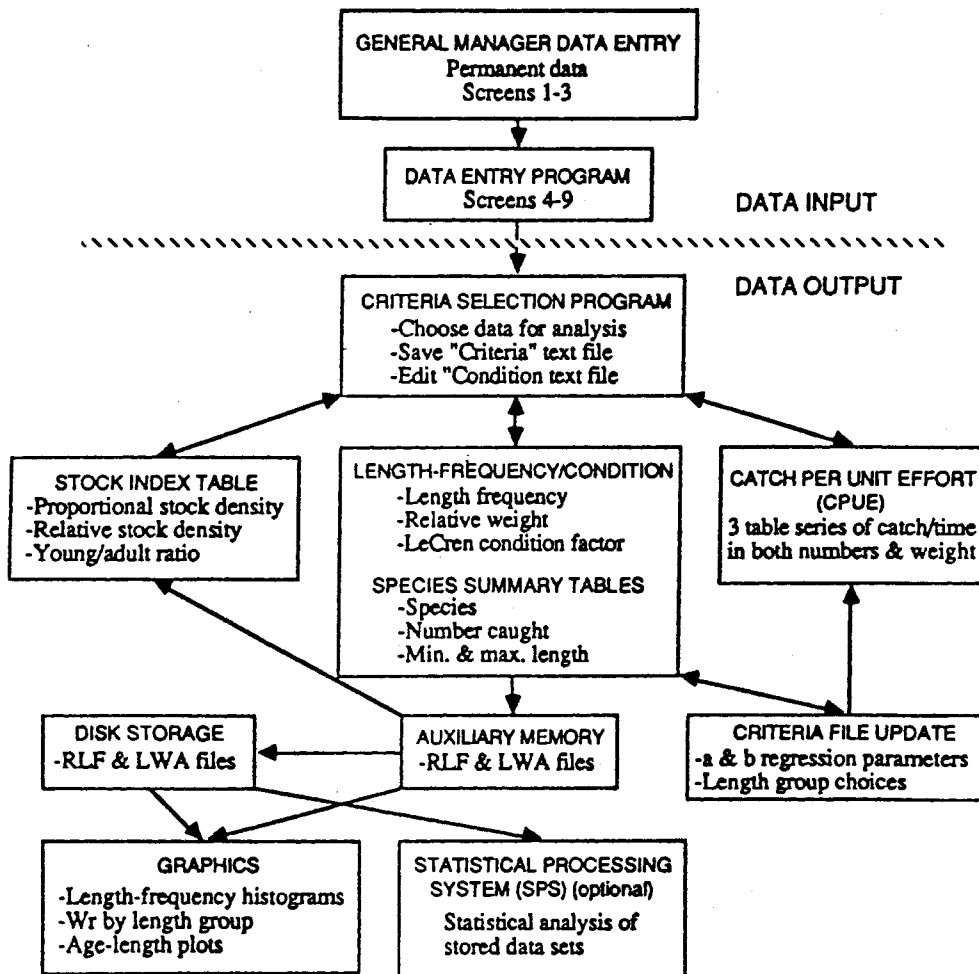


Figure 6. In DOC9, tabular and graphical outputs consist of a series of programs that are linked together by several different files.

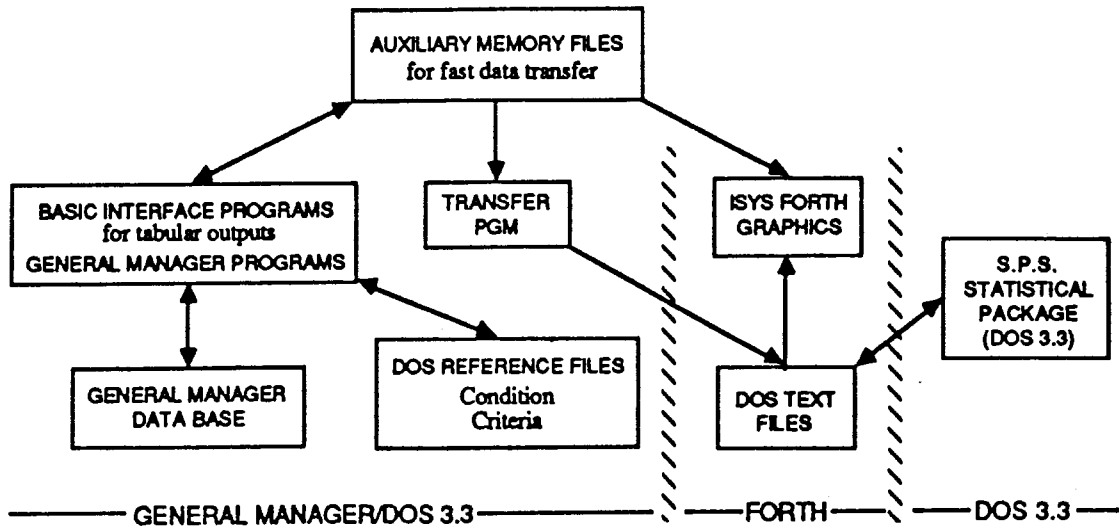


Figure 7. The file management system of DOC9.

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