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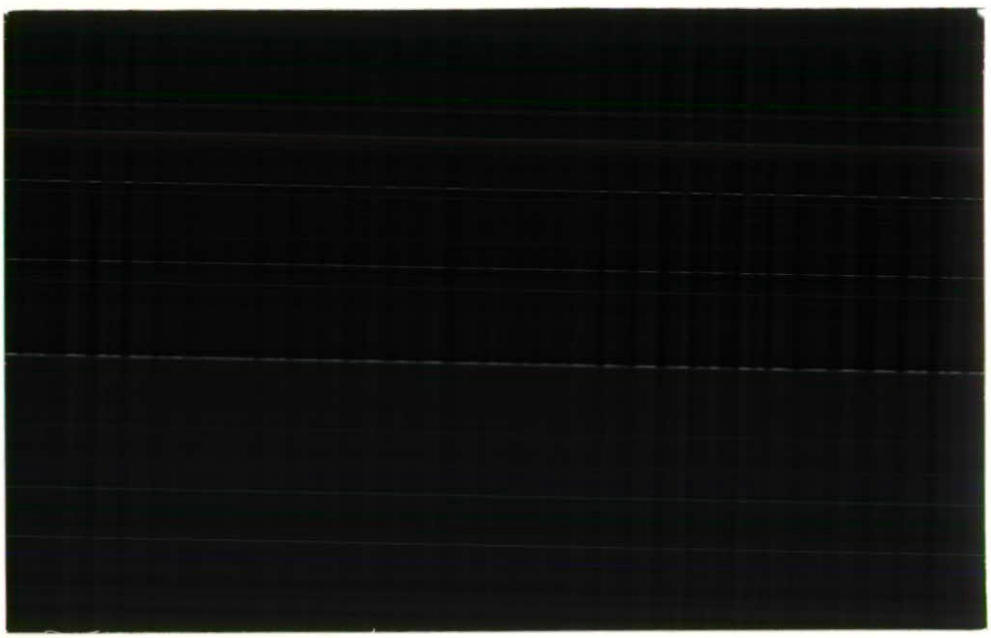

Natural Environment Research Council

1994

WORKSHOP GUIDE TO PHABSIM

PHYSICAL HABITAT SIMULATION SYSTEM

NRA RELEASE VERSION

I.W. JOHNSON & C.R.N. ELLIOTT

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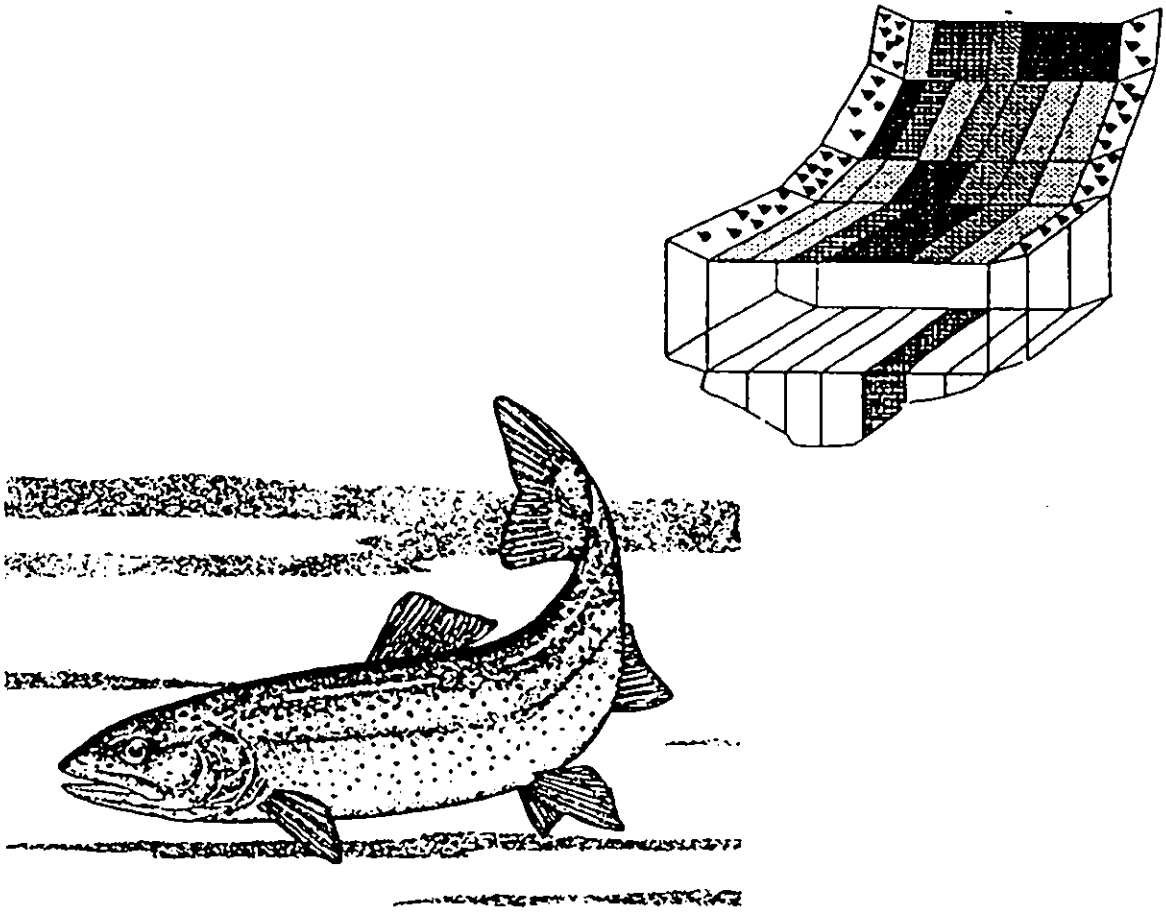
WORKSHOP GUIDE TO

PHABSIM

PHYSICAL HABITAT SIMULATION SYSTEM

NATIONAL RIVERS AUTHORITY
RELEASE VERSION



Hardware and software requirements

In order to run the PHABSIM programs the following hardware/software is required:

1: IBM compatible microcomputer - 386 PC (or above) with math-coprocessor is recommended.

2: At least 1 Mbyte available RAM memory.

3: At least one 3.5 inch floppy disk drive.

4: MS-DOS version 5.00 or later.

5: An editor with ASCII file compatibility (usually DOS EDIT).

6: A mass storage device, ie. a hard disk with at least 10Mb of memory (the software and workshops occupy 5-6 Mb, remember you will need space for your own data and output).

7: The programs provided with the PHABSIM software that allow graphic output may be used with either: Hewlett Packard Laserjet III or Hewlett Packard Paint Jet printers (remember PHABSIM also produces data output files designed to be used with commercially available software such as spreadsheets so it is not essential to have either of the above printers).

8: A colour monitor with 640 *200 graphics (eg VGA).

1: Installing PHABSIM for use under DOS

1: On the PC that you will be installing the software on, create the following directory: **C:\PMENU**

2: Copy the contents of the PHABSIM floppy diskettes numbered 1 to 3 into the directory created above. Then, within the C:\PMENU directory you should create the six workshop directories and copy the relevant data files for each workshop from the diskette labelled "workshops" into them.

3: PHABSIM requires the following in your CONFIG.SYS and AUTOEXEC.BAT files (remember to make backup copies of both files before you make any changes). The CONFIG.SYS file should include the following:

FILES=20	(or more)
BUFFERS=20	(or more)
SHELL=X:\COMMAND.COM/E:2000/P	(Where X=drive where system commands are stored, it is usually C)

The AUTOEXEC.BAT file should contain the following:

```
GRAPHICS
PATH C:\PMENU
SET \RMFORT.ERR=\PMENU\RMFORT.ERR
```

4: Move to the directory that contains the data for the workshop you are working on, or any data of your own that you wish to use (eg: C:\PMENU\WORK1).

5: Type in 'RPM (enter)' and answer the prompts as detailed in workshop 1.

6: To work on data in another directory quit the PHABSIM menu, move to the new directory and repeat step 4, above.

2: Acessing PHABSIM via WINDOWS.

1: Follow steps 1, 2 & 3 in installing PHABSIM for use under DOS, above. File copying may be achieved via the windows file manager.

In order to be able to access the PHABSIM menu from WINDOWS (PHABSIM is not fully WINDOWS compatible as yet, it will run in the same way as it would under DOS but this allows you to switch to applications that run under WINDOWS without quitting PHABSIM) carry out the following:

2: In WINDOWS, open the program group that you want PHABSIM to be run from (eg. open the program group "APPLICATIONS" by double clicking (using the L.H. button on the computers mouse) on the applications icon).

3: Using the mouse, go to "FILE" in the windows menu at the top of the screen and click on "NEW". The "NEW PROGRAM OBJECT" dialogue box should appear. Highlight "PROGRAM ITEM" and click the "OK" button.

4: A new dialogue box should appear titled "PROGRAM ITEM PROPERTIES" type the following in the relevant boxes:

DESCRIPTION:	PHABSIM
COMMAND LINE:	C:\PMENU\RPM
WORKING DIRECTORY:	WORK1
SHORTCUT KEY:	NONE

NB. The working directory will change according to where the data being analysed is situated. However, to begin the exercises in the workshop guide at workshop 1 enter the information as given above. The rest of the workshops contain details of which working directory you should use as you work through them.

5: To select an icon for the software click on the "CHANGE ICON" button. An information message should appear saying "There are no icons available for the specified file...". Click the "OK" button and the "CHANGE ICON" dialogue box will appear. Select a suitable icon and click on the "OK" button (there are a range of icons

in the C:\WINDOWS\PROGMAN.EXE file, or click on the "BROWSE" button and a list of files will appear, there are more icons in the "MORICONS.DLL" file). You should now be returned to the "PROGRAM ITEM PROPERTIES" dialogue box and the icon you have chosen will be displayed in the lower L.H. corner.

6: Click on the button marked "OK" and there should now be a program item called PHABSIM with the icon you chose in the relevant program group (in the APPLICATIONS group if you followed the above example).

7: Double click on the PHABSIM icon and the PHABSIM menu system will now run. Type in the answers to the prompts as in workshop 1.

Workshop 1: Setting up and using The RPM Program Menu

OBJECTIVES

TO FAMILIARISE USERS WITH THE PHABSIM MENU STRUCTURE AND MENU FUNCTION KEYS.

TO RETRIEVE AND EDIT DATA FILES

TO REVIEW HYDRAULIC DATA GRAPHICALLY USING LOTUS FREELANCE

WORKING DIRECTORY: C:\WORK1

DATA FILES: **FISHCRV.NRA**
PIDDLE.PRE
MKIFG4.DAT

PHABSIM PROGRAMS USED: **RPM**

Setting up PHABSIM to run under WINDOWS

Follow the instructions in part 2 of hardware/software requirements, above, to install PHABSIM and set it up to run under windows if you have not already done so. You will then be able to begin workshop 1. If you want to run under DOS, simply move to the relevant workshop directory (in this case it should be C:\PMENU\WORK1) and type **RPM** and the PHABSIM menu will execute.

Workshop Steps

1. Executing The RPM Program Menu

1. If WINDOWS is not running type '**WIN**' to bring up the Windows Menu.

2. Click on '**Window**' and choose '**Applications**'

3. Double click on the PHABSIM icon to execute **RPM**.

   The following Prompts appear - answer as indicated

'Do you have a colour monitor ?'	-Answer '**Y**'
'Enter the name of your browse utility'	-Type '**EDIT**' (the DOS editor)
'Enter the name of your text editor'	-Type '**EDIT**' again
'Enter the drive & path name where the' PHABSIM programs have been installed'	-Type '**C:\PMENU**
'Will you be using the long or short menus ?'	-Type 'S' for short

The PHABSIM Program Menu should now appear on your screen.

NOTE: These prompts only appear the first time that you execute RPM in any given working directory. If you press F9 to return to DOS you will notice that you are in a directory **C:\WORK1** which we have created on the machine.

2. Changing the working directory

If you wish to work in a different directory you must change the working directory associated with the PHABSIM icon. Click on the Icon once - choose '**File**' then '**Properties**' and edit the working directory line to your new directory name. Try creating a new working directory and executing **RPM** again.

3. Help messages

Move around the menu using the cursor keys and you will see the various HELP messages associated with the different programs. The messages appear in 3 different places: for each menu item there is a one line description which appears at the top of the menu when an item is highlighted using the cursor keys; pressing **F1** gives more detailed help for each menu item; if you move to the right of the menu and select a particular program a help message appears above the 'dialogue box' (which lists input/output files). If you press **F4** (answer **C:\PMENU** as the path to the PHABSIM programs) you enter the 'PHABSIM INFORMATION NETWORK' - this has not been altered from the original U.S. code, thus it deals with some programs which do not exist in your version and programs added at IH are not covered.

4. Function keys

Use of the function keys is explained in the accompanying documentation from the U.S Fish & Wildlife service. A brief summary of the most useful function keys is as follows. If you wish to try selecting a file from the current working directory and editing it there is an HSI curve data file **FISHCRV.NRA** in the working directory **C:\PMENU.**

F3 - Edit key

F3 is used to edit a file that you have highlighted in the program dialogue box. Exiting the editor returns you to the dialogue box.

F8 - Dir key

F8 is used to display the list of files in the current working directory. If you want to retrieve a file from the directory (while you are in the program dialogue box) press **F8**, scroll down to the file you require and press 'enter'.

F9 DOS Key

Pressing **F9** from anywhere in the menu lets you exit to DOS (in your current working directory). Type 'EXIT' from DOS to return to the menu.

F10 'Run' key

Pressing the **F10** key while you have a program dialogue box displayed executes the given program with the filenames you have entered in the input/output boxes.

F1 'Help' key

The **F1** key displays help messages associated with the various PHABSIM programs and menu items.

Have a play around !

5. Reviewing hydraulic data with FREELANCE

We use Lotus FREELANCE as a tool for displaying and visually checking survey data. In directory **C:\WORK1** there is a file **PIDDLE.PRE** which contains plots summarising PHABSIM hydraulic survey data from a current IFIM application on the River Piddle at Briantspuddle.

To have a look at the data double click on the FREELANCE icon in the **'Applications'** window. Choose **'Work on an existing Presentation'** and select **C:\WORK1\PIDDLE.PRE**

In the file you will see plots of the surveyed bed elevations, velocity distributions and water surface elevations for each of the transects in the reach. You will also see a plot giving the longitudinal water surface profiles and the thalweg elevation at the three calibration discharges.

If you want a sneak preview of the IH standard file format for a single flow PHABSIM initial survey data file you can look at the file **MKIFG4.DAT** in **C:\WORK1** which corresponds to the data plotted in **PIDDLE.PRE**.

If you do not have **FREELANCE** available then data may be examined using other commercially available software such as spreadsheets. Many of the output files are generated in such a form as to be easy to import into this type of software, simply import them as **ASCII** files.

Workshop 2: MKIFG4.DAT File Building and Data Review

OBJECTIVES

TO ASSEMBLE AN IH FORMAT **MKIFG4.DAT** SINGLE FLOW HYDRAULIC SURVEY DATA FILE FROM ITS COMPONENT DATA FILES.

TO REVIEW WATER SURFACE ELEVATION AND VELOCITY/DISCHARGE DATA.

TO RECOGNISE POSSIBLE SURVEY ERRORS USING CHECK PROGRAMS.

TO CONSTRUCT HEAD-PIN ELEVATION, REACH LENGTH AND WSL ELEVATION DATA FILES FROM RAW DATA.

WORKING DIRECTORY: **C:\WORK2**

DATA FILES:
- **CS.DAT**
- **RLS.DAT**
- **ELEV.DAT**
- **WTS.DAT**
- **CSV1.DAT**
- **CSV2.DAT**
- **CSV3.DAT**
- **WSL1.DAT**
- **WSL2.DAT**
- **WSL3.DAT**
- **MKIFG41.ERR**
- **SVF.DAT**
- **SVB.DAT**
- **WSLIN.DAT**
- **PIDDLE.PRE**

PHABSIM PROGRAMS USED:
- **MKFILE**
- **REV1WSL**
- **REV3WSL**
- **CKIHDA**
- **CKDEP**
- **RLSIN**
- **SURVIN**
- **WSLIN**

Function of PHABSIM Programs used

MKFILE - Assembles the component survey data files to build a single flow hydraulic calibration data file in the standard **MKIFG4.DAT** format.

CKIHDA- Provides a summary of the information of the **MKIFG4.DAT** file & computes cross-section discharges.

CKDEP- Similar to **CKIHDA** but with additional checks which compare discharges calculated using wading rod depths with those from surveyed WSLs

REV1WSL- Plots water surface elevations (for a single discharge) and thalweg elevations from a **MKIFG4.DAT** single flow hydraulic calibration data file.

REV3WSL- Plots water surface elevations for 3 calibration flows (+ thalweg elevation) from 3 single flow **MKIFG4.DAT** hydraulic calibration data files.

RLSIN- Used to build an **RLS.DAT** reach length data file from reach lengths measured on left and right banks.

SURVIN- Used to enter headpin elevation survey data from **SVF.DAT, SVB.DAT** files, or from the keyboard, to make an **ELEV.DAT** head-pin elevation data file.

WSLIN- Used to enter water surface elevation data measured at the left, right and centre of the stream to make a **WSL.DAT** water surface elevation data file.

Example data set: River Piddle at Briantspuddle

The data used for this workshop was collected from the River Piddle at Briantspuddle. Mean daily discharges for the initial survey (Calibration Flow 1) and repeat calibration surveys (Calibration Flows 2 and 3) were as follows:

Calibration Flow 1 = 0.292 cumecs

Calibration Flow 2 = 0.148 cumecs

Calibration flow 3 = 1.019 cumecs

Hydraulic survey data are summarised in the FREELANCE file **PIDDLE.PRE** which you will find alongside the other data files for the workshop.

Workshop Steps

1. Locating the data

Data for this workshop is located in directory **C:\WORK2**

Before you begin the workshop change the working directory for the PHABSIM interface (click on the PHABSIM icon, choose **'File'** then **'Properties'** and fill in **'WORK2'** as the new directory).

After changing the working directory double click on the PHABSIM icon to restart PHABSIM in directory **C:\WORK2**. Answer the prompts as you did in Workshop 1. If you are working under DOS go to **C:\PMENU\WORK2** and type **RPM** and answer the prompts.

2. Data Files for the Workshop

Press **F8** from the menu and you should see, amongst the files in **C:\WORK2** the following hydraulic survey data files for use in Workshop Steps 3-5 :

CS.DAT- file containing cross-section morphology and channel index data. For the channel index this file contains substrate data only. In other examples the **CS.DAT** file may contain substrate and cover data, or the seven channel indices defined in the 'Data Requirements' report. It is important to note that all data in this file is not dependent on discharge - there are no water surface level or velocity data in the file.

RLS.DAT- file containing reach length data - again, these are independent of discharge.

ELEV.DAT- file containing head-pin elevation data - again, these are independent of discharge.

WTS.DAT- file containing upstream weighting factors - again, these are independent of discharge.

CSV1.DAT - file containing point velocity data from calibration flow 1.

CSV2.DAT - file containing point velocity data from calibration flow 2.

CSV3.DAT - file containing point velocity data from calibration flow 3.

WSL1.DAT- file containing water surface level staff readings for calibration flow 1.

WSL2.DAT- file containing water surface level staff readings for calibration flow 2.

WSL3.DAT- file containing water surface level staff readings for calibration flow 3.

In addition you should see the file **MKIFG41.ERR** - a **MKIFG4.DAT** for calibration flow 1 which we have prepared for you to use for Workshop Step 6. The file contains some errors which have been introduced artificially. The three data files listed below are for use in the optional Workshop Step 8

SVF.DAT - file containing backsight/foresight data from the outward (forward) leg of the head-pin elevation survey loop.

SVB.DAT - file containing backsight/foresight data from the return (backward) leg of the head-pin elevation survey loop.

WSLIN.DAT- file containing water surface level staff readings taken at left, centre and right of each cross-section. The staff reading to the left and right head-pins are also included for each cross-section.

3. Assembling single flow MKIFG4.DAT files

- MKFILE program

The **MKIFG4.DAT** single flow hydraulic calibration data file forms the basis of the IH standard format for hydraulic survey data. The file contains discharge independent channel morphology and channel index (substrate/cover) data, together with discharge dependent water surface elevation and velocity data for a single measured calibration discharge. Channel index data (included in the **CS.DAT** input file) may be substrate data only, substrate and cover, or the 7 channel indices defined in the NRA 'Data requirements and data collection procedures' report. For this examples the **CS.DAT** file contains substrate data only

For each of the 3 observed calibration flows you mist build a separate single flow **MKIFG4.DAT** file.

a) Move to program **MKFILE** which is under '**DATA PROCESSING - Single Flow**' in the menu.

b) Build a **MKIFG4.DAT** file using flow data (**WSL1.DAT, CSV1.DAT** from calibration flow 1 (together with the various discharge independent data files) as follows:

(i) Using the **F8** key load the appropriate data files into the boxes indicated by the help message.Since you are building a file for calibration flow 1 call the output file **MKIFG4.1**.

(ii) Press the **F10** key to run the program and answer the prompts. Look at the completed output file **MKIFG4.1** and refer to notes on file formats to understand the format.

NOTE: The **MKFILE** program also produces two files with default file names **HI.DAT** and **HI.BAK**. The file **HI.DAT** contains '**height of instrument**' data which are needed to adjust WSL staff readings for flows 2 and 3 (see the optional **WSLIN** run at the end of the workshop). Use the **F8** key to check that the **HI.DAT** file has been produced. **HI.BAK**

contains a record of the steps involved in computing the height of instrument. This is useful for tracking down surveying errors. Look at **HI.BAK** using the editor.

c) Repeat step b) using flow data for calibration flows 2 and 3 (call your outputs **MKIFG4.2** and **MKIFG4.3**.

4. Plot the water surface elevations for each flow

- REV1WSL program

Program **REV1WSL** is used to plot the longitudinal water surface profile for a single flow from a **MKIFG4.DAT** data file.

a) Move to program **REV1WSL** in the **'DATA PROCESSING' - 'Data File Review'** in the menu.

b) Type, or use the **F8** key to place **MKIFG4.1** (output from **MKFILE**) in the input file box.

c) Press **F10** to run the program.

d) To clear the graphics from the screen type any integer and press 'return' - this is necessary to clear the graphics screen for any of the PHABSIM plotting programs.

e) Repeat Step d) for flows 2 and 3 (using **MKIFG4.2, MKIFG4.3** as input files).

5. Plotting the WSL elevations for flows 1,2 and 3 together

- REV3WSL program

Water surface elevations for all 3 flows can be plotted together using the program **REV3WSL**.

a) Move to program **REV3WSL** next to **REV1WSL** in the menu.

b) Load in 3 single flow data files **MKIFG4.1, MKIFG4.2 & MKIFG4.3** the into the appropriate boxes.

c) Press **F10** to run the program.

6. Checking data in a MKIFG4.DAT file

- CKIHDA and CKDEP programs

For this part of the workshop use the file **MKIFG41.ERR** which is in the current working directory **C:\WORK2**

MKIFG41.ERR contains the same data as the file **MKIFG4.1** you built using **MKFILE** but we have doctored it to introduce a few errors. To find the errors try to locate discrepancies in discharges calculated for individual cross-sections and look for possible errors in the surveyed WSL elevations by comparing depths calculated using these data with those read directly from the wading rods.

a) Move to the **CKIHDA** program under **'DATA PROCESSING - Data File Review'**

b) Run the program using **MKIFG41.ERR** as the input file. Try both **'Wading Rod Depths'** & **'Surveyed WSL elevations'** options and compare the outputs.

(NOTE: If you choose **'Surveyed WSLs'** you will note negative depths appearing in the print out for each cross-section . With this option

depth = surveyed WSL elevation - bed elevation

so negative depths appear when WSL elevation < bed elevation.)

c) Review the **CKIHDA** output - look at the discharge summary at the bottom of the output file.

d) Move to the **CKDEP** program next to **CKIHDA** in the menu and run **CKDEP** using **MKIFG41.ERR** as the input file. Review the **CKDEP** output file : examine differences in the two depth calculations for points across each of the cross sections In the output file **'DEP'** refers to wading rod depths an d **'PDEP'** refers to the depths computed as

depth = surveyed WSL elevation - bed elevation.

Also examine the discharge summary at the bottom of the output file.

7. Editing out the mistakes

In practice any suspected errors highlighted by the check programs would lead us to refer back to the data on the original survey sheets. For this workshop you can check if your suspected errors are indeed errors by looking at the (hopefully correct) **MKIFG4.1** file you built from the (correct) component data files in Step 3 of the workshop. Edit out your mistakes and re-run the check programs.

8. Building reach length, water surface level and headpin elevation data from the keyboard or from files (optional)

- SURVIN, RLSIN and WSLIN programs

In Step 3 of this workshop you assembled individual files containing different types of hydraulic data to build a complete **MKIFG4.DAT** hydraulic data file. In practice data recorded on field survey sheets are typed in using a text editor (eg. EDIT) or spread-sheet (eg. EXCEL, LOTUS 1-2-3) . To assist in the task of processing head-pin elevation survey, reach length and water surface level data programs **SURVIN, RLSIN** and **WSLIN** may be used. Survey sheets giving the raw data form field observations are included at the end of the notes for this workshop.

a) Move to **RLSIN** under '**DATA PROCESSING - Data Entry**'. Press **F10** to execute the program and type in the reach lengths measured on left and right banks from the survey sheet.

The output file **RLS.DAT** gives the averaged (between left and right banks) reach lengths in the correct format for entry to the **MKFILE** program. The other output file **RLS.BAK** gives a record of the data which was entered to make the **RLS.DAT** file. Have a look at each of them.

b) Move to **SURVIN** in the same part of the menu. Press **F10** to execute the program.

The program prompts the user as to whether data is to be entered from the keyboard or from files. If you selected the '**keyboard**' option, type in the data recorded on the survey sheets. You may avoid this step by selecting the '**Enter from files**' option and loading in the data files **SVF.DAT** and **SVB.DAT** which contain the data for outward & return legs of the survey loop.

NOTE: In our applications we have used a convention of defining an arbitrary datum level of 100.0m which we assign to the left hand (looking downstream) head-pin marking cross-section 1 (the most downstream, by convention, in PHABSIM).

The output file **ELEV.DAT** gives the computed elevations in the correct format for entry to the **MKFILE** program. The other output file **SV.BAK** is a record of the data which was entered to produce the **ELEV.DAT** file, together with the computed survey errors and total misclosure (which should be around 10mm or less). Look at the **SV.BAK** file to find the misclosure for this example.

c) Move to **WSLIN**, above **SURVIN** in the menu. Load in the data file **WSLIN.DAT** - look

at it to see the data recorded in the field. Press **F10** to execute the program.

The output file **WSL.DAT** gives the averaged (and adjusted according to the height of the level) water surface elevations for entry to the **MKFILE** program. The other output file **WSL.BAK** gives a record of the data entered to make the **WSL.DAT** file which is useful for tracking down survey errors.

SURVEY DATA FOR STEP 8

a) Reach Length Data

RIVER PIDDLE AT BRIANTSPUDDLE
5.7.93

Reach length survey data from measurements on left and right banks.

	Reach Lengths	
C/S	LEFT	RIGHT
1	0.00	0.00
2	2.78	4.6
3	6.11	5.77
4	10.25	10.5
5	24.90	25.4
6	9.24	6.02
7	0.00	5.50
8	4.55	8.74
9	3.23	3.51

b) Head-pin elevation survey data

RIVER PIDDLE AT BRIANTSPUDDLE
5.7.93
Forward (outward) head-pin elevation survey data.
Survey conducted on left bank (looking downstream)

C/S	BS	FS
1	1.537	
2	1.347	1.473
3	1.533	1.482
4	1.668	1.505
5	1.442	1.484
6	1.356	1.242
7	1.234	1.400
8	1.800	1.564
9		1.733

see overpage for return leg of survey loop

RIVER PIDDLE AT BRIANTSPUDDLE
5.7.93
Backward (return) head-pin elevation survey data.
Survey conducted on left bank (looking downstream)

C/S	BS	FS
9	1.471	
8	1.515	1.538
7	1.406	1.185
6	1.287	1.361
5	1.539	1.487
4	1.662	1.722
3	1.788	1.690
2	1.492	1.652
1		1.557

Workshop 3: HSI Curve Entry & Management

OBJECTIVES

TO BECOME FAMILIAR WITH US FISH & WILDLIFE SERVICE (US F&WS) 'FISHCRV' AND 'STANDARD IH' FORMAT FOR HABITAT SUITABILITY INDEX DATA FILES. ENTERING DATA IN IH FORMAT, CONVERTING TO THE US F&WS 'FISHCRV' FORMAT AND GRAPHICAL REVIEW OF DATA.

WORKING DIRECTORY : **C:\WORK3**

DATA FILES : **FISHCRV.NRA**
FISHCRV.DOE
FISHCRV.WES
INVCRV.NRA
INVCRV.DOE
MACCRV.NRA
MACCRV.DOE

PHABSIM PROGRAMS USED **CONVER**
VERCON
SIPLT

Function of PHABSIM programs used

CONVER - Converts HSI curve data in US F&WS '**FISHCRV**' format to the '**standard IH**' (IHHSI) format.

VERCON - Converts HSI curve data in IHHSI format to US F&WS '**FISHCRV**' format.

SIPLT - Plots HSI curves from an input file in either US F&WS '**FISHCRV**' format or the IHHSI standard format.

Example Data Sets: Habitat Suitability Indices

Example data sets used in this workshop contain habitat suitability index data (for depth, velocity and substrate/cover) for a number of fish, macroinvertebrate and macrophyte species. All of these data are in the US F&WS '**FISHCRV**' format (in imperial units)

Workshop Steps

1. Locating the data

Data for this workshop is located in directory **C:\WORK3**

Before you begin the workshop change the working directory for the PHABSIM interface to **C:\WORK3** as you did in the last workshop.

2. Data Files for the Workshop

Press **F8** from the menu and you should see, amongst the files in **C:\WORK3** the following HSI data files. All of these files are in the US F&WS '**FISHCRV**' format (in imperial units). These data have been developed by various different organisations as part of R&D projects and NRA operational investigations. A list of data sources and applications for those data included in **C:\WORK3** is as follows:

	Developed By	Applied under Project
FISHCRV.NRA	IFE	NRA R&D B2.1
FISHCRV.DOE	IFE	DOE IFIM assessment
FISHCRV.WES	Wessex NRA	River Allen IFIM study
INVCRV.NRA	IFE	NRA R&D B2.1
INVCRV.DOE	IFE	DOE IFIM assessment
MACCRV.NRA	IFE	NRA R&D B2.1
MACCRV.DOE	ITE	DOE IFIM ASSESSMENT

3. Changing formats

- **Conver and Vercon programs**

A: 'FISHCRV' FORMAT TO STANDARD IH (IHHSI) FORMAT

Under '**S.I.CURVES - 'Management**' run program **CONVER** to convert any (or all!) of the data files from their **FISHCRV** format to the **IHHSI** format - Give the output files a different name/extension.

Look at the output files and note the straightforward **IHHSI** format. The format is self-explanatory, but note the following restrictions :

TITLE LINES:	Files must have 2 title lines, each up to 80 characters long.
SPECIES NAME:	Up to 40 characters long.
LIFE-STAGE:	Up to 8 characters long.
SPECIES ID NO.:	The species ID number , next to the species name must **end** in column 6 - it can be up to six figures but must be entered as 000194 or 3 blanks followed by '194'

B: STANDARD IH (IHHSI) FORMAT TO 'FISHCRV' FORMAT

Now run program **VERCON** on any of your outputs from **STEPA**- this converts them back to the FISHCRV format - look and see !

4. Plotting the HSI curves

- SIPLT program

Plot some HSI curves from any of the data files using the program **SIPLT** in the same part of the menu. Note that you can plot curves from either **FISHCRV** or **AYAHS** formats - try at least one of each format.

5. D.I.Y HSI curves

Using the DOS editor or EXCEL input an HSI curve yourself. Enter them in the AYAHS format and convert them to FISHCRV format. Units for depth and velocity are m and m/s, substrate codes are 1-8. Make a directory **C:\SIDATA** and copy your file there - we will use them in a later workshop.

FISHERIES STAFF (& OTHERS WHO FANCY A TRY)

Enter your own HSI curves sets for adult, fry/juvenile and spawning trout based upon your judgement of their habitat preferences. Assume that your curves are going to be applied on the Rivers Allen and Piddle.

OTHERS (+ KEEN FISHERIES STAFF !)

Your young child enjoys paddling in the Rivers Allen and Piddle. She likes it even more if it is deep enough to swim. She is not a good swimmer and becomes scared when the water is too deep or fast-flowing . She prefers gravel to mud or silt but doesn't like big stones Enter an HSI curve to describe her preferred paddling habitat !

Workshop 4: IFG4 Calibration & Simulation

OBJECTIVES

TO CREATE AN IFG4 HYDRAULIC SIMULATION DATA FILE CONTAINING WATER SURFACE LEVELS FROM 3 MEASURED CALIBRATION FLOWS AND VELOCITIES FROM THE HIGHEST FLOW.

TO SIMULATE DEPTHS AND WATER SURFACE LEVELS AT THE CALIBRATION FLOWS USING IFG4 AND COMPARE WITH OBSERVED DATA.

TO SIMULATE DEPTHS AND VELOCITIES USING IFG4 FOR A RANGE OF SIMULATION DISCHARGES.

WORKING DIRECTORY : **C:\WORK4**

DATA FILES : **MKIFG4.1**
MKIFG4.2
MKIFG4.3

PHABSIM PROGRAMS USED : **MKI4DA**
MAKEV
ADIHCV
MAK1VL
CHSTA
IFG4

Example data set: River Piddle at Briantspuddle

3 Calibration flows measured:

Calibration flow 1 = 0.292 cumecs (10.31 in imperial units)

Calibration flow 2 = 0.148 cumecs (5.23 in imperial units)

Calibration flow 3 = 1.019 cumecs (35.99 in imperial units)

Function of PHABSIM Programs used

MKI4DA - Converts an IH standard format **MKIFG4.DAT** single flow hydraulic calibration data file (with data in metric units) to a PHABSIM **IFG4** data file (with data converted to imperial units).

ADIHCV - Adds repeat calibration flow water surface level and velocity data from a single flow **MKIFG4.DAT** file into an existing PHABSIM **IFG4** file (containing data from one or more different flows).

MAK1VL - Removes velocity data from the **IFG4** data file leaving 1 set of velocity d and 3 sets of water surface level data.

CHSTA - Changes cross-section 'labelling' to 'stationing' in a PHABSIM **IFG4** file.

IFG4 - Simulates depths and velocities using calibration data from the three measured flows.

Workshop Steps

1. Locating the data

Data for this workshop is located in directory **C:\WORK4**

Before you begin the workshop change the working directory for the PHABSIM interface to **C:\WORK4** by clicking on the PHABSIM icon.

2. Data Files for the Workshop

Press **F8** from the menu and you should see, amongst the files in **C:\WORK4** the following data files.

MKIFG4.1 - Data file containing the calibration data set for flow 1
MKIFG4.1 - Data file containing the calibration data set for flow 2
MKIFG4.3 - Data file containing the calibration data set for flow 3

3. Building a single flow IFG4 data file

- MKI4DA program

Under **'DATA PROCESSING - Single flow'** run program **MKI4DA** to convert the file **MKIFG4.1** containing cross-section data, water surface levels and velocities from the initial survey (calibration flow 1) into an **IFG4** data file (call it **ZIFG4.1**). When you run the program the following prompt appears :

ENTER MEAN FLOW IN METRIC UNITS

Enter the mean flow for calibration flow 1 (0.292 cumecs).

The program next prompts for the type of channel index data present in the input file **MKIFG4.1**:

ENTER 0 FOR NO CHANNEL INDICES
1 FOR SEVEN CHANNEL INDICES
2 FOR SUBSTRATE ONLY
3 FOR SUBSTRATE AND COVER

In this example the data file **MKIFG4.1** contains substrate data only.

NOTE: US F&WS PHABSIM hydraulic/habitat simulation programs were written to run in imperial units (feet and inches). Data entry/conversion programs written at IH convert data from metric to imperial automatically - it is assumed that all input data is in metric units. All data in the output file **ZIFG4.1** is converted to imperial units.

4. Adding repeat calibration flow data to an existing IFG4 file

- ADIHCV program

Under **'DATA PROCESSING - Multiple Flows'** run program **ADIHCV** to add the water surface elevation and velocity data from flows 2 and 3 (contained in the files **MKIFG4.2, MKIFG4.3**) into the single flow **IFG4** file **ZIFG4.1** (created in Step 3, containing data from flow 1). This is done using one set of data at a time, so on the first run you will require the input files to be **ZIFG4.1** and **MKIFG4.2** : call the output file **ZIFG4.12**. On the second run, the input files will be **ZIFG4.12** (output from the first **ADIHCV** run) and **MKIFG4.3** - call the output file **ZIFG4.123**.

During each run you will need to enter the mean flow for the water surface level/velocity data set that you are adding to the existing **IFG4** file. You should now have an **IFG4** file containing 3 sets of hydraulic calibration data.

5. Stripping velocity data from a 3 flow IFG4 file

- MAK1VL program

Velocity simulation in PHABSIM uses the **IFG4** hydraulic simulation program. If the **IFG4** input file contains two or more sets of velocity calibration data the program attempts to set up point based velocity-discharge regressions which invariably cause the program to crash. For this reason we advise the use of single velocity set **IFG4** data files. In this step you will remove two of the velocity data sets from the three velocity set **IFG4** file you created in Step 4. (NOTE : In Step 4 both water surface level **and** velocity data from flows 2 and 3 were added to the IFG4 file. In this step you will remove the velocity data from two of the three flows but water surface level data from **all** 3 flows will be retained)

Under **'HYDRAULICS' - 'File Modification'** run the program **MAK1VL** to edit the three velocity set **IFG4** data file so that only the velocities for the highest of the 3 measured flows remain. (We generally choose the highest flow set since there will be more wetted points with measured velocities than at the lower flows).

As input data use the 3 flow **IFG4** file **ZIFG4.123** from Step 5. Retain velocity set 3 and call your output **ZIFG4.V3**.

6. Changing to 'stationing'

- CHSTA program

In a PHABSIM **IFG4** file data from each cross section appears on lines which are preceded with the number (label) of the cross-section. In order to use some of the hydraulic simulation programs (and some of the plotting routines) these labels must be replaced with the distance of the cross section from the most downstream cross-section (cross-section 1 by convention). This is achieved using the **CHSTA** program.

Under **'HYDRAULICS - File Conversion'** select **CHSTA**.

Run **CHSTA** using **ZIFG4.V3** from Step 6 as input data. Call the output **file ZIFG4.CAL** - this is your completed **IFG4** calibration data file. Compare the input and output files using the editor - remember that distances are in imperial units !

7. Editing the QARD lines

In a PHABSIM **IFG4** file there are lines near the top of the file which begin with the letters **'QARD'** followed by a real number. These **QARD** lines are the discharges for which the user requires depths, velocities (and ultimately Weighted Usable Areas) to be simulated.

When you ran the **MKI4DA** and **ADIHCV** programs in Steps 3 and 4 the mean flows for calibration flows 1,2 and 3 were automatically written on the **QARD** lines in the **IFG4** output file. When we calibrate PHABSIM hydraulic models our first simulations will use only these three flows. At a later stage in the calibration procedure we may wish to add more simulation discharges on additional **QARD** lines. A new **QARD** line must begin with the letters **'QARD'**. The discharge must be entered in columns 6-10 and **MUST BE IN IMPERIAL UNITS.**

Using the editor look at your output file **ZIFG4.CAL** from Step 6. Look for the 3 **QARD** lines near the top of the file, containing the three calibration flows. You don't need to edit any more **QARD** lines in at the moment, but it's worth appreciating what they mean and how the numbers came to be there.

You have now built an **IFG4** file to simulate depths and velocities at the measured calibration flows.

8. Comparing observed data and IFG4 simulation output

- IFG4 program

In order to calibrate the **IFG4** hydraulic simulation model the model is run with the three measured calibration flows defined as the simulation discharges (on the **QARD** lines in the **IFG4** data file). Simulated depths and velocities output from **IFG4** may then be compared with the observed data to check the accuracy of the calibration procedure. There are a variety of calibration options (see documentation provided) which may be used to "tune" the calibration to increase accuracy. The options defined in the **IFG4** file you built in the previous steps contains a set of "default" options which are, in this case, sufficient to provide acceptable accuracy.

Under **'HYDRAULICS - WSL Calibration'** select **IFG4**. Run the program using the **IFG4** data file **ZIFG4.CAL** from Step 7 as the input file. Select the graphics option which plots for the calibration flows only, showing simulated and observed water surface profiles (this can be used for up to a maximum of three calibration flows).

Simulated and observed water surface profiles will be output graphically to the screen - compare them visually. To clear the screen enter any integer. In the **ZOUT** output file look for the error in the stage-discharge regression for each cross-section - 10% or less indicates acceptable accuracy.

At present velocities can only be listed by running the **LSTTP4** program - the output is in

imperial units. There is no updated graphics to display simulated velocities at present.

9. Simulating with IFG4 for a range of discharges

In the **IFG4** data file **ZIFG4.CAL** edit the **QARD** lines (following the instructions given in Step 8) and replace the three calibration flow with a range of simulation discharges (in imperial units). For this example a sensible range is 0.05-2.5 cumecs. Enter 10-15 discharges to cover this range - remember to enter them in cusecs (1 cumec=35.3198 cusecs). Call the edited file **ZIFG4.SIM**. Run the **IFG4** program and review the output.

NOTE: For the graphics make sure you select the option which **DOES NOT** plot for the calibration flows only. At the post-calibration simulation stage we are interested in displaying water surface levels over the whole range of simulation flows, not in comparing simulated vs. observed flows for the calibration flows only.

The plotting procedure can only display the results for a maximum of ten simulation flows - if you enter more than ten it will display results for the lowest and highest flows but will skip some of the flows in between`

Workshop 5: Habitat Modelling

OBJECTIVES

TO COMBINE HYDRAULIC SIMULATION OUTPUT WITH HABITAT SUITABILITY INDEX DATA TO PRODUCE WUA vs Q CURVES.

WORKING DIRECTORY: **C:\WORK5**

DATA FILES: **FISHCRV.WES**
ZHABIN.WES
TAPE3
TP4

PHABSIM PROGRAMS USED: **CRVFIL**
HABINS
HABTAT

Function of PHABSIM Programs used

CRVFIL - Converts the formatted habitat suitability indices contained in the **FISHCRV** file to an unformatted **FISHFIL** file to be used by the **HABTAT** program. Units are imperial.

HABTAT - Combines the HSI data with the hydraulic simulation output and produces WUA vs Q curves in metric units.

HABINS - Produces a **ZHABIN** file which controls the options used when running the **HABTAT** program.

Example data set: River Allen D/S study site

Hydraulic simulation output from **IFG4** for the River Allen downstream study site, giving simulated depths and velocities at fifteen simulation discharges, together with substrate data, are contained in the unformatted files **TAPE3** and **TP4** . Formatted HSI data for brown trout and salmon in the US F&WS **FISHCRV** format is given in **FISHCRV.WES**.

Workshop Steps

1. Locating the data

Data for this workshop is located in directory **C:\WORK5**

Remember, before you begin the workshop, to change the working directory for the PHABSIM **RPM** interface to **C:\WORK5.**

2. Data Files for the Workshop

Press **F8** from the PHABSIM menu and you should see, amongst the files in **C:\WORK5** the following data files.

FISHCRV.WES	- File containing HSI data for life-stages of trout and salmon.
ZHABIN.WES	- Input/output options control file.
TAPE3	- Unformatted cross section morphology data file.
TP4	- Unformatted hydraulic simulation output (velocities and depths) from an **IFG4** simulation. Simulated depths and velocities are given for 15 simulation discharges defined on the **QARD** lines of the **IFG4** input file.

Copy your own HSI file, produced in Workshop 3 from **C:\WORK3** into **C:\WORK5** as **FISHCRV.YOU.**

3. Converting formatted HSI data file into an unformatted file

- CRVFIL program

Before habitat suitability index data in a **FISHCRV** file can be used by the **HABTAT** habitat simulation program it must be converted to an unformatted file, called a **FISHFIL** file.

Under **'S.I. CURVES' - 'Management'** select program **CRVFIL**. Run **CRVFIL** with the formatted HSI data file **FISHCRV.WES** as the input file. Call the unformatted output file, **FISHFIL.WES**. Repeat the process using our own HSI data file **FISHCRV.YOU** to produce an unformatted **FISHFIL.YOU**.

4. Editing the ZHABIN file

Before you run the **HABTAT** program you must construct a **ZHABIN** input/output control file. The file **ZHABIN.WES** contained in **C:\WORK5** is shown below.

```
IOC      00000001010000000000000000000000000000
HEADER    5
CURVES      194     192     191     891     892
```

The line containing a string of ones and zeros controls various options in the computation of WUA by the **HABTAT** program. The file **ZHABIN.WES** contains a default set of options which have been used for all PHABSIM modelling at IH. If you wish to change any of the options consult the relevant documentation. You can try running the **HABINS** program (under **'HABITAT-Input'**) to create a **ZHABIN** file yourself by answering a series of prompts.

In a **ZHABIN** file The **'HEADER'** line defines the number of habitat suitability curve sets to be used in the simulation. The **'CURVES'** line defines the labels of the individual target species life-stages for which WUA is to be computed. Look at the HSI data file **FISHCRV.WES** and you will see that the numbers on the **'CURVES'** line in the **ZHABIN** file match those for adult,fry and spawning trout, fry and spawning salmon.

Copy **ZHABIN.WES** to a new file - say **ZHABIN.YOU**. Using the editor change the **'5'** on the header line and the labels on the **'CURVES'** lines to match your HSI data in **FISHCRV.YOU**.

NOTE : The **ZHABIN** file has a strictly defined format - labels must be entered in the right columns - see documentation on file format included at the end of the notes for this workshop. As long as you use labels with six or less figures, ending in the same columns as those in the example **ZHABIN.WES** you shouldn't have any problems.

5. Producing Weighted Usable Area vs Discharge curves

- HABTAT program

The habitat simulation program **HABTAT** predicts values of Weighted Usable Area (WUA) available to individual target species life-stages for up to 25 simulation discharges.

Under **'HABITAT' - 'Simulation'** run program **HABTAT** using the input files **ZHABIN.WES, FISHFIL.WES, TAPE3** and **TP4** to produce a PHABSIM **'ZHAQF'** file which contains the WUA vs Q outputs. The HSI data file **FISHFIL.WES** contains HSI data for three life-stages of brown trout and two life-stages of salmon.

Press **F10** to run the program. The program plots output (in metric units) to the screen, for one species at a time. To clear the screen when a plot has been produced type in any integer and press return.

Output from the program is written to the **ZHAQF** file in metric units. The file contains total habitat area vs Q and also WUA vs Q data for each species life-stage.

6. Using your HSI data

Repeat the above using your own HSI data file form Step 3 (don't forget to use the appropriately edited **ZHABIN.YOU** file from Step 3).

Workshop 6: Habitat time series modelling

OBJECTIVES:

TO PRODUCE HABITAT TIME SERIES OUTPUT FROM THE WUA vs Q OUTPUTS PRODUCED IN WORKSHOP 5.

TO PRODUCE HABITAT DURATION CURVES FOR INDIVIDUAL SPECIES LIFE-STAGES.

WORKING DIRECTORY : **C:\WORK6**

DATA FILES : **ZHAQF.WES**
FLOWS.HIS
FLOWS.NAT

PHABSIM PROGRAMS USED : **WUAQT**
HABTS

Function of PHABSIM programs used

WUAQT - Combines flow data (mean monthly/mean daily) with WUA vs Q relationships to produce corresponding habitat (WUA) time series. The program computes the time series for each life-stage of a given species.

HABTS - Analyses habitat time series outputs from **WUAQT** to give habitat (WUA) duration curves and summary statistics.

Example data set: River Allen D/S study site

The data file **ZHAQF.WES** gives total habitat area and WUA vs Q for life-stages of trout and salmon for a range of simulation discharges at the River Allen downstream study site. The data should match your output from Step 4 of Workshop 5. Flow data for the workshop are twenty year records of mean monthly historical and naturalised (without abstraction) flows.

Workshop Steps

1. Locating the data

Data for this workshop is located in directory **C:\WORK6**

REMEMBER before you begin the workshop, to change the working directory for the PHABSIM interface to **C:\WORK6.**

2. Data Files for the Workshop

Press **F8** from the menu and you should see, amongst the files in **C:\WORK** the following data files :

ZHAQF.WES - WUA values for three life-stages of brown trout (adult, fry/juvenile and spawning) and two life-stages of salmon (fry/juvenile) and spawning computed at 15 simulation discharges.

FLOWS.HIS - Record of gauged mean monthly historical flows , 1970-1992.

FLOWS.NAT - Record of gauged mean monthly naturalised flows 1970-1992.

3. Producing habitat time series: program WUAQT

Under **'HABITAT- TIME SERIES'** select program **WUAQT**. Run the program using the data files **ZHAQF.WES** and **FLOWS.NAT**.

The program will prompt you to select a species : choose **'brown trout'** to produce time series of WUA values for life-stages of brown trout - call the output **TROUT.NAT**. Look at **TROUT.NAT** and you will see, for each mean monthly flow , corresponding WUA values for the three life-stages of trout. Repeat, selecting **'salmon'** to produce **SALMON.NAT**.

Now substitute **FLOWS.HIS** for **FLOWS.NAT** to produce corresponding outputs **TROUT.HIS** and **SALMON.HIS**.

4. Producing habitat duration curves and statistics: program HABTS

Under **'HABITAT- TIME SERIES'** select program **HABTS**. Run the program using one of your outputs from Step 3 as input data - say for example **TROUT.HIS**.

The program will prompt you to specify a particular life-stage of the species - the program computes duration curves and summary statistics one life-stage at a time.

The program allows you to select **'all months'** ,**'summer months only'** or **'winter months only'** to produce year-round and seasonal duration curves - try the different options.

For each run rename and keep the **DCTAB** output file which contains summary statistics.

5. Assessing impacts - comparing duration curves and statistics.

DCTAB summary outputs from **HABTS** for individual species life-stages using historical and naturalised flow records may be compared to assess the impact of abstraction upon habitat availability at different levels of exceedance. Use your outputs from Step 4 to answer the following questions:

Using your **DCTAB** outputs from Step 4 answer the following questions (use a calculator or spread-sheet):

What is the reduction in '**year round**' WUA for fry/juvenile trout at the 50,90 and 95 percentile exceedance levels? How does this compare this with the corresponding '**summer only**' and '**winter only**' reductions.

How do the '**year-round**', '**summer only**' and '**winter only**' reductions for fry/juvenile salmon compare with those predicted for trout?

What minimum flow should be specified to maintain summer WUA for fry/juvenile trout above its naturalised 90 percentile exceedance level?

HINT: the WUA vs Q curve gives the flow corresponding to given values of WUA. Naturalised summer flows range from ** to ** cumecs.