

1. Technical Manual

1.1 INTRODUCTION

This manual represents a standalone document and resource for users of the AWRD, and describes the utilization of the various modules and tool-sets which make up the overall GIS interface. As such, some effort has been made to limit references to specific text within the general publication, necessitating some duplication of the information.

GIS training

FAO's Aquaculture Management and Conservation Service (FIMA) has been active in promoting the use of GIS and remote sensing in fisheries and aquaculture since 1985. Promotional activities have been carried out by holding training courses and workshops.

FIMA has developed several GIS resources which complement this manual. Readers who wish to explore more general fisheries-related GIS analyses and training are highly recommended to investigate these additional resources: (1) an FAO manual for self-training on GIS and remote sensing applications (Meaden & Kapetsky, 1991); (2) a hands-on technical manual on GIS in fisheries management and planning (de Graaf *et al.*, 2003); and (3) a Global Gateway to GIS, Remote Sensing and Mapping for Aquaculture and Inland Fisheries.

- 1) Meaden, G.J. and Kapetsky, J.M. 1991. *Geographical information systems and remote sensing in inland fisheries and aquaculture*. FAO Fisheries Technical Paper No. 318. Rome, FAO. 262 pp.

This document was prepared to meet the need for a reference to remote sensing and geographical information systems that maintains a balance between the technologies and their applications in fisheries and aquaculture.

This manual was published in 1991, but it is still being widely disseminated to date as much of the main text remains relevant (see <http://www.fao.org/DOCREP/003/T0446E/T0446E00.HTM>).

- 2) de Graaf, G., Martin, F.J.B., Aguilar-Manjarrez, J. and Jenness, J. 2003. *Geographic Information Systems in fisheries management and planning. Technical manual*. FAO Fisheries Technical Paper No. 449. Rome, FAO. 162 pp.

This document is a technical manual to use along with GIS software for fisheries biologists in the field, explaining GIS in a way that is understandable to non-GIS users. It is a "do-it-yourself-manual" giving a short introduction to GIS software and its applications in fishery science. The overall objective of this manual is to encourage fishery managers to use GIS to foster the sustainable use of natural resources. It is aimed at fisheries biologists, aquatic resource managers and decision makers in developing countries who have no knowledge about GIS. The manual is useful for a broad range of fishery applications. Although the manual by no means covers all possibilities of GIS, it touches upon some of the most important features for fisheries management and planning.

The Environmental Systems Research Institute (ESRI, Inc.) supported this manual with the donation of free copies of ArcView, enabling institutes/organizations in developing countries to perform spatial analyses of their data using GIS Criteria for software donation:

The institute/organization should be located in a developing country, to be determined by whether or not the country is on the World Bank list of low income and lower middle income countries.

(http://www.worldbank.org/data/countryclass/classgroups.htm#Low_income); involved in research or education in inland fisheries biology/management/planning; a non-profit organization; recognized nationally or regionally by the government(s) involved; in need of support in respect with software; and endorsed by the FAO's Regional Aquaculture/Fisheries Officer (Bangkok, Thailand; Accra, Ghana; Santiago de Chile, Chile).

- 3) The “GISFish” Global Gateway to GIS, Remote Sensing and Mapping for Aquaculture and Inland Fisheries.

There are many opportunities to use GIS and remote sensing to improve the sustainability of aquaculture and inland fisheries, and fundamental issues in aquaculture and inland fisheries can be resolved with the help of GIS and remote sensing. However, overall, our research has concluded that the aquaculture and inland fisheries GIS user base is low. Therefore, the objectives of this Gateway are to: (1) improve the sustainability of aquaculture and inland fisheries by promoting the use of GIS, remote sensing and mapping; (2) facilitate the use of GIS, remote sensing, and mapping through easy access to comprehensive information on applications and training opportunities; and (3) provide a “one stop” site from which to obtain the depth and breadth of the global experience on GIS, remote sensing and mapping in aquaculture and inland fisheries.

The Gateway is being designed for a very broad range of users. The beneficiaries will mainly consist of people working with global and regional analysis on aquaculture and inland fisheries management and planning, including researchers and project managers in national and international organizations and scientific institutes. Other beneficiaries are the commercial sector and planners and managers in fields apart from aquaculture and inland fisheries, specifically those involved with coastal area management and river and lake basin management.

The Gateway is available at <http://www.fao.org/fi/gisfish>.

Installation of software

This manual includes 2 DVD's containing the AWRD spatial data archive. To use this manual you need to have ArcView3.x installed. ESRI's Spatial Analyst extension is not required for the AWRD, but it would be very useful for those who want to work with raster data. The system requirements for ArcView 3.3 using Microsoft Windows are:

- Computer: Industry-standard personal computer with at least a Pentium or higher Intel-based microprocessor and a hard disk
- Memory: The minimum requirements recommended by ESRI are 24 MB RAM (32 MB recommended, and performance will increase as RAM increases). However, some functions within the AWRD are very memory-intensive and may require considerably more memory in order to run efficiently, and users are encouraged to install the maximum amount of RAM possible.
- Operating System: Windows 98/98SE, Windows Me, Windows NT 4.0, Windows 2000, and Windows XP--Home Edition and Professional. ArcView 3.x is not expected to run under Windows Vista.

(For additional details see: <http://www.esri.com/software/arcview/arcview3x.html>)

ArcView Spatial Analyst 2 requires ArcView 3.2 or higher and is supported on:

- Microsoft Windows: Windows XP (Home Edition and Professional), Windows 2000, Windows NT 4.0 and Windows 95/98. (For additional details see: <http://www.esri.com/software/arcview/extensions/spatialanalyst/index.html>)

Note The AWRD data archive and extensions are available on the DVDs that accompany the present publication. Additionally, this material and future updates and/or enhancements will also be made available in the Internet in a Web site dedicated to the AWRD.

To install ArcView and the Spatial Analyst extension: put the ArcView installation CD-ROM in your PC and follow the instructions on your screen. After the installation of ArcView is complete you might be asked if you want to install Seagate Crystal reporting. This will take a lot of space on your hard disk, and for the exercises in the manual you do not need it, so press NO unless you plan to use Crystal Reports for other purposes. After you have installed ArcView, you may install the optional Spatial Analyst extension if it is available: put the installation CD-ROM of the Spatial Analyst extension in your PC and follow the instructions on your screen.

Installation of AWRD extension

Installation of this AWRD extension is similar to that of most ArcView 3.x extensions, in that it requires only that you place a single file into the ArcView extensions folder. To install the AWRD:

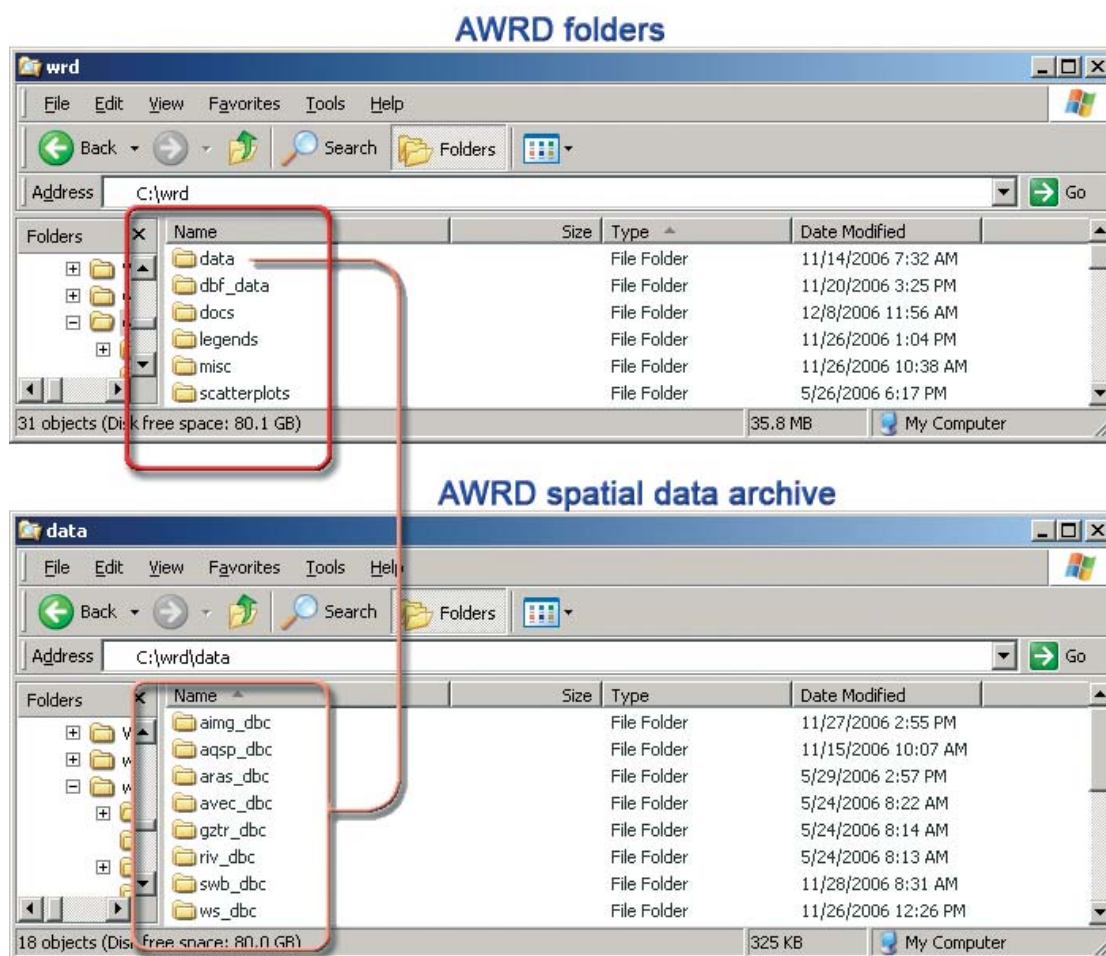
1. Open Windows Explorer and locate the file “awrd_tools.avx” in DVD1. It should be at the top level in DVD1, so you do not need to search through any of the folders.
2. Copy that file by selecting it and clicking the “Edit” menu, then “Copy”, or by simply clicking [Control]-C.
3. Using Windows Explorer, open the ArcView extensions folder on your hard drive. This folder is named “ext32” and is located inside the “ArcView” folder. In almost all cases, the full pathname for the Extensions folder is: “C:\esri\av_gis30\arcview\ext32”.
4. Paste the “awrd_tools.avx” file into the “ext32” folder by clicking the “Edit” menu, then “Paste”, or by simply clicking [Control]-V.
5. The AWRD extension requires the AWRD data archive in order to function properly, so install the data archive before trying to use the AWRD extension in ArcView.

Installation of AWRD data archive

The AWRD data archive is quite large (approximately 5.5 GB in this general release). The AWRD will function best with all the data installed on the hard drive and available to the extension. However, the authors of the AWRD recognize that in some cases users will not have the hard drive capacity to install the entire archive. Therefore we present 3 installation options for users with differing levels of available space.

In all cases, the AWRD data archive must be organized correctly. The AWRD tools expect to find specific datasets in specific folders, so the tools may crash if the datasets are not in the correct location. As seen in Figure 1.1, the general AWRD folder must contain several subfolders named “data”, “dbf_data”, “docs”, “legends”, “misc” and “scatterplots”. The “Data” subfolder contains the actual data archive, and is divided up into a number of database components containing different types of data. The additional folders “dbf_data”, “docs”, “legends”, “misc” and “scatterplots” contain additional tools, documents and tables that are used by the AWRD extension.

FIGURE 1.1
The AWRD data structure



The majority of the AWRD data archive (approximately 4.3 GB) is located on DVD1. Additional raster data (approximately 1.2 GB) is located on DVD2. Installation of the data requires that you simply copy or drag-and-drop data from the DVDs to your hard drive.

Option A: Install the entire archive (recommended option)

Required space = approximately 5.5 GB.

The simplest way to install the entire AWRD data archive is to use Windows Explorer to drag-and-drop the folders from the DVDs to your hard drive. Do the following:

- a) Open DVD1 using Windows Explorer.
- b) Locate the folder “wrld” in DVD1.
- c) Drag the folder “wrld” up to your C: drive (or D:, E:, etc. drive if you have additional hard drives that you would prefer to use). **Important:** Make sure not to place “wrld” in a path containing any spaces (see note below). It is recommended that you place the “wrld” folder directly on the “C” drive and not in any subfolders.
- d) When your data has finished copying to the hard drive, open the folder “wrld” on your hard drive and find the subfolder “data”.
- e) Open DVD2 using Windows Explorer.
- f) Locate the folder “aras_dbc” in DVD2.

- g) Drag the folder “aras_dbc” into the “wrд\data” folder on your hard drive.
- h) After all desired files have been copied, remember to set the file attributes so they are not “read-only” or “archive” (see note below).

Option B: Install a subset of the AWRD archive

Required space = 935 MB to 5.5 GB.

If you have limited space, you may install a subset of the data archive. The AWRD tools will have reduced functionality in this case, but most functions will still work.

Important: This installation option is slightly more complicated than Option 1 and requires that you take care to install data in the correct folder. Do the following:

- a) Decide which hard drive you plan to install the AWRD data to. This example will assume you are installing to the C: drive.
- b) Open the C:\ drive using Windows Explorer.
- c) Add a new folder named “wrд”. **Important:** Make sure not to place “wrд” in a path containing any spaces (see note below). It is recommended that you place the “wrд” folder directly on the “C” drive and not in any subfolders.
- d) Open DVD1 using Windows Explorer.
- e) Open the folder “wrд” in DVD1.

Required Files:

- a) Locate the folders “dbf_data”, “docs”, “legends”, “misc” and “scatterplots” in the “wrд” folder in DVD1 and drag them into the “wrд” folder on your hard drive. These necessary files require approximately 290 MB.
- b) Locate the folder “wrд” on your hard drive and add a new subfolder named “data”.
- c) Return to DVD1 and open the folder “wrд\data”.
- d) Find the subfolders “aqsp_dbc”, “swb_dbc” and “ws_dbc” in the “wrд\data” folder and drag them into your “wrд\data” folder on your hard drive. These necessary files require approximately 645 MB.

Optional Files:

All of these are important to various AWRD functions, but the AWRD should function in a diminished capacity without them. These datasets are described in detail in Section 2.2 of part 1.

- a) *Background Imagery:* Find the folder “aimg_dbc” from the “wrд\data” folder on DVD1, and drag it into your “wrд\data” folder on your hard drive. All the background imagery files require 630 MB.
- b) *Ancillary Vector Data:* Find the folder “avec_dbc” from the “wrд\data” folder on DVD1, and drag it into your “wrд\data” folder on your hard drive. All the ancillary vector files require approximately 2.15 GB.
- c) *Gazetteer Data:* Find the folder “gztr_dbc” from the “wrд\data” folder on DVD1, and drag it into your “wrд\data” folder on your hard drive. All the gazetteer files require approximately 528 MB.
- d) *Rivers:* Find the folder “riv_dbc” from the “wrд\data” folder on DVD1, and drag it into your “wrд\data” folder on your hard drive. All the river data files require approximately 112 MB.
- e) *Ancillary Raster Data:* Insert DVD2 and find the folder “aimg_dbc”. Drag this folder into your “wrд\data” folder on your hard drive. All the ancillary raster data files require approximately 1.15 GB.

After all desired files have been copied, remember to set the file attributes so they are not “read-only” or “archive” (see note below).

Notes:

- You are recommended to copy the data contained on the DVDs onto your hard drive into a single folder (for instance: C:\wrd), making sure that the entire path contains no spaces or long names, as ArcView has problems with these types of paths. For example, do not copy the data into your 'My Documents' folder, because the name of this folder contains a space between the words "My" and "Documents." In some cases, this space will cause ArcView to be unable to find documents that are stored in this folder, causing ArcView to crash at unexpected times.
- If you have installed data using either Option 1 or Option 2, pay special attention to the fact that when you copy files from any CD or DVD onto your hard disk, these files will likely be designated as "Archive" and "Read Only". To be able to work with the files, you will need to change the properties of the files you use: open the Windows Explorer, right-click on the file(s) you copied and are going use, click properties, and look in the General tab under Attributes (at the bottom). All tick boxes need to be empty. If one of the boxes is ticked, untick it, so that the files can be edited. You are encouraged to do this for all files that you copy from the DVDs, and you can do this quickly by right-clicking on your single folder containing all folders and files (i.e. "C:\wrd\"), unticking the tick boxes as described above, and clicking "OK". Windows will likely ask you whether you wish to apply this change to just the single folder to all folders, subfolders and files, so chose the "all folders, subfolders and files" option and click "OK".
- Because the data are available uncompressed on the DVDs, you may at any time copy individual datasets to your hard drive. You may want to do this if, for example, you accidentally delete or corrupt one of the AWRD original datasets on the hard drive. If you wish to copy individual datasets from the DVD to the hard drive, you are recommended to use the standard "Manage Data Sources" function available in ArcView. This function will make sure that all necessary spatial files are copied over:
 1. Open a view
 2. Click the "File" menu, then "Manage Data Sources..."
 3. Use the "Source Manager" dialog to copy data from the DVDs to your hard drive.

Important: If you are replacing archive data, make sure that you copy the DVD data to the original location of the data that you are replacing. If you place it in the incorrect folder, the AWRD tools will not be able to find it.

Option C: Read data from the DVD (least recommended)

The worst-case scenario would be that you do not have space to install even the minimum required AWRD data. In this case you may be able to run certain functions directly from DVD1. Operation may be very slow and some functions will not work, and a few functions may actually crash ArcView if you attempt them. However, you should be able to perform some of the more important tasks. If you do choose this option, and you encounter a crash, please let the authors of the AWRD know what the circumstances of the crash were so we can revise the AWRD extension to prevent the crash. If you choose this option, you will not be able to access any of the ancillary raster data. To use this option, you only need to place DVD1 in your DVD player. When you load the AWRD tools into ArcView, you will be asked to specify the DVD drive name.

Loading AWRD Tools into ArcView

After installing the AWRD extension and the AWRD data archive, you may now start ArcView and load the AWRD extension into your project by clicking on the "File" menu, then "Extensions...", scrolling down through the list of available extensions, and then clicking on the checkbox next to the extension named "African Water Resource Database".

AWRD archive

Table 1.1 is an inventory of the AWRD archive, it provides an alphabetical listing of the data layers contained in all eight of the component databases (DBCs) for the AWRD.

With regards to filenames for the spatial data it was adopted the older 8 characters ISO standard in order to enable the use of the data across Operating Systems platforms. This choice may inhibit the “readability” of some names, so users should always refer to the description of the name provided in Table 1.1 and view the specific metadata for any other additional information.

TABLE 1.1
List of AWRD data layers

Database name	Short name	Feature type	Scale	Source
Ancillary Image Database Component				
2.5d Colored Etopo5 Terrain/Bathymetry	Africa_Background	Image	0.08333°	ETOPO5
2.5d Enhanced 30 as ETM+ Shaded Mosaic	ETM_Mosaic_Sh	Image	465 metre	ETM+ Browse
2.5d Enhanced Etopo2 Colored Terrain/Bathymetry	Etopo2_2-5d	Image	0.03333°	ETOPO2
2.5d Enhanced NASA Blue Marble 30 as Mosaic	BluMrbl_Sh	Image	0.00833°	MODIS BlueMarble-1
African Virtual Base Map	Vrtl_Map	Image	1:750 000	FAO
Baseline 15 as ETM+ Image Mosaic	ETM_Mosaic	Image	465 metre	ETM+ Browse
Class-flattened SRTM 30 Relief w/Etopo2 Bathymetry	Af_RlfFt	Image	0.00833°	SRTM 30as v.2
Classified Etopo2 Terrain/Bathymetry	Etopo2_RGB	Image	0.03333°	ETOPO2
Classified SRTM30as DEM w/Etopo2 Bathymetry	Af_Rlf3d	Image	0.00833°	SRTM 30as v.2
Color Shade of SRTM30as w/Etopo2 Bathymetry	SRTM30_ShdBath	Image	0.00833°	SRTM 30as v.2
ETM+ Satellite Image mosaic, 2.5d enhanced (~230)	af_etm-shd	Image	0.0020833333°	ETM+ Browse
Flattened SRTM 30 as Based Elevation/Relief	SRTM30_Flat	Image	0.00833°	SRTM 30as v.2
Greyscaled 15 as ETM+ Image Mosaic	ETM_Mosaic_HShd	Image	465 metre	ETM+ Browse
Greyscaled Hillshade of Etopo2 Terrain/Bathymetry	Etopo2_Sh	Image	0.03333°	ETOPO2
Greyscaled Hillshade of SRTM30as w/Etopo2 Bath.	SRTM30_HShd	Image	0.00833°	SRTM 30as v.2
Lake Tanganyika ETM+ Images	2 tiles	Image	14.25 metre	ETM+
Lake Tanganyika SRTM ~90m Hillshade Mosaic	lktan_hshd	Image	0.000833°	SRTM
MODIS Satellite Image mosaic, 2.5d enhanced (~230 m)	af_bmng-shd	Image	0.0020833333°	MODIS BlueMarble-2
Nominal 230 metre greyscaled hillshade with bathymetry	7-5as_gscl_srtm-bath	Image	0.0020833333°	SRTM 3as v.2
Nominal 460 metre ETM+ based Satellite Image Mosaic	af_etm_base	Image	465 metre	ETM+ Browse
Nominal 460 metre MODIS based Satellite Image Mosaic	af_bmng_base	Image	0.0041666667°	MODIS BlueMarble-2
SRTM-3as 2.5d Classified Hillshaded-DEM Image Tile	s09e026	Image	0.000833°	FAO
Volta Basin TM Images	2 tiles	Image	28.5 metre	TM
Volta River Basin SRTM ~90m Hillshade Mosaic	Volta_HShd	Image	0.000833°	SRTM 3as v.2
Aquatic Species Database Component				
Aquatic Species Political Boundary Reference	aqsp_political	Polygon Shapefile	1:1 000 000	FAO
Aquatic Species Watershed Modeling Reference	aqsp_ws_heds	Polygon Shapefile	5 000 cell	WWF/ALCOM
SAIAB Aquatic Species Locations	aq_species	Multipoint Shapefile	n/a	FIMA
SAIAB Threatened and Endanger Species Boundaries	aqsp_thrtnd_py	Polygon Shapefile	n/a	SAIAB
Ancillary Raster Database Component				
Annual Total Air Temperature	airtmp_ann	Grid	0.05°	CRES I FAO
Annual Total Evapotranspiration	et_yr	Grid	0.16667°	CRU
Annual Total Precipitation	prcp_yr	Grid	0.16667°	CRU
Average Monthly Air Temperature (Annual)	airtmp_avq	Grid	0.05°	CRES I FAO
Consolidated 30 as SRTM-Etopo2 Hillshade	hshdbath	Grid	0.00833°	SRTM 30as v.2
Consolidated SRTM 30 as DEM and Etopo2 Bathymetry	srtmbath	Grid	0.00833°	SRTM 30as v.2
Etopo2 2 arc-minute Hill-Bathymetric Shading	etopo2_hshd	Grid	0.03333°	ETOPO2
Etopo2 2 arc-minute Terrain and Bathymetric DEM	etopo2	Grid	0.03333°	ETOPO2
FAO-AquaStat 1 km Hydrologically Filled DEM	wrialaea	Grid	1 km	FAO

GLC-2000 Based 1 km Global Land Cover	glc2000	Grid	1 kilometre	JRC – FAO
Historic Rainfall	414 datasets	Grid	8 km	EDC
HYDRO1 Kilometer Hydrologically Filled DEM	h1k laea	Grid	1 km	HYDRO1k
Lake Tanganyika SRTM 3 as DEM Mosaic	dem_mos	Grid	0.000833°	SRTM
Lake Tanganyika SRTM 3 as Hillshade Mosaic	hshd_mos	Grid	0.000833°	SRTM
Land-Ocean Processing Mask	af-cru_mask	Grid	0.16667°	CRU
Land/Island 30 as Mask based on WVS+	wvs_mask	Grid	1:250 000	WVS+
Maximum Monthly Water Temperature (Annual)	wattmp_max	Grid	0.05°	CRES FAO
Mean Monthly Air Temperature (Annual)	airtmp_mn	Grid	0.05°	CRES FAO
Mean Monthly Water Temperature (Annual)	wattmp_mn	Grid	0.05°	CRES FAO
Median Monthly Water Temperature (Annual)	wattmp_med	Grid	0.05°	CRES FAO
Minimum Monthly Water Temperature (Annual)	wattmp_min	Grid	0.05°	CRES FAO
Minority Monthly Water Temperature (Annual)	wattmp_mnrty	Grid	0.05°	CRES FAO
Monthly Air Temperature	9 datasets	Grid	0.05°	CRES FAO
Monthly Potential Evapotranspiration	12 datasets	Grid	0.16667°	CRU
Monthly Precipitation	12 datasets	Grid	0.16667°	CRU
Monthly Water Temperature	15 datasets	Grid	0.05°	CRES FAO
Range of Monthly Water Temperature (Annual)	wrtmp_rng	Grid	0.05°	CRES FAO
SRTM 30 as DEM w/Oceans Masked	srtmgt30	Grid	0.00833°	SRTM 30as v.2
SRTM 3as 2.5d Hillshade Grid Tile	s09e026	Grid	0.000833°	FAO
SRTM 3as Baseline Grid Tile	s09e026	Grid	0.000833°	NASA SRTM
SRTM 3as Null Set Grid Tile	s09e026	Grid	0.000833°	FAO
SRTM 3as Null/Backfilled Grid Tile	s09e026	Grid	0.000833°	FAO
SRTM-SWBD Based 30 Arc-Second Land/Ocean Mask	src_mask	Grid	0.00833°	SRTM 30as v.2
Volta Basin SRTM 3 as Based DEM Mosaic	dem_mos	Grid	0.000833°	SRTM 3as v.2
Volta Basin SRTM 3 as Based Hillshade Mosaic	hshd_mos	Grid	0.000833°	SRTM 3as v.2

Ancillary Vector Database Component

1995 Decadal Rainfall	RFE_1995	Table	8 km	EDC
1996 Decadal Rainfall	RFE_1996	Table	8 km	EDC
1997 Decadal Rainfall	RFE_1997	Table	8 km	EDC
1998 Decadal Rainfall	RFE_1998	Table	8 km	EDC
1999 Decadal Rainfall	RFE_1999	Table	8 km	EDC
2000 Decadal Rainfall	RFE_2000	Table	8 km	EDC
2001 Decadal Rainfall	RFE_2001	Table	8 km	EDC
2002 Decadal Rainfall	RFE_2002	Table	8 km	EDC
2003 Decadal Rainfall	RFE_2003	Table	8 km	EDC
2004 Decadal Rainfall	RFE_2004	Table	8 km	EDC
30+ Year Long Average Decadal Rainfall	RFE_Lavg	Table	8 km	EDC
7 Year Short Average Decadal Rainfall	RFE_Savg	Table	8 km	EDC
Air Temperature	AT_Mnthly	Table	0.05°	CRES FAO
Consolidated Vmap0 Bathymetric, Coast and Contour Lines	Hypso_Ln	Polyline Shapefile	1:1 000 000	Vmap0 5 th Ed.
Consolidated Vmap0 Feature Point Reference	GnFtr_Pt	Point Shapefile	1:1 000 000	Vmap0 5 th Ed.
Cross Table of potential coding attributes	af_qa_c	Table		
Cross-Table for Differentiating DCW SWB-River Anno	dnano_ly	Table	1:1 000 000	DCW
Cross-Table of FIPS-ISO-UN Political Codes	WVS_Code	Table	1:250 000	WVS+
Cross-Table of Uniq Vmap0 General Point Encoding	GnFtr_Pt_CodeAll	Table	1:1 000 000	Vmap0 5 th Ed.
Cross-Table of Uniq Vmap0 Linear Pipeline Encoding	Pipe-Ln_CodeAll	Table	1:1 000 000	Vmap0 5 th Ed.
Cross-Table of Uniq Vmap0 Linear Railway Encoding	RR_All-Cd_Describd	Table	1:1 000 000	Vmap0 5 th Ed.
Cross-Table of Uniq Vmap0 Linear Roads Encoding	Rd_All-Cd_Describd	Table	1:1 000 000	Vmap0 5 th Ed.
Cross-Table of Uniq Vmap0 Linear Utility Encoding	Util-Ln_CodeAll	Table	1:1 000 000	Vmap0 5 th Ed.
Cross-Table of Uniq Vmap0 Polygonal Industry Encod	Ind-Py_CodeAll	Table	1:1 000 000	Vmap0 5 th Ed.
Cross-Table of Unique Soils Attributes	Uniq_Soil-Codes	Table	1:5 000 000	FAO
Cross-Table of Unique Vmap0 FCODE-FACC Encoding	FCOD_ALL	Table	1:1 000 000	Vmap0 5 th Ed.
CRU Evapotranspiration	et_mnthly	Table	0.16667°	CRU
CRU Precipitation	rf_mnthly	Table	0.16667°	CRU
DCW Annotation and Map Labels	Af_Anno	Coverage	1:1 000 000	DCW
DCW Cultural Landmark Map Labels	clln	Annotation	1:1 000 000	DCW
DCW Cultural Landmark Point Map Labels	clpnt	Annotation	1:1 000 000	DCW
DCW Data Quality Map Labels	dqnet	Annotation	1:1 000 000	DCW
DCW Dated Political Map Labels	ponet	Annotation	1:1 000 000	DCW
DCW Drainage Network Point Features	DnNet_Pt	Point Shapefile	1:1 000 000	DCW
DCW Drainage Point Features	DnPnt_Pt	Point Shapefile	1:1 000 000	DCW
DCW Elevation Class Polygons (Hypsography)	Hypso_Py	Polygon Shapefile	1:1 000 000	DCW
DCW Land Cover (Hydrological Features)	af_lchyd	Polygon Shapefile	1:1 000 000	DCW
DCW Land Cover (Land Surface Features)	af_lcsrf	Polygon Shapefile	1:1 000 000	DCW
DCW Linear Ocean Feature Map Labels	ofln	Annotation	1:1 000 000	DCW
DCW Linear Physiographic Map Labels	phln	Annotation	1:1 000 000	DCW
DCW Linear Transportation Map Labels	tsln	Annotation	1:1 000 000	DCW
DCW Point Drainage Network Map Labels	dnpnt	Annotation	1:1 000 000	DCW
DCW Point Land Cover Map Labels	lcpt	Annotation	1:1 000 000	DCW

DCW Point Ocean Feature Map Labels	ofpnt	Annotation	1:1 000 000	DCW
DCW Point Transportation Map Labels	tspnt	Annotation	1:1 000 000	DCW
DCW Polygonal Drainage Network Map Labels	dnnet	Annotation	1:1 000 000	DCW
DCW Polygonal Land Cover Map Labels	lcpy	Annotation	1:1 000 000	DCW
DCW Populated Place Map Labels	pppnt	Annotation	1:1 000 000	DCW
DCW Railway Line Map Labels	rrln	Annotation	1:1 000 000	DCW
DCW Roads Map Labels	rdln	Annotation	1:1 000 000	DCW
DCW Utility Line Map Labels	utln	Annotation	1:1 000 000	DCW
Equator, Tropics and Meridian Reference	Trop_Ref	Polyline Shapefile	1:1 000 000	FIMA
FAO 1:5 Million Scale Soils	Soils_Py	Polygon Shapefile	1:5 000 000	FAO
FAO National-Ad1 Boundaries	Ad1_Py	Polygon Shapefile	1:1 000 000	FAO
FAO Subnational-Ad3 Boundaries	Ad3_Py	Polygon Shapefile	1:1 000 000	FAO
RWDB2 Administrative Centres and Populated Places	RWDB_PPI	Point Shapefile	1:3 000 000	RWDBII
RWDB2 Airports	RWDB_Aprt	Point Shapefile	1:3 000 000	RWDBII
RWDB2 Coastal-Surface Water Body Linear Boundaries	RWDB_Bnd-Ln	Polyline Shapefile	1:3 000 000	RWDBII
RWDB2 Coastal-Surface Water Body Polygon Boundary	RWDB_Bnd-Py	Polygon Shapefile	1:3 000 000	RWDBII
RWDB2 Gazetteer Named Locations	RWDB_Gztr	Point Shapefile	1:3 000 000	RWDBII
RWDB2 National-Ad1 Linear Boundaries	RWDB_Ad1-Ln	Polyline Shapefile	1:3 000 000	RWDBII
RWDB2 National-Ad1 Polygonal Boundaries	RWDB_Ad1-Py	Polygon Shapefile	1:3 000 000	RWDBII
RWDB2 Ports and Harbours	RWDB_Port	Point Shapefile	1:3 000 000	RWDBII
RWDB2 Railway Lines	RWDB_RR	Polyline Shapefile	1:3 000 000	RWDBII
RWDB2 River-Surface Water Body Network	RWDB_Hyd-Ln	Polyline Shapefile	1:3 000 000	RWDBII
RWDB2 Roads	RWDB_Rd	Polyline Shapefile	1:3 000 000	RWDBII
RWDB2 Subnational-Ad2 Linear Boundaries	RWDB_Ad2-Ln	Polyline Shapefile	1:3 000 000	RWDBII
RWDB2 Subnational-Ad2 Polygonal Boundaries	RWDB_Ad2-Py	Polygon Shapefile	1:3 000 000	RWDBII
RWDB2 Surface Water Bodies	RWDB_SWB-Py	Polygon Shapefile	1:3 000 000	RWDBII
SRTM 1-by-1 Degree Reference Polygons	1x1_Py	Polygon Shapefile	1:100 000	SRTM-SWBD
SRTM Coastlines	Cstln_Ln	Polyline Shapefile	1:100 000	SRTM-SWBD
SRTM Data Source Reference Polygons	Src_Py	Polygon Shapefile	1:100 000	SRTM-SWBD
SRTM Landmass and Oceanic Island Polygons	Mask_Py	Polygon Shapefile	1:100 000	SRTM-SWBD
Vectorized 10-by-10 minute Grid (Point)	CRU_Pt	Point Shapefile	0.16667°	CRU
Vectorized 10-by-10 minute Grid (Polygon)	CRU_Py	Polygon Shapefile	0.16667°	CRU
Vectorized 8-by-8 Kilometer Grid Reference	RFE_Py	Polygon Shapefile	8 km	EDC
Vectorized CRES 3-by-3 Minute Point Reference	CRES_Pt	Point Shapefile	0.05°	CRES FAO
Vectorized CRES 3-by-3 Minute Polygon Reference	CRES_Py	Polygon Shapefile	0.05°	CRES FAO
Vmap0 Airports	Airpt_Pt	Point Shapefile	1:1 000 000	Vmap0 5 th Ed.
Vmap0 Canals	Canal_Ln	Polyline Shapefile	1:1 000 000	Vmap0 5 th Ed.
Vmap0 Capital Cities	Caplt_Pt	Point Shapefile	1:1 000 000	Vmap0 5 th Ed.
Vmap0 Generalized Coastline-National Reference	Ed5LR_Ln	Polyline Shapefile	1:1 000 000	Vmap0 5 th Ed.
Vmap0 Industrial Pipeline Reference	Pipe_Ln	Polyline Shapefile	1:1 000 000	Vmap0 5 th Ed.
Vmap0 Industrial Processing Polygons	Indus_Py	Polygon Shapefile	1:1 000 000	Vmap0 5 th Ed.
Vmap0 International Date Line	IntDt_Ln	Polyline Shapefile	1:1 000 000	Vmap0 5 th Ed.
Vmap0 Land Surface and Physiographic Reference	Phys_Py	Polygon Shapefile	1:1 000 000	Vmap0 5 th Ed.
Vmap0 Landmass and Oceanic Island Polygons	Mask_Py	Polygon Shapefile	1:1 000 000	Vmap0 5 th Ed.
Vmap0 Major Road Library Reference	LR_Rd_Ln	Polyline Shapefile	1:1 000 000	Vmap0 5 th Ed.
Vmap0 National-Ad1 Linear Boundaries	Ad1_Ln	Polyline Shapefile	1:1 000 000	Vmap0 5 th Ed.
Vmap0 National-Ad1 Polygonal Boundaries	Ad1_Py	Polygon Shapefile	1:1 000 000	Vmap0 5 th Ed.
Vmap0 Ocean and Sea Polygon Reference	Ocea_Py	Polygon Shapefile	1:1 000 000	Vmap0 5 th Ed.
Vmap0 Oceanic Island Point Reference	Islnd_Pt	Point Shapefile	1:1 000 000	Vmap0 5 th Ed.
Vmap0 ONC and Data Quality Reference	Ed5DQ_Py	Polygon Shapefile	1:1 000 000	Vmap0 5 th Ed.
Vmap0 Populated Place Point Reference	PPI_Pt	Point Shapefile	1:1 000 000	Vmap0 5 th Ed.
Vmap0 Populated Place Polygon Reference	PPI_Py	Polygon Shapefile	1:1 000 000	Vmap0 5 th Ed.
Vmap0 Railway Line Reference	RR_Ln	Polyline Shapefile	1:1 000 000	Vmap0 5 th Ed.
Vmap0 Roads Reference	Rd_Ln	Polyline Shapefile	1:1 000 000	Vmap0 5 th Ed.
Vmap0 Spot Elevation Points	Hypso_Pt	Point Shapefile	1:1 000 000	Vmap0 5 th Ed.
Vmap0 Subnational-Ad2 Linear Boundaries	Ad2_Ln	Polyline Shapefile	1:1 000 000	Vmap0 5 th Ed.
Vmap0 Subnational-Ad2 Polygonal Boundaries	Ad2_Py	Polygon Shapefile	1:1 000 000	Vmap0 5 th Ed.
Vmap0 Utilities Line Reference	Util_Ln	Polyline Shapefile	1:1 000 000	Vmap0 5 th Ed.
Water Temperature	WT_Mnthy	Table	0.05°	CRES FAO
WVS+ Coastline-Political Boundary Linear Reference	Cadm_n_Ln	Polyline Shapefile	1:250 000	WVS+
WVS+ Landmass-Island-National Boundary Reference	Cadm_n_Py	Polygon Shapefile	1:250 000	WVS+
WVS+ Landmass-Island-National Point Reference	Cadm_n_Pt	Point Shapefile	1:250 000	WVS+
Gazetteer Database Component				
Cross Table of potential coding attributes	gns_gztr_c	Table		
Cross-Table of Unique DCW Gazetteer Encoding	dcw_featur_code	Table	1:1 000 000	
Cross-Table of Unique GEOnet (GNS) Encoding	DSG_Code	Table	1:250 000	GEOnet
DCW Gazetteer	DCW_Gztr	Point Shapefile	1:1 000 000	DCW
GEOnet Gazetteer Database	gns_gztr	Point Shapefile	1:250 000	GEOnet
Rivers Database Component				
Consolidated Vmap0 River-Surface Waterbody Network	vmap_riv	Polyline Shapefile	1:1 000 000	Vmap0 DCW
Cross Table of potential coding attributes	WRIA_Riv_c	Table		

FAO-AquaStat 1:5m African Rivers	wria_riv	Polyline Shapefile	1:5 000 000	FAO
HYDRO-1 Kilometer Flow Drainage Network	h1k_flow	Polyline Shapefile	4 000 cell	HYDRO1k
River Features from GEOnet Gazetteer	gns_riv	Point Shapefile	1:250 000	GEOnet
RWDB2 Rivers and Surface Water Body Outlines	rwdb_riv	Polyline Shapefile	1:3 000 000	
Surface waterbodies Database Component				
AfriCover Surface Water Body Features	africvr	Polygon Shapefile	~1:250 000	FAO
Consolidated Vmap0 Surface Water-Hydro Features	vmap_py	Polygon Shapefile	1:1 000 000	Vmap0 DCW
Consolidated WCMC Wetlands	WtInd_Py	Polygon Shapefile	1:1 000 000	WCMC
Cross Table of potential coding attributes	af_swbpt_c	Table		
Cross-Table of Unique AfriCover Attributes	AfriCvr_SWB_Attrib	Table	~1:250 000	FAO
FAO-AquaStat 1:1m Major African SWBs	wria_swb	Polygon Shapefile	1:1 000 000	FAO
FAO-AquaStat Large African Dam Database	wria_dam	Point Shapefile	10 000 cell	FAO
FAO-MRAG Lake-River Fisheries: 1 st Global Referenc	wl_sptl	Table	n/a	FAO
FAO-MRAG Lake-River Fisheries: Catch Data	wl_fao-d	Table	n/a	FAO
FAO-MRAG Lake-River Fisheries: Chemistry/Biology	wl_cmbio	Table	n/a	FAO
FAO-MRAG Lake-River Fisheries: Demography	wl_demog	Table	n/a	FAO
FAO-MRAG Lake-River Fisheries: Fisheries Data	wl_fish	Table	n/a	FAO
FAO-MRAG Lake-River Fisheries: Hydrology/Climate	wl_hyclm	Table	n/a	FAO
FAO-MRAG Lake-River Fisheries: Morphology	wl_morph	Table	n/a	FAO
FAO-MRAG Lake-River Fisheries: References	wl_ref	Table	n/a	FAO
FAO-MRAG Lake-River Fisheries: Summary	wl_sumry	Table	n/a	FAO
FAO-MRAG Lake-River Fisheries: Water Bodies	wl_wtrby	Table	n/a	FAO
FAO-MRAG Spatially Referenced Water Bodies	af_wl_pt	Point Shapefile	n/a	FAO
FAO-MRAG World Lakes and Rivers Point Reference	af_wldlk	Point Shapefile	n/a	FAO
Harmonized DCW-Vmap0 Surface Water Bodies	dniw_hyd	Polygon Shapefile	1:1 000 000	DCW Vmap0
Linear representation of consolidated Vmap0 SWBs	vmap_ln	Polyline Shapefile	1:1 000 000	Vmap0 DCW
National summary cross-table of Water Bodies: DCW/Vmap	Af-Hyd_Ad1	Table	n/a	Vmap0 FIMA
National summary cross-table of Water Bodies: RWDB2	Af-RWDb2_Ad1	Table	n/a	Vmap0 FIMA
National summary cross-table of Water Bodies: Vmap0	Af-VmapEd5_Ad1	Table	n/a	Vmap0 FIMA
National summary cross-table of Water Bodies: WCMC	Af-WCMC_Ad1	Table	n/a	Vmap0 FIMA
Original SADC-WRD Surface Waterbodies Database	SWB_SADC	Table	1:250 000	ALCOM
Point representation of consolidated Vmap0 SWBs	vmap_pt	Multipoint Shapefile	1:1 000 000	Vmap0 DCW
RWDB2 Surface Water Bodies	rwdb_swb	Polygon Shapefile	1:3 000 000	RWDBII
SADC Surface Water Body Database	sadc_swb	Point Shapefile	1:250 000	ALCOM
SRTM River-Surface Water Bodies	swbd_py	Polygon Shapefile	1:100 000	SRTM-SWBD
SRTM Surface Water Body Linear Outlines	swbd_ln	Polyline Shapefile	1:100 000	SRTM-SWBD
SRTM Surface Water Body Point Reference	swbd_pt	Point Shapefile	1:100 000	SRTM-SWBD
Subnational summary cross-table of SWBs: DCW/Vmap	Af-Hyd_Ad2	Table	n/a	Vmap0 FIMA
Subnational summary cross-table of Water Bodies: Vmap0	Af-VmapEd5_Ad2	Table	n/a	Vmap0 FIMA
Surface Water Body Features from GEOnet Gazetteer	gns_swb	Point Shapefile	1:250 000	GEOnet
Surface Water Body-Watershed Ad1 Units	vmap_sum_ad1	Polygon Shapefile	1:1 000 000	Vmap0
Surface Water Body-Watershed Ad2 Units	vmap_sum_ad2	Polygon Shapefile	1:1 000 000	Vmap0
Vmap0 Surface Water Feature Point Reference	dniw_pnt	Point Shapefile	1:1 000 000	Vmap0 DCW
Watersheds Database Component				
ALCOM-WWF Watershed Model	alcomwwf	Polygon Shapefile	5 000 cell	WWF ALCOM
Cross-Table of WRI Watersheds Attributes	wri_data	Table	~250 000 cell	WRI
Cross-Table of WS Summary Statistics	alcmwwf_stat	Table	5 000 cell	WWF/ALCOM
FAO-AquaStat Major Basins Watershed Model	faaawria	Polygon Shapefile	10 000 cell	FAO
GIWA Large Marine Ecosystem/Basin Delineation	qiwa_lme	Polygon Shapefile	~100 000 cell	GIWA - URI
HYDRO-1 Kilometer Watershed Model	h1k_lev6	Polygon Shapefile	4 000 cell	HYDRO1k
Watershed Orientation Encoding for HYDRO1k	h1k_ornt	Table	4 000 cell	HYDRO1k
WRI Major Watersheds of the World Delineation	wribasin	Polygon Shapefile	~250 000 cell	WRI-Rutgers

Overview of AWRD interface, menus and additional view and table functions

The full suite of tools provided with the AWRD are available through several buttons and menu options on the ArcView View, Table and Layout interfaces. These include a variety of statistical tools and general enhancements to the basic ArcView interface as well as several functions specifically designed to analyse surface water bodies, watersheds and aquatic species. There are four main interfaces to access the different tools and modules developed for the AWRD: (a) AWRD Interface, (b) AWRD Modules, (c) AWRD Tools and (d) AWRD Table and View functions. These interfaces are briefly mentioned here and described in more detail later in the manual.

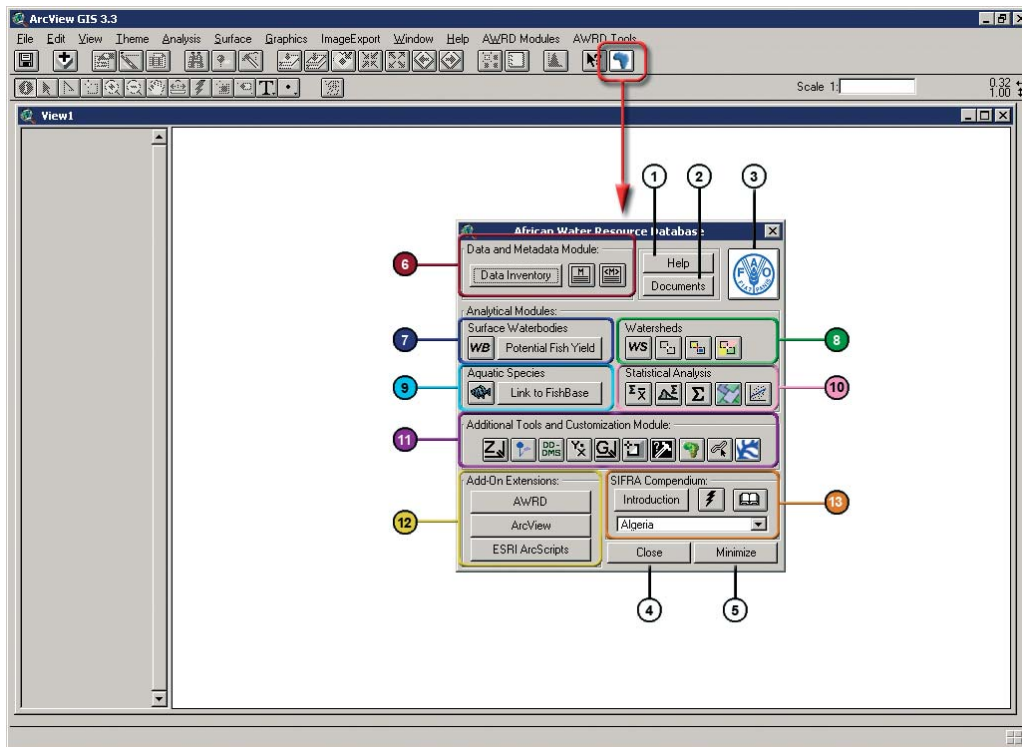
Notes The customized applications described in this publication are formally known as “Dialogs”.

Backdrop images against which the core functionality of the AWRD interface can be displayed and highlighted are included in most the figures in this section to provide users with a number of ways to visualize landscapes and differentiate hydrographic features.

AWRD interface




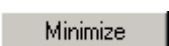
For most users, the primary source for AWRD functions will be the AWRD Interface, accessible by clicking the  button in the ArcView View button bar (Figure 1.2).

FIGURE 1.2
The AWRD Interface



This interface offers links to five generic buttons; six AWRD Modules; Add-on extensions and a link to the SIFRA Compendium (Table 1.2).

TABLE 1.2
AWRD interface description

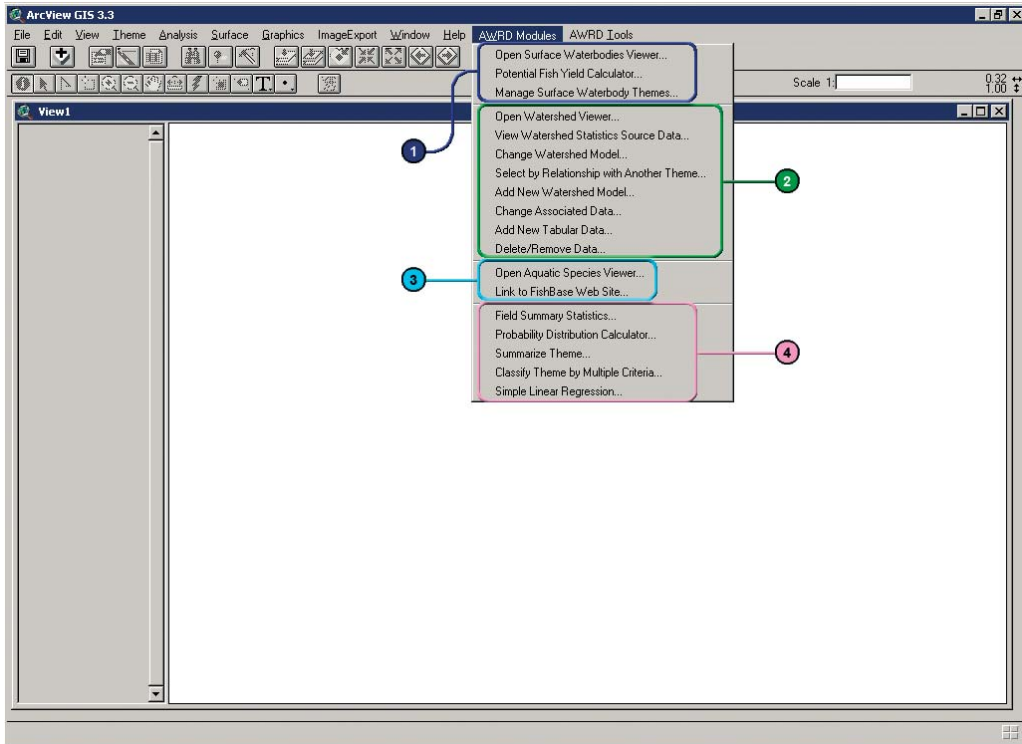
Label (Fig. 1.2)	AWRD Generic buttons	Description
1		Help: this button opens an Help file specific for the AWRD Interface, describing in details all the buttons and functions available.
2		Documents: Documents used, referenced by, or supporting AWRD data and functions.
3		FAO: this button links users directly to FAO Fisheries Web page.
4		Close: This button permits user to close the AWRD Interface when desired.
5		Minimize: AWRD Interface: this button reduces the size of the AWRD Interface.
AWRD Analytical Modules		
6	Data and Metadata	Comprised of a "Data Inventory" and metadata tools.
7	Surface Waterbodies	Provides tools for analysing surface waterbody data and for predicting potential fish yield.
8	Watersheds	Includes several tools for reviewing statistics on watersheds, identifying and selecting watersheds based on their location within the hydrological network, and for selecting watersheds based on their proximity to other features.
9	Aquatic Species	Provides tools to view the known distributions of aquatic species, to identify species within a particular area and to easily review data on different species.
10	Statistical Analysis	Includes several tools for analysing data including descriptive statistics, simple linear regression, classification and testing values against several probability distributions.
11	Additional Tools and Customization	The AWRD includes several additional tools to enhance the analytical power of the four modules. These tools can be used in conjunction with any of the modules.
12	Add-on Extensions	Extensions are tools which can be added to ArcView to enhance the overall functionality of the software. The AWRD itself is an example of an ArcView extension. The AWRD provides a simple means of reviewing, loading and/or unloading a number of additional extensions written by the authors of the AWRD ("AWRD" button), as well as the basic ArcView extensions ("ArcView" button) and many more customized tools developed by ArcView user community ("ESRI ArcScripts" button).
13	SIFRA Compendium	The Source Book for the Inland Fishery Resources of Africa (SIFRA) (Vanden Bossche and Bernacsek, 1990a; 1990 b; 1991) is a comprehensive compendium of information on physical characteristics, limnology and fisheries in Africa, organized by country. The AWRD provides tools to review the SIFRA data on a particular country by either selecting it from a list or by clicking on the country in the View.

Most of the functions listed above are available on the AWRD Interface, but some users may find it convenient to access the functions directly from the AWRD Modules Menu or AWRD Tools menu respectively as described below:

AWRD Modules menu

The AWRD Modules menu provides direct access to four of the six AWRD modules: (1) surface waterbodies; (2) watersheds; (3) aquatic species and (4) statistical analysis (Figure 1.3). These four modules are primarily designed for analytical purposes.

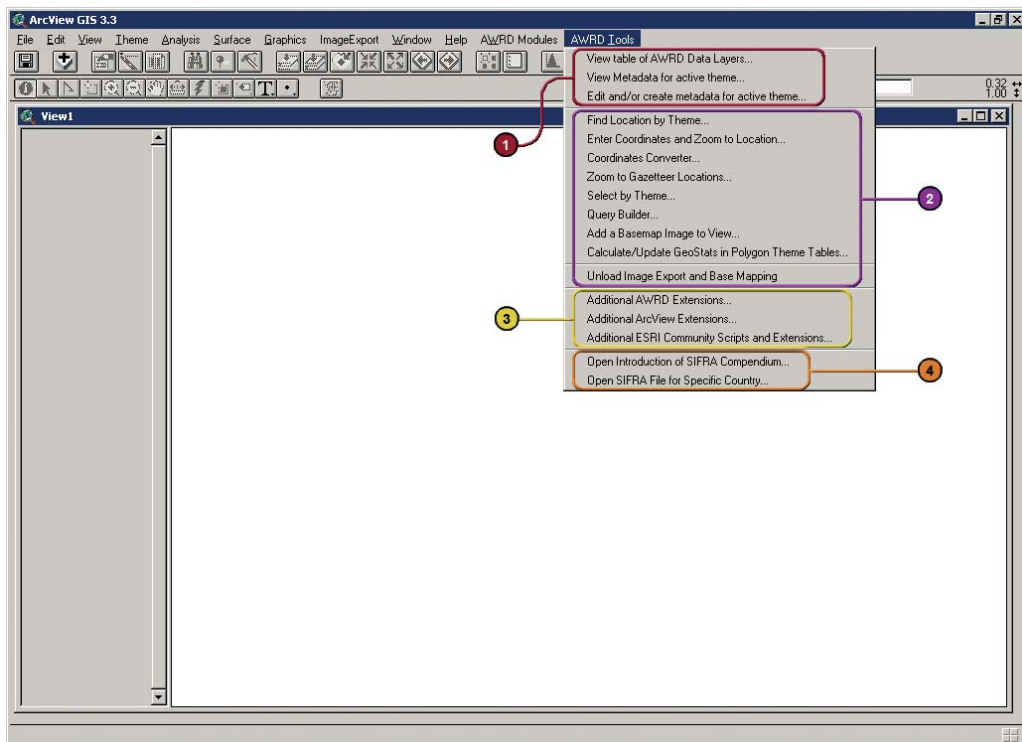
FIGURE 1.3
The AWRD Modules menu



AWRD Tools menu

The AWRD Tools menu provides direct access to many of the more general GIS-based tools. The AWRD Tools menu is separated into four sections based on: (1) Data and Metadata Module; (2) Additional Tools and Customization Module; (3) Add-on extensions; and (4) SIFRA compendium (Figure 1.4).

FIGURE 1.4
The AWRD Tools menu



Additional AWRD tools

In addition to the primary AWRD interface and menu items, the AWRD also includes several general tools and functions that enhance basic ArcView functions. Table 1.3 provides a summary of these tools.

TABLE 1.3
Additional AWRD tools

AWRD More tools	Description
AWRD Help menu options	The standard ArcView "Help" menu, available in any View, Table and Layout menu bar includes six AWRD specific options: Four references to Help files; AWRD Documents; and a link to the FAO Fisheries Web site.
Additional AWRD View tools	In addition to the primary AWRD Interface and menus, the AWRD also includes several general tools and functions that enhance basic ArcView functions, as well as tools to quickly load AWRD data into the view and to modify polygon theme symbology.
Additional AWRD table tools	The AWRD contains a few tools designed specifically to work with "tables" in ArcView.
Information and Editing Tools	All table information and editing tools are located in the "Edit", "Table" and "Field" menus
Excel Import and Export Tools	The AWRD provides tools to import and export to Microsoft Excel spreadsheets. Both of these functions require that Microsoft Excel be installed on the user's computer and are available as buttons in any Table button bar.

Note Appendix 1 provides a summary index of all the tools available in AWRD Interface, AWRD Modules, AWRD Tools; and AWRD table and view functions; whilst Annex 2 illustrates an overview of AWRD Interface, Menus and Additional View and table Functions in schematic diagrams.