WESTERN AUSTRALIA

AUStralian RIVer Assessment System

AUSRIVAS

ACCREDITATION MANUAL

COOPERATIVE RESEARCH CENTRE FOR FRESHWATER ECOLOGY

Natural Heritage Trust

Environment Australia

Department of the Environment and Heritage

WESTERN AUSTRALIA AUStralian RIVer Assessment System (AUSRIVAS) ACCREDITATION MANUAL

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For further information, visit the AUSRIVAS web site at
http://ausrivas.canberra.edu.au

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Front Cover Photograph:
Aeshna brevistyla (Aeshnidae). Photo by Ms Jane Mcrae.

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INTRODUCTION

AUSRIVAS sampling methods are standardized within each State and Territory, but vary nationally. Therefore, AUSRIVAS Training and Accreditation Courses have been tailored specifically for each State and Territory. Additional training and accreditation may be required to use AUSRIVAS as an accredited operator outside the state or territory where accreditation was originally obtained.

The Western Australian AUSRIVAS Training and Accreditation Course has been developed to provide uniformity and consistency in the application of AUSRIVAS methods in Western Australia. The course comprises two major components, a training component and an accreditation component. Each of these components consists of four modules (listed below). Depending on the needs of the course participant, one or all of the modules may be completed (i.e., training with or without accreditation or just accreditation).

Module 1
Pre-Field & Site Information
- Preparation for field work
- Collection of site information

Module 2
Field Work
- Collection of field data
- Macroinvertebrate sampling
- Sample processing – live-sorting

Module 3
Laboratory
- Macroinvertebrate Identification
- Data entry (Training Component only)
- Quality Assurance/Quality Control (Training Component only)

Module 4
AUSRIVAS Predictive Models
- Using the predictive models
- Interpreting the results

The Western Australian AUSRIVAS Accreditation Manual provides details of the accreditation component, including the assessment sheets and instructors notes for each of the four modules. The manual also provides a guide to the level of training required to become accredited. For more information on the training component, see the AUSRIVAS Training and Accreditation Course Outline, Content and Structure document, or visit the AUSRIVAS web site at http://ausrivas.canberra.edu.au.

Assessment Sheets

Assessment sheets have been provided for each of the four modules. Each assessment sheet details a number of exercises that course participants must pass to be accredited as a Western Australian AUSRIVAS operator. Assessment sheets should be photocopied from the manual or printed from the Western Australian AUSRIVAS Training and Accreditation CD and handed out to course participants at the beginning of each accreditation module.

Instructor's Notes

For each accreditation module, instructor's notes have been provided to aid instructors in preparing, conducting and assessing the accreditation exercises. The notes also ensure a standardized accreditation procedure among instructors. Included in the instructor's notes are Mark Allocation Sheets. These sheets provide the instructor with the marking scheme to be used when assessing exercises.

Accreditation Assessment Results Summary Sheet

An Accreditation Assessment Results Summary Sheet (Appendix 1) is included in the Western Australian AUSRIVAS Accreditation Manual to summarize the accreditation assessment results for each course participant.

AUSRIVAS ACCREDITATION

MODULE 1 – ASSESSMENT SHEET

Page 1 of 1

Name: _____

Pre-Field & Site Information

Collection of Site Information

Exercise 1. Site Information
Complete the "Site Details" section of a field sampling sheet for sites _____, _____, and _____.

(Exercise 1 Mark =____%).

Note: A mark of 90% or greater (averaged over the three sites) is required in Exercise 1 to pass Module 1.

AUSRIVAS ACCREDITATION

MODULE 1 - INSTRUCTORS NOTES

Pre-Field & Site Information

A list of materials and resources required for Module 1 is given below.

- Western Australian Sampling and Processing Manual
- Field Sampling Sheets
- Maps (laminated and non-laminated)
- Map measuring devices eg. digital planimeter, map wheel, ruler etc.
- Magnifying glass
- GPS (for converting grid references to latitude and longitude)

Collection of Site Information

Exercise 1. Site Information

Preparation

Before conducting Exercise 1, the instructor must complete the "Site Details" section of a field sampling sheet for each of the three sites being assessed. The information collected by the instructor will become the answers against which the course participants site information will be assessed. The sites used in the Module 1 (and Module 2) assessment should be reference sites from the area in which the course is being conducted. The use of local sites increases the information retained by the participants because the information is more relevant. The use of the same sites throughout the accreditation process provides continuity between accreditation modules, and enables course participants to gain a detailed knowledge of the sites being examined.

Copy the site numbers of the three sites being assessed onto the Module 1 assessment sheet. For each site, place a dot on the relevant map indicating the site's location.

Assessment

Attach copies of the AUSRIVAS accreditation Module 1 assessment sheet and mark allocation sheet No. 1 to three blank field sampling sheets and hand out to each course participant. Participants must complete the "Site Details" section of a field sampling sheet for each site. Once participants have completed the exercise, collect sheets, ensuring participant's names are on the assessment sheet.

Marking

Award marks for each question according to the marking scheme on mark allocation sheet No. 1. An answer is marked as correct if it is the same as the instructor's answer, or for variables listed in Table 1, within the acceptable error range. Answers for variables not listed in Table 1 must be the same as the instructor's answer to be marked correct (i.e., no variation is allowed). Answers receive full marks if correct, and zero marks if incorrect (i.e., a proportion of a question's mark cannot be given). Missing values are to be marked as wrong even when the correct answer is zero.

Mark Allocation Sheet No. 1

Department of Conservation and Land Management
CALM**Science** Division
Monitoring River Health in Western Australia

Site Details

Site No. 5 **Site name** 5 **SOE (Y/N)** N/A

River System 1 **River Name** 5 **IBRA Region** 1

Latitude ____ ° 5 ’ ____ ” S **Longitude** ____ ° 5 ’ ____ ’’ E

Altitude 5 **(m)** **Slope** 5 **(m/km)** **DFS** 5 **(km)**

Flow pattern cat. 5 **Discharge cat.** 5 **Av. ann. rainfall** 1 **(mm)**

Site description (riparian vegetation, stream condition, catchment condition, surrounding landuse, etc.):

Complete in Field

Photo taken by N/A **Film No.** N/A **Frame No.** N/A **Entered into database by** N/A

N/A = Not Assessed

IBRA Region:	IBRA Region:	IBRA Region:	Flow:
(AW) Avon Wheatbelt	(GAS) Gascoyne	(NK) North Kimberley	1=Permanent
(CAR) Carnarvon	(GD) Gibson Desert	(NUL) Nullabor	2=Semi-permanent
(CK) Central Kimberley	(GS) Geraldton Sandplains	(OVP) Ord-Victoria Plains	3=Seasonal
(COO) Coolgardie	(GSD) Great Sandy Desert	(PIL) Pilbara	4=Episodic
(CR) Central Ranges	(GVD) Great Victoria Desert	(SWA) Swan Coastal Plain	
(DL) Dampierland	(HAM) Hampton	(TAN) Tanami	
(ESP) Esperance Plains	(JF) Jarrah Forest	(VB) Victoria Bonaparte	
	(LSD) Little Sandy Desert	(WAR) Warren	
	(MAL) Mallee	(YAL) Yalgoo	
	(MUR) Murchison		

Table 1. The acceptable error for specific variables in the "Site Details" section of the field sampling sheet. Variables not listed below must be the same as the instructor's answer to be marked correct.

Variable	Acceptable Error
Latitude	± 00° 00' 04"
Longitude	± 000° 00' 04"
Altitude	± 20m
Slope	± 10%
Distance from Source	± 10%
Average Annual Rainfall	± 10%

A mark of 90% or greater (averaged over the three sites) is required in Exercise 1 to pass Module 1. Record the mark for Exercise 1 in the space provided on the assessment sheet, and on the participant's Accreditation Assessment Results Summary Sheet (Appendix 1). Hand the assessment sheet and field sampling sheets back to participants and work through any areas of difficulty with them. Participants should retain their field sampling sheets for use in Module 2.

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MODULE 2 – ASSESSMENT SHEET

Page 1 of 2

Name: _____

Field Work

Collection of Field Data

Exercise 1. Field Sampling Sheet
Complete a field sampling sheet for sites _____ and _____. A mark of 90% or greater (averaged over the two sites) is required to pass Exercise 1.

(Exercise 1 Mark =____%).

Macroinvertebrate sampling

Exercise 2. Sample Collection
Collect a 10m channel and macrophyte sample from site _____ and place into separate live-sorting trays. A mark of 90% or greater (averaged over the two habitats) is required to pass Exercise 2.

Assessable Criteria	Channel Mark	Macrophyte Mark
• 10m of habitat sampled	___/ 2	___/ 2
• Available range of micro-habitats sampled	___/ 5	___/ 5
• Habitat sampled effectively	___/ 3	___/ 3
• Net rinsed when necessary	___/ 2	___/ 2
• Sample transferred successfully from net to live-sorting tray	___/ 3	___/ 3
Total	___/ 15	___/ 15

(Exercise 2 Mark =____%).

MODULE 2 – ASSESSMENT SHEET

Page 2 of 2

Exercise 3. Live-Sorting

Live-sort your channel and macrophyte samples according to the Western Australian live-sort protocols (see Western Australian Sampling and Processing Manual for details). Retain the sample residues for further laboratory processing. Remember to label both the sample vials and sample residues with the site number; river name; date; your name; and habitat sampled. Your mark for this exercise will be determined after the macroinvertebrates have been identified in Module 3, Exercise 2.

The instructor will analyse your data using the WISE Access macro and to pass you are required to achieve:

- A sample size of 200 animals or failing this, show evidence that the sample has been sorted for one hour;
- A sample size of chironomid larvae > 20 individuals (target 30) wherever the corresponding number in the Whole Sample Estimate (WSE) also exceeds this value;
- a Live-Sort/Whole of Sample Estimate (LS/WSE) taxa number ratio > 0.9 (result displayed as "Actual" LS/WSE in WISE macro results);
- A Bray-Curtis dissimilarity measure (pres/abs) calculated between LS and WSE that is < 0.3 (result displayed as "Actual", "Unadjusted Bray-Curtis" Pres/Abs in WISE macro results);
- A Bray-Curtis dissimilarity measure (pres/abs) calculated between taxa in the live-sort component that are common to those in the residue, and all WSE taxa, that is ≤ 0.25 (result displayed as "Actual", "Bray-Curtis less taxa unique to LS" Pres/Abs in WISE macro results).

(Exercise 3 Mark =____%).

Note: To pass Module 2 you must pass all three exercises.

AUSRIVAS ACCREDITATION

MODULE 2 - INSTRUCTORS NOTES

Field Work

A list of materials and resources required for Module 2 is given below.

ITEM	QUANTITY	CHECK
Western Australian Sampling and Processing Manual		
Kicknets 250 mm mesh		
Set of sieves covering a range of mesh sizes		
20 Litre bucket		
70% alcohol		
250ml plastic bottles for water quality samples		
Flow meter		
Float (if flow meter fails)		
Waders + spare		
Wader repair kit		
Field meters for DO, pH, EC and Temp.		
Spare batteries		
Spare DO membranes & O_2 probe solution		
Calibration standards		
Calibration instructions		
Alkalinity kit		
GPS		
Field Sampling Sheets		
Clipboard		
Maps		
Marker pens/ pencils		
Esky (large) & ice and/or freezer		
First Aid Kit		
Tape measure 100m		
Camera & film		
Sunscreen		
Rain Jackets		
Labels and rubber bands		
Reference - "A Field Guide to Waterplants in Australia" Sainty and Jacobs 1994		
Card table and chairs		
Forceps + pipettes		
Squeeze bottles		
Large white plastic sorting trays		
Counters		
Vials		

Collection of Field Data

Exercise 1. Field Sampling Sheet

Preparation
Before conducting Exercise 1, the instructor must complete field sampling sheets for the two sites being assessed. These sheets will provide the answers against which the course participant's field sampling sheets will be assessed. The sites should be selected from the three reference sites used in the Module 1 assessment.

Copy the site numbers of the sites being assessed onto the Module 2 assessment sheet.

Assessment
Attach copies of the AUSRIVAS accreditation Module 2 assessment sheet to mark allocation sheet No. 2 and hand out to each course participant. Participants should already have field sampling sheets from Module 1. The participants must complete a field sampling sheet for each site. Once participants have completed the exercise, collect the field sampling sheets, ensuring participant's names are on the front page. Participants should retain their Module 2 assessment sheet until all Module 2 exercises have been completed.

Marking
Award marks for each question according to the marking scheme on mark allocation sheet No. 2. An answer is marked as correct if it is the same as the instructor's answer, or for variables listed in Table 2, within the acceptable error range. Answers for variables not listed in Table 2 must be the same as the instructor's answer (or within the same category) to be marked correct. Answers receive full marks if correct, and zero marks if incorrect (i.e., a proportion of a question's mark cannot be given). Missing values are to be marked as wrong even when the correct answer is zero.

Mark Allocation Sheet No. 2

Department of Conservation and Land Management
CALM**Science** Division
Monitoring River Health in Western Australia

Site Details

GRAND TOTAL = 234

Site No. Completed **Site name** Completed **SOE (Y/N)** N/A

River System Completed **River Name** Completed **IBRA Region** Completed

Latitude ____ ° Completed ’ ____ ” S **Longitude** ____ ° Completed ’ ____ ’’ E

Altitude Completed (m) **Slope** Completed (m/km) **DFS** Completed (km)

Flow pattern cat. Completed **Discharge cat.** Completed **Av. ann. rainfall** Completed (mm)

Site description (riparian vegetation, stream condition, catchment condition, surrounding landuse, etc.):

5

Photo taken by N/A **Film No.** N/A **Frame No.** N/A **Entered into database by** N/A

N/A = Not Assessed

IBRA Region:	IBRA Region:	IBRA Region:	Flow:
(AW) Avon Wheatbelt	(GAS) Gascoyne	(NK) North Kimberley	1=Permanent
(CAR) Carnarvon	(GD) Gibson Desert	(NUL) Nullabor	2=Semi-permanent
(CK) Central Kimberley	(GS) Geraldton Sandplains	(OVP) Ord-Victoria Plains	3=Seasonal
(COO) Coolgardie	(GSD) Great Sandy Desert	(PIL) Pilbara	4=Episodic
(CR) Central Ranges	(GVD) Great Victoria Desert	(SWA) Swan Coastal Plain	
(DL) Dampierland	(HAM) Hampton	(TAN) Tanami	
(ESP) Esperance Plains	(JF) Jarrah Forest	(VB) Victoria Bonaparte	
	(LSD) Little Sandy Desert	(WAR) Warren	
	(MAL) Mallee	(YAL) Yalgoo	
	(MUR) Murchison		

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Monitoring River Health in Western Australia

Access Details

Site No. 5 **Site name** 5

Latitude ° 5 ’ ” S **Longitude** ° 5 ’ ’’ E

WAC (1:1,000,000) **1:250,000 Topo**

1

1:100,000 Topo **1:50,000 Topo**

Land tenure Given **Access by** Given
Air / Ground / Boat

Contact Given **Position** Given **Phone** Given

Postal address Given

CALM Region Given **CALM District** Given **DRA Permit (Y/N)** N/A

Notes N/A

Schematic diagram of 100 m reach:

Include:

- **river and flow direction** 1
- **site location** 1
- **roads** 1
- **access details (location of turnoffs, distances and landmarks leading to site)** 1
- **a northing** 1

Draw access sketch on other side

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Access Sketch

Include:

- **location of channel, riffle, pool rock and macrophyte habitats within the reach** (1)
- **flow direction** (1)
- **access point** (1)
- **channel and macrophyte sampling locations** (1)
- **a northing** (1)

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Water Chemistry

Site No. 5 **Site name** 5 **Date** 5

Round No. 1 **Season** 1 (Wet / Dry) **Mean River Width** 3 **(m)**

Site type 1 **Landuse** 1 **Impact 1** 1 **Impact 2** 1

NB only assign an impact category if there is physical evidence of disturbance at the site at the time of sampling

Water Chemistry		Units
pH	5	$[H^+]$
Temperature	5	(°C)
Conductivity	3	(mS/cm)

Water Samples	Check (Ō)	Bottle No.
125 ml water sample, filtered and frozen	1	1
250 ml water sample, unfiltered	1	1

Habitats within 100 m reach	%
Channel	3
Macrophytes	3
Riffle	3
Pool Rocks	3
Total	1

Comments N/A

Site Types:	Landuse:	Impacts:	Impacts:
REF1 = highest quality	(AG) Agriculture	(AB) Abstraction	(OR) Organic load
REF2 = minimally disturbed	(AR) Aboriginal Reserve	(CM) Channel modification	(PE) Pesticides
REF3 = best available	(CO) Conservation	(CR) Cropping	(RO) Roading
TEST = not reference	(FO) State Forest	(DW) De-watering	(RE) Recreation pressure
	(IN) Industrial	(ER) Erosion	(RI) Riparian veg cleared
	(MI) Mining	(FI) Fire	(RR) River regulation
	(PA) Pastoralism	(HC) Hydrocarbons	(SA) Secondary salinization
	(RV) Remnant Vegetation	(HM) Heavy metals	(SE) Sedimentation
	(TO) Tourism	(IM) Impoundment	(ST) Stock
	(UR) Urban	(MI) Mining	(WE) Weeds
	(VC) VCL	(NI) No Impact	
	(WC) Water catchment	(NU) Nutrients	

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Habitat Details

Site No. 5 **Site name** 5 **Date** 5

Habitat 3 **% of 100 m reach** 3

Sample collected by 1 **60 minute live pick by** 1 **&** 1

Mineral Substrate	%	Breakdown of habitat surface area	%	Density (1 = sparse; 5=dense)
Bedrock	3	Mineral substrate	1	
Boulders (>256 mm)	3	Emergent Macrophyte	5	1 2 3 4 5 1
Cobbles (64 – 256 mm)	3	Submerged Macrophyte	1	1 2 3 4 5 1
Pebbles (16 – 64 mm)	3	Floating Macrophyte	1	1 2 3 4 5 1
Gravel (4 – 16 mm)	3	Algal Cover	1	1 2 3 4 5 1
Sand (1 – 4 mm)	3	Detritus	1	1 2 3 4 5 1
Silt (< 1mm)	3	Riparian veg draped in water	1	
Clay	3	Other		
Total	1	Total	1	

Depth 5 **1** (< 25 cm) **2** (< 50 cm) **3** (< 100 cm) **4** (< 200 cm) **5** (> 200 cm)

Flow **Meter used** 1 **Max flow =** 1 **revs/30s** = 1 **revs/sec** = 5 **cm/s**

1 **Yes**
No **Fan used** 1 **x** **Min flow =** 1 **revs/30s** = 1 **revs/sec** = 3 **cm/s**

Dissolved Oxygen: **Top** of water column = 3 % saturation
Bottom of water column = 3 % saturation

Taxon	Log abundance	Estimate of total no.	Taxon	Log abundance	Estimate of total no.
Nematoda			**Hemiptera** Corixidae		
Platyhelminthes			Notonectidae		
Oligochaeta			Gerridae		
Hirudinea					
Bivalvia					
Gastropoda			**Coleoptera** Dytiscidae		
Acarina			Hydrophilidae		
Diptera Chironomidae					
Ceratopogonidae					
Culicidae			**Odonata** Epiproctophora		
Empididae			Zygoptera		
Ephydridae			**Trichoptera** Leptoceridae		
Simuliidae			Ecnomidae		
Stratiomyidae					
Tabanidae					
			Amphipoda Ceinidae		
			Perthiidae		
Plecoptera Gripopterygidae			**Isopoda**		
Ephemeroptera Baetidae			**Decapoda** Atyidae		
Caenidae			Palaemonidae		
Leptophlebiidae			Parastacidae		

Abundance **1** = (A≤10) **2** = (11≤A≤100) **3** =(101≤A≤1000) **4** = (A>1000+)

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FNARH HABITAT ASSESSMENT SHEET

Site No. 5 Site name 5 Date 5

HABITAT PARAMETER	OPTIMAL CONDITION	SUB-OPTIMAL CONDITION	MARGINAL CONDITION	POOR CONDITION	
Degree of naturalness	Pristine	Minimally disturbed	Moderately disturbed	Heavily disturbed	3
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	
Catchment condition	Pristine	Minimally disturbed	Moderately disturbed	Heavily disturbed	3
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	
Landuse at site	Near pristine	Minimally disturbed	Moderately disturbed	Heavily disturbed	3
	Left bank 10 9	8 7 6	5 4 3	2 1 0	
	Right bank 10 9	8 7 6	5 4 3	2 1 0	
Physical substrate characterisation	Optimal mix of substrate types: Many interstitial spaces	Sub-optimal mix of substrate types	Minimal substrate diversity	Lack of substrate types and spaces: Bedrock only	3
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	
Biological substrate characterisation	Optimal: decaying twigs, leaf litter, epiphytes etc	Sub-optimal: some leaf litter, epiphytes etc	Minimal leaf litter, epiphytes etc	Complete absence of detritus and epiphytes	3
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	
Vegetative protection	Pristine	Minimally disturbed	Moderately disturbed	Heavily disturbed	3
	Left bank 10 9	8 7 6	5 4 3	2 1 0	
	Right bank 10 9	8 7 6	5 4 3	2 1 0	
Width of riparian vegetation	Pristine	Minimally disturbed	Moderately disturbed	Heavily disturbed	5
	Left bank 10 9	8 7 6	5 4 3	2 1 0	
	Right bank 10 9	8 7 6	5 4 3	2 1 0	
Bank stability					
	Left bank 10 9	8 7 6	5 4 3	2 1 0	3
	Right bank 10 9	8 7 6	5 4 3	2 1 0	
Sediment deposition	Optimal condition	Sub-optimal condition	Marginal condition	Poor condition	3
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	
Impoundments, abstraction or channelisation	Optimal condition	Sub-optimal condition	Marginal condition	Poor condition	3
	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	

TOTAL 5

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Table 2. The acceptable error for specific variables on the field sampling sheet. Variables not listed below must be the same as the instructor's answer (or within the same category) to be marked correct.

Variable	Acceptable Error
Latitude	± 00° 00' 04"
Longitude	± 000° 00' 04"
pH	± 10%
Temperature (^{0}C)	± 10%
Conductivity (µS cm^{-1})	± 10%
% channel within 100m reach	± 10%
% macrophytes within 100m reach	± 10%
% riffle within 100m reach	± 10%
% pool rocks within 100m reach	± 10%
% of habitat within 100m reach	± 10%
Mineral Substratum description (% cover of each size category)	± 10%
Breakdown of habitat surface area (% of each category)	± 10%
Flow	± 20%
Dissolved Oxygen (% saturation)	± 10%

A mark of 90% or greater (averaged over the two sites) is required to pass Exercise 1. Where a participant's mark falls just below the 90% threshold, assessment of a third site may be permitted at the instructor's discretion. Record the mark for Exercise 1 in the space provided on the participant's Accreditation Assessment Results Summary Sheet (Appendix 1). Hand the field sampling sheets back to participants and work through any areas of difficulty with them. Participants may record their mark on the Module 2 assessment sheet.

Macroinvertebrate Sampling

Exercise 2. Sample Collection

Assessment
While completing Exercise 1, take each course participant aside and assess them collecting a channel and macrophyte sample as outlined in Exercise 2.

Marking
Award marks according to the marking scheme shown below. Participants receive full marks for each criterion correctly completed, and zero marks for those criteria incorrectly completed (i.e., a proportion of a mark cannot be given). A mark of 90% or greater (averaged over the two habitats) is required to pass Exercise 2. Record the marks for Exercise 2 in the space provided on the assessment sheet and on the Accreditation Assessment Results Summary Sheet. Hand the assessment sheet back to participants and work through any areas of difficulty with them.

Assessable Criteria	**Channel Mark**	**Macrophyte Mark**
• 10m of habitat sampled	___/ 2	___/ 2
• Available range of micro-habitats sampled	___/ 5	___/ 5
• Habitat sampled effectively	___/ 3	___/ 3
• Net rinsed when necessary	___/ 2	___/ 2
• Sample transferred successfully from net to live-sorting tray	___/ 3	___/ 3
Total	___/ 15	___/ 15

Exercise 3. Live-Sorting

Assessment
Channel and macrophyte samples are to be live-sorted according to the Western Australian live-sort protocols (see Western Australian Sampling and Processing Manual for details). Participants are required to retain the sample residues for further laboratory processing.

On return to the laboratory, sub-sample the preserved residues using the following procedure:

1. Using a multi-cell sub-sampler, take a sufficient sub-sample of animals likely to result in slightly more animals than were live-sorted (this estimate is typically derived by sorting the contents of just one or two cells). Where less than 100 animals were live-sorted, a minimum sub-sample size of 100 organisms is required.

2. Sort and identify the contents of sufficient cells to derive approximately 50 animals. This portion of the 'sub-sample' is used to estimate the taxa and relative abundances of animals that are 'common' in the sample.

3. Sort the remainder of the sub-sample, ignoring (leaving behind) the taxa that were recovered in step 2.

4. Scale up the raw taxa abundances derived from step 2 to the full sub-sample fraction taken in step 1. Add together taxa and relative abundances from step 2 (scaled up) and step 3, which now forms the sub-sample of the residue.

5. Enter the residue sub-sample and live-sort data (once identified in Module 3, Exercise 2 and QA/QC has been conducted by instructor) into the Whole of Individual Sample Estimate (WISE) database to obtain a Live-Sort/Whole of Sample Estimate taxa number ratio (LS/WSE) and Bray-Curtis dissimilarity index.

The WISE database is an MS Access database that automatically calculates the LS/WSE and Bray-Curtis dissimilarity index. Instructions on the installation and use of the WISE database can be down loaded from the AUSRIVAS web site at http://ausrivas.canberra.edu.au.

Marking

To pass participants are required to achieve:

- A sample size of 200 animals or failing this, show evidence that the sample has been sorted for one hour;
- A sample size of chironomid larvae > 20 individuals (target 30) wherever the corresponding number in the Whole Sample Estimate (WSE) also exceeds this value;
- a Live-Sort/Whole of Sample Estimate (LS/WSE) taxa number ratio > 0.9 (result displayed as "Actual" LS/WSE in WISE macro results);
- A Bray-Curtis dissimilarity measure (pres/abs) calculated between LS and WSE that is < 0.3 (result displayed as "Actual", "Unadjusted Bray-Curtis" Pres/Abs in WISE macro results);
- A Bray-Curtis dissimilarity measure (pres/abs) calculated between taxa in the live-sort component that are common to those in the residue, and all WSE taxa, that is ≤ 0.25 (result displayed as "Actual", "Bray-Curtis less taxa unique to LS" Pres/Abs in WISE macro results).

Note: To pass Module 2 participants must pass all three exercises.

AUSRIVAS ACCREDITATION

MODULE 3 – ASSESSMENT SHEET

Page 1 of 2

Name: _____

Laboratory

Macroinvertebrate Identification

Exercise 1. Reference Collection Identification
Identify macroinvertebrates in the reference collection to family taxonomic level, except for Oligochaeta (Class), Acarina (Order) and Chironomidae (Sub-family), using the keys recommended by Hawking (2000). You may also use the Interactive Guide to Australian Aquatic Invertebrates CD (Gunn *et al*. 1999) to aid in identifications.

Each taxon should be placed into a separate vial and the count for each recorded on a data sheet. To pass Exercise 1 you must achieve a "Percent Taxa Error" of ≤ 5%. A "Taxa Error" is defined as a mis-identification resulting in the loss or addition of a taxon. The "Percent Taxa Error" is the "Number of Taxa Errors" divided by the "Total Number of Original Taxa", multiplied by one hundred.

Percent Taxa Error	
Number of Taxa Errors (a)	
Total Number of Original Taxa (b)	
Percent Taxa Error ([a/b] x 100)	
Pass or Fail? (Pass if ≤ 5%)	

(Exercise 1 Mark =____%).

MODULE 3 – ASSESSMENT SHEET

Page 2 of 2

Exercise 2. Sample Identification

Identify each of the macroinvertebrate samples collected from the channel and macrophyte habitats to family taxonomic level, except for Oligochaeta (Class), Acarina (Order) and Chironomidae (Sub-family), using the keys recommended by Hawking (2000). You may also use the Interactive Guide to Australian Aquatic Invertebrates CD (Gunn *et al*. 1999) to aid in identifications.

Each taxon should be placed into a separate vial and the count for each recorded on a data sheet. Remember to record important sample information on the data sheet, such as the site number; river name; date; your name; habitat sampled, total number of organisms, total number of taxa etc.

To pass Exercise 2 you must achieve a "Percent Taxa Error" of ≤ 5% (averaged over the two samples).

(Exercise 2 Mark =____%).

Note: To pass Module 3 a "Percent Taxa Error" of ≤ 5% (averaged over Exercises 1 and 2) is required.

AUSRIVAS ACCREDITATION

MODULE 3 - INSTRUCTORS NOTES

Laboratory

A list of materials and resources required for Module 3 is given below.

- Reference collection containing all families used in the creation of the Western Australian AUSRIVAS models
- Channel and macrophyte macroinvertebrate sample
- Taxonomic keys for invertebrate taxa. See Key to Keys: A guide to keys and zoological information to identify invertebrates from Australian inland waters. Identification Guide No. 2, 2nd Edition.
  (Hawking 2000). Visit the AUSRIVAS web site for a list of keys to families.
- *Interactive Guide to Australian Aquatic Invertebrates*, Compact Disk. 2nd Edition. (Gunn *et al*. 1999)
- Computer to run interactive identification CD.
- Invertebrate data sheets
- Staff with macroinvertebrate identification expertise
- Laboratory with stereo microscopes
- Forceps
- Vials
- Channel trays or grided dishes
- Counters
- Labels
- Ethanol
- Squeeze bottles (for water and ethanol)
- Glycerol (dropper bottle)

Macroinvertebrate Identification

Exercise 1. Reference Collection Identification

Preparation
Prepare laboratory with equipment required for macroinvertebrate identification (see above). A reference collection containing all families used in the creation of the Western Australian AUSRIVAS models is needed for this exercise.

Assessment
Participants are required to identify macroinvertebrates in the reference collection to family taxonomic level except for Oligochaeta (Class), Acarina (Order) and Chironomidae (Sub-family) using the keys recommended by Hawking (2000). The Interactive Guide to Australian Aquatic Invertebrates CD (Gunn *et al*. 1999) may also be used to aid in identifications. Once participants have completed the exercise, collect identification sheets, ensuring participant's names are written on the sheet.

Marking
To pass Exercise 1, participants must achieve a "Percent Taxa Error" of ≤ 5%. A "Taxa Error" is defined as a mis-identification resulting in the loss or addition of a taxon. The "Percent Taxa Error" is the "Number of Taxa Errors" divided by the "Total Number of Original Taxa", multiplied by one hundred.

Percent Taxa Error	
Number of Taxa Errors (a)	
Total Number of Original Taxa (b)	
Percent Taxa Error ([a/b] x 100)	
Pass or Fail? (Pass if ≤ 5%)	

Record the mark for Exercise 1 in the space provided on the Accreditation Assessment Results Summary Sheet. Hand sheets back to participants and work through with them any areas of difficulty.

Exercise 2. Sample Identification

Preparation
Prepare laboratory with equipment required for macroinvertebrate identification (see above). Two samples are required for this exercise, one from a channel habitat and another from a macrophyte habitat.

Assessment
Participants are required to identify macroinvertebrate samples collected from both the channel and macrophyte habitats to family taxonomic level, except for Oligochaeta (Class), Acarina (Order) and Chironomidae (Sub-family) using the keys recommended by Hawking (2000). The Interactive Guide to Australian Aquatic Invertebrates CD (Gunn *et al*. 1999) may also be used to aid in identifications. Once participants have completed the exercise, collect identification sheets, ensuring participant's names are written on the sheet.

Marking
To pass Exercise 2, participants are required to achieve a "Percent Taxa Error" of ≤ 5% (averaged over the two samples). Record the mark for Exercise 2 in the space provided on the Accreditation Assessment Results Summary Sheet. Hand sheets back to participants and work through with them any areas of difficulty.

Note: To pass Module 3 a "Percent Taxa Error" of ≤ 5% (averaged over Exercises 1 and 2) is required.

AUSRIVAS ACCREDITATION

MODULE 4 – ASSESSMENT SHEET

Page 1 of 4

Name: _____

AUSRIVAS Predictive Models

Using the Predictive Models

Exercise 1. Single-Season Predictive Model

a) Determine the habitat predictor variables required by the _____ _____ AUSRIVAS model and list below.

Predictor Variables Used:

_____
_____
_____
_____
_____
_____
_____
_____
_____

b) Place macroinvertebrate and habitat data into the format required by AUSRIVAS.
c) Import the bug and habitat files into AUSRIVAS and run model. Save the file on the floppy disk provided. Call the file "your name_single_model.AUS".
d) Export the AUSRIVAS sheet labelled Predicted/Collected containing the Observed to Expected (O/E) ratios and open in Excel.
e) Save this file as an Excel spreadsheet on the floppy disk provided. Call the file "your name_single_oe.xls". Ensure your name is written on the disk.

A mark of 90% or greater is required to pass Exercise 1.

(Exercise 1 Mark =____%).

MODULE 4 – ASSESSMENT SHEET

Page 2 of 4

Exercise 2. Combined-Season Predictive Model

a) Determine the habitat predictor variables required by the _____ _____ AUSRIVAS model and list below.

Predictor Variables Used:

_____
_____
_____
_____
_____
_____
_____
_____
_____

b) Combine the macroinvertebrate data for autumn and spring.
c) Combine the habitat data for autumn and spring.
d) Place macroinvertebrate and habitat data into the format required by AUSRIVAS.
e) Import the bug and habitat files into AUSRIVAS and run model. Save the file on the floppy disk provided. Call the file "your name_combined_model.AUS".
f) Export the AUSRIVAS sheet labelled Predicted/Collected containing the Observed to Expected (O/E) ratios and open in Excel.
g) Save this file as an Excel spreadsheet on the floppy disk provided. Call the file "your name_combined_oe.xls". Ensure your name is written on the disk.

A mark of 90% or greater is required to pass Exercise 2.

(Exercise 2 Mark =____%).

MODULE 4 – ASSESSMENT SHEET

Page 3 of 4

Interpreting the Results

Exercise 3. Site Assessment
Using the information provided, complete the summary table below.

Site	Overall Site Assessment (Band)	Habitat used for Overall Site Assessment	Taxa Predicted to occur but not collected in the habitat used for overall site assessment

Note: If both channel and macrophyte habitats are placed into the same band, refer to the habitat with the lowest O/E taxa ratio.

One mark is awarded for each section of the table completed correctly. A mark of 90% or greater is required to pass Exercise 3.

(Exercise 3 Mark =____%).

MODULE 4 – ASSESSMENT SHEET

Page 4 of 4

Exercise 4. Interpreting Results
List 5 of the steps that one can take when interpreting AUSRIVAS results.

1. _____

2. _____

3. _____

4. _____

5. _____

One mark is awarded for each step listed. A mark of 4 out of 5 (80%) or greater is required to pass Exercise 4.

(Exercise 4 Mark =____%).

Note: To pass Module 4 you must pass all four exercises.

AUSRIVAS ACCREDITATION

MODULE 4 - INSTRUCTORS NOTES

AUSRIVAS Predictive Models

A list of materials and resources required for Module 4 is given below.

- Predictive Model Manual - hard copy
- Macroinvertebrate and habitat data for two sites assessed as mildly impacted
- AUSRIVAS combined season channel and macrophyte model outputs for five sites
- Access to AUSRIVAS models (password)
- Computers with AUSRIVAS software
- Access to the Internet
- Floppy disk for each participant containing the above data

Note: The AUSRIVAS Training and Accreditation CD contains demonstration data from the ACT that may prove useful when developing data sets for Western Australia.

Using the Predictive Models

Exercise 1. Single-Season Predictive Model

Preparation
Prepare a data set comprising macroinvertebrate and habitat data collected from two mildly impacted test sites. The macroinvertebrate data may be from any habitat for which there is a single season model and should be saved as an Excel spreadsheet. Photocopies of the field sampling sheets can be used to provide the habitat data.

Assessment
Participants are required to manipulate the data into the format required by AUSRIVAS and run the data through a single season model.

Marking
Award marks for each question according to the marking scheme shown below. Participants receive full marks for each criterion correctly completed, and zero marks for those criteria incorrectly completed (i.e., a proportion of a mark cannot be given). A mark of 90% or greater is required to pass Exercise 1. Record the mark for Exercise 1 in the space provided on the Accreditation Assessment Results Summary Sheet. Work through any areas of difficulty with participants.

Assessable Criteria	**Marks**	**Comments**
• Predictor Variables Correct	___/ 5	
• Macroinvertebrate data in correct format:		
- Adults and larvae combined	___/ 2	
- Bug codes correct	___/ 5	
- Zeros added and no blanks found	___/ 2	
- Data with sites as rows and bugs as columns	___/ 2	
- File saved as text (tab delimited) file	___/ 1	
• Habitat data in correct format:		
- Habitat codes correct	___/ 3	
- Zeros added and no blanks found	___/ 2	
- Data with sites as rows and habitat variables as columns	___/ 2	
- Sites in the same order as the bug data	___/ 2	
- File saved as text (tab delimited) file	___/ 1	
• Imported the bug file into AUSRIVAS successfully	___/ 2	
• Imported the habitat file into AUSRIVAS successfully	___/ 2	
• Choose the correct AUSRIVAS model i.e. region, season and habitat	___/ 3	
• Exported the AUSRIVAS predicted/collected sheet successfully	___/ 2	
• Opened the AUSRIVAS predicted/collected sheet in excel and saved the file as an excel spreadsheet	___/ 2	
Total	___/ 38	

Exercise 2. Combined-Season Predictive Model

Preparation

Prepare a data set comprising macroinvertebrate and habitat data collected from two mildly impacted test sites. The macroinvertebrate data should be from the same habitat and include both autumn and spring data. The data should be saved as an Excel spreadsheet. Photocopies of the autumn and spring field sampling sheets can be used to provide the habitat data.

Assessment

Participants are required to manipulate the data into the format required by AUSRIVAS and run the data through a combined season model.

Marking

Award marks for each question according to the marking scheme shown below. Participants receive full marks for each criterion correctly completed, and zero marks for those criteria incorrectly completed (i.e., a proportion of a mark cannot be given). A mark of 90% or greater is required to pass Exercise 2. Record the mark for Exercise 2 in the space provided on the Accreditation Assessment Results Summary Sheet. Work through any areas of difficulty with participants.

Assessable Criteria	**Marks**	**Comments**
• Predictor Variables Correct	___/ 5	
• Macroinvertebrate data in correct format:		
- Autumn and spring macroinvertebrate data combined	___/ 5	
- Adults and larvae combined	___/ 2	
- Bug codes correct	___/ 5	
- Zeros added and no blanks found	___/ 2	
- Data with sites as rows and bugs as columns	___/ 2	
- File saved as text (tab delimited) file	___/ 1	
• Habitat data in correct format:		
- Autumn and spring habitat data combined	___/ 5	
- Habitat codes correct	___/ 3	
- Zeros added and no blanks found	___/ 2	
- Data with sites as rows and habitat variables as columns	___/ 2	
- Sites in the same order as the bug data	___/ 2	
- File saved as text (tab delimited) file	___/ 1	
• Imported the bug file into AUSRIVAS successfully	___/ 2	
• Imported the habitat file into AUSRIVAS successfully	___/ 2	
• Choose the correct AUSRIVAS model i.e. region, season and habitat	___/ 3	
• Exported the AUSRIVAS predicted/collected sheet successfully	___/ 2	
• Opened the AUSRIVAS predicted/collected sheet in excel and saved the file as an excel spreadsheet	___/ 2	
Total	___/ 48	

Interpreting the Results

Exercise 3. Site Assessment

Preparation
Prepare two data sets comprising AUSRIVAS combined season channel and macrophyte model outputs for five sites. As the first part of this exercise is designed to test whether course participants know the rules for combining bands, sites exhibiting different band assessments between habitats should be used.

Assessment
Participants are required to complete the summary table, indicating the:

- Overall site assessment - determined by combining assessments from the channel and macrophyte habitats.

  The rules for combining assessments from different habitats are as follows. Where the bandings from both habitats allocate the site to the same band, then that is the final band allocation for the site. Where there is a mismatch in the band allocation from the two habitats, then allocate the site to the band that is farther from band A. In the rare event that the alternative bands are band B and band X, allocate to band B, because this is the most precautionary approach.

- Habitat used for the overall site assessment. If both channel and macrophyte habitats are placed into the same band, the habitat with the lowest O/E taxa ratio should be referred to.

- Taxa predicted to occur but not collected in the habitat used for the overall site assessment.

Marking
Award marks for each question according to the marking scheme shown below. Participants receive full marks for each criterion correctly completed, and zero marks for those criteria incorrectly completed (i.e., a proportion of a mark cannot be given). A mark of 90% or greater is required to pass Exercise 3. Record the mark for Exercise 3 in the space provided on the Accreditation Assessment Results Summary Sheet. Work through any areas of difficulty with participants.

Assessable Criteria	**Marks (1 mark per site)**	**Comments**
• Overall site assessment correct	/ 5	
• Habitat used in overall site assessment correct	/ 5	
• Taxa predicted but not collected correct	/ 5	
Total	/ 15	

Exercise 4. Interpreting Results

Assessment
Participants are required to list 5 of the steps that one can take when interpreting AUSRIVAS results. Steps include:

- Check for data entry errors – bug data and habitat data.
- Check "Unused Bugs" for any bugs which should have been used by AUSRIVAS but were maybe given the wrong code.
- Examine O/E values in relation to the band width e.g., if a site is assigned Band B, how far below reference is the site?
- Band X – may require further examination – possible biological "hot spot", nutrient enrichment, constant flow in normally intermittent stream etc.
- Examine the list of taxa predicted to occur but not collected.
- Examine field data sheets for impact indicators, including
    - poor water quality
    - poor habitat
    - land use impacts
    - point source pollution
    - non-point source pollution
    - dams/barriers upstream
    - recent flooding or low flows
    - under-sampling
    - poor live-sorting conditions
- May need to draw a conclusion of "no reliable assessment possible"

Steps other than those listed above may be deemed acceptable.

Marking
Award 1 mark for each of the 5 steps listed. A mark of 4 out of 5 (80%) or greater is required to pass Exercise 4. Record the mark for Exercise 4 in the space provided on the Accreditation Assessment Results Summary Sheet. Work through any areas of difficulty with participants.

Note: To pass Module 4 participants must pass all four exercises.

REFERENCES

Gunn, B., Cranston, P.S., Dimitriadis, S. & Trueman, J.W.H. (1999). *Interactive guide to Australian Aquatic Invertebrates*. Windows edn 2. CSIRO, Land & Water Resources Research & Development Corporation, & Environment Australia: Canberra.

Hawking J.H. (2000) *Key to Keys: A Guide to keys and zoological information to identify invertebrates from Australian inland waters, Identification Guide No. 2*, 2nd Edn. Cooperative Research Centre for Freshwater Ecology, Albury, NSW.

APPENDICES

Appendix 1 Accreditation Assessment Results Summary Sheet

Participants Name: _____

MODULE	MARK (%)	MARK (%) REQUIRED TO PASS	PASS/FAIL	COMMENTS
MODULE 1				
Exercise 1		≥90		
MODULE 2				
Exercise 1		≥90		
Exercise 2		≥90		
Exercise 3		See Page 19		
MODULE 3				
Exercise 1		≥95		
Exercise 2		≥95		
MODULE 4				
Exercise 1		≥90		
Exercise 2		≥90		
Exercise 3		≥90		
Exercise 4		≥80		

MODULE	PASS/FAIL
Module 1	
Module 2	
Module 3	
Module 4	

Organisation Conducting Course: _____

Instructor's Name: _____

Instructor's Signature: _____

Date: _____