NORTHERN TERRITORY

AUStralian RIVer Assessment System

AUSRIVAS

ACCREDITATION MANUAL

LANDS PLANNING ENVIRONMENT
Northern Territory Government

COOPERATIVE RESEARCH CENTRE FOR FRESHWATER ECOLOGY

Natural Heritage Trust

Environment Australia
Department of the Environment and Heritage

NORTHERN TERRITORY AUStralian RIVer Assessment System (AUSRIVAS) ACCREDITATION MANUAL

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Front Cover Photograph:
Robinson River Gorge.

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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 Northern Territory AUSRIVAS Training and Accreditation Course has been developed to provide uniformity and consistency in the application of AUSRIVAS methods in the Northern Territory. 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

Module 3
Laboratory
- Sample processing – laboratory sub-sample
- 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 Northern Territory 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 Northern Territory AUSRIVAS operator. Assessment sheets should be photocopied from the manual or printed from the Northern Territory 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 Northern Territory AUSRIVAS Accreditation Manual to summarize the accreditation assessment results for each course participant.

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MODULE 1 – ASSESSMENT SHEET

Page 1 of 1

Name: _____

Pre-Field & Site Information

Collection of Site Information

Exercise 1. Site Information
Complete the "Site Name", "Site Code", and "Site Description" sections 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.

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MODULE 1 - INSTRUCTORS NOTES

Pre-Field & Site Information

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

- Northern Territory 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 Name", "Site Code", and "Site Description" sections 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 Name", "Site Code", and "Site Description" sections 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

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ACCESS SKETCH

SITE NAME (1)

GRAND TOTAL = 26

SITE CODE (1)

Complete in Field

Page Total = 2

Indicate any features that assist locating exact sample site on subsequent trips.

AUSRIVAS NT

SITE DESCRIPTION

Basin	River	Tributary
1	1	1

Disturbance

¨ Little
¨ Moderate
¨ High

Impacts

¨ Pastoralism
¨ Mining
¨ Urban

¨ Industrial discharge
¨ Impoundments
¨ Agri/horticulture

Landholders and contact details Given

Site history and comments Given

Map name 1

Map scale 1 **Map datum** 1

Altitude 5 **(m)** **Catchment area** 5 **(km^2)**

Distance from source 5 **(m)** **Stream order** 3

Page Total = 24

Table 1. The acceptable error for specific variables in the "Site Description" 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
Altitude	± 20m
Catchment Area Upstream	± 10%
Distance from Source	± 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 1

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 edge and sand bed sample from site _____ and place into separate labelled sample containers. A mark of 90% or greater (averaged over the two habitats) is required to pass Exercise 2.

Assessable Criteria	**Edge Mark**	**Sand Bed 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 sample container	___/ 4	___/ 4
• Sample container correctly labelled	___/ 2	___/ 2
• Sample preserved correctly	___/ 2	___/ 2
Total	___/ 20	___/ 20

(Exercise 2 Mark =____%).

Note: A mark of 90% or greater is required in both exercises to pass Module 2.

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MODULE 2 - INSTRUCTORS NOTES

Field Work

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

ITEM	QUANTITY	CHECK
Northern Territory Sampling and Processing Manual		
Kicknets 250 mm mesh		
Sieves, 250 mm mesh for "rapid" sampling		
Small plastic bucket		
Medium white tray		
Ethanol		
Gloves		
Bug sampling containers		
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.		
Alkalinity kit		
Spare batteries		
Spare DO membranes & O_2 probe solution		
Calibration standards		
Calibration instructions		
GPS		
Digital camera		
Mobile phone		
Field Sampling Sheets		
Clipboard		
Maps		
Marker pens/ pencils		
Esky (large) & ice and/or fridge		
First Aid Kit		
4WD recovery equipment		
Tape measure 100m		
Camera & film		
Sunscreen		
Toilet paper / shovel		
Rain Jackets		
Plastic bags for veg. samples		
Labels and rubber bands		
Reference - "A Field Guide to Waterplants in Australia" Sainty and Jacobs 1994		

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 **GRAND TOTAL = 139**

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ACCESS SKETCH

SITE NAME **SITE CODE**

Completed Completed

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)

Indicate any features that assist locating exact sample site on subsequent trips.

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SITE DESCRIPTION

Basin Completed

River Completed

Tributary Completed

Disturbance

¨ Little
¨ Moderate
¨ High

2

Impacts

¨ Pastoralism
¨ Mining
¨ Urban

¨ Industrial discharge
¨ Impoundments
¨ Agri/horticulture

2

Landholders and contact details Given

Site history and comments Given

Map name Completed

Map scale Completed **Map datum** Completed

Altitude Completed **(m)** **Catchment area** Completed **(km^2)**

Distance from source Completed **(m)** **Stream order** Completed

Page Total = 4

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WATER QUALITY

Date (1) **Site Code** (1) **Field Team** (1)

Time (1) **Horiba Serial No.** (1)

pH (5) **units** **E.C.** (5) **mScm^{-1}**

D.O. (5) **mg/L** **Turbidity** (5) **NTUs**

Water Temp (5) **^{o}C** **Air Temp** (1) **^{o}C**

GPS Easting (5) **Northing** (5)

MACROINVERTEBRATE SAMPLING

EDGE

Length sampled_____m
Sampling depth_____cm
Collected by _____
Containers used_____
Fine organics, mud, muck _____%*
Coarse organics, sticks, leaves_____%*
(1)

*Does not have to total 100%

Substrate 100%____%Bedrock
____%Boulders (>256mm)
____%Cobbles (64-256m)
____%Pebbles (16-64mm)
____%Gravel (4-16mm)
____%Sand (1-4mm)
____%Silt/Clay (<1mm)
(5)

Percentage coverage	**<10**	**10-35**	**35-65**	**65-90**	**>90**
Algal cover	0	1	2	3	4
Adjacent macrophytes	0	1	2	3	4
Overhanging vegn	0	1	2	3	4
Trailing root vegn	0	1	2	3	4

(1)

Edge description
¨ Vertical 90^{o}
¨ Angled 45-90^{o}
¨ Undercut
(1)

SAND/SILT BED

Length sampled (1) ___m
Sampling depth (1) ___cm
Collected by (1) _____
Containers used (1) _____
Fine organics, mud, muck (1) ___%*
Coarse organics, sticks, leaves (1) ___%*

*Does not have to total 100%

Substrate 100%
____%Bedrock
____%Boulders (>256mm)
____%Cobbles (64-256m)
____%Pebbles (16-4mm)
____%Gravel (4-16mm)
____%Sand (1-4mm)
____%Silt/Clay (<1mm)
(5)

Sand sweep description
¨ Horizontal
¨ Angled 0-45^{o}
¨ Angled 45-90^{o}
¨ Shallow <20cm
¨ Deep 20-50cm
(1)

Percentage coverage	**<10**	**10-35**	**35-65**	**65-90**	**>90**
Algal cover	0	1	2	3	4
Adjacent macrophytes	0	1	2	3	4
Overhanging vegn	0	1	2	3	4

(1)

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PHYSICAL CHARACTERISTICS

Habitat velocities & depths **Flow meter serial no._____Fan set no.__** (1)

	Meter Readings (Revolutions per 40s)				Habitat depths (cm)		
Habitat	**1**	**2**	**3**	**Fan details**	**1**	**2**	**3**
Edge							
Sand/silt bed							

(5) (5)

Channel Transects (m) Indicate: Estimated/Measured

Transects	**Widths**	**Depth 1/4 way** LH bank facing downstream	**Depth 1/2 way**	**Depth 3/4 way** LH bank facing downstream
1 furthest upstream	E/M	E/M	E/M	E/M
2	E/M	E/M	E/M	E/M
3 furthest downstream	E/M	E/M	E/M	E/M

(5)

Habitats within 100m reach (Estimate % habitat components looking from above)

HABITAT	% TOTAL AREA	HABITAT	% TOTAL AREA
Sand/Silt bed		Macrophytes	
Gravel/Rock bed		Snags	
Riffle		Pool/Edge/ unknown substrate	

(5)

Width between top of levee banks **m** (1)

Width between immediate stream banks (if different to above) **m** (1)

Height of levee bank from water surface **m** (1)

Riparian zone width -left bank (facing downstream) **m** (1)

- right bank **m** (1)

Flow Level

Relative to normal dry season flow, if known. Normal inundation level marked by limit of terrestrial grasses or by eroded area, or boundary in bank sediment types. (Note: These markers may not be relevant to Top End rivers.)

1 low	**2 moderate**	**3 high**	**4 flood**
<watermark	= watermark	>watermark	

(1)

1 no flow **2 flow** **3 unknown** (1)

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RIPARIAN VEGETATION (within 100m reach)

Vegetation cover of river (Estimation of shade on river at midday)

¨ <5% ¨ 6-25% ¨ 26-50% ¨ 51-75% ¨ >76% (1)

Vegetation type	% Cover (use Specht chart)	Description
trees (>10m)	(1)	(1)
trees (<10m)	(1)	(1)
shrubs / vines	(1)	(1)
grasses / ferns / sedges	(1)	(1)

Native vegetation _____**%** **Exotic vegetation** _____**%** (1)

Weed types:

Erosion in Riparian Zone

	Left Bank (facing downstream)	Right Bank
Bare ground above water mark (due to erosion/disturbance)	**1 yes 2 no** (1)	**3 yes 4 no** (1)
Tree roots exposed (due to erosion/disturbance)	**1 yes 2 no** (1)	**3 yes 4 no** (1)
Gully erosion	**1 yes 2 no** (1)	**3 yes 4 no** (1)
Slumping banks	**1 yes 2 no** (1)	**3 yes 4 no** (1)
Excessive fallen trees/wood debris (due to erosion/disturbance)	**1 yes 2 no** (1)	**3 yes 4 no** (1)

Local Catchment Erosion **1 none 2 little 3 moderate 4 heavy** (1)

Landuse (left bank) facing downstream (1)

¨ Native Woodland ¨ Forestry

¨ Recreational ¨ Grazing

¨ Cropped ¨ Residential

¨ Commercial ¨ Industrial

¨ Other.....

Landuse (right bank) (1)

¨ Native Woodland ¨ Forestry

¨ Recreational ¨ Grazing

¨ Cropped ¨ Residential

¨ Commercial ¨ Industrial

¨ Other.....

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OBSERVATIONS

						Score	
Water Clarity	**1 clear** >1.5m	**2 good** 0.3-1.5m	**3 fair** 0.1-0.3m	**4 poor** zero vis.			(1)
Water Odour	**1 normal**	**2 sewage**	**3 petrol/chems**	**4 other**			(1)
Water Oils	**1 none**	**2 sheen**	**3 slick**	**4 globs**	**5 other**		(1)
Foam/ Scum	**1 none**	**2 pollen/leaves**	**3 algal scum**	**4 foam**	**5 other**		(1)
Plume	**1 little**	**2 some**	**3 lots**				(1)
Sediment Oils	**1 absent**	**2 light**	**3 moderate**	**4 profuse**			(1)
Sediment Odours	**1 normal** **5 other**	**2 sewage**	**3 petrol/chems**	**4 anaerobic**			(1)

Fish: ¨ **no** ¨ **yes**

Birds :

Other wildlife : (eg feral and pastoral animals, native reptiles and mammals - comment on scats, diggings, footprints, slide marks etc)

Evidence of fire **Riparian Zone** ¨ **no** ¨ **yes** (1)

Beyond Levee Banks ¨ **no** ¨ **yes** (1)

Comments (eg height of tree burn scars) (1)

Evidence of human impact (eg litter, pipes, drains, concrete structures, damaged vegetation, campfires, boat & vehicle access) (2)

Site accessed by: ¨ **vehicle** ¨ **helicopter** (1)

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SKETCH OF 100M REACH

Presentation (1)

Relevant Detail (1)

Indicate: **n water quality measurements** **macroinvertebrate habitats** **cross section location**
- water sample collection **10m sweeps** **transect measurements**
D direction of photographs **¬ direction of flow** **location of vehicle access**

SKETCH OF CHANNEL CROSS SECTION

Presentation (1)

Relevant Detail (1)

Indicate: bank heights, vegetation heights and channel width & depths

Page Total = 4

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
pH	± 10%
Conductivity (µS cm^{-1})	± 10%
Dissolved Oxygen (mg l^{-1})	± 10%
Turbidity (NTU)	± 10%
Water Temperature (^{o}C)	± 10%
Air Temperature (^{o}C)	± 10%
Easting	± 100m
Northing	± 100m
Length sampled	± 10%
Sampling depth	± 10%
Fine organics mud, muck	± 10
Course organics, sticks, leaves	± 10
Substratum description (% cover of each size category)	± 10%
Habitat velocities	± 20
Habitat depths	± 20
Channel Transect Widths	± 20
% habitat area within 100m reach	± 10
Width between top of levee banks	± 20%
Width between immediate stream banks	± 20%
Height of levee bank from water surface	± 20%
Riparian zone width	± 20%
% cover trees >10m	± 10
% cover trees <10m	± 10
% cover shrubs / vines	± 10
% cover grasses / ferns / sedges	± 10
% Native Vegetation	± 10%
% Exotic Vegetation	± 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 an edge and sand bed 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	**Edge Mark**	**Sand Bed 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 sample container	___/ 4	___/ 4
• Sample container correctly labelled	___/ 2	___/ 2
• Sample preserved correctly	___/ 2	___/ 2
Total	___/ 20	___/ 20

Note: A mark of 90% or greater is required in both exercises to pass Module 2.

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MODULE 3 – ASSESSMENT SHEET

Page 1 of 2

Name: _____

Laboratory

Sample Processing

Exercise 1. Laboratory Sub-Sample
Collect a 200 organism sub-sample from both an edge and sand bed sample following the Northern Territory laboratory sub-sampling protocols (see Northern Territory Sampling and Processing Manual for details). Retain the sub-sample residues in separate containers. Your instructor will sort through the sub-sample residues to ensure all the required animals have been removed. To pass you are required to recover an average of ≥ 95% of the total number of organisms from the two sub-samples.

(Exercise 1 Mark =____%).

Macroinvertebrate Identification

Exercise 2. 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 2 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 2 Mark =____%).

MODULE 3 – ASSESSMENT SHEET

Page 2 of 2

Exercise 3. Sample Identification
Identify each of the macroinvertebrate sub-samples collected from the edge and sand bed habitat 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 3 you must achieve a "Percent Taxa Error" of ≤ 5% (averaged over the two samples).

(Exercise 3 Mark =____%).

Exercise 4. Scan
Place the unsorted sample residues into separate trays and scan each for 15 minutes, collecting any taxa not found in the sub-samples. Macroinvertebrates collected during the scans should be kept separate from macroinvertebrates collected in the sub-samples and recorded on separate data sheets.

After you have scanned each of your samples for 15 minutes, your instructor will also scan the samples. To pass you are required to collect ≥ 90% of the taxa collected by your instructor (averaged over the two samples). Remember, only taxa not found in the original sub-sample should be collected.

(Exercise 4 Mark =____%).

Note: To pass Module 3 you must pass Exercises 1 and 4 and achieve a "Percent Taxa Error" of ≤ 5% (averaged over Exercises 2 and 3).

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 Northern Territory AUSRIVAS models
- Edge and sand bed 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
- Sub-sampling box and vacuum pump
- Large white plastic sorting tray (for scan)
- Ethanol
- Squeeze bottles (for water and ethanol)
- Glycerol (dropper bottle)

Sample Processing

Exercise 1. Laboratory Sub-Sample

Preparation
Prepare laboratory with equipment required for sub-sampling (see above).

Assessment
Participants are required to collect a 200 organism sub-sample from both an edge and sand bed sample following the Northern Territory laboratory sub-sampling protocols (see Northern Territory Sampling and Processing Manual for details). Ask participants to retain the sub-sample residues in separate containers. Sort through each participant's sub-sample residues and ensure all the required animals have been removed. Record the number of organisms missed by each participant. Place these organisms into separate vials. These organisms should be added to the 200 organism sub-samples once Exercise 1 has been assessed.

Marking
To pass participants are required to recover an average of ≥ 95% of the total number of organisms from the two sub-samples. 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.

Macroinvertebrate Identification

Exercise 2. 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 Northern Territory 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 2, 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 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.

Exercise 3. Sample Identification

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

Assessment
Participants are required to identify macroinvertebrate sub-samples collected from both the edge and sand bed 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 3, participants are required to achieve a "Percent Taxa Error" of ≤ 5% (averaged over the two samples). Record the mark for Exercise 3 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 4. Scan

Preparation
Prepare laboratory with equipment required for a scan (see above).

Assessment
Participants are required to place their unsorted sample residues into separate trays and scan each for 15 minutes, collecting any taxa not found in the sub-samples. Macroinvertebrates collected during the scans should be kept separate from macroinvertebrates collected in the sub-samples and recorded on separate data sheets.

After the participants have scanned each of the samples for 15 minutes, re-scan the samples for another 15 minutes, collecting taxa not found in the original sub-samples.

Marking
To pass participants are required to collect ≥ 90% of the taxa collected by the instructor (averaged over the two samples). Record the mark for Exercise 4 in the space provided on the Accreditation Assessment Results Summary Sheet. Show participants any taxa missed in their scan.

Note: To pass Module 3 participants must pass Exercises 1 and 4 and achieve a "Percent Taxa Error" of ≤ 5% (averaged over Exercises 2 and 3).

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 edge and sand bed 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 edge and sand bed 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 the Northern Territory.

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 edge and sand bed 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 edge and sand bed 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 edge and sand bed 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		
MODULE 3				
Exercise 1		≥95		
Exercise 2		≥95		
Exercise 3		≥95		
Exercise 4		≥90		
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: _____