ENVIRONMENTAL MONITORING METHOD:

Gnamma Monitoring

About This Method

This document helps you to monitor the water quality and biodiversity of gnammas (water holes) using water quality meters, water and soil samples, eDNA samples, and camera traps. This method has been adapted from: Empowering traditional owners by documenting the ecological and cultural values of rock holes in North East Victoria, D. Michael (CSU). You can find more information on the Monitoring Country website: monitoringcountry.org.au or scan the QR code.

This method has three parts: **1. Get Ready**, **2. Out on Country** and **3. Back in the Office.** Each part can be undertaken separately but you must complete all three parts to finish the method. At the end of the document, you will find guidance for all the gear you need - **Gather Your Gear – Complete List**.

We recommend you read the whole document before you start.

Part 1: Get Ready

GATHER YOUR GEAR

Equipment required for this part:

- ☐ Tablets/phones with:
  - ability to take photos
  - data collection and navigation apps
- ☐ Laptop/computer with software for:
  - mapping
- ☐ GPS device (recommended)
- ☐ Camera traps (1 per site) with:
  - SD cards (2 per camera)
  - Rechargeable batteries (1 set per camera)
- ☐ Camera cleaning kit (e.g. soft brush or compressed air duster)
- ☐ Permanent marker
- ☐ Remote camera user guide/manual (optional)

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ENVIRONMENTAL MONITORING METHOD:

Gnamma Monitoring

KEEP IN MIND

Why?

Make sure there is a clear monitoring question and that the method you have selected will answer the monitoring question.

If this is the first time you are monitoring, you will need to design the survey: what are you monitoring, where will you survey, and when and how often you will survey?

When?

Prepare well before heading out on Country so that you have time to gather gear or train staff, if needed.

Who?

1 ranger/staff to plan and prepare

Training and skills

Staff involved in planning are trained and competent in:

- ☐ Mapping software (like QGIS or Google Earth) and/or monitoring point generator
- ☐ Navigation systems (like Avenza app or GPS device)
- ☐ Data collection systems (like Fulcrum app or paper datasheets)
- ☐ Programming cameras

Check permissions

Consult with Traditional Owners, landholders and relevant government agencies and authorities, to determine appropriate access and approvals for environmental monitoring:

1. Where you can go – consult with the owners/managers of the land.
2. What you can do – check if you need scientific licences or ethics permits
3. What or who can you take photos of
4. What can be done with data and photos – who owns them, where will they be stored and how will data be interpreted and communicated.

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ACTIONS

Make a plan and prepare

If you have done this monitoring before, it is best to do the surveys at the same time and same sites so that you can compare the data to previous surveys and see if there have been changes.

1. Plan which dates you will monitor gnammas
   - Some gnammas may not have water in them all year round
   - Some sites may not be accessible immediately after rain
2. Gather records of gnammas or identify where potential gnammas may be
   - Such as from Traditional Owners or government databases
3. Use the monitoring point generator or mapping software to select your sites
   - Gnammas are found on the slopes or summits of dome-shaped granite outcrops
   - Satellite imagery can be used to identify granite outcrops
   - Aim to sample at least 2 gnammas per site
   - It can be helpful to pre-check that your sites have water and are accessible
4. Give each site a unique name, and export and save the location data in your data management system
   - The site code could be a shortened form of the rocky outcrop's name, and then each gnamma could have a number. For example, there is a rocky outcrop called Flat Rock and it has 5 gnammas on it. The site code is FR and each gnamma is numbered; FR1, FR2 etc
5. Prepare maps of sites and load sites onto navigation devices
6. Plan how you will record information on Country (electronic data forms or paper datasheets)
7. Plan your data management system (how you will store images and sampling data)
8. Check **GATHER YOUR GEAR** lists for **Get Ready, Out on Country** and **Back in the Office** (complete list on last page) and get any equipment you don't have.
   - See buying guide(s) for advice on which water quality meters, sampling nets, or cameras may be suitable to buy
9. Charge electronic devices (tablets/phones, power banks, GPS) and batteries
10. If you are using camera traps, decide which software you will be using:
    - image management software (e.g. CPW Photo Warehouse, Wildlife Insights, Camelot, Timelapse Image Analyser)
    - image classifier or objector detector (to speed up image processing, e.g. Megadetector, WildObs)

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Check sampling equipment is clean and in working order

1. Check that the water quality probe is working
   - Read the instruction manual of your water quality probe to find out how to setup, test and calibrate it
2. Check nets for holes and damage, and repair or replace any damaged nets before the survey
3. Check that all sampling equipment is clean

Prepare cameras

1. Give each camera a unique name (e.g. 'CAM01') and write it on the camera with a permanent marker
2. Allocate each camera 2 SD cards, label each card with a name that matches the camera but allows you to tell the 2 SD cards apart (e.g. 'CAM01A' and 'CAM01B')
3. Check all cameras are clean and in good working order
   - Clean all lenses with a soft brush or compressed air duster
   - Consider testing cameras – older or damaged cameras can take photos that are very dark which will make it hard to identify animals
4. Check SD cards are empty/cleared of images
5. Charge camera batteries
6. Insert SD cards and charged batteries into cameras
7. Check and change camera settings so that they are all the same. Common settings are:
   a. Schedule = active 24 hours
   b. Number of images = 3 images per trigger
   c. Time between pictures = rapid succession
   d. Quiet period = no wait between triggers
   e. PIR sensitivity = high
   f. Shutter speed >= 1/60th second
8. Enter the camera's unique name and set the label to be printed on images
9. Check camera date and time are correct
10. Turn off the camera

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Train

4. Check the **Training and skills** requirements for **Get Ready**, **Out on Country** and **Back in the Office** steps and arrange any training or expertise that you need.
5. Run everyone involved in the survey through the plan.
    - Be clear on how many people will be involved, what everyone will be doing, and what they will need to do the survey.
6. Run a training session for all rangers involved in the survey to learn or refresh:
    a. How to use the devices (like tablets/phones and GPS)
    b. How to use data collections apps and record data
    c. How to program and deploy cameras
    d. How to use water quality meters

Next Section – Part 2: Out on Country

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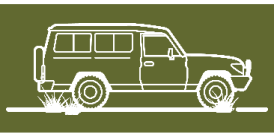
Part 2: Out on Country



GATHER YOUR GEAR

<u>One set</u> of this equipment for <u>each team</u>:

- ☐ Tablets/phones
- ☐ Power bank (optional)
- ☐ GPS device and spare batteries (recommended)
- ☐ Reference documents or field guides: macroinvertebrate ID guide (optional)
- ☐ Handheld water quality meter (e.g. Horiba U-50)
- ☐ Water quality meter guide/manual (optional)
- ☐ Remote camera user guide/manual (optional)
- ☐ Measuring rod (with 10, 20 or 30 cm segments)
- ☐ Soft tape measure
- ☐ Disposable gloves – powder free and stored in a clean ziplock bag
- ☐ Esky with ice or portable car freezer
- ☐ 5L bucket with volume markings on the inside
- ☐ Conical plankton net (63 µm mesh)
- ☐ Aquatic dip net (250 mm mesh)
- ☐ Picking equipment (for macroinvertebrate Option 1: pick now)
  - Camping/plastic table and chairs
  - White plastic sorting tray
  - Tweezers, spoons and pipettes
- ☐ 80% ethanol
- ☐ Sticker labels
- ☐ Pencil
- ☐ Permanent marker
- ☐ Mallet, hammer or picket driver
- ☐ Pliers, multi-tool and/or adjustable wrench
- ☐ 22L water jerry can filled with fresh tap water
- ☐ Camera cleaning kit (soft brush or compressed air duster) (recommended)

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One set of this equipment for each site:

- ☐ Camera trap with empty SD card and charged batteries
- ☐ Mounting hardware (e.g. bungee cord, bolt, brackets)
- ☐ Stake, star picket, or sand peg

One set of this equipment for each gnamma:

- ☐ EnviroDNA eDNA sampling kit:
  - 50mL syringe, 1.2-micron PES filter, preservative syringe, ziplock bag
  - 50mL syringe, 5-micron PES filter, preservative syringe, ziplock bag

KEEP IN MIND

When?

Has recent rain made your site inaccessible?

Where

Aim to take water samples from at least 2 gnammas per site and try to sample from gnammas that are deep and shallow (pan gnammas).

Consider only deploying cameras at sites that aren't publicly accessible to reduce the risk of camera theft.

Who?

2 rangers per team

Training and skills

Make sure everyone knows the plan.

Field staff are trained and competent in:

- ☐ Navigation systems (like Avenza app or GPS device)
- ☐ Data collection systems (like Fulcrum app or paper datasheets)
- ☐ Using water quality meters and understanding the readings
- ☐ Collecting eDNA, microinvertebrate and macroinvertebrate samples
- ☐ Correct storage and handling of ethanol
- ☐ Deploying and activating camera traps
- ☐ Picking macroinvertebrates

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ACTIONS

Check that your electronic devices (tablets/phones, power banks, GPS, batteries) are charged before you head out.

Water Quality

Remember: Don't touch the water with your bare hands until you having finished the eDNA sampling

1. Prepare (e.g. connect and take off probe covers) and turn on the handheld water quality meter
2. Put the meter into the water so that it is in the centre of the gnamma and the probe is fully covered by the water
   - You can hold the device or hold onto the wire and dangle it into the water
   - Aim to submerge to the same depth every time, generally around 15 cm deep. This is because some measurements, like temperature and dissolved oxygen, can be very different at the surface and deeper in the water, particularly in summer
   - If it is a pan gnamma or there hasn't been enough rain, the water may not be deep enough to take a water quality reading
3. Check the LED screen and wait for the readings to stabilise
4. Press the measure button on the LED screen to take readings of the dissolved oxygen, water temperature, pH, conductivity and turbidity
   - Dissolved oxygen is measured in milligrams per litre (mg/L) or percentage (%)
   - Water temperature is measured in degrees Celsius (˚C)
   - pH values will be between 0 -14. A reading of 1 is very acidic, 7 is neutral and 14 is very basic (or alkaline)
   - Conductivity is measured in microsiemens per centimetre (µS/cm)
   - Turbidity is measured in Nephelometric Turbidity Units (NTU)
5. Check whether the readings look normal or atypical. If the readings are atypical:
   a. Check if there are obvious equipment problems like a broken cable, dirty sensor or low batteries
   b. If there aren't any obvious equipment problems, check that the device has been calibrated properly and take measurements from another gnamma at the site to see if it takes similar atypical readings
   - Dissolved oxygen is usually 6-10 mg/L but may be higher if there are algal blooms or lower if there are anoxic conditions

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- Conductivity is usually <1500 µS/cm
- pH is usually 6-8.5 but may be lower if acid rock drainage or acid sulfate soils are present

6. Record **water quality data**
   - Some meters store the data which you can download later when you're back in the office, but it is a good idea to also record the data on your electronic device in case something happens to the meter

eDNA

Remember: Don't touch the water with your bare hands until you having finished the eDNA sampling

1. Put on a fresh pair of gloves
2. Using a fresh syringe, pull 50 ml of water into the syringe from 5-15 cm below the water surface
3. Screw the filter onto the syringe
   - Use 1.2-micron PES filters for surface samples and 5-micron PES filters for benthic samples
4. Push the water from the syringe through the filter
5. Continue collecting and filtering water from various locations in the gnamma until no more water can be pushed through the filter
   a. Remove the filter from the syringe before collecting more water, and then screw the same filter back on
   b. Keep track of how much total water is pushed through the syringe, it will be about 100-300 mL total
6. Unscrew the filter
7. Uncap the preservative syringe, screw it onto the filter and push the preservative in
8. Leave the preservative syringe attached and put the preservative cap onto the other end of the filter
9. Place the filter into a ziplock bag, label the bag and put it in an esky on ice/in a portable car freezer
   - Labels need to include site/gnamma code, type of water source (gnamma), coordinates, date, volume of water filtered
10. Using a stick, gently disturb the sediment layer at the bottom of the pool
11. Put on a fresh pair of gloves

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12. Using a fresh syringe, pull 50 ml of water into the syringe from the bottom of the pool (benthic zone)
    - If the water is too deep, collect the water in a falcon tube first by attaching the falcon tube onto an extendable pole and scooping water up from the bottom of the pool
13. Repeat steps 7-17 but using a 5-micron PES filter
14. Record **eDNA data**

Microinvertebrates (Zooplankton)

Remember: Don't touch the water with your bare hands until you having finished the eDNA sampling

1. Attach a 40 ml specimen container onto the cod end of the conical plankton net
2. Using a 5L bucket, collect water from the bottom of the pool where the sediment has been disturbed
    - Keep track of how much water you collect
3. Hold the conical plankton net over the gnamma and pour most of the water from the bucket into the net
    - Keep 10% of the water in the bucket
4. Unscrew the collection container at the bottom of the net and empty it into a 40 mL specimen container
5. Add the last of the water from the bucket, including any sediment, into the specimen container
6. Fill up the rest of the container with 80% ethanol, screw the cap back on and label it
    - Labels need to be written in pencil because ethanol can wash away pen
    - Labels need to include site/gnamma code, type of water source (gnamma), coordinates, date
7. Record **microinvertebrate data**

Macroinvertebrates

1. Drag a handheld net through the water to collect any visible water beetles, insects and worms
    - Do not collect tadpoles or frogs
2. Collect the samples with either *Option 1: Pick Now* or *Option 2: Pick Later*
3. Take photos of any tadpoles to identify them later
4. Record **macroinvertebrate data**

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Option 1: Pick Now

1. Set up table and chairs with the trays, picking tools (tweezers, spoons, pipettes), specimen container and 80% ethanol
2. Empty the net into a tray
3. Splash water onto the net to wash any remaining invertebrates off the net and into the tray
4. Spend 15 minutes looking for invertebrates in the bucket/tray. Use tweezers, spoons or pipettes to pick them up and put them into a specimen container
5. Spend 5 minutes looking for the most common and active species, then the next 10 minutes looking for new species
    - If you think you have already collected 10 of the same species, look for something different
    - Make sure you look for cryptic or small species, as well as the more obvious or bigger ones
    - Check that nothing is stuck at the bottom of the bucket/tray like flat worms and snails
6. Fill the container with 80% ethanol, screw the cap on and label it
    - Labels need to be written in pencil because ethanol can wash away pen and permanent marker
    - Labels need to include date and the site/gnamma code

Option 2: Pick Later

1. Empty the net into a specimen container
2. Splash water onto the net to wash any remaining invertebrates into the container
3. Fill the rest of the container with 80% ethanol, screw the cap on and label it
    - Labels need to be written in pencil because ethanol wash away pen and permanent marker
    - Labels need to include date and the site/gnamma code

Site and gnamma data

1. Lower a stick down into the water until it touches the bottom and then lift the stick out and see how high the water mark goes
2. Line up the stick next the measuring rod and estimate the depth by counting the number of segments up to the water mark.
    - The segments are usually 10, 20 or 30 cm
    - You can also take a photo to estimate the depth when you're back at the office

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3. Find the longest distance across the gnamma, and measure this part with the measuring tape
    - This measurement is the length of the gnamma
4. Find the widest part of the gnamma that crosses the length at a right angle (make a cross shape), and measure this part with the measuring tape.
    - This measurement is the width of the gnamma
5. Record **site data**
6. Once you have finished sampling, clean the water quality meter, bucket and nets by rinsing them with fresh tap water
    - Rinse equipment away from the gnammas so that the water won't run into the gnamma

Remote cameras

1. Choose which gnamma you will deploy the camera on
    - Choose a gnamma that is deep (>1 m) and can hold water even during dry periods
    - The gnamma needs to be near (1-2 m) a tree or rock that the remote camera can be tied to, or soft ground so that a star picket/stake can be hammered into the ground
2. Attach the remote camera to a tree or rock with a bungee cord or to a star picket/stake with a bolt or bracket so that the camera is:
    - 1-2m away from the gnamma, facing the gnamma, about 1 m off the ground, secure so that it won't move or sway
3. Turn on the camera, check that the batteries are full and SD card is empty
4. Use the 'walk test' mode to check the camera is facing the correct direction
5. Arm the cameras
6. Once the camera is armed, walk in front of it once to trigger an image
    - This image will be used to confirm that the camera was operational when it was out
7. Record **camera deployment data**
8. After the cameras have been deployed for the set period of time (e.g. 2-4 weeks), come back to collect them.
    - If you are leaving the cameras deployed for longer than one month, consider scheduling in time to swap out batteries and SD cards
9. Open the camera and check if it is still on and taking photos
10. Turn off the camera
11. Collect the camera and its mounting equipment
12. Record **camera collection data**

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RECORD DATA

Data to record when taking water samples/measurements

What to record	Required?	Notes
Information to record about each gnamma sampled		
Site and gnamma name/number	Yes	Record the individual name/number of the site and gnamma that was sampled
Information to record about water quality		
Water quality reading taken?	Yes	Record whether you did or didn't take a water quality reading and if you didn't, why (e.g. water not deep enough)
Water quality reading normal?	Yes	Record whether the readings looked typical/normal or not)
Dissolved oxygen	Recommended	Record the dissolved oxygen reading, in mg/L or %
Water temperature	Recommended	Record the water temperature reading, in ˚C
pH	Recommended	Record the pH reading, 0-14
Conductivity	Recommended	Record the conductivity reading, in µS/m
Turbidity	Recommended	Record the turbidity reading, in NTU
Information to record about eDNA samples		
eDNA samples taken?	Yes	Record whether you did or didn't take the three eDNA sample types (surface sample, filter membrane sample, benthic sample) and if you didn't, why
eDNA sampling method	Yes	Record whether you used Option 1 (filter now) or Option 2 (filter later) to collect the eDNA water samples
Total water filtered for surface sample	Option 1(filter now) only	Record how much water was filtered for the eDNA water sample collected from near the surface of the water
Total water filtered for benthic sample	Option 1(filter now) only	Record how much water was filtered for the eDNA water sample collected from near the bottom of the gnamma
Information to record about microinvertebrate samples		
Microinvertebrate sample taken?	Yes	Record whether you did or didn't take the microinvertebrate sample and if you didn't, why
Total water filtered	Yes	Record how much water was collected in the bucket
Information to record about macroinvertebrate samples		
Macroinvertebrate sample taken?	Yes	Record whether you did or didn't take the macroinvertebrate sample and if you didn't, why
Macroinvertebrate sampling method	Yes	Record whether you used Option 1 (pick now) or Option 2 (pick later) to collect the macroinvertebrate sample
Photos of tadpoles	Optional	Take a photo any tadpoles, and make a note of which camera/tablet/phone it was taken on, and the filename of the photo (usually ends in .JPG)

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Data to record when measuring gnamma size

What to record	Required?	Notes
Information to record about each site		
Project name	Yes	Make it clear which project this data belongs to and its purpose
Date	Yes	Record the date the gnammas were sampled
Personnel	Yes	Record the name of the people who did the sampling- this is helpful if any questions come up about the data
Site and gnamma name/number	Yes	Record the individual name/number of the site and, if not already mapped, give each gnamma an individual name/number
Gnamma location coordinates	Yes	If not already mapped, record an accurate location (using a handheld GPS if possible) (latitude and longitude or eastings and northings) for each gnamma
Gnamma description	Yes	If not already described, record the type (e.g. pan or pit) of each gnamma
Water depth	Optional	Record the estimated depth of the water. This can be estimated back at the office if you took a photo of the wet stick and measuring rod.
Gnamma length and width	Optional	Record the length and width of the gnamma.
Recent rainfall	Optional	Record information about the most recent rainfall (e.g. amount in mm, date(s), unusual rain events)
Signs of disturbance	Optional	Record the types and causes of disturbance at the site, e.g. presence of weed species, signs of introduced species like cats, or human activities like rock removal or rubbish,
Habitat description	Optional	Record the vegetation type and landscape features at the site; record species of any plants growing in the gnammas
Photos of site and gnammas	Optional	Take a photo of the outctop and gnammas, and make a note of which camera/tablet/phone it was taken on, and the filename of the photo (usually ends in .JPG)
Stories and notes	Optional	Record information or stories from Elders, and anything else worth noting about the site, such as when the gnamma was last cleaned/maintained, presence of capping rocks
Video	Optional	Record videos of information or stories from Elders, and rangers performing or describing the work they are doing.

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Data to record when deploying and collecting cameras

What to record	Required?	Notes
Information to record about each camera deployed and collected		
Site and gnamma name/number	Yes	Record the individual name/number of the site and gnamma that has a camera deployed
Camera ID	Yes	Record the individual name/number of the camera
Deployment date	Yes	Record the date that the camera was deployed
Collection date	Yes	Record the date that the camera was collected
Deployment comments	Optional	Record anything of note about the deployment, including details about where it has been deployed (e.g. tree 2m to south of gnamma)
Collection comments	Optional	Record any issues with the camera on collection (e.g. camera not on, SD card full, camera facing wrong direction, camera wet inside))

Next section – Part 3: Back in the Office

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Part 3: Back in the Office

GATHER YOUR GEAR

Equipment required for this part:

- ☐ Tablets/phones (or paper datasheets) that you used to record data
- ☐ Data management system
- ☐ Laptop or computer with software for:
  - Image management software e.g. CPW Photo Warehouse, Timelapse Image Analyser) and image classifier software (e.g. Megadetector, WildObs)
  - Spreadsheets
  - Mapping
- ☐ Freezer (less than -20˚C)
- ☐ Reference documents or field guides: macroinvertebrate and tadpole ID guide (optional)
- ☐ Picking equipment (for macroinvertebrate Option 2: pick later)
  - White plastic sorting tray
  - Sieve
  - Tweezers, spoons and pipettes
- ☐ 80% ethanol
- ☐ Sticker labels
- ☐ Pencil
- ☐ Macroinvertebrate identification equipment:
  - Microscope
  - Squeeze bottle with 70% ethanol
  - 60ml glass or plastic petri dishes
  - Stereo microscope with 10X magnification
- ☐ SD card reader
- ☐ SD cards from cameras
- ☐ External hard drive (optional)
- ☐ Storage boxes for camera traps (recommended)
- ☐ SD card holder (recommended)
- ☐ Camera cleaning kit (e.g. soft, brush or compressed air duster)

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KEEP IN MIND

When?

Always try to complete this work as soon as you can after returning from your time on Country so that samples are stored correctly, photos on SD cards don't get deleted and what you did and what you saw is fresh in your memory.

Who?

1 person to manage the data

Training and skills

Staff managing data are trained and competent in:

- ☐ Mapping software (like QGIS or Google Earth)
- ☐ Spreadsheet software (like Microsoft Excel)
- ☐ Data collection systems (like Fulcrum app or paper datasheets)
- ☐ Data management systems (like databases, cloud storage and external hard drives)
- ☐ Using image processing software
- ☐ Using image classified software (optional)
- ☐ Identifying animals in camera images
- ☐ Correct storage and handling of ethanol
- ☐ Picking macroinvertebrates

ACTIONS

Clean equipment

1. Rinse all equipment used for the water sampling with fresh tap water
2. Read the instruction manual for the water quality probe to find out how to clean, service and store the device
3. Check nets for holes and damage, and flag them with pink flagging tape
   - Consider repairing or replacing damaged nets now, so that they are ready to go when you do the next survey
4. Take batteries out of cameras and check that they are in good working order and clean
5. Put equipment away in storge including cameras into storage boxes and empty SD cards into SD card holder

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Store and send samples

1. As soon as you get back to the office, transfer the eDNA samples from the esky/car freezer into a -20C freezer so that they stay frozen
2. Put the microinvertebrate and macroinvertebrate samples in a room that stays cool
3. As soon as possible, send:
    a. eDNA samples via courier to the eDNA lab for analysis,
    b. microinvertebrate samples to an expert in microinvertebrate taxonomy for processing,
    c. if you aren't planning to ID them yourselves, the macoinvertebrate samples to an expert in macroinvertebrate taxonomy for processing
    - The eDNA lab and/or experts will be able to give you instructions on packaging and sending samples
4. Wait for the results
5. Update the data in your data management system with the eDNA results and microinvertebrate and macroinvertebrate IDs

Pick macroinvertebrate samples

If you didn't pick the macroinvertebrate samples in the field, you will need to pick them when you are back at the office. If you have a microscope and identification keys, you can decide to identify macroinvertebrate samples yourself instead of sending them away to an expert.

1. Empty the macroinvertebrate sample container into a sieve and rinse it with tap water
2. Empty the sieve into a tray
3. Use tweezers, spoons or pipettes to pick up invertebrates, sorting different species into separate small petri dishes for later identification (or into specimen containers if sending away for ID), until all specimens have been removed from the tray
    - Make sure you look for cryptic or small species, as well as the more obvious or bigger ones
    - Check that nothing is stuck at the bottom of the bucket/tray like flat worms and snails
4. Fill the container with 80% ethanol, screw the cap on and label it
    - Labels need to be written in pencil because ethanol can wash away pen and permanent marker.
    - Labels need to include date and the site/gnamma code

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Process camera images

1. Create an image filing system on your computer:
    a. Create a project folder and give it a short name like the project or survey area
        - If monitoring is done at the same sites over time, consider adding another folder level to separate out each monitoring period (like the year or season)
    b. Within the project folder, make a folder for each site
2. After you collect cameras, for each SD card:
    c. Go to the folder for the site that the SD card came from
    d. In the site folder, make another folder. Give it the same name as the camera and the date it was collected e.g. CAM01_20260108
    e. Put the SD card into the SD card reader
    f. Copy the images from the SD card into the folder
    g. After the images have been copied, check that the number of images on the SD card matches the number in the folder (to make sure they all copied over)
3. Back up your data (save a copy on the cloud and/or on an external hard drive)
4. When you are sure that the data is secure, erase images from each SD card
5. Run images through object detector or image classifier (optional)
    - Always proof automated processing by scanning through images and checking classifications are correct (especially false positives or negatives!)
6. Import the images into the image processing software
7. Review the images to classify images (e.g. false trigger) and identify species
8. If you have enough time and people, get somebody else to proof the data including species identification
9. Export the data to upload to your data management system
10. Import the data into a spreadsheet for analysis

Data entry, analysis and reporting

1. Record a summary of what you did and why, any observations (like weather conditions, fire history and site condition), anything that went wrong or didn't work and things that worked well.
2. Upload the **water quality data, eDNA data, microinvertebrate data, macroinvertebrate data, site data,** camera **deployment data** and **camera collection data** to your data management system
    - Recommended: get someone else to proof the data to check for mistakes
3. Upload any photos or videos taken during the survey to your data management system

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4. Use reference materials like frog or tadpole ID books or apps to identify species from photos taken of tadpoles
    a. Narrow down what species it could be by finding out what frog species are known or likely to occur on Country. You can also contact a frog expert to get help with the identification.
5. Import all data into relevant spreadsheets. Your data analysis will depend on the project purpose and the data collected. It could include:
    a. Camera data might give you enough information to estimate species occupancy or calculate activity rates
    b. Use GIS software to map where gnammas are and where species were detected to see if there are patterns in their distribution across the landscape
    c. Calculate species richness – count how many species you detected. Consider splitting it up into different taxonomic groups (e.g. mammals, reptiles, birds, invertebrates, plants)
    d. Create bar graphs in excel to compare measurements across different sites (e.g. water quality measurement, species)
    e. Create line or bar graphs in excel to track changes in measurements over time
        i. line graphs for water quality measurements
        ii. bar graphs for species richness
        iii. Add reference lines to show things like baseline data or healthy water quality ranges
        iv. If you have implemented a management action, add in a line along the time axis to see if there are differences in the before/after management.
6. Discuss with the ranger team or community the results of the monitoring, any reasons for the for the water quality results and species detected, and if there have been any changes to previous years
    - Consider whether trends might be related to your management (like fencing gnammas) to check how well management is working, or if you need to make adjustments
7. Share the data according to any data sharing or funding agreements you have made

Next section – Full Equipment List

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Gather Your Gear – Complete List

The complete **GATHER YOUR GEAR** list for **Get Ready**, **Out on Country** and **Back in the Office**.

Gear List	Required?	Get Ready	On Country	In Office
Tablets/phones: • Ability to take photos • Apps for data collection (like Fulcrum) and navigation (like Avenza)	✓	✓	✓	✓
Laptop or computer with software for: • Mapping (like QGIS or Google Earth) • Spreadsheets (like Microsoft Excel) • Image management software (e.g. Timelapse, CPW Camera Warehouse) • Image classifier software (optional)	✓	✓		✓
GPS device & spare batteries	**Recommended**	✓	✓	
Power bank	**Recommended**		✓	
Reference documents and/or field guides: • Macroinvertebrate guide • Tadpole/frog guide	✓		✓	✓
Camera traps (1 per site) with: • SD cards (2 per camera) Rechargeable batteries (1 set per camera)	✓	✓	✓	✓
Remote camera user guide/manual	**Optional**	✓	✓	
Camera fixings (1 set per site) e.g. brackets and bolts, strap or bungee cord	✓		✓	
Stake, star picket or sand peg (1 per site)	✓		✓	
EnviroDNA eDNA sampling kits • 50mL syringe, 1.2-micron PES filter, preservative syringe, ziplock bag 50mL syringe, 5-micron PES filter, preservative syringe, ziplock bag	✓		✓	
Handheld water quality meter (e.g. Horiba U-50)	✓		✓	
Water quality metre user guide/manual	**Optional**	✓	✓	✓
Measuring rod 10, 20 or 30 cm segments	✓		✓	
Soft tape measure	✓		✓	
Disposable gloves • Powder free	✓		✓	

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Stored in clean, ziplock bag				
Esky with ice or portable car fridge/freezer	✓		✓	
5L bucket Volume markings on side	✓		✓	
Conical plankton net 63µm mesh	✓		✓	
Aquatic dip net 250mm mesh	✓		✓	
Picking equipment: • Camping/plastic table and chairs • Sieve • White plastic sorting tray Tweezers, spoons and pipettes	**Optional**		✓	✓
80% ethanol	✓		✓	
Stationery: Sticker labels, pencil, permanent marker	✓		✓	
Pliers, multi-tool and/or adjustable wrench	✓		✓	
Mallet, hammer or picket driver	✓		✓	
22L water jerry can Filled with fresh tap water	✓		✓	
Freezer <-20˚C	✓			✓
Macroinvertebrate identification equipment: • Microscope • Squeeze bottle with 70% ethanol • 60ml glass or plastic petri dishes Stereo microscope with 10X magnification	**Optional**			✓
Camera cleaning kit e.g. soft brush or compressed air duster	**Recommended**	✓	✓	✓
Storage box for transporting/storing camera traps	**Recommended**		✓	✓
Storage box for SD cards	**Recommended**		✓	✓
Data management system (like databases, cloud storage and external hard drives)	✓			✓

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