# Before going on Country
# Monitoring with BRUVS
## *(Baited Remote Underwater Video System)*

Standard operating Procedure

# Get ready to go on Country

## Gather your gear

Electronic device(s) – ensure waterproof, charge ready for use, check data collection systems (e.g., Fulcrum) and navigation system (e.g., Avenza, GPS) have site points, and load site maps, Standard or Stereo BRUVS parts

## Consider

### Location:
Your office and workshop

### Training and skills:
- Preparing rangers trained and competent in:
- Mapping software (e.g., ARCGIS, QGIS)
- Navigation systems (e.g., Avenza/GPS)
- Data collection systems (e.g., Fulcrum/ Datasheets)
- Construction and set up of BRUVS
- Use and set up of underwater cameras

### People
At least one person to plan and prepare.

### Timing
Prepare well before Go on Country so that you have time to gather equipment or train staff, if needed.

### Buying
Check equipment lists and buy any equipment you don't have.

### Check Permissions
Which areas you can go to set up monitoring sites.

Data sharing permission, and who it can be shared with is determined by the decision makers in the community, and any rules about who can see the data, and when they need to check back in with you for its use.

## Actions

### Plan
1. Plan which dates you will deploy your BRUVS.

2. If this is the first year you are monitoring, think about which species you are planning to monitor and where you plan to deploy BRUVS. This will guide your site choices, equipment and planning.

- Discuss with decision makers in the community where you can go to set up sites.

- Set up data sharing agreements e.g. with the Commonwealth Government if you would like to contribute to a big picture understanding.
    - Check with decision makers in the community who they are happy to share data with and decide on any rules about the data.

- What kind of water vessel (if any) will you need to deploy BRUVS?

- What depths will you be deploying BRUVS?
    - Deep water BRUVS need specialised set ups.

- The species you are interested in monitoring will guide:
    - Where in the water body you will deploy BRUVS. For example:
    - Where do the species you want to monitor spend their day?
    - The chosen site and species of interest will guide how far apart you will deploy BRUVS, for example:
        » Estuary spacing = at least 100 m apart
        » Sharks and rays = at least 500 m apart
        » Freshwater turtles = at least 70 m apart

3. Check equipment lists for all steps and get any equipment you don't have. See 'BRUVS buying and construction guide' for advice on which BRUVS may be suitable for your monitoring and how to construct them.

4. Plan how you will store the video data, as they can take up a lot of memory.

5. Plan and set up how you will record information on when, where, and for how long each BRUVS will be recording e.g. Fulcrum electronic data forms, or waterproof datasheets.

Prepare maps to show where BRUVS will be placed, e.g. georeferenced PDFs for Avenza, with existing sites and/or potential sites.

Load apps, maps and data collection forms onto your electronic device.

Check that rangers know how to do the following and arrange training if needed:

Use the devices, data collection apps, navigation systems etc.

How to construct, set up and deploy BRUVS and underwater cameras

How to analyse videos, record data and identify species.

## Choose sampling design and sites:
If you already have established monitoring sites, continue monitoring these sites.

If you are surveying for the first time:

Choose the waterbody(s) you will monitor.

Choose sites within the waterbody to monitor – you have several options:

Target one species – choose sites where the species is known to occur, or where there is habitat it prefers.

All the species that live in a waterbody – choose a variety of sites that cover the different habitats.

Compare areas under different management – choose the same number of sites in each management area, make sure sites in each area are similar e.g. same habitat, depth, water quality etc.

Give each site a unique name.

Make labelled maps or waypoints of the section(s) start and end points for navigation. Load onto your navigation device(s).

## Construct and prepare BRUVS:
- Make the BRUVS.

- If you are making more than one BRUV, make sure they are all identical, with the same measurements.

- Charge and check the settings of the camera, make sure the date and time settings are correct.

- Give each camera a unique name and label it. Label the SD cards with the same name as the camera it will be put into.

## Next Step

Going on Country

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## Going on Country
# Monitoring with BRUVS
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# Go on Country

## Gather your gear

- Electronic device(s) – charged and ready to record data, with:
- Data collection system (app and form)
- Site maps
- Navigation tools e.g. GPS device or chart plotter
- For each standard BRUVS
- Underwater camera(s) with memory card installed and fully charged battery
- Spare batteries, or battery extenders are recommended
- Spare memory cards
- Waterproof camera housing
- BRUVS frame
- Bait arm
- Bait bag
- Bait (crushed or minced oily fish)
- Rope
- Surface float
- Weight
- Tools to put together BRUVS
- Multiparameter water quality meter (optional for turbidity measurements)
- Depth sounder (or other method to measure deployment depth)
- Slate board (or similar)
- Vessel appropriate to deploy BRUVS e.g. boat or kayak
- Safety equipment and PPE for boat and water-based field work, local conditions and regulations.

### Personal protective equipment (PPE):

- Hat
- Sunglasses
- Sunscreen
- Long sleeved shirt
- Long pants
- Life jacket

## Consider

### Location

- BRUVS deployment sites
- Training and Skills
- Field staff trained and competent in:
- Navigation systems (e.g., Avenza)
- Data collection systems (e.g., Fulcrum)
- Construction and set up of BRUVS
- Water quality meter use
- Boat and water-based work protocols and safety

### People

- 2 – 3 people are required
- 1 boat operator
- 1 – 2 BRUVS handlers

### Timing

Ensure conditions will be suitable, including:

- Wind, weather and tide conditions
- Seasonal conditions
- Ensure enough time is allocated to conduct work, considering how many sites you plan to monitor, and how many deployments per day.

## Actions

### *BRUVS Deployment*

At each site, choose the exact location(s) where you will deploy the BRUVS.

If you are targeting a species, choose locations within the habitat they prefer.

If you are doing general monitoring, choose a variety of habitats.

### *Prepare the BRUVS:*

- Attach ropes and floats
- Fill the bait container with ~ 1 kg of bait
- Turn on, set to record, and attach the camera to the BRUVS frame.
- Deploy BRUVS(s) at each location
- Write the site name, location name, camera name, date, and time on a slate (or similar) and record the slate on the camera.
- Give each location that a BRUVS is deployed a unique name. We suggest that you use the waterbody/site name or an abbreviation of it, followed by sequential numbers e.g. 'Big_Wetland01', 'Big_Wetland02'; or 'BW01', 'BW02'.
- Lower the BRUVS into the water at the chosen site.
- Name and record the exact GPS coordinates for each BRUVS deployment site.
- Move at least 200 m away from where the BRUVS was deployed so that animal behaviour is not disturbed by your presence.

### *Record*

Information to record about each BRUVS site:

- Site name
- BRUVS/camera name
- Date BRUVS deployed
- Time BRUVS deployed
- Time BRUVS retrieved
- Names of everybody in the team deploying BRUVS

- GPS coordinates of BRUVS deployment
- Type and amount of bait used
- Depth where BRUVS deployed
- Water turbidity
- Water and weather conditions
- Site description and habitat
- Anything else of interest e.g.
- Observations of species
- Signs of pollution, disturbance, or damage e.g. from introduced species

### *BRUVS Retrieval*

- Once deployment (sampling) time is complete, return to the BRUVS location.
- Pull up the BRUVS using the attached rope.
- When the BRUVS is on the boat or shore, remove and turn of the camera, then store in a safe place.

### *Next Step*

After going on Country

## Record

| Who | |
|---|---|
| Ranger group or organisation | |
| How many people searching | |
| Name of person recording | |

| When | | | |
|---|---|---|---|
| Date (DD/MM/YYYY) | | | |
| Start time (HH:MM AM/PM) | | Finish time (HH:MM AM/PM) | |

| Where | | | |
|---|---|---|---|
| Latitude | | Longitude | |
| Datum | | | |
| Property or IPA name | | | |
| Plot name | | | |
| Photograph ID | | | |

### Signs - *All tracks, burrows, diggings, sightings or scats seen*

| Animal name (species name and language or local name) | | | | |
|---|---|---|---|---|
| | | fresh (1-2 days) | old (3 days - 1 week) | very old (more than 1 week) |
| How many of each seen | tracks | | | |
| | burrows | | | |
| | digging | | | |
| | sightings | | | |
| | scats | | | |

### About the plot

| | |
|---|---|
| What sort of habitat is it? | |
| What is the fire age? | |
| Photograph of the site to make a permenant record of the vegetation | |
| Record notes about anything interesting you see | |
| Optional: What are the most common shrub and understorey plant species? What is the size of teh Spinifex? | |

**Resilient Landscapes**

# After going on Country
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# After going on Country

## Gather your gear

- Electronic device(s) that you used to record your BRUVS site, deployment retrieval data.
- BRUVS cameras
- Data management system e.g. cloud storage.
- Computer or laptop with:
- Ability to play videos
- Spreadsheet software e.g. Microsoft Excel.

## Consider

### Location
Your office

### Training and skills
- Rangers/staff managing data are trained and competent in:
- Species and habitat identification
- Use of data collection apps and data management system
- Use of computer, and video and spreadsheet software

### People:
At least one person to manage data and analyse videos.

Ranger team.

### Timing:
As soon as possible after your monitoring so that what you did and what you saw is fresh in your memory.

### Check Permissions:
Data sharing permission, and who it can be shared with, is given by the decision makers in the community, and any rules about who can see the data, and when they need to check back in with you for its use.

## Action

1. Upload your data to your data management system. Create a folder for the project and name it something that makes it easy to recognise e.g. [Your IPA name_BRUVS], and then:
   - Store and back up the videos.
   - Within the project folder, create a folder for each waterbody. Name the folder for the waterbody e.g. Curly_Creek
   - Within the waterbody folder, create a folder for each site that a camera was deployed e.g. CC_01 or CurlyCreek01
   - Upload each video to the appropriate folder. Name the video with the site name, date and time e.g. BW01_20240626_0615
   - Waterbody, site, and metadata entered or uploaded to your data management system.

2. View the video footage and record data. In this SOP, we describe the MaxN method (the maximum number of animals visible at any one time) in this SOP. For each deployment video:
   a. Record the site name, deployment date, start and finish time.
   b. Record the habitat type that the BRUVS landed.
   c. Estimate the water visibility (if you took a turbidity measurement, skip this step).
   d. Play the video and identify all the species you see.
   e. For each species, count the maximum number of individuals observed in any single frame throughout the video. This is the MaxN value for that species.
      i. Record the video timestamp when you record MaxN for a species.
      ii. You can also record the sex and a size/age category of all individuals at MaxN.

3. You can make simple graphs showing the MaxN for each species at a site or habitat. This allows you to see the different species abundance at a site.
4. You could combine site data, which allows you to see how the abundance of species differs across sites e.g.
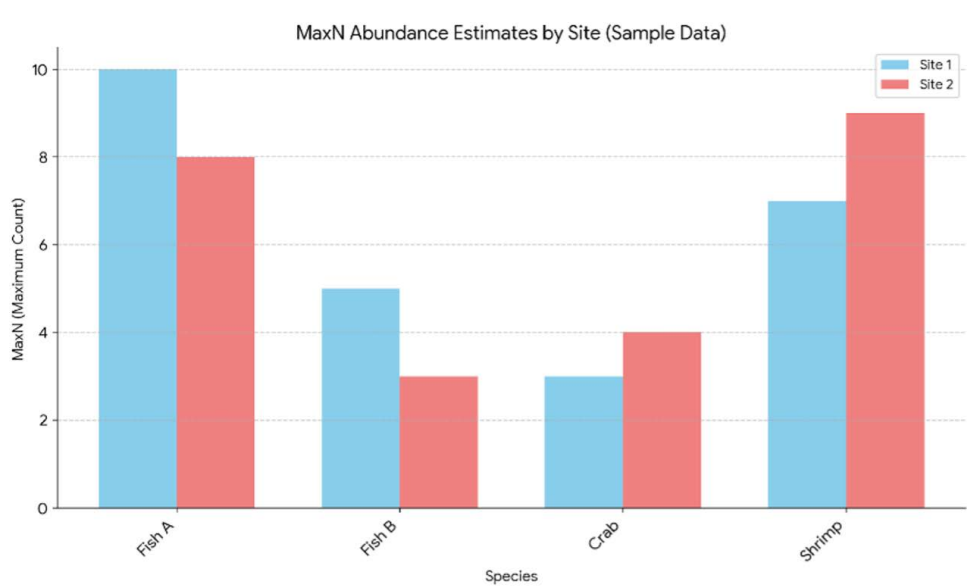


*Figure 1 Example of how to graph MaxN abundance of fish species at different sites. This bar chart shows the relative abundance (MaxN) of four species recorded at Site 1 and Site 2. Created with assistance from Bard, a large language model by Google AI.*

5. Discuss with the ranger team any reasons for changes since the previous year, or why the number of species, or individuals was different between sites.
   - Discuss whether trends might be related to your management (e.g. pig management or fencing to protect freshwater turtles; or no – fishing areas) to check how well your management is working, or if you need to make adjustments.
6. Share the data according to any data sharing or funding agreements you have made.