tern
Ecosystem Research
Infrastructure

Ecological Field Monitoring Protocols Manual

Using the Ecological Monitoring System Australia

Opportune Module – PROCEDURE ONLY

NCRIS
National Research
Infrastructure for Australia
An Australian Government Initiative

Citation

Bignall J, Laws M, McCallum K, Cox B, O'Neill S, Potter T, Morgan R, Sparrow B. (2024) Opportune Module. In 'Ecological Field Monitoring Protocols Manual using the Ecological Monitoring System Australia'. (Eds S O'Neill, K Irvine, A Tokmakoff, B Sparrow). TERN, Adelaide.

Version

Readers are advised that all modules of the Ecological Field Monitoring Protocols Manual regularly undergo revision. Readers should check the website emsa.tern.org.au/documents to ensure they are viewing the current version.

Version 2

Last updated: 28 November 2024

Acknowledgements and contributors

This publication is the result of a body of work funded by the Australian Government Department of Climate Change, Energy, the Environment and Water to develop standardised ecological monitoring standards.

Key components of this module were developed, written, and field tested by the TERN Ecosystem Surveillance team based at The University of Adelaide. Additional to the authors, the following team members made contributions to the project: Ellen Kilpatrick, Kate Matthews, David Peacock, and Carly Steen. Technical components, including the development of the accompanying app, were developed by the team led by Andrew Tokmakoff, including Luke Derby, Matthew Barty, Jin Zhou, Ho Hai Huy Vo, Walid Al Naim, Muhummad Khan, and Michael Doroch. Aspects of the protocols that have been built on by this project are the result of the extensive and ongoing body of work conducted by the TERN Ecosystem Surveillance team, as part of TERN's field-based ecosystem monitoring program. A full list of team members who have contributed is available on the TERN eSupport Services website.

TERN is funded by the National Collaborative Research Infrastructure Strategy.

Copyright

Disclaimer

The information contained in this document comprises information and instructions for implementing ecological monitoring field surveys. The reader is advised that TERN has made best efforts to ensure instructions are comprehensive enough to fulfil the tasks required to the standards required at the time of publication. All field surveys must be carefully planned to ensure the safety of personnel is paramount and that the required scientific permits and wildlife licences are obtained from the appropriate jurisdictions and conditions strictly adhered to. Such requirements may go above and beyond those listed in this manual. TERN, including the project personnel, are excluded from all liability to any person for the consequences, including but not limited to all losses, damages, costs, expenses, and any other compensation arising directly or indirectly from using this publication (in part or in whole) and any information or material contained in it.

Photographs presented in this report are provided by TERN unless otherwise indicated.

Main front cover photograph: *Moloch horridus* (Thorny devil), Eurardy Reserve, Western Australia.

Version control

Readers are advised that all modules of the Ecological Field Monitoring Protocols Manual regularly undergo revision. Readers should check the website tern.org.au/emsa-protocols-manual/ to ensure they are viewing the current version.

The version history of this module are identified below. The version history of the Ecological Field Monitoring Protocols Manual, the methods and data implications, both historical, current and future interpretations of data, are available from the TERN website. Enquiries should be directed to tern@adelaide.edu.au.

Version	Date	Version update overview
1	20 November 2025	First published version

1 Opportune protocol

1.1 Field collection

1.1.1 Pre-requisites

Pre-requisites for completing this protocol:

- Opportune observations can be recorded at any stage of a field survey and are not dependent on other modules.

1.1.2 Time requirements

Time estimates vary depending on the level of detail recorded and whether voucher specimens are collected. As a general guide, allow:

- 1–3 minutes to record an opportune flora observation in the Monitor app, depending on if a voucher specimen is collected.
- 1–5 minutes to record an opportune fauna observation in the app, depending on if measurements are recorded and/or a voucher specimen is collected.
- Up to 5 minutes processing time per flora voucher specimen (barcode and press).
- 5–15 minutes processing time per fauna voucher specimen (e.g. tissue sampling, preservation, labelling, barcode).
- 1–2 minutes per record to upload any photos/videos/audio recordings collected outside of the app.

1.1.3 Personnel requirements

Number of personnel and skills:

- Opportune observations can be completed by one person but is easier with two, so one can make the observations and the other can record the data directly into the app.
- Surveyors making the observations should be familiar with and experienced in identifying the flora and fauna within the area.
- Scientific permits may be required for the collection of voucher specimens. Land access permissions are required.

1.1.4 Equipment

General

- Mobile device (tablet/phone) capable of recording location (GPS/GNSS or similar), taking high resolution photos and loaded with the Monitor app, electronic field guides, interactive identification keys and call playback apps
- Copy of applicable permits and licences
- Flora and fauna checklists, reference keys, field guides and apps for the region
- TERN Vascular Plant Collection Guidelines
- Hand lens
- Binoculars
- Camera, ideally with a long-focal length lens (for distant sightings) and macro lens (for close-ups of small organisms)
- Photo scale card
- Hand-held GPS
- Spotlight and head torch (for night work).

Vouchering (general)

- Material Safety Datasheets (MSDS) for chemical/dangerous substances
- Voucher barcode labels (see the Generating Voucher Barcode Labels for EMSA Specimens and Samples information sheet)
- Permanent markers
- Masking tape.

Vouchering (vascular flora)

- Secateurs
- Newspaper (tabloid size) and cardboard (43.5 x 28.5 cm)
- Plant press and straps (for storage)
- Specific flora vouchering equipment (see Floristics Module).

Vouchering (vertebrate fauna) – deceased fauna, hair, scats

- Masks, disposable gloves, medium snap-lock bags, paper bags (for collection of scats and animal remains)
- Heavy-duty large plastic bags (for collection and transport of animal remains)
- Silica, ideally self-indicating granules (for storage of moist scat samples)
- Callipers, ruler or tape measure (for fauna measurement)
- Fauna processing kit: Eppendorf tubes/vials, preservative solutions (e.g. formalin and ethanol), paper, pencil, pencil sharpener, scissors, glue, ruler, eraser, tags/labels/thread, dissecting kit, utility knife, paper towel, long forceps, plastic tongs, suitable storage containers (for preparing and storing fauna voucher specimens) (see Vertebrate fauna Module)
- Large plastic bags, secure storage containers, insulated box (polystyrene or similar) (for transporting fauna specimens).

Vouchering (non-vascular flora)

- Chisel and hammer (for collection)
- Screw cap plastic bottles, paper bags, newspaper, cardboard boxes, ethanol/formalin preservative solution (for storing specimens).

Vouchering (invertebrate fauna)

- Sweep net, flat head tweezers, artists paintbrush, aspirator, knife, scraper (for collection)
- Specimen containers, vials, preservative solution, labels, pencil, scissors (for storing specimens).

1.1.5 Instructions and procedures

1. Open the Monitor app and select the Opportune Module from the projects page or via the quick-access opportune button located in the app menu.
2. Since the opportune collection is not plot-based, and therefore not associated with a plot visit, record the *start date time* (yyyy-mm-dd hh:mm:ss) of the opportune survey. This is only required prior to recording the first opportune record.
3. Complete the opportune survey (start) component. The first opportune record will open. A unique sequential *observation ID* is automatically assigned to the record.
4. Media including *photos, video* or *audio* can be recorded for the observation. Enter a *comment* to accompany each file (e.g. *close up of thorns*).
5. The *date*, *time* and *location* of the observation are automatically recorded but can be changed as necessary (i.e. if entering a record after the event). To change the location, select *choose on map* or enter specific coordinates.
6. Select the *taxa type* from the drop-down list. This filters the species and other drop-down lists.
7. Record the *species* from the drop-down list. Begin typing the scientific or common name to query the species list. If the identification is unknown and pending the review of evidence collected, then manually enter a descriptive

field name instead (e.g. Acacia spiky). The field name given during this step should be used as the field name every time that species is encountered within a survey event.

8. Untick the *confident* checkbox to indicate the identification is uncertain. The default is *ticked* (see Additional guidelines).
9. Record the *number of individuals* observed (zero, blank and no selection are invalid) and select if the number of individuals is *exact* or an *estimate*.
10. Select the *observation method* (tier 1 to tier 3) from the drop-down list (refer to Appendix 1 for the full list of options).
11. Select the *observers* (drop-down list, multiple selections allowed, or manually enter first name, middle initial and last name).
12. Record the *habitat (major vegetation group)* (optional) from the drop-down list.
13. Record any *comments* (optional) (e.g. additional habitat information, condition, fauna behaviour, presumed cause of death, appearance, signs of disease, tag details (ID number/colour/Bluetooth ID).
14. For flora, select the *growth form* and *life stage* (multiple selections allowed) from the drop-down lists.
15. For fauna, check the checkbox to record *additional fauna details* (optional; refer to Appendix 2). Relevant fields will be visible based on the selection of taxa type in Step 5. For direct observations of fauna, select the *sex*, *age class* and *breeding status* from the drop-down lists and record *fauna measurements* (where relevant).
16. If a *voucher specimen* is collected, check the checkbox. Assign a unique *voucher barcode* to the specimen and *scan the barcode* (see section 3.2.2 Voucher specimen collection). Select *voucher type* (tier 1 and tier 2) from the drop-down list (refer to Appendix 3. for the full list of options). For vertebrate fauna remains (i.e. carcasses), select the *condition of the specimen* from the drop-down list. Select the *preservative type* (drop-down list) and specify the *concentration* if relevant (e.g. 95% undenatured ethanol). Record a *voucher comment* (optional) (e.g. physical description of the specimen, linked voucher IDs, prey/parasites collected with samples).
17. Add additional voucher specimens for the same observation (e.g. a plant voucher and a plant tissue voucher) if required. Each specimen is allocated a unique barcode.
18. Save the opportune record. Add another opportune record for the current location if required. A new opportune record will open. The next unique sequential *observation ID* is automatically assigned to the record. Repeat steps 4–18.
19. After all opportune records for the current location are saved, select the back button at the top of page to return to the project page.
20. Record additional records by selecting the Opportune Module and then the edit button.
21. At the end of the survey, complete the opportune component and then record the *end date time* (yyyy-mm-dd hh:mm:ss) of the opportune survey. Check the summary of the data and queue the collection for submission.

1.2 Additional guidelines

1.2.1 Field collection

General

- Opportune observations can be recorded at any time and location within a project area, including within monitoring plots.
- If uncertainty exists in the taxonomic identification, switch the confident toggle to off. If the genus is unknown at the time of the survey and there is no evidence to accompany the record, there is generally no benefit in recording the observation.
- If the taxonomic identification is unknown when the observation is recorded, or if a lower taxonomic identification is possible with accompanying evidence (e.g. high-quality photos, physical voucher specimens), the record is given a descriptive field name and the confident toggle is off, acting as a flag to review the record. After reviewing the accompanying evidence, the identification can be edited in the Monitor app and the confident toggle switched on.
- When assigning a descriptive field name, the field name must make sense to you as it will be used in subsequent modules for data collection. Avoid generic labels such as Acacia sp. as this can create confusion. Use a descriptive word (e.g. Acacia spiky). Use this name consistently across the project area for that species.
- Use the optional fields to record additional information. The comment field can be used to record details of the surrounding habitat, such as the vegetation association and important habitat features (e.g. found in a large tree hollow in *Eucalyptus viminalis*).

Flora

- Only record opportune vascular flora observations within a plot if outside of a designated monitoring event, as all flora species within the plot are recorded during the Floristics Module. This is to capture any new flora sightings (e.g. annuals that may not have been detected during a formal plot monitoring event).

Fauna

- Opportune records are recommended for all vertebrate fauna observations, however, it may prove too time-consuming to record every observation for some species. Any sighting of a significant species should be recorded. If some species or their signs are particularly common, consider only recording spatially representative samples.
- When the species selected is Koala (*Phascolarctos cinereus*), a *clinical scoring – rump* field will appear under *advanced fields* for recording the condition of the animal's rump (see Appendix 2).

Evidence (photos, video and audio)

- It is not always possible or warranted to provide evidence of opportune fauna observations (e.g. if observed at a distance through binoculars, if the species is common and readily identifiable, or if the observer is experienced). Bird observations are often visual records only, justified by the high level of taxonomic discrimination and the wide availability of expertise in their identification (Wildlife Ethics Committee 2020).
- Accompanying evidence needs to be sufficiently distinctive to enable identification. Photos should be high resolution, show distinguishable features, and ideally include a scale card or something for scale (e.g. pencil). For plants, photograph an individual with good vigour that is representative of the population recorded. Photos of the habit of the plant and the surrounding habitat are also helpful for identification. Refer to Appendix 4 for plant photo voucher instructions and guidelines.

1.2.2 Voucher specimen collection

General

- Collection of voucher specimens is not essential for opportune observations but is considered best practice. Herbaria typically require physical specimens for positive identification. In most cases, opportune fauna observations will not have an associated voucher specimen given the incidental and unobtrusive nature of the

record. In the absence of a voucher specimen, other evidence such as a photo, video, or audio file help to validate the record.

- Voucher specimens should only be collected if the relevant permits and approvals have been obtained. Only collect voucher specimens from within the project area (animal remains/signs on public roads being an exception).
- Seek advice from the relevant herbarium/museum regarding the species to voucher, and the collection, preservation and labelling requirements for voucher specimens. Accessioning of voucher specimens is at the discretion of the herbarium/museum.
- Before collecting a voucher specimen, consider if there are existing specimens of the species from the area (previous records and those recorded during other EMSA modules), the existing survey effort, scientific knowledge gaps, representation of specimens currently held in collections, the importance of and the quality of the specimen.
- When there are multiple voucher specimens from the same observation, each specimen is given a unique, sequential barcode. Take care to ensure the correct barcode is assigned.
- Voucher specimen details may be entered into the app after the event (e.g. if the specimen cannot be processed at that time). If this is the case, affix the barcode to the sample and include any additional, sequential barcodes required (e.g. for a tissue sample) in a plastic bag with the sample. Then, when appropriate, process the voucher and edit the details in the Monitor app.
- The voucher comment field can be used to record important additional information, such as linked voucher records (e.g. to link the voucher ID of a parasite to the voucher ID of its host).

Vascular flora voucher specimens

- For a full guide to flora vouchering (collecting, pressing, preparing, labelling and storing specimens) refer to the Floristics Module. Also refer to the Plant Tissue Vouchering Module for procedures and guidelines to collect and store leaf tissue samples for DNA and isotope analysis. Also consult with the relevant herbarium for guidance.
- The collection of flora voucher specimens is optional, but highly recommended when:
  - Species identification is uncertain
  - A new species is recorded for the project area
  - A new species is recorded for a monitoring plot outside of a dedicated monitoring event (e.g. annual species that were not present during plot monitoring)
  - Advised by the herbarium to address scientific knowledge gaps and improve representation within their collection
  - It is a condition of a scientific research permit
  - A new population of a rare, threatened or endangered flora species is found (unless collecting a specimen would jeopardise the population, see below)
  - A species has atypical characteristics
  - A species is recorded outside of its known range, including introduced and weedy species
  - A species is located within a habitat in which it is unknown or has not previously been detected
  - A species is flowering outside its typical flowering time (EPA 2016; DPIE 2020).
- If collecting a voucher specimen would jeopardise the continued existence of a rare, threatened or endangered flora population, the following can serve as the required voucher (listed in decreasing order of preference):
  - A portion of the fertile plant without the root
  - Photos of the plant in conjunction with a piece of fertile plant or plant parts (leaves and flowers or fruits)
  - Photos of fertile plant in conjunction with sterile plant specimen
  - Sterile plant specimen only, or photos only (preferably with descriptive notes).

- Tag each specimen securely with a unique voucher barcode label. Place the label on stems or away from any plant parts that will need to be examined for identification purposes. Use paper envelopes for small specimens and attach the voucher label to the envelope.
- Where possible, a voucher should include enough material to cover an A3 size herbarium sheet.
- As soon as possible, voucher specimens should be placed into a folded sheet of newspaper and transferred into a plant press to maintain their integrity.

Non-vascular flora voucher specimens

- The collection and preparation of non-vascular flora is detailed in Eldridge et al. (2003). A summary is provided below given non-vascular flora is not included in other EMSA modules. Also consult with the relevant herbarium/museum for guidance.
- Minimise damage to colonies by only collecting small amounts as non-vascular plants can have limited distributions and can be slow-growing. A number of small, representative samples is generally better than numerous random samples. For seasonally variable organisms (e.g. fungi) collections need to be made at different times of the year.

Dry-area species

- Species growing on trees and soil can be prised off with a knife or scraper.
- Species growing on rocks, if difficult to remove, may need to be collected with the rock attached using a chisel and hammer.
- Choose specimens with fruiting bodies if available to assist in identification.
- Collect specimens in paper bags or folded newspaper envelopes (not plastic).
- Include a small amount of soil for moss/liverwort/hornwort samples to preserve rhizoids/protonema (do not press specimens).
- For fragile soil-borne specimens, wrap them in paper before placing them in a paper bag.
- Thallose liverworts/hornworts (i.e. with undifferentiated vegetative tissue), especially when reproductive, may be placed in small screw-cap plastic containers or cardboard boxes, to protect fragile sporophytes.
- Store samples in a cool, dry place.

Wet-area species

- Place wet specimens in plastic snap-lock bags or screw-top plastic containers.
- Keep specimens cool and moist (not frozen); they can be fragile and difficult to identify when dry.
- Drip-dry moist or waterlogged algae samples first to remove excess fluid (do not squeeze).
- Aquatic bryophyte, moss and liverwort voucher specimens can be collected and transported in paper.
- If algae specimens are to be kept for over 48 hours before laboratory examination, they should be fixed with 70% alcohol (containing 7% formalin).

Fungi

- Collect fungi specimens in paper bags and keep them from becoming either too dry or sweating. Drying may require special equipment.

Vertebrate fauna voucher specimens

- Consult with the relevant museum for guidance on vertebrate fauna vouchering (preparing, labelling, preserving, storing and transporting specimens). Vertebrate vouchering is not covered in the EMSA Modules (including the Vertebrate Fauna Module).
- Circumstances for the opportune collection of vertebrate fauna voucher specimens (animal remains or signs) include when:
  - Species identification is uncertain
  - A record is considered important (e.g. the species has a limited occurrence, there are few existing records,

the record represents a range extension (including introduced species), the specimen has atypical characteristics)

  - The voucher is in better condition or has more scientific value (e.g. more likely to provide species identification) than previously collected specimens
  - Animal remains or signs are considered important for other studies (e.g. genetics, diet, parasites and zoonoses)
  - Advised by the relevant museum to address scientific knowledge gaps and improve representation within their collection
  - It is a required condition of permits, approved by an animal ethics committee
  - A dead specimen or sign is of a threatened or presumed extinct species, no matter what the quality/condition.
- Unless there are overriding circumstances, fauna voucher specimens should only be collected if they are considered a suitable condition for accessioning and if they can be prepared, preserved, stored and transported appropriately. As a guide, suitable specimen quality should be interpreted as:
  - Road kill, beach washed and freshly deceased: whole, with the skull intact, clean (no blood stains) and not decomposing (strong odour, fur, feathers or skin easily fall off) or desiccated.
  - Skeletal material: dry, whole and partial skeletal material may be useful, depending on species and condition. Broken or fractured bones/skulls are not useful.
  - Eggs and nests: abandoned nests or eggs are a good record of breeding data for birds. Alternatively, a photo and measurements of the eggs and/or nest can be used as an observational record (DPaW 2013).
- Road kills or specimens found dead or injured need to be processed as soon as possible to maximise the usefulness of tissue samples. If an animal has been dead for some time, tissue samples can still be taken but record in the field notes how long you estimate it was dead before the tissues were sampled. This will assist in interpreting potentially anomalous results in the lab (Owens 2000). Photos can be taken of the specimen (with scale) to accompany the record. Ideally include close-ups showing features, any tags/microchip numbers, etc., as well as photos of the surrounding environment.
- If a specimen is not required, is not of a suitable condition for collection, or animal ethics approval has not been obtained, then take photos (with scale) instead (DPaW 2013).
- Tag the bag or container containing the specimen with a unique voucher barcode label. The labelling requirements vary depending on the type of specimen and method of preservation.
- After labelling and scanning, place fauna voucher specimens in airtight bags and storage containers. Storage requirements vary depending on the type of specimen and method of preservation.
- For preservation recommendations (where to take samples and what to preserve them in), refer to O'Meally *et al.* (2011).
- Recently dead animals can be a good source of ectoparasites (fleas, mites, ticks, and lice). For ectoparasite collection information, refer to Upton *et al.* (2010).
- Arrange for any fresh fauna voucher specimens of significance (e.g. road kill of a threatened species) to be transported ASAP to the relevant museum (refer to the museum for advice).
- Scats, sub-fossil material and skeletal remains should be put in the freezer for a minimum of two weeks to kill any insects which may infest museum collections (Owens 2000).

Invertebrate fauna voucher specimens

- For a full guide to invertebrate fauna vouchering (preserving, sorting, preparing, labelling, transporting and storing specimens) refer to the Post-field sample curation protocol in the Invertebrate Fauna Module. Also consult with the relevant museum for guidance.

2 Post-field survey tasks

2.1 Sample curation

Sample curation is only required if voucher specimens are collected.

- Inspect pressed flora specimens and change the newspaper where necessary. Allow 10 minutes per plant press every 2–3 days.
- Inspect fauna specimens, check and change silica, and check preserving solutions where necessary. Allow 1–2 minutes per fauna voucher specimen.
- Deliver voucher specimens, accompanied by the necessary information from the Monitor app, to the relevant herbarium or museum (or approved taxonomist) for identification and accessioning. The procedures for lodging specimens may vary depending on the herbarium/museum, and accessioning is at their discretion (also see the Lodging EMSA Specimens and Samples information sheet).

We at TERN acknowledge the traditional owners and their custodianship of the lands on which TERN operates. We pay our respects to their ancestors and their descendants, who continue cultural and spiritual connections to country.

TERN is enabled by NCRIS. Our work is a result of collaborative partnerships with many universities and institutions.

To find out more please go to tern.org.au