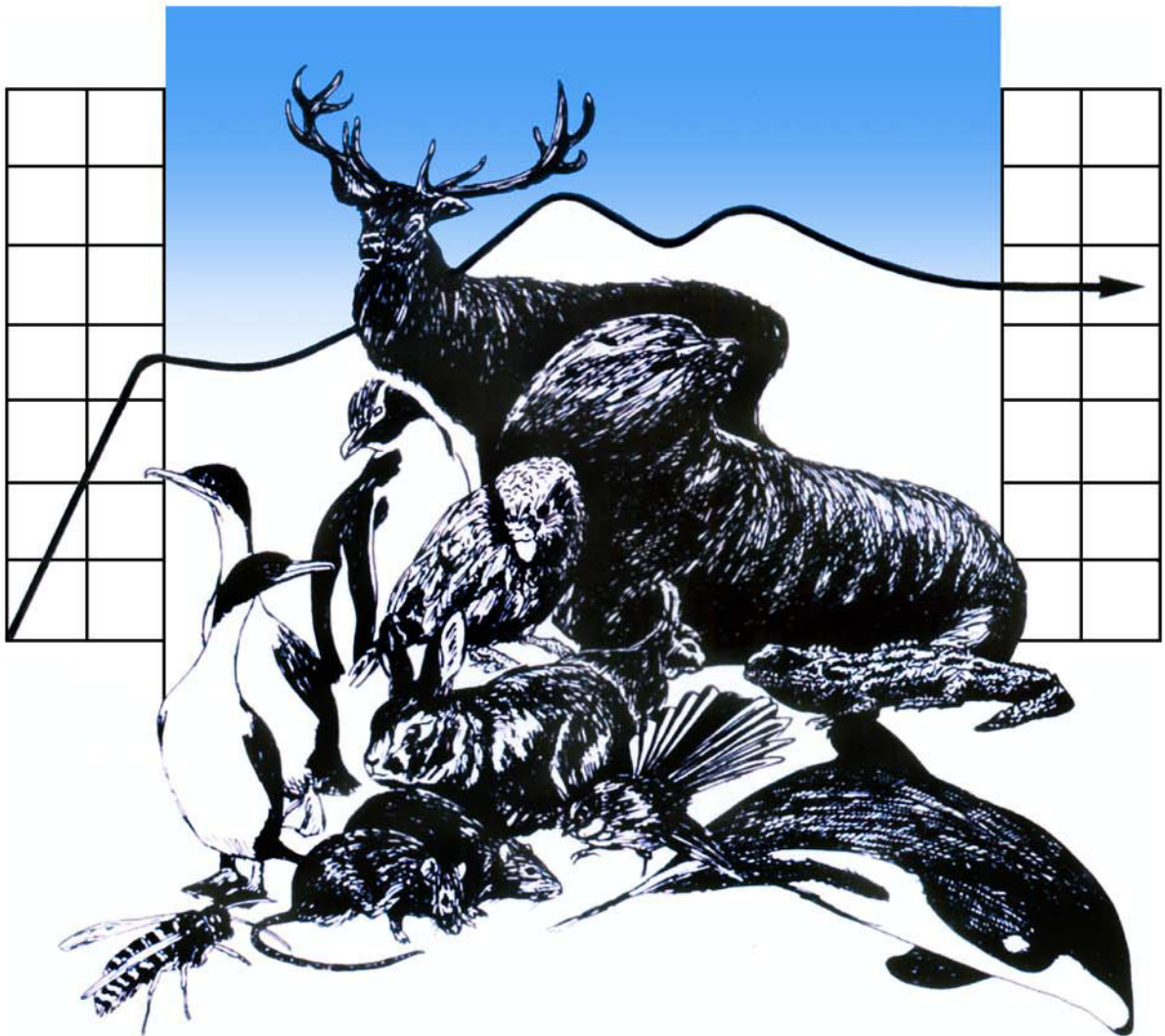




DEPARTMENT OF ZOOLOGY



WILDLIFE MANAGEMENT

Radio-tracking lizards

Standard Operating Procedure

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A report submitted in partial fulfilment of the
Post-graduate Diploma in Wildlife Management

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Radio-tracking lizards

Standard Operating Procedure

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I. Purpose

The purpose of this SOP is:

- To provide guidance to DOC staff or independent science providers commissioned by DOC and are planning to radio track New Zealand lizards.
- To provide a formal mechanism (Standard Operation Procedure) for ensuring that any impacts on manipulated animals are minimised during radio transmitter attachment, removal, and tracking.
- To enable DOC staff to meet statutory species management requirements involving a significant amount of routine interaction with live animals without the requirement for DOC AEC approval if the manipulation of animals:
 1. Constitutes routine management; or
 2. Forms part of a routine procedure where techniques are already developed as part of conservation management or research.

Separate AEC approval is required for any project involving manipulation of animals that does not constitute routine species management or research for management purposes (see 1 & 2 above).

This SOP is not a replacement for appropriate training and practical experience.

Scope

This SOP fits within the scope of *conservation management* of wild and captive lizard species.

- Methods of catching lizards for radio tracking are beyond the scope of this SOP – refer to the DOC website’s herpetofauna toolbox for advice on best practice.
<http://www.doc.govt.nz/publications/science-and-technical/doc-procedures-and-sops/biodiversity-inventory-and-monitoring/herpetofauna/>
- Analysing and interpreting the radio tracking data is also beyond the scope of this SOP.

II. Process

This SOP contains key information to assist project managers and *trained* operators to:

- Plan the project safely and appropriately.
- Ensure relevant experience is accredited to operator.
- Handle lizards appropriately.
- Attach and remove radio transmitters appropriate for the type of lizard.
- Radio-track lizards with animal welfare being paramount.

***Permit requirements**

Users of this SOP must note that:

- Capture and holding of protected species by DOC staff as part of their normal routine work duties does not require a permit under the Wildlife Act.
- All native lizards are protected under the Wildlife Act.
- **Other users of this document will need to ensure they obtain the appropriate permits from DOC for the capture and holding of protected species and also obtain AEC approval for any research projects involving manipulations of these animals.**

III. Requirements table

Tier 4 or higher managers are authorised to approve variation from SOP requirements and are accountable for those decisions. They are required to use their professional judgement and seek advice when in doubt. All decisions should be documented. It is expected that variations from requirements will be the exception rather than the norm, and that legal (i.e. legislation and case law), and health and safety requirements are effectively compulsory. Common sense should prevail in the case of exceptional or emergency field situations.

REQUIREMENTS (NOTE THAT THE PROJECT MANAGER MAY ALSO BE THE OPERATOR)	WHO IS ACCOUNTABLE FOR CARRYING OUT THE REQUIREMENT	WHY?/ CONSEQUENCE	LINKS	COMPLETED/ COMMENTS
Identify the need for radio tracking lizards: <ul style="list-style-type: none"> Ensure the purpose and benefit of radio tracking is sufficient to justify any adverse effects. 	Project Manager	Legal requirement to avoid putting protected species, individual animals and/or threatened populations at unecessary risk – Wildlife Act (1953); Animal Welfare Act (1999) via the DOC Code of Ethical Conduct for the Care and Manipulation of Live Animals.	Section 1.1 DOC Code of Ethical Conduct – OLDDM-766783 (or Section IV for weblink)	
Obtain permission from local iwi for project.	Project Manager	Legal requirements in accordance with Conservation Act.	Section 1.1	
Obtain separate AEC approval for projects that: <ul style="list-style-type: none"> Do not constitute routine 	Project Manager	Legal requirement to avoid putting protected species, individual animals and/or threatened	Section 1.2 DOC AEC applications –	

REQUIREMENTS (NOTE THAT THE PROJECT MANAGER MAY ALSO BE THE OPERATOR)	WHO IS ACCOUNTABLE FOR CARRYING OUT THE REQUIREMENT	WHY?/ CONSEQUENCE	LINKS	COMPLETED/ COMMENTS
<p>species management or research.</p> <ul style="list-style-type: none"> Involve any other unusual radio tracking protocols not outlined in this manual. 		<p>populations at unnecessary risk – Wildlife Act (1953); Animal Welfare Act (1999) via the DOC Code of Ethical Conduct for the Care and Manipulation of Live Animals.</p>	<p>Section IV for weblink</p> <p>DOC Code of Ethical Conduct – OLDDM-766783 (or Section IV for weblink)</p>	
<p>Plan project safely and appropriately:</p> <ul style="list-style-type: none"> Plan to minimise, reduce or eliminate any adverse effects resulting from the radio tracking process. Identify potential impacts of attaching/removing transmitters and radio tracking species/individuals at particular times of the year. Provide Health and Safety briefs, including local risk management, for all hazardous procedures to ensure operator safety. 	<p>Project Manager</p>	<p>Legal requirement to avoid putting individual animals and/or threatened populations at unnecessary risk – Wildlife Act (1953); Animal Welfare Act (1999) via the DOC Code of Ethical Conduct for the Care and Manipulation of Live Animals.</p> <p>Legal requirement to comply with Health and Safety in Employment Act (1992).</p> <p>Planning the project safely and appropriately helps to avoid wasting resources.</p>	<p>Section 1.1 and 1.2</p> <p>DOC Code of Ethical Conduct – OLDDM-766783 (or Section IV for weblink)</p> <p>DOC Health and Safety Management Systems Manual http://intranet/en/Procedures-and-Guides/Health-and-Safety-Manual/</p>	

REQUIREMENTS (NOTE THAT THE PROJECT MANAGER MAY ALSO BE THE OPERATOR)	WHO IS ACCOUNTABLE FOR CARRYING OUT THE REQUIREMENT	WHY?/ CONSEQUENCE	LINKS	COMPLETED/ COMMENTS
<p>Ensure relevant experience is accredited to operator:</p> <ul style="list-style-type: none"> • Confirm operator has completed necessary training and practice under supervision prior to attaching/ removing transmitters and radio tracking independently. • Ensure operator is aware of obligations under the DOC Code of Ethical Conduct for the Care and Manipulation of Live Animals (complies with all requirements of the Animal Welfare Act 1999). 	<p>Project Manager</p>	<p>Legal requirement to avoid putting individual animals and/or threatened populations at unnecessary risk – Wildlife Act (1953); Animal Welfare Act (1999) via the DOC Code of Ethical Conduct for the Care and Manipulation of Live Animals.</p>	<p>Section 1.3</p> <p>DOC Code of Ethical Conduct – OLDDM-766783 (or Section IV for weblink)</p>	
<p>Follow Health and Safety precautions for all hazardous procedures to ensure operator health and safety.</p>	<p>Operator</p>	<p>Legal requirement to comply with Health and Safety in Employment Act (1992).</p>	<p>Section 1.3</p> <p>DOC Health and Safety Management Systems Manual http://intranet/en/Procedures-and-Guides/Health-and-Safety-Manual/</p>	

REQUIREMENTS (NOTE THAT THE PROJECT MANAGER MAY ALSO BE THE OPERATOR)	WHO IS ACCOUNTABLE FOR CARRYING OUT THE REQUIREMENT	WHY?/ CONSEQUENCE	LINKS	COMPLETED/ COMMENTS
<p>Animal welfare being paramount:</p> <ul style="list-style-type: none"> • During any lizard handling. • When attaching or removing transmitters. • During radio tracking. • Avoid using animals that don't meet the minimum requirements or are in poor condition. • Maintain hygiene between lizard individuals. 	<p>Operator</p>	<p>Legal requirement to avoid unnecessary suffering of individual animals, and to avoid compromising the recovery of threatened populations – Wildlife Act (1953); Animal Welfare Act (1999) via the DOC Code of Ethical Conduct for the Care and Manipulation of Live Animals.</p>	<p>Section 2.1 to 2.3 Section 3.1</p> <p>DOC Code of Ethical Conduct – OLDDM-766783 (or Section IV for weblink)</p>	

IV. About this document

Coordinator

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Author

Compiled by Sunny Yet

Approved for use

DDG Conservation Services

Signed

Date

Relevant DDG from National Office

Signed

Date

Amendments

Amendment date	Amendment details	DOCDM version	Amended by

Terminology and definitions

- Refer to Appendix 4.1 for glossary of scientific terms.
- DOC Code of Ethical Conduct for the Care and Manipulation of Live Animals as required by AWA 1999 – <http://intranet/en/Procedures-and-Guides/Manipulation-of-Live-Animals-Code-Process/>
- Animal Ethics Committee (AEC) – DOC application forms can be found at <http://intranet/en/Conservation-Management/Science/Animal-Ethics/?mode=forms>
- Operator – person who has been trained by an experienced person to attach/remove transmitters and radio-track lizards.

1. Planning the radio tracking process

1.1 Project criteria

REQUIREMENTS	WHO IS ACCOUNTABLE FOR CARRYING OUT THE REQUIREMENT	WHY?/ CONSEQUENCE
Ensure the purpose and benefit of radio tracking is sufficient to justify any adverse effects.	Project Manager	Legal requirement to avoid putting protected species, individual animals and/or threatened populations at unnecessary risk – Wildlife Act (1953); Animal Welfare Act (1999) via the DOC Code of Ethical Conduct for the Care and Manipulation of Live Animals.
Plan to minimize, reduce or eliminate any adverse effects resulting from the radio tracking process.	Project Manager	As above. Planning the project safely and appropriately helps to avoid wasting resources.
Obtain permission from local iwi for project.	Project Manager	Legal requirement in accordance with the Conservation Act.

A radio-tracking project can only proceed if:

- There is a clear benefit to the conservation, health, or welfare of the species. This is particularly important with:
 1. Threatened and endangered species;
 2. Species inhabiting sites of significant conservation value.
- There are no other means of obtaining the same information (e.g. monitoring techniques with lower impact, work undertaken in less fragile ecosystems).
- Any potential negative effects of the conservation of the species are avoided, remedied or mitigated.
- Relevant parties are consulted where appropriate (e.g. DOC Wildlife Health Coordinator, iwi/runanga).

1.2 Ethical considerations

REQUIREMENTS	WHO IS ACCOUNTABLE FOR CARRYING OUT THE REQUIREMENT	WHY?/ CONSEQUENCE
Obtain separate AEC approval for projects that: <ul style="list-style-type: none"> • Do not constitute routine species management or research. • Involve any other unusual radio tracking protocols not outlined in this manual. 	Project Manager	Legal requirement to avoid putting protected species, individual animals and/or threatened populations at unnecessary risk – Wildlife Act (1953); Animal Welfare Act (1999) via the DOC Code of Ethical Conduct for the Care and Manipulation of Live Animals.

Individual health

- The weight of the lizards should be monitored throughout the radio-tracking process. Each individual should be weighed monthly at the very least. Individuals showing 5% weight loss should be monitored closely. If there is continual evidence of 5-10% weight loss (of original body weight), the transmitter should be removed.
See Section 3.3 for other cues for removing transmitters.
- The life stage (adult/sub-adult/juvenile) of the individuals used will be dependent on the project. Due to transmitter weight limitations (see below) this usually excludes juveniles. Juveniles may be used for radio tracking as long as they are big enough to satisfy the body weight requirements.
- Pregnant females may be used, given that any part of the radio-tracking process will not interfere with any aspect of the pregnancy. This may vary for different species, time of the year, habitat etc.

Transmitter weight

The weight of radio transmitters is mainly the weight of the battery. The trade-off with having a lighter battery is that the life of the transmitter is shorter which can limit the length of the project. Generally, the larger the species, the more scope there is for transmitter weight.

- The attachment materials are included in the ‘transmitter weight’.
- The absolute maximum weight limit for transmitters for lizards is 7.5% of body weight.
- Will require **separate AEC approval** if planning on exceeding the 7.5% limit.

As New Zealand lizards are fairly small animals, not breaching the maximum transmitter weight limit of 7.5% means that the only option is using relatively small, light batteries (i.e. weighing $\leq 0.7\text{g}$ plus harness/attachment materials). However, radio-tracking technology is constantly advancing, allowing for lighter transmitters and extending battery life.

Organisations like the American Society of Ichthyologists and Herpetologists (ASIH) do endorse transmitters weighing 10% of body weight (ASIH 2004), but recent research suggests that lizards with transmitters weighing over 7.5% body weight have negative effects such as lower climbing performance (Knapp and Abarca 2010).

Tracking period

The tracking period of each project will be dependent and/or limited by:

- Transmitter battery life. The battery life for transmitters used for lizards are typically 21-30 days.
- Effects of transmitter weight on the species being radio-tracked.
- Weather.

1.3 Operator experience

REQUIREMENTS	WHO IS ACCOUNTABLE FOR CARRYING OUT THE REQUIREMENT	WHY?/ CONSEQUENCE
Confirm operator has completed necessary training and practice under supervision prior to attaching/ removing transmitters and radio tracking independently.	Project Manager	Legal requirement to avoid putting protected species, individual animals and/or threatened populations at unnecessary risk – Wildlife Act (1953); Animal Welfare Act (1999) via the DOC Code of Ethical Conduct for the Care and Manipulation of Live Animals.
Ensure operator is aware of obligations under the DOC Code of Ethical Conduct for the Care and Manipulation of Live Animals (complies with all requirements of the Animal Welfare Act 1999).	Project Manager	As above.
Provide Health and Safety briefs, including risk	Project Manager	Legal requirement to comply with Health and Safety in Employment Act

management, for all procedures to ensure operator safety.

(1992).

Health and Safety Requirements

All handlers must read and follow the Department of Conservation's Risk Management and Safety Planning Procedures.

2. Radio transmitter attachment and removal

2.1 Handling

REQUIREMENTS	WHO IS ACCOUNTABLE FOR CARRYING OUT THE REQUIREMENT	WHY?/ CONSEQUENCE
Plan to minimize, reduce or eliminate any adverse effects resulting from the radio tracking process.	Operator	<p>Legal requirement to avoid unnecessary suffering of individual animals, and to avoid compromising the recovery of threatened populations – Wildlife Act (1953); Animal Welfare Act (1999) via the DOC Code of Ethical Conduct for the Care and Manipulation of Live Animals.</p> <p>Planning the project safely and appropriately helps to avoid wasting resources.</p>
<p>Animal welfare being paramount:</p> <ul style="list-style-type: none"> • During any lizard handling. • Avoid using animals that don't meet the minimum requirements or are in poor condition. • Maintain hygiene between individuals. 	Operator	<p>Legal requirement to avoid putting individual animals and/or threatened populations at unnecessary risk – Wildlife Act (1953); Animal Welfare Act (1999) via the DOC Code of Ethical Conduct for the Care and Manipulation of Live Animals.</p>

Handling tips

For each animal, it is important for operators to:

- Minimise handling time of individuals.
- Anticipate that individuals and/or different species are going to respond to prolonged handling and manipulation differently.

- Never hold individuals solely by the tail.
- To avoid heat stress, handle the lizards in the shade (if handling during daytime).
- Handle the lizards with an adjustable grip that is firm but sensitive.
- Let the lizard get relaxed in the operator's hand first before proceeding to attach or remove transmitters.
- Some lizards will struggle, so allow them to move through the handler's fingers in a controlled manner that limits the movement space and prevents escape until they are relaxed.

Caudal autotomy/tail loss

Although lizards are generally robust, stress should be minimised as it may cause a lizard to drop its tail. Although tail loss is common in many species of lizards as a natural mechanism usually employed to escape predators, it also has many physiological and functional costs such as hindered climbing ability.

(See Appendix 4.2 for more information on tail loss.)

Some species are more prone to tail loss during handling, so be aware of the tail loss characteristics of the species you are handling.

Hygiene

Basic hygiene needs to be maintained between handling different individuals in order to prevent the spread of diseases and parasites.

This may include washing or sanitising hands before handling a new individual.

2.2 Transmitter attachment techniques

REQUIREMENTS	WHO IS ACCOUNTABLE FOR CARRYING OUT THE REQUIREMENT	WHY?/ CONSEQUENCE
Animal welfare being paramount: <ul style="list-style-type: none"> • When attaching or removing transmitters. 	Operator	Legal requirement to avoid putting individual animals and/or threatened populations at unnecessary risk – Wildlife Act (1953); Animal Welfare Act (1999) via the DOC Code of Ethical Conduct for the Care and Manipulation of Live Animals.

Attachment materials

- Micropore, breathable, self-adhesive tape (sports/surgical tape).
 - It is best to avoid paper tape as it will fall off more easily.
 - Make sure that the width of the tape is appropriate for transmitter attachment to the individual. See the methods section below for more guidance on the width of the tape.
 - This type of tape is used for its lightness, breathability and flexibility.
- Xylene-free, non-toxic, waterproof permanent marker.
 - The colour of the marker should match the colour of the animal as closely as possible.
 - The marker will be used to colour the tape (if it is not clear tape) **prior to attachment**.
 - The tape is coloured to avoid radio-tracked individuals from standing out to visual predators (primarily avian).
- Reflective tape spots
 - An optional extra for nocturnal species – if sighting the lizards at night is required.
 - Two reflective spots are required – one placed on either side of the transmitter, so the lizard can be seen regardless of the direction they are facing.
 - These reflective spots are only a few millimetres in diameter.
 - There has been no evidence to suggest that reflective spots will attract predators.

See Appendix 4.3 for brands known to produce these types of tapes and markers.

*Different attachment methods not outlined in this manual **will require separate AEC approval.***

*Operators must be **trained** by an experienced person before undertaking attachment/removal of transmitters independently.*

‘Backpack’ attachment for geckos*:

- This method of attachment is also known as ‘harness’ type attachment.
- Place the transmitter squarely on the back of the lizard, in line with the front arms with the aerial going along its back.
- Make sure that the front tip of the transmitter is not so far forward that it hinders head and neck movement.
- Ensure that the width of the tape can neatly fit over the lizard’s shoulders without over-extending either side to the face and arm, and will not obstruct movement.

- Wrapping:
 1. Start on the lizard's back with the tape lying diagonally over the transmitter – the shorter end directed toward the back legs and affixed on the lizard's side for the initial attachment; and the longer end in line with the opposite shoulder (diagonally opposite the short end of the tape).
 2. Bring the tape down over the shoulder, then back diagonally along the front of the ventral surface (i.e. chest), just behind the opposite arm, but back far enough so it will not obstruct movement.
 3. Wrap the tape horizontally around the lizard's back and the transmitter. Then bring the tape diagonally up on the ventral surface again and up over the other shoulder.
 4. Finally bring the tape back diagonally along the lizard's back and up across the transmitter (across the point at which the antenna joins the transmitter), bring it behind the opposite arm.
 5. Finish by wrapping horizontally around ventral surface.
- Ensure that the transmitter is still centrally positioned and sufficiently fastened by the tape and that the whole attachment is secure.
- It is important to make sure that the attachment is not too tight but still prevents escapement from the harness.
- If pregnant females are being used, ensure that the straps of the transmitter attachment is not obstructing their embryos.

Figure 1: 'Backpack' attachment on Jewelled gecko



Photo courtesy of Jo Monks

***Exceptions**

For gecko species or individuals where a transmitter attached via backpack method would interfere with habitat use (e.g. rock crevices as retreats) a tail mount would be more appropriate. See below for tail mount attachment methods.

Note that the backpack method is preferable for geckos because the probability for a complete tail loss in most cases related to carrying transmitters is higher than for skinks.

Tail mount attachment for skinks:

- Place the transmitter to the base of the tail about 2-3mm below the cloaca on the left or right side with the aerial going along the tail. The attachment must allow for normal function (including birth if applicable).
- Wrap the tape around the attachment point about 1.5 times (but may need more than this depending on the tape).
- Ensure the tape is not too narrow or too wide; just wide enough for a secure attachment.
- Ensure that the transmitter is sufficiently fastened by the tape and that the whole attachment is secure.

Figure 2: Sinbad skink tail mount



Photo courtesy of Jo Monks

Figure 3: Forest gecko tail mount



Photo courtesy of Jo Monks

Note that with tail attachments, there is a possibility that the whole tail (and transmitter) will be lost if the lizard is threatened by predator. See Appendix 4.2 for more information on tail loss.

Walking test

A “walking test” **must** be conducted prior to release in order to make sure that the lizard’s locomotive abilities are not hindered by the transmitter attachment.

- Allow the lizard to walk on a flat surface – the lizard may be reluctant to move initially, so the operator must wait to observe.
 - ‘Backpack’ method – Ensure that the lizard has full range of motion in both front legs and the tape is not causing any restrictions.

- Tail mount – ensure that the lizard has full range of motion in both back legs and the tape/transmitter is not interfering with walking.
- If the individual does not have a full range of motion in all legs then the transmitter will require **reattachment** – the tape will need to be removed and the transmitter will need to be reattached with a new piece of tape. See Section 2.3 for transmitter removal.
- If the individual does have a full range of motion in all legs and locomotive abilities are not hindered, then the individual may be released.

Release

In a natural situation where the project is looking at lizard movement *in situ*, lizards should be placed exactly where they were originally found.

2.3 Transmitter removal

REQUIREMENTS	WHO IS ACCOUNTABLE FOR CARRYING OUT THE REQUIREMENT	WHY?/ CONSEQUENCE
Animal welfare being paramount: <ul style="list-style-type: none"> • When attaching or removing transmitters. 	Operator	Legal requirement to avoid putting individual animals and/or threatened populations at unnecessary risk – Wildlife Act (1953); Animal Welfare Act (1999) via the DOC Code of Ethical Conduct for the Care and Manipulation of Live Animals.

Transmitter removal

- Ensure that the individual is relaxed in hand before starting removal.
- Gently peel the tape off:
 - Using a finger to soak the tape with water will make the tape easier to remove.
 - The unravelled sections of tape may be cut off to prevent the lizard becoming entangled in the tape.
 - Try not to pull the skin of the lizard too much as that can lead to unnecessary stress.

If an individual cannot be recaptured for an unforeseen reason such as battery failure, the individual will be able to escape from the attachment themselves by:

- Climbing out of the attachment materials after a heavy rain event (as the material stretches when drenched).
- Shedding the attachment materials during the sloughing of skin. Sloughing occurs naturally about twice a year for NZ lizards.

3. Radio-tracking process

3.1 Radio-tracking

REQUIREMENTS	WHO IS ACCOUNTABLE FOR CARRYING OUT THE REQUIREMENT	WHY?/ CONSEQUENCE
Animal welfare being paramount: <ul style="list-style-type: none"> • During radio tracking. 	Operator	Legal requirement to avoid putting individual animals and/or threatened populations at unnecessary risk – Wildlife Act (1953); Animal Welfare Act (1999) via the DOC Code of Ethical Conduct for the Care and Manipulation of Live Animals.

During radio-tracking:

- Minimise physical interaction with the animals.
- May be a risk of standing on individuals – always be cautious of foot placement.
- Listen as well as look for the animals.
- Only move a lizard during radio-tracking if they are caught or stuck in something.

Sighting individuals

It is important to keep track of the frequency of sightings per individual. It is not necessary to sight them each tracking session, as long as the data indicates that the individual still has its transmitter and is still moving.

However if an individual has not been seen in a few tracking sessions it is a good idea to make sure you sight them (this would also be dependent on the tracking frequency of the project) to make sure that both the lizard and transmitters are still in good condition and the lizard is not stuck. This may involve hand searching (and moving vegetation) which can cause disturbance to the animal. The animal’s response to the disturbance will need to be factored in if the animal continues to be tracked.

Weather

Radio-tracking should be done in fine weather if possible, as rain, mist and water caught in foliage etc. can:

- Interfere with radio signals;

- Damage equipment (radio receivers are expensive and not waterproof).

Generally, lizards will also be harder to locate when the weather is unfavourable due to the basking behaviour of ectotherms.

3.2 Signs for transmitters requiring reattachment

- After rain events – look out for loose or peeling tape, especially after heavy rain events as the attachment material will stretch when wet, allowing individuals to escape. (Knox and Monks in press).
- Sloughing – if an individual is showing signs of sloughing, make sure to sight them on subsequent tracking sessions as the transmitter will be shed with the old skin. Although don't wait till the last opportunity to reattach the transmitter. Geckos will shed their whole skin at one whereas skinks will shed some scales at a time.
- Refer to Section 2.2 and 2.3 for transmitter removal and attachment.

Figure 4: Reattached transmitter on Jewelled gecko in final stages of sloughing



Photo courtesy of Sunny Yet

3.3 Signs for transmitters requiring removal

If a lizard is showing any of the below symptoms, their transmitter must be removed and the lizard cannot continue as part of the radio-tracking project. See Section 2.3 for transmitter removal.

- Abrasions and/or swelling.
- Body weight loss of 5-10% (See Section 1.2 for further guidance).
- Obvious discomfort with the transmitter. E.g. limited walking mobility.

4. Appendices

4.1 Glossary of terms

Caudal autotomy	(Voluntary) shedding of the tail
Herpetofauna	Reptiles and amphibians
Operator	Person who has been trained by an experience person to attach/remove transmitters and radio-track lizards
Sloughing	Shedding a layer of dead skin

4.2 Tail loss and consequences

Tail loss occurs at predetermined fracture planes* in the tail, but the number and locations of these planes will vary from species to species. Regeneration will usually occur after a tail drop, although future tail drops will occur at the same site or more proximally as regenerated tails do not have fracture planes (Barr 2009).

Tail loss can result in reduced climbing ability, growth rate, locomotor performance, reproductive output, mating opportunities and probability of survival (Hare and Miller 2010). A major function of the tail is the storage of fats, which is big issue if the tail is lost.

**Note that Naultinus sp. geckos only have one fracture plane. Other gecko species and all skink species have multiple fracture planes along the length of the tail.*

4.3 Equipment suppliers

There are several companies specialising in radio-tracking equipment and transmitters. These include, but are not limited to:

- Sirtrack Ltd., Havelock North, NZ (<http://www.sirtrack.com>)
- Holohil Systems, Canada (<http://www.holohil.com>)

Brands that produce materials appropriate for transmitter attachment include but are not limited to:

- Micropore, breathable self-adhesive tape
 - Leucopor® surgical tape (Barr 2009; Germano 2007)
 - Mefix tape (Hoare et al. 2007)
 - Easifix tape (Hoare et al. 2007)

- Xylene-free, non-toxic, waterproof permanent marker (certain colours only- confirm with product itself)
 - Artline permanent markers (Hoare et al. 2007)
 - Sharpie permanent markers

4.4 Acknowledgements

The author wishes to thank Jo Monks (DOC), Carey Knox (EcoGecko Consultants), Orokonui Ecosanctuary and the University of Otago for providing the opportunity for this project. Also thanks to DOC for providing the opportunity for involvement in other aspects related to this project.

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