

NAWAC GUIDELINE 09:

Assessing the welfare performance of restraining and kill traps

1. Introduction

The purposes of this guideline are to:

- (a) standardise the testing of welfare performance of traps;
- (b) encourage the continuing development of new and existing traps to improve the effectiveness of kill traps and the welfare of animals caught in restraining traps, including the reduction of injuries and minimisation of suffering;

Note: This guideline focuses on the assessment of the welfare performance of traps NOT on how effectively the traps capture target animals or how target-selective, mechanically robust or user safe they are.

2. Scope

This guideline applies to all types of traps designed to restrain or kill animals. This guideline confines the measurement of animal welfare associated with the use of traps to physical trauma, and does not include psychological and physiological distress. This is because insufficient information exists on what physiological parameters to measure and, for any one parameter, what levels could be considered as the minimum.

3. Definitions

For the purposes of this guideline (including the appendices), the following definitions apply:

Capture efficiency

the capability of the trap to capture target animals, expressed as the number of animals trapped per 100 trap nights (see definition of *Trap-night*).

Captured animals

all animals caught in traps, plus those identified as having escaped.

Clamping force

the steady-state force (Newtons) exerted on an animal's limb or body by any mechanically powered trap.

Corneal reflex

blinking reflex invoked by gently touching or blowing air onto the surface of the eye (cornea). The palpebral reflex may be used as an alternative, which is the blinking reflex invoked by gently touching the eyelid. Whichever method is used should be recorded. Animals that do not show this reflex are considered to be unconscious.

Effective kill

death of an animal in a trap within the time limits established by this guideline for it being rendered irreversibly unconscious and subsequently determined to be dead.

Effective restraint

the restraint of an animal in a trap during which physical injury remains at or below the trauma thresholds established by this guideline.

Impact momentum

the force (kg m/sec) delivered to an animal when struck by the striking component(s) of the trap.

Killing effectiveness

the ability of a trap to produce an effective kill (see above)

Non-target animal

an individual of any species other than those which the trap is set to capture.

Palpebral reflex

blinking reflex invoked by gently touching the eyelid (palpebra). The palpebral reflex can be tested as an alternative to the corneal reflex.

Reference trap

the trap and trap system most commonly used for the same purpose and target animal as the test trap as determined by the trap-testing agency, used for reference purposes during testing.

Selectivity

the capability of the trap to minimise the capture of non-target animals, expressed as the number of non-target captures per 100 trap nights.

Striking component

the part(s) of the trap that strike or contact the animal and deliver the impact momentum and/or clamping force, or other mechanism intended to result in death (e.g. lethal injection, electrocution)

Target animal

an individual of a species that the trap has been set to capture.

Trap

the device used to capture or kill the target animal.

Trap-night

one trap set for one night (for example, four traps set for four nights equals 16 trap-nights).

Trap system

includes the trap and how it is set (that is, additional equipment such as trap covers, and whether the trap is set on or above the ground, baited or not baited). In most cases it is the trap system that is tested not just the trap.

Trap-testing agency

an organisation authorised by the Ministry of Agriculture and Forestry to undertake the evaluation of traps according to this guideline.

Trauma threshold

the highest allowable trauma level for a trap according to this guideline.

4. Welfare Performance Criteria

4.1. Effective restraint (restraining trap systems only)

The trap system shall restrain the target animal effectively when tested and evaluated in the field test (see 5.1 below).

4.2. Effective kill (kill trap systems only)

The trap system shall kill the target animal effectively when successfully tested and evaluated in an enclosure or field test (see below).

5. Trap test preparation

Traps for testing shall be prepared in accordance with the following procedure before each test.

5.1. Sampling of traps

The method of selection of individual traps for testing shall be at the discretion of the trap-testing agency.

5.2. Preparation of traps

Traps shall be prepared according to the manufacturer's and/or national distributor's instructions and, prior to each test of mechanically powered traps, the trap shall be fired ten times at intervals of no less than 5 minutes using a substitute target that will not damage the striking component.

5.3. Test Personnel

The test personnel shall be experienced in the field use of the traps, and capable of trapping the target species. They shall also be familiar with the testing procedures.

5.4. Retesting

A trap system that fails the welfare tests is excluded from further testing until it has been modified as a result of the previous test results.

6. Restraining trap welfare performance testing

6.1. Principle

The ability of the trap system to meet the welfare performance criteria is tested by capturing a sufficiently large number of animals to assess the extent of any pathology resulting from capture.

6.2. Test procedure

The following test procedure must be undertaken:

- (a) A suitable field site must be selected so that the 25 captures required to meet the minimum required is achievable (see Appendices C(a) and C(b)). Sufficient trapping must be carried out to ensure that at least ten different traps or traps at ten sites each have a capture.
- (b) Traps must be set according to the manufacturer's and/or national distributor's instructions. For prototype traps, the procedure for setting the trap must be documented.
- (c) The traps must be checked within the time period determined by legislation. All captured animals must be euthanased immediately by a method that minimises additional trauma. They should then be removed from the traps.
- (d) The following data must be recorded each day when checking the traps:
 - (i) date and time
 - (ii) trap system
 - (iii) site location of the trap
 - (iv) status of the trap (fired, not fired)
 - (v) species captured (include identifiable escapes)

- (vi) condition of the animal (dead, alive, unconscious, predated)
 - (vii) location on body where animal is held by trap (eg head, neck, torso, body, hindquarters, tail)
 - (viii) unique identification number for each animal.
- (e) All target animals captured in the experimental traps (whole carcass or that part caught by the trap) must be labelled with the following information:
- (i) date of capture
 - (ii) unique identification number of each animal
 - (iii) method of euthanasia.

6.3. Pathological evaluation

The following procedure shall be undertaken:

- (a) The labelled carcasses must be placed in plastic bags and frozen. Make sure that the carcasses are not damaged during handling and transport. Keep the carcasses frozen until pathological and/or radiological examination is performed.
- (b) All the target animals shall be examined, using only the file numbers as identification, by a veterinary pathologist (preferably experienced in the examination of wildlife species). The pathologist shall identify the traumas (described in Appendix A) that each animal has sustained (see Annex A for descriptions). The trap-testing agency will then use this information to determine the total trauma class for each animal, using Appendix B.

6.4. Evaluation of the results

Traps have an opportunity to pass one of two welfare performance classes (A or B). For both classes, traps have to meet BOTH conditions to pass.

Once the trauma for each captured animal has been scored, count the number of individual animals in each of the four trauma categories (mild, moderate, moderately severe, severe). Note that "mild" also includes no identifiable trauma.

Class A: To qualify as a Class A trap, the following two conditions must be met:

Referring to Appendix C (a) for the selected sample size in both cases:

- (i) the maximum allowable number of animals with trauma more severe than *mild* must not be exceeded; and
- (ii) the maximum allowable number of animals with trauma more severe than *moderate* must not be exceeded.

Class B: To qualify as a Class B trap, the following two conditions must be met:

Referring to Appendix C (b) for the selected sample size in both cases:

- (i) the maximum allowable number of animals with trauma more severe than *moderate* must not be exceeded; and

- (ii) the maximum number of individual animals with trauma more severe than *moderately severe* must not be exceeded.

7. Kill trap welfare performance testing

7.1. Principle

The ability of the trap system to kill the target animal effectively is tested by allowing animals to freely approach the test traps in an enclosure or in the field.

7.2. Apparatus

Enclosure – The enclosure (or test room)¹ shall be of adequate size to allow the target animals to move freely and contain a nest box or equivalent area where the animal is able to rest. Animals should be able to be observed without disturbance from the observer.

Field site – a suitable field site must be chosen so that the required number of animals and/or trap sites is achievable. Trap sites must be able to be monitored by observers without disturbance to the animals, but observers must be sufficiently close that they can measure the time to loss of corneal or palpebral reflex and the presence/absence of the heart beat of the animal without undue delay after the trap is sprung.

Traps – each test animal should be tested, where possible, using a different trap of the same trap system. At the discretion of the trap-testing agency, the same trap may be reused if the trap is a “prototype”.

Video recorder – use is recommended if testing is done in the field to allow detailed monitoring and analysis of the test.

Tester for eye (corneal) reflexes – a lens cleaner or equivalent apparatus using air shall be used to test the corneal reflexes.

7.3. Test Animals

The test animals shall be representative of the size and weight of those found over the animal's range in the wild. The test animals must be free of injury or signs of ill-health. The number of animals to be tested must be at least 10 but the number must be chosen before the test starts, and when the maximum allowable number of failures is reached the trial must be stopped.

The choice of how many animals are used must be made by the person testing the trap or submitting the trap for testing by others, with the understanding that the lower sample sizes have a greater risk of an effective trap being rejected.

7.4. Conditioning of animals in enclosure trials

Wild-captured animals of the target species, and their nest boxes, should be transferred to the test room or enclosure and time allowed for acclimatisation.

¹ An enclosure can be a cage or box, providing the animal can move freely and its approach to the trap is not forced or unnatural because of the confinement or the presence of observers.

7.5. Test procedure

Traps must be set in accordance with the manufacturer's and/or national distributor's instructions; the procedure for setting prototype traps must be recorded. The animals must be monitored as they freely approach and enter the traps. This should be done either by using a video recorder or by direct observation and written records of animal responses.

Animals that are struck by the striking component and escape shall be deemed to have been caught but not killed within five minutes.

If the impact point is not in a vital region (head, neck, thorax or other specified area), kill the animal immediately by an appropriate method.

If the impact point is in a vital region, monitor the time to loss of corneal or palpebral reflex and the presence/absence of the heart beat of the animal. If loss of the reflex is not achieved in five minutes, euthanase the animal immediately, using an appropriate method.

Note: Animals are left for five minutes before being euthanased to provide information on how close the trap is to achieving the standards required. Few conscious animals will be subjected to the five-minute time frame. In a test of 25 animals, a maximum of four animals are allowed to exceed the designated time frame (that is, Class A, 30 seconds; Class B, three minutes), For a test involving only ten animals, no animal is allowed to exceed the designated time frame.

The time to loss of the corneal reflex, the precise point of impact and/or clamping point and the position of the animal in the trap must all be recorded for each test animal.

7.6. Evaluation of the results

Traps have an opportunity to pass one of two welfare performance classes (A or B). For both classes, traps have to meet BOTH conditions to pass.

Class A: To qualify as a Class A trap, the following two conditions must be met:

Referring to Appendix D (a) for the selected sample size in both cases:

- (i) the maximum allowable number of animals retaining corneal reflexes after *30 seconds* must not be exceeded; and
- (ii) the maximum allowable number of animals retaining corneal reflexes after *three minutes* must not be exceeded.

Class B: To qualify as a Class B trap, the following two conditions must be met:

Referring to Appendix D (b) for the selected sample size in both cases:

- (i) the maximum allowable number of animals retaining corneal reflexes after *three minutes* must not be exceeded; and
- (ii) the maximum allowable number of animals retaining corneal reflexes after *five minutes* must not be exceeded.

Otherwise the trap has failed the test.

Appendix A: Pathological Observations of Trauma for Restraining Traps

See Annex A for trauma descriptions

1) Mild Trauma

- a) No identifiable trauma
- b) Claw loss
- c) Oedematous swelling or haemorrhage
- d) Minor cutaneous laceration
- e) Minor subcutaneous soft tissue maceration or erosion (contusion)
- f) Major cutaneous laceration, except on foot pads or tongue
- g) Minor periosteal abrasion

2) Moderate Trauma

- a) Severance of minor tendon or ligament (each)
- b) Amputation of one digit
- c) Permanent tooth fracture exposing pulp cavity
- d) Major subcutaneous soft tissue maceration or erosion
- e) Major laceration on foot pads or tongue
- f) Severe joint haemorrhage
- g) Joint luxation below carpus or tarsus
- h) Major periosteal abrasion
- i) Simple rib fracture
- j) Eye lacerations
- k) Minor skeletal muscle degeneration

3) Moderately Severe Trauma

- a) Simple fracture at or below carpus or tarsus
- b) Compression fracture
- c) Comminuted rib fracture
- d) Amputation of two digits
- e) Major skeletal muscle degeneration
- f) Limb ischaemia

4) Severe Trauma

- a) Amputation of three or more digits
- b) Any fracture or joint luxation on limb above carpus or tarsus
- c) Any amputation above the digits
- d) Spinal cord injury
- e) Severe internal organ damage (internal bleeding)
- f) Compound or comminuted fracture at or below carpus or tarsus
- g) Severance of major tendon or ligament
- h) Compound rib fracture
- i) Ocular injury resulting in blindness of an eye
- j) Myocardial degeneration
- k) Death

Appendix B

Determining Total Trauma Class when an Animal receives more than one Trauma

Mild = 1 mild trauma

Moderate = 1 moderate trauma

or 3 mild traumas

Moderately severe = 1 moderately severe trauma

or 2 moderate traumas

or 1 moderate + 2 mild traumas

or 5 mild traumas

Severe = 1 severe trauma

or 2 moderately severe traumas

or 1 moderately severe + 1 moderate + 2 mild traumas

or 1 moderately severe + 2 moderate traumas

or 1 moderately severe + 5 mild traumas

or 3 moderate traumas

or 2 moderate + 4 mild traumas

or 10 mild traumas

Appendix C: (a) Specification for Acceptable Trauma of Class A Restraining Traps

For example, from a sample of 25 animals there must be no more than eight animals with trauma more severe than mild and no more than two with trauma more severe than moderate.

Note: The upper and lower threshold sample sizes are designed to give 90 per cent confidence that traps which pass the test will perform below the lower threshold 70 per cent of the time and below the upper threshold 80 per cent of the time.

Number of animals in test	Maximum allowable number of animals with trauma above the mild and moderate levels			Number of animals in test	Maximum allowable number of animals with trauma above the mild and moderate levels	
	> Mild	and	Moderate		Mild	Moderate
25	8		2	63	25	8
26	9		2	64	26	8
27	9		2	65	26	8
28	10		2	66	27	8
29	10		2	67	27	8
30	10		2	68	28	8
31	11		2	69	28	9
32	11		3	70	29	9
33	12		3	71	29	9
34	12		3	72	30	9
35	13		3	73	30	9
36	13		3	74	30	9
37	14		3	75	31	10
38	14		4	76	31	10
39	15		4	77	32	10
40	15		4	78	32	10
41	15		4	79	33	10
42	16		4	80	33	10
43	16		4	81	34	11
44	17		4	82	34	11
45	17		5	83	35	11
46	18		5	84	35	11
47	18		5	85	36	11

48	19	5	86	36	12
49	19	5	87	37	12
50	19	5	88	37	12
51	20	6	89	37	12
52	20	6	90	38	12
53	21	6	91	38	12
54	21	6	92	39	13
55	22	6	93	39	13
56	22	6	94	40	13
57	23	7	95	40	13
58	23	7	96	41	13
59	24	7	97	41	14
60	24	7	98	42	14
61	24	7	99	42	14
62	25	7	100	43	14

Appendix C: (b) Specification for Acceptable Trauma of Class B Restraining Traps

For example, from a sample of 25 animals there must be no more than eight animals with trauma more severe than moderate and no more than two with trauma more severe than moderately severe.

Note: The upper and lower threshold sample sizes are designed to give 90 per cent confidence that traps which pass the test will perform below the lower threshold 70 per cent of the time and below the upper threshold 80 per cent of the time.

Number of animals in test	Maximum allowable number of animals with trauma above the moderate and moderately severe levels		Number of animals in test	Maximum allowable number of animals with trauma above the moderate and moderately severe levels	
	Moderate	Moderately severe		Moderate	Moderately severe
25	8	2	63	25	8
26	9	2	64	26	8
27	9	2	65	26	8
28	10	2	66	27	8
29	10	2	67	27	8
30	10	2	68	28	8
31	11	2	69	28	9
32	11	3	70	29	9
33	12	3	71	29	9
34	12	3	72	30	9
35	13	3	73	30	9
36	13	3	74	30	9
37	14	3	75	31	10
38	14	4	76	31	10
39	15	4	77	32	10
40	15	4	78	32	10
41	15	4	79	33	10
42	16	4	80	33	10
43	16	4	81	34	11
44	17	4	82	34	11
45	17	5	83	35	11

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46	18	5	84	35	11
47	18	5	85	36	11
48	19	5	86	36	12
49	19	5	87	37	12
50	19	5	88	37	12
51	20	6	89	37	12
52	20	6	90	38	12
53	21	6	91	38	12
54	21	6	92	39	13
55	22	6	93	39	13
56	22	6	94	40	13
57	23	7	95	40	13
58	23	7	96	41	13
59	24	7	97	41	14
60	24	7	98	42	14
61	24	7	99	42	14
62	25	7	100	43	14

Appendix D: (a) Specification for Acceptable Killing Effectiveness of Class A Kill Traps

For example, from a sample of 20 animals there must be no more than three retaining their corneal reflexes after 30 seconds and no more than one retaining its corneal reflex after three minutes.

Note: This table is designed to give 90 per cent confidence that traps which pass the test will perform below the lower threshold 70 per cent of the time and below the upper threshold 80 per cent of the time.

Number of animals ²	Maximum allowable number of animals retaining corneal reflexes after 30 seconds and 3 minutes	
	30 seconds	3 minutes
10	0	0
15	2	0
20	3	1
25	4	2
30	5	2
35	6	3
40	7	4
45	9	5
50	10	5

The choice of how many animals are used must be made by the person submitting the trap, with the understanding that the lower sample sizes have a greater risk of an effective trap being rejected.

² The number of animals to be tested must be chosen before the test starts, and when the maximum allowable number of failures is reached the trial must be stopped. For example, if a sample size of ten is chosen and the trap fails to render the first animal unconscious within three minutes, then the trial must stop because the maximum allowable number of failures has been exceeded.

Appendix D: (b) Specification for Acceptable Killing Effectiveness of Class B Kill Traps

For example, from a sample of 20 animals there must be no more than three retaining their corneal reflexes after three minutes and no more than one retaining its corneal reflex after five minutes.

Note: This table is designed to give 90 per cent confidence that traps that pass the test will perform below the lower threshold 70 per cent of the time and below the upper threshold 80 per cent of the time.

Number of animals ³	Maximum allowable number of animals retaining corneal reflexes after 3 minutes and 5 minutes	
	3 minutes	5 minutes
10	0	0
15	2	0
20	3	1
25	4	2
30	5	2
35	6	3
40	7	4
45	9	5
50	10	5

The choice of how many animals are used must be made by the person submitting the trap, with the understanding that the lower sample sizes have a greater risk of an effective trap being rejected.

³ The number of animals to be tested must be chosen before the test starts, and when the maximum allowable number of failures is reached the trial must be stopped. For example, if a sample size of ten is chosen and the trap fails to render the first animal unconscious within three minutes, then the trial must stop because the maximum allowable number of failures has been exceeded.

Appendix E: Guidelines for Assessing Capture Efficiency, Target Selectivity, Mechanical Robustness and User Safety

1. Capture efficiency

The capture efficiency of a new or modified trap is assessed by comparing the number of captures it achieves per 100 trap-nights with the number of captures achieved using a “control” trap.

Both test and control traps should be set in accordance with the manufacturer’s and/or national distributor’s instructions. Additionally, any treatment (for example, leaving traps in place but left unset) must be applied to both the test and control traps.

Test and control traps should be set out to ensure that the trap systems do not compete with each other and that the sample units (either the line or individual traps) are independent (consult a statistician on appropriate survey design).

Check the traps daily, and euthanase all captured animals immediately and remove them from the traps.

Record the following data each day when checking the traps:

- date and time
- trap system
- site location of the trap
- status of the trap (fired, not fired)
- species captured (include identifiable escapes)
- condition of the animal (dead, alive, unconscious, predated)
- location on body where animal is held by trap
- file number for each animal.

The capture efficiency of the test trap, when used in accordance with the manufacturer’s and/or national distributor’s instructions, shall be at least 80 per cent of the control trap’s capture efficiency before the test trap can be considered as a replacement for an existing trap (that is, the existing trap can be considered for prohibition).

2. Target selectivity

Selectivity will vary from site to site because of varying distribution and abundance of non-target animals. However, when assessing capture efficiency in the field, recording the capture of target and non-target animals will provide some information on the trap’s selectivity. For species such as kiwi and weka, specific field trials may be required to test the risk that a trap might pose to these species.

The selectivity of the trap, when used in accordance with the manufacturer’s and/or national distributor’s instructions, should not be less than that of the control trap.

Note: Consideration needs to be given to whether the actual, and likely, non-target animals are protected animals or other pest species. Greater leniency should be given where the non-target animals are pest species.

3. Mechanical robustness

3.1 Principle

The material and workmanship of the trap are examined to determine the ability of the trap to continue to meet the killing effectiveness, capture efficiency, target selectivity and user safety criteria.

3.2 Examination of material and workmanship

All traps (whether kill or restraining) shall be examined and determined to be free from imperfections and defects, and have adequate strength and rigidity to prevent, under normal use, breakage or permanent deformation that would cause performance to rapidly fall outside killing effectiveness, capture efficiency, target selectivity or user safety criteria.

If appropriate, the traps shall incorporate a means of securing them to their intended place of use so as to prevent removal by captured animals.

The trap material, as well as welding or bonding, shall comply with applicable international and/or national standards.

Replacement parts shall meet the same specifications as the original parts.

4. User safety

4.1 Principle

The safety of the trap for the users while handling and setting it is inspected and tested.

4.2 Inspection and testing procedure

- a. Test whether the trap can be opened using one hand (the feet, and any setting tool supplied, may be used to help open the trap).
- b. Note whether the impact momentum and/or clamping force is sufficient to cause serious injury.
- c. Apply any integral or accessory safety devices provided with the trap and fire the trap. Note whether the striking component remains in the cocked position if the trigger is activated. Alternatively, if the striking component moves out of the cocked position, note whether it exerts any impact momentum or clamping force.

4.3 Evaluation of the results

A trap shall be deemed to pass the safety requirements if the operator has the ability to open the trap as described in 4.2(a) of this appendix, and if the trap meets one of the following requirements when inspected and tested as specified in 4.2(b) and (c) of this appendix:

- a. the impact momentum and clamping force of the trap are insufficient to seriously injure the operator;
- b. the trap can be set in such a way that the operator's limbs do not come within the arc of the striking component; or

- c. when fired with safety devices applied as specified in 4.2(c) of this appendix, the striking component remains in the cocked position or exerts no impact momentum or clamping force if it moves out of the cocked position.

In all other cases, the trap has failed and further testing shall not be conducted.

When appropriate, the instructions for use, as well as the packaging, shall carry a warning.

Annex A: Description of Pathological Observations and Their Relevance to the Clinical Welfare of the Animal

The following is an attempt to describe the predicted clinical impact on the well-being of a trapped animal of the injuries listed in Appendix A. While the immediate clinical/anatomical assessment of physical trauma by veterinary practitioners on the live animal can be done quite accurately and consistently, the long-term impact of an untreated injury on the other hand is rather difficult to assess and would depend on the type of animal involved, the length of time since the injury was sustained and the expertise of the clinician.

1. Claw loss: Note that this type of injury is common in some animals and is usually not associated with any behavioural change.

2. Oedematous swelling or haemorrhage: Partial impairment of venous and lymphatic return from the tissue distal to a constriction results in plasma leakage and sometimes red blood cell leakage from vessels. The extent is dependent on the length of time and constriction pressure. Consequently, there is always a variation in the amount of oedema.

Relevance: Slight oedema causes no observable discomfort. Severe swelling of tissue, particularly of the distal limbs, will cause temporary disuse or cautious use of the limb. The condition is usually transient and recovery may be seen as early as half an hour after release. Persistence may indicate infection.

3. Minor cutaneous laceration: This is a cut or tear involving the full thickness of the skin. It is less than half of the width of a distal limb, but lacerations of the body have to be judged in relation to total body size. It does not leave an open gap and, while likely to get contaminated, is unlikely to become seriously inflamed.

Relevance: Minor cutaneous lacerations are a common injury for free-roaming animals. Apart from momentary avoidance reaction, there are no behavioural changes besides licking of the affected tissue.

4. Minor subcutaneous soft tissue maceration or erosion (contusion): This is a small lesion associated with a small contact area of a retaining device. It is usually the result of blunt impact and not associated with a cutaneous cut. It may involve tissue underlying a tendon or overlying bony prominence. The absolute size of the lesion has to be judged in relation to the size of the surrounding soft tissue mass.

Relevance: A limited number of wild animals observed (mammals and birds) do not show any behavioural changes in minor soft tissue lacerations and they are sometimes discovered as incidental findings.

5. Major cutaneous laceration, except on foot pads or tongue: This is a cut or tear involving the full thickness of the skin. The length or extent of the laceration should be assessed in relation to the width or circumference of the affected limb or body part, rather than by an absolute measurement. Several small lacerations next to one another should be assessed as cumulative.

Relevance: This depends very much on the location, and the degree of contamination the laceration has or to which it might be predisposed. A laceration on the metatarsus or carpus is of little consequence, and animals with such cuts show normal behaviour during field activities. Very large lacerations will have the potential to become contaminated, leading to secondary infections. Most of those, however, are open wide enough so that the infected area will drain and heal successfully without problems.

6. Minor periosteal abrasion: This is a small abrasion that does not cause a significant bone abrasion. However, the underlying bone surface may have a rough appearance.

Relevance: This is a painful injury. There is a potential for contamination and secondary infection. This has to be judged in conjunction with the location and associated cutaneous laceration.

7. Severance of minor tendon or ligament: Minor tendons or ligaments are defined as those below the carpi or tarsi. These injuries usually involve extensor tendons.

Relevance: There is little if any pain from such an injury. However, if several tendons are severed, the inability to extend the digits may interfere with locomotion. This is of temporary impact, as the animal will learn to place the paw accordingly. Severance of three or four tendons will impede the animal temporarily.

8. Amputation of one digit: This is complete severance of a digit. The digit may still be attached by skin or ligaments.

Relevance: This is a painful injury causing temporary disuse of the affected limb, but often heals without inflammation through extensive fibrosis.

9. Permanent tooth fracture exposing pulp cavity: This could be a transverse fracture or a longitudinal fracture.

Relevance: A longitudinal fracture may be more severe than a transverse fracture. There is some initial tenderness for several days, but subsequently an animal appears to masticate without any visible problems. The sequel to a tooth fracture is quite variable, in that old tooth fractures with exposed pulp cavities can be seen in animals without any root canal infections and periodontitis. However, others are observed to get impacted and infected root canals that may lead, over time, to inflammation of surrounding tissues and chronic pain.

10. Major subcutaneous soft tissue maceration or erosion: This covers a large area of soft tissue, perhaps half or full width of a limb, and possibly the entire thickness of the soft tissue.

Relevance: This causes immediate pain and dysfunction of the affected body part. The animal might use the affected limb during flight, although it is likely to favour the limb. It will cause restriction in movement which may particularly affect hunting by predators, but will heal well with scar formation.

11. Major laceration on foot pads or tongue: This is a cut or tear involving the full thickness of the skin. The length or extent of the laceration should be assessed in relation to the width or circumference of the affected foot pad or tongue, rather than by an absolute measurement. Several small lacerations next to one another should be assessed as cumulative.

Relevance: Foot pad lacerations cause temporary lameness and heal relatively slowly. A deep laceration involving the length or width of an entire foot pad may take two weeks to heal, during which time the animal will favour the limb and is likely to be hampered during hunting activity. A major tongue laceration may impede feeding and drinking, as well as healing relatively slowly.

12. Severe joint haemorrhage: This is a rarely observed injury which could occur as a secondary injury during struggle. Capillaries may burst during stretching of the joint capsule and ligaments, and in rare cases a large pericapsular vessel may rupture.

Relevance: The clinical signs relate more to the stretching or tearing of the joint capsule or periosteal insertion of the ligament than the actual haemorrhage. The more severe the haemorrhage, the more extensive the ligament injury. Blood-tinged synovial fluid reflects a mild injury and may not have any clinical consequence. Puffed up joints, on the other hand, cause pain resulting in disuse of this joint for many days or even weeks.

13. Joint luxation below carpus or tarsus: This is a misalignment of metacarpal/metatarsal phalangeal joints between the metatarsi and phalanges or interphalangeal joints. The joint capsule is usually ruptured.

Relevance: This is a painful lesion causing disuse of the affected limb. Luxation of the distal phalanx of one or two digits may be overcome by some species, but would likely have greater significance in others.

14. Major periosteal abrasion: This is a large abrasion of the periosteum and should be assessed in relation to the size of the bone affected and the size of the animal rather than by absolute measurement. Contamination is likely to be present or to occur. Laceration of the overlying tissue is implied.

Relevance: This is a painful injury. There is potential for contamination, and secondary infection is greater than for a minor abrasion. This has to be judged in conjunction with the location and associated cutaneous laceration.

15. Simple rib fracture: This is a partial or complete fracture of the rib without splintering, fragmentation or broken skin.

Relevance: Some discomfort is present but is usually overcome during activity, particularly if it is a partial fracture. Complete fractures are more painful and carry the danger of injuring the lung. Hunting activity may be reduced, but only for a short time, as many animals are found in good condition showing healed simple rib fractures.

16. Eye lacerations: This is an incising injury of the eyeball. It may involve the cornea and/or the sclera. The injury may be superficial or involve the entire thickness of the cornea or sclera.

Relevance: All types of injury to the eye cause discomfort. Animals respond by excessive blinking or keeping the eye closed. Superficial lacerations of the sclera heal relatively quickly, as do lacerations of the cornea. There may, however, be a pannus formation, which is an invasion of the cornea by non-transparent tissue and vessels. This causes a blind spot and partial impairment of vision of that eye. Tearing is common during the healing phase, and, in some animals, secondary bacterial infection can occur. Deep lacerations with penetration of the full thickness of the sclera or cornea lead to loss of eye fluid and cause considerable discomfort. The animal would keep the eye closed and therefore have impaired vision. Healing will take place unless secondary bacterial contamination has occurred leading to abscess formation. Complete loss of vision could result.

17. Minor skeletal muscle degeneration: This is muscle degeneration attributable to physical exertion and identifiable by gross examination affecting a small amount (less than 10 per cent of the mass) of a muscle group.

Relevance: This causes pain but not impairment of the affected muscle group (that is, sore but functioning) and would be a survivable injury.

18. Simple fracture at or below carpus or tarsus: This is a non-fragmenting fracture of the metatarsi or metacarpi and/or phalanges.

Relevance: Fractures are painful causing disuse of the affected limb. In this area they tend to heal well in normal alignment.

19. Compression fracture: This is a distinct depression in the bone cortex, with relatively sharp edges. The opposite side of the impact has not fractured. This is to be differentiated from cortical bone abrasions, which have gradual shallow angles on the edges.

Relevance: This is a painful lesion causing disuse of the affected limb. It will take several weeks to heal, in which time the animal will show some debilitation. Compression fractures have to be evaluated in conjunction with skin lacerations, soft tissue lacerations, tendon severance and the possibility of contamination.

20. Comminuted rib fracture: In this case, the bone is splintered or crushed, with fragmentation.

Relevance: This is a painful injury and may cause secondary problems such as lung lacerations.

21. Amputation of two digits: A complete severance of two digits. The digits may still be attached by skin or ligaments.

Relevance: This is a painful injury causing temporary disuse of the affected limb, but often heals without inflammation through extensive fibrosis. Amputation of several digits compounds the length of time the limb is disused.

22. Major skeletal muscle degeneration: This is muscle degeneration (necrosis) attributable to physical exertion and identifiable by gross examination affecting a large amount (greater than 10 per cent of the mass) of a muscle group.

Relevance: This causes excessive pain and probable disuse (loss of function) of the affected muscle group and may not be a survivable injury.

23. Limb ischaemia: Ischaemia means total suppression of blood flow to tissue. This therefore differs from the cause of oedema, where the vascular impairment is of the return flow. Limb ischaemia is observed in paralysed large animals resting for prolonged periods in one position or during surgery in anaesthetised large animals. In these cases the pressure on the *relaxed* muscle is severe enough to occlude the arteries. Ischaemia results in pale muscle tissue, usually with a sharp demarcation of colour change outlining the area normally supplied by the compromised vessel. Complete limb ischaemia by restraining traps is rare. In many cases, this may need histological confirmation.

Relevance: Tissue injuries caused by ischaemia are time-related. They may result in acute muscle fibre degeneration or in more extensive sarcoplasmic degeneration with calcium deposition or, eventually, a necrosis with break-up of sarcolemmal nuclei. Depending on the degree of damage, there may be uneventful repair, with fibrosis or sloughing of the necrotic muscle. A complicating factor may be gangrene. Ischaemic necrosis no doubt leads to disuse; however, it is doubtful from behavioural observations that ischaemia causes severe pain.

24. Amputation of three or more digits: This is a complete severance of the digits. The digits may still be attached by skin or ligaments.

Relevance: This is a painful injury causing temporary disuse of the affected limb, but often heals without inflammation through extensive fibrosis. Amputation of several digits compounds the length of time the limb is disused.

25. Any fracture or joint luxation on the limb above carpus or tarsus: “Fracture” for this purpose is defined as a complete fracture of the bone (as compared to a partial fracture or compression fracture); and “joint luxation” is defined as a total dislocation, usually occurring at the hock or elbow joint.

Relevance: Both lesions are quite painful causing immediate disuse of the limb with little chance of repair. Occasionally, deer are observed with previous fractures of the long bones which have repaired through fibrosis and remineralisation; however, these animals were permanently crippled due to the misalignment of the fracture without surgical intervention.

26. Any amputation above the digits: This is a total transaction of bone and soft tissue; however, the distal portion may still be attached by skin or tendons.

Relevance: This is a painful injury causing disuse of the affected limb. There can be remarkable repair of the stump through fibrosis, and quite a few carnivores have been observed with a well-healed amputated limb which hardly impeded their mobility or ability to hunt.

27. Spinal cord injury: This is usually a crushing injury, but on occasion can be secondary to dislocation and separation of vertebrae.

Relevance: The outcome depends upon the location at which the injury occurs. If the spinal cord injury is at the cervical vertebra 3 or above, it is likely to cause sudden death. Spinal cord injuries below that level cause paralysis of either the entire body and all four limbs, or the hind legs, depending on at which level the injury occurs. Behavioural assessment of pain perception on spinal cord injuries is difficult because of the paralytic effect on the one hand, and the strictly reflex responses on the other hand. A clear severance of the cord is likely to be less painful than crushing of the cord, which would involve damage surrounding soft tissue and bone and which can be assumed to be a very painful injury.

28. Severe internal organ damage (internal bleeding): This is defined as crushing or rupture of heart, lung, liver, spleen, kidney, intestinal tract or bladder. This is to be differentiated from bruising, which may result in small localised haemorrhage, particularly on the kidneys or liver.

Relevance: Severe damage to the heart results in rupture of the heart and therefore instantaneous death. Severe injuries to the lung will result in intrapulmonary and/or extrapulmonary haemorrhage or pneumothorax with increasing impairment of respiration, which in severe cases may result in asphyxiation. Rupture of liver or spleen usually results in severe haemorrhage causing shock. This can also occur secondary to rupture of the kidney if it is near the centre of the kidney where the major blood vessels supply that organ. Rupture of the intestine or bladder will result in peritonitis. All of these injuries, except for the cardiac rupture, cause discomfort and lead to shock.

29. Compound or comminuted fracture at or below carpus or tarsus: In a compound fracture, the opened bone is exposed to the outside, thus involving penetration of the skin, while a comminuted fracture is one in which the bone is splintered or crushed.

Relevance: Any of these fractures are painful causing disuse of the limb. Compound fractures are likely to get contaminated resulting in osteomyelitis, while comminuted fractures usually do not reunite. It should be pointed out, however, that comminuted fracture of one small phalangeal bone will result in initial lameness but will repair sufficiently through fibrosis.

30. Severance of major tendon or ligament: “Major tendons and ligaments” are defined as those above carpi or tarsi, thus being involved in flexing or extending the entire distal limb.

Relevance: Clinical signs are related primarily to the physical impairment rather than discomfort. It causes permanent disuse of the distal limb, with secondary injuries from dragging and abrasions.

31. Compound rib fracture: This is a fracture in which a fragment or fragments pierce the skin.

Relevance: This rarely occurs on just a single rib and may involve more than one rib. It is a painful lesion causing changes in respiratory pattern and, consequently, avoidance of respiratory efforts as may be required during running. There is a chance that the bone marrow will become infected. There is also a chance that one of the sharp fragments may pierce the thoracic pleura, causing pneumothorax and/or pulmonary laceration and haemorrhage.

32. Ocular injury resulting in blindness of an eye: Collapse of the globe and secondary to full thickness laceration of the eyeball.

Relevance: Such an injury would result in blindness in the eye and loss of binocular vision. This would affect all functions relying on vision.

33. Myocardial degeneration: Any amount of myocardial degeneration (necrosis) identifiable by gross examination.

Relevance: This is presumed to be painful and is presumed to result in impairment or threat to continuance of cardiac function. It is highly probable that such a lesion is not survivable.

This guideline was originally approved by NAWAC on 27 April 2000 and has since been updated. This guideline is not a legal interpretation of the Animal Welfare Act 1999. It is anticipated that this guideline will be updated from time to time in light of experience gained by NAWAC during its deliberations.