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The coil spring of the trap is strong, but should not be left under tension indefinitely. If the traps are to be left set for a long time, you should schedule a "maintenance round" every so often, when you spring, clean, check and reset every trap.

5.2 Design of trap tunnels

The Fenn is designed to be operated in a tunnel little larger all round than the trap (Fig. 13). The tunnel has three important functions: to orient the animal relative to the trap, so that the jaws close across its back; to disguise the trap and protect it against the weather and human interference; and to keep out birds and non-target mammals.

For routine control work in New Zealand, DoC advocates a portable tunnel made out of wood and incorporating four features (Fig. 13 and 14):

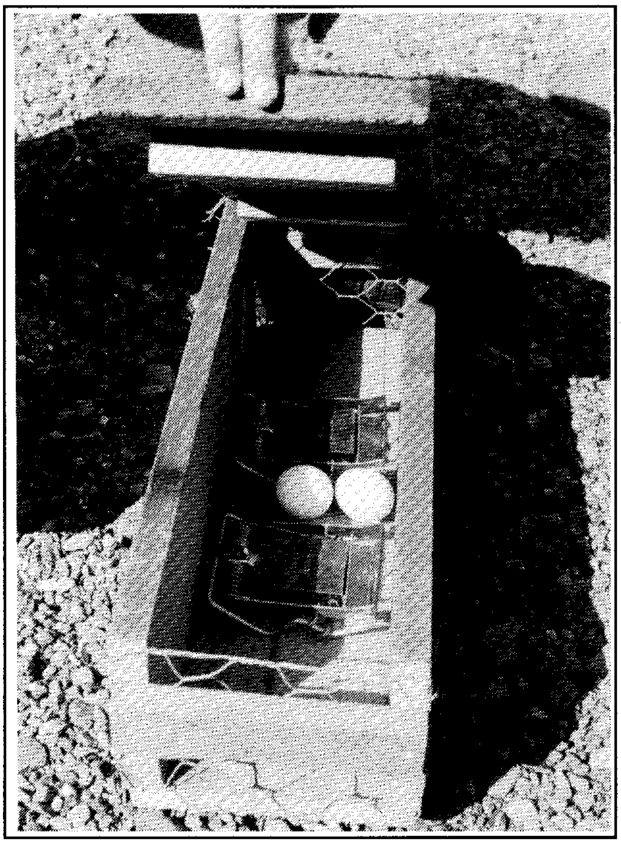

Fig. 13 **A wooden trapping tunnel complete with two Fenn traps and egg baits. (C. O'Donnell)**

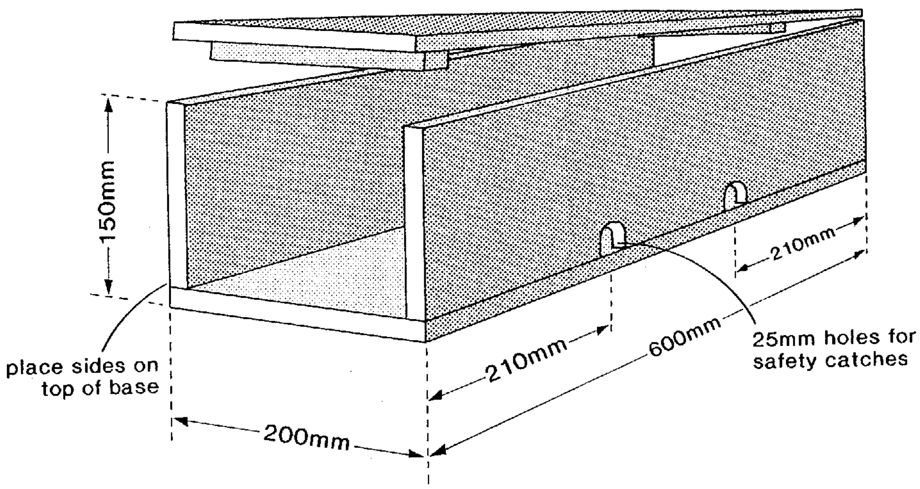

Fig. 14 **Plan of the wooden floored trap tunnel developed for Fenn traps. Note the two holes or notches required to accomodate the safety catches. (C. O'Donnell)**

(a) It is long enough to contain two traps (minus chains) with bait between them at sufficient distance from the entrances to stop interference by other animals.

(b) It has a removable cover to enable rapid checking and easy access to the inside of the box.

(c) It has a base with uncamouflaged traps. The base enables quick setting and placement of traps.

(d) It has wire netting over each end to prevent non-target animals entering the tunnel.

If such tunnels are not available, or if it is not important to use standardised sets, the traditional gamekeepers' tunnels are very effective. They are constructed from any material handy and suitable for the site, such as planks, bricks, tiles, logs, drainpipes, even bales of straw-anything to make a narrow covered runway with internal dimensions of about 15 x 15 cm. Portable tunnels without floors can be made from three rough off-cuts of timber or from a shaped piece of galvanised iron, but these should be pegged or weighted down to reduce interference by possums, and accidental captures of possums and other animals.

Mustelids can be caught in quite undisguised artefacts such as an upturned nailbox or a piece of drainpipe. But trap tunnels set in a public area should be camouflaged, to reduce thefts and interference.

5.3 Where to set Fenn tunnels

Tunnels can be placed along fences, hedgerows, banks of streams, or in isolated patches of cover or woodpiles; in forests, among tree roots, beside a fallen log or in dry culverts (make sure it is permanently dry!). The entrance of the tunnel must be kept clear of leaves, weeds and snow. In some habitats it may be possible to find natural runways along which tunnels can be set so that approaching animals must either pass over the trap or turn back; in other habitats, especially forest, it may be sufficient to place well-baited tunnels more or less at random.

Tunnels maybe either "blind" or "open". Blind tunnels are shorter and closed at one end, and are baited at the back, just behind the trap. Open tunnels may have either one trap in the middle with bait on both sides, or two traps with the bait between them (Fig. 13). The two-trap arrangement ensures that a mustelid entering the tunnel from either end will cross a trap to get to the bait. But this method calls for twice as many traps and longer tunnels, so that the traps are still well in from the entrances. Blind tunnels, if equally effective, would allow twice the coverage with the same number of traps. Trials are in progress to determine which is best.

Some trap sites are always more successful than others, either because they are better placed, or because the smell of one animal on a trap attracts another. At Craigieburn Forest Park, 166 stoats were caught in 18 Fenn traps; the four most successful traps on this line collected more than half the total catch, whilst the four least successful caught nothing at all. Sites that catch nothing after a long time might be better abandoned. On the other hand, a consistently unproductive site may suddenly start catching, perhaps reflecting changes in numbers or movements of the local animals.

Individual animals may avoid traps, but become accustomed to running through empty tunnels, especially unfloored tunnels well placed along a normal travelling route. One way to outwit them is to remove the traps from the tunnels during non-trapping periods; even the wariest old adults may be caught as soon as the traps are set next time. Alternatively, the traps can be sprung against the safety catch and left inside, well covered up, if the non-trapping period is short.

5.4 Trap spacing and layout, and timing of operations

Trapping operations have to be carefully planned to maximise the probability of mustelids encountering traps. Good trappers have already decided on the spacing, layout and timing appropriate to each particular operation long before going out into the field. For advice on planning and for an example of a grid layout, see Part 1 (King 1994).

5.5 Protection of non-target species

To protect ground-feeding birds, place the trap well in from the entrance to the tunnel, and restrict the entrance with wire mesh nailed across the ends (Fig. 13). Portable metal tunnels can be pegged down with a length of heavy wire looped through holes in each end of the tunnel roof, which both holds the tunnel in place and also restricts the entrance.

5.6 Marking trap sites

Every trap must have a number, clearly marked on a weatherproof tag on the tunnel or somewhere nearby. Trap sites must be recorded so that they can quickly be found by the trapper; in areas open to the public, the site markers should be discreet. Where human interference is not a risk, the simplest marker is a length of brightly coloured plastic ribbon tied to a nearby tree. The ribbon is cheap, visible (especially if fluttering in the wind), and easily removed or renewed.

5.7 Lures and baits

A lure is a powerful smell that attracts a mustelid to the trap without necessarily offering it anything to eat. For example, the smell from a smear of rabbit gut rubbed on the tunnel is attractive to mustelids, but the smear muse be renewed daily. Artificial lures that imitate the natural body scents of mustelids have been developed, but have not performed well in field trial; (Clapperton *et al.* 1994).

A bait is something edible, placed so that any animal attempting to pick it uF or eat it will set off the trap. If the gut contents of the mustelids trapped are tc be analysed, natural baits indistinguishable from prey must be avoided.

Good baits are attractive, strong smelling, convenient to carry, easily avail able and require minimal preparation. Recent field trials on stoats have compared fish-based catfood (used in Fenn trapping for many years) with pos. sum carcases, hens' eggs, dead mice and synthetic lures based on the ana sac secretions of mustelids (bilks *et al* 1992). Of these, eggs and mice were by far the most effective, but mice last only a few days whereas eggs may last up to 1-2 months in cool weather. Both attract all three mustelids and both European rats. "Pre-baiting" is probably not worth while, though it has not been tried.

We recommend baiting tunnels with two eggs, as follows. First make a small hole in one of the eggs (to provide a scent) and leave the second egg whole (to provide a long-lasting visual lure). Place the eggs between the traps (Fig. 13). Eggs are cheap, clean, long lasting and easy to procure, handle, and dispense.

Mustelids can be caught without either bait or lure if the tunnels are well sited, because they are naturally curious animals and investigate any hole or burrow when hunting. But this does not mean that bait is unnecessary. Early trials on stoats with fish-based catfood showed that baited traps were very much more effective than unbaited ones, and traps with fresh bait were slightly more effective than those with stale bait (King 1980). These trials should be repeated with eggs. Unbaited traps in well-placed tunnels may be used in programmes where trapping is a contingency against predator invasion, but not where a programme is attempting to achieve a rapid reduction in numbers.

Some trappers take great trouble to avoid leaving their own scent on the traps or on the vegetation around it; others do not bother. Critical field trials are needed to show which policy is more cost-effective, and also whether different baits are better for ferrets and weasels.

5.8 Checking the traps

TheAnimals ProtectionAct (1960, section 6) requires that all traps be checked at least once every 24 hours.

It may be argued that a trap such as the Fenn, which is designed to kill at once, should be exempt from this rule, but you should comply with the law anyway. Incorrectly set Fenn traps can and do hold animals alive (King 1981); and the law in its present form allows for no exceptions (the wording is "any trap, noose or similar contrivance").

In any case, traps which are not inspected daily are less efficient. This is because any trap which has been set off, by a target animal, a non-target animal or some accidental disturbance, cannot catch again until it is reset. If this happens a lot (e.g., if there are a lot of rats or possums in the area which often block the traps), you can expect to catch fewer mustelids the longer the interval between inspections. Frequent checking and resetting is necessary to keep all the traps fully functional.

DATE:
OBSERVER:
LOCATION:

Tunnel t	Stoats	Tunnel 26	Stoats
2		27	
3		28	
4		29	
5		30	
6		31	
7		32	
8		33	
9		34	
10		35	
11		36	
12		37	
13		38	
14		39	
15		40	
16		41	
17		42	
18		43	
19		44	
20		45	
21		46	
22		47	
23		48	
24		49	
25		50	

TOTAL CAUGHT:
NUMBER OF TRAP NIGHTS:
KEY: O=0K, X=Sprung, S=Stoat, R=Rat, M=Mouse, P=Possum, B=Bait gone

Fig.15 Afield recording sheet. Every cell should be filled in for everyday the traps are set. (C. O'Donnell)

Other good reasons for daily checks include: to remove stoat bodies for autopsy whilst still fresh; to kill any animals held alive in the trap; to replace baits; and to check the condition of traps and reset them if necessary.

If it is possible to arrange each trap so that it can be seen from some distance away, that can help to prevent unnecessary trampling or other damage to the habitat during routine inspections. The jaws of the trap can be linked to a signal arm placed above the tunnel, which drops as the jaws spring up. An even better system would be to equip each trap with a switch arranged to remain "on" for as long as the trap's jaws are open; the switch can be interrogated from a distance by radio. This would greatly increase the efficiency of the trapper's time, which in turn could allow either much more frequent inspections (more rounds per session) or a vastly greater area oll coverage; but it would be expensive to set up.

5.9 Recording the results

The methods used and results obtained from every mustelid trapping programme should be recorded accurately and made accessible to everyone. The collection of information on the success and failure of all operations allows DoC to continue developing and improving its mustelid control techniques.

Documentation should include the justification and objectives for the operation; the methods, results, and performance measures used; and problems and suggestions for improvement. It is important to record such details as the location and layout of traps, duration of the operation, baits used and how often they are replaced, and any changes in design you made. Whenever traps are checked, record on a sheet the date, the total numbers of animals (target and non-target) caught, their age and sex, and the state ol each trap (sprung or untouched, with or without a capture, what was caught; bait untouched or gone, fresh or stale) and any other observations that were important to your programme (e.g., diet/stomach contents, disease). An example of a daily recording sheet is shown in Fig. 15.

5.10 Calculating a density index

The density index is the number of mustelids caught per 100 trapnights. It indicates relative numbers only, and cannot be used in the same way as ar estimate of absolute numbers (e.g., to calculate the productivity of a loca mustelid population), but it is vastly easier to calculate than absolute density

A trapnight is one trap set for 24 hours. For examples of density indices it different habitats, see Part 1 (King 1994).

A period of several days during which traps are set is called a session; one complete inspection of all the traps is called a round. If the traps are set periodically, e.g., for monitoring, a session might be about ten days long with one round a day. If the traps are set all the time, e.g., for a control operation, you can define each session as arbitrary periods of, say, consecutive weeks.

At the end of the session, calculate the results as shown in Table 3. In this example, 10 mustelids were caught in 150 traps set for 3 nights. Assuming that, on average, every sprung trap is out of commission for half a night, half a trap-night is subtracted for every trap sprung, for whatever reason. This is especially important if the proportion of traps being sprung each night is high. So although 150 traps were set for 3 nights, the total number of trapnights available to catch mustelids was not 3 x 150 = 450, but the sum of column F, that is, 438.5. The corrected density index is 10/438.5 x 100 = 2.28.

The density index is simply the capture rate per unit of effort. It varies during and between years, mainly reflecting (we think) real variations in the number of mustelids available to be caught. Other factors include whether or not the traps are baited; the spacing between them; seasonal changes in behaviour (in spring, adult males move about more, and females less); the success of

Table 3 How to calculate a density index from trapping results.

	A Traps untouched	B Mustelids caught	C Rats etc. caught	D Traps sprung, empty	E B+C+D divided by 2	F 150 - E
Day 1	144	2	4	0	3	147
Day 2	139	5	4	2	5.5	144.5
Day 3	144	3	2	1	3	147
Totals	427	10	10	3	11.5	438.5

The density index is the number of mustelids caught per 100 trapnights. Altogether, 10 mustelids were caught in 150 traps set for 3 nights. But every trap that is set off, by a mustelid or for any other reason, cannot catch again until it is reset. If the proportion of traps being sprung each night is high, this can significantly alter the calculated index. So we make a correction by assuming that, on average, every sprung trap is out of commission for half a night, and we subtract half a trap-night for every trap sprung. So although 150 traps were set for 3 nights, the total number of trapnights available to catch mustelids was not 3 X 150 = 450, but the sum of column F, that is, 438.5. The corrected density index is 10/438.5 X 100 = 2.28.

the previous breeding season (i.e., the proportion of juveniles in the population); and the annual mid summer dispersal of the family groups. These must be allowed for if you are avoid reaching a false estimate of the number of mustelids in the area. In general, the yield from a year-round line is lowest from August to November (when females are giving birth and caring for their young) and highest from December to July (when the young are dispersing).

5.11 Determining sex and age of dead mustelids

Records of the sex and age of mustelids captured can provide useful information on the ecology of the animals and on the effectiveness of trapping.

Sexing mustelids is generally easy. The following description is for stoats, but weasels and ferrets are similar except for size.

The most obvious distinction is that the female has a vaginal opening about 3-5 mm from the anus, while the male's penis opening is located well forward on the underside, about a third of the distance between the hind and front legs. In kill-trapped animals the opening is often marked by a yellowish discharge. Males also have a furred scrotum, though it is small from late February to early August. All male mustelids have a baculum, which is a bone that runs the full length of the penis (Fig. 16). The baculum lies in a pouch in the abdominal wall, on the underside of the body forward of the scrotum. The easiest way to locate the baculum is to grasp the skin and underlying muscle of the abdomen between the hind legs and roll it between your thumb and forefinger. You should be able to feel the hard, matchstick-sized bone, even in damaged or poorly preserved specimens.

Determining the age of an adult mustelid is difficult, because the diagnostic features show a lot of morphological variation, and some require laboratory preparation. Distinguishing young from adults is easier.

In fresh or live summer-caught specimens, the scrotum of an adult male is large and obvious, whereas that of a subadult is inconspicuous; adult females that have produced young have large nipples, whereas in non-breeding adults and young of the year the nipples are very small or invisible. These distinctions visible in live stoats were confirmed from carcases by King and McMillan (1982).

In carcases, skull and baculum measurements (Fig. 16), skull crests and sutures, wear of the carnassial teeth and growth lines within the canine teeth all provide clues to age. Familiarity with handling mustelids is needed to develop confidence in determining age class and sex. For a comprehensive

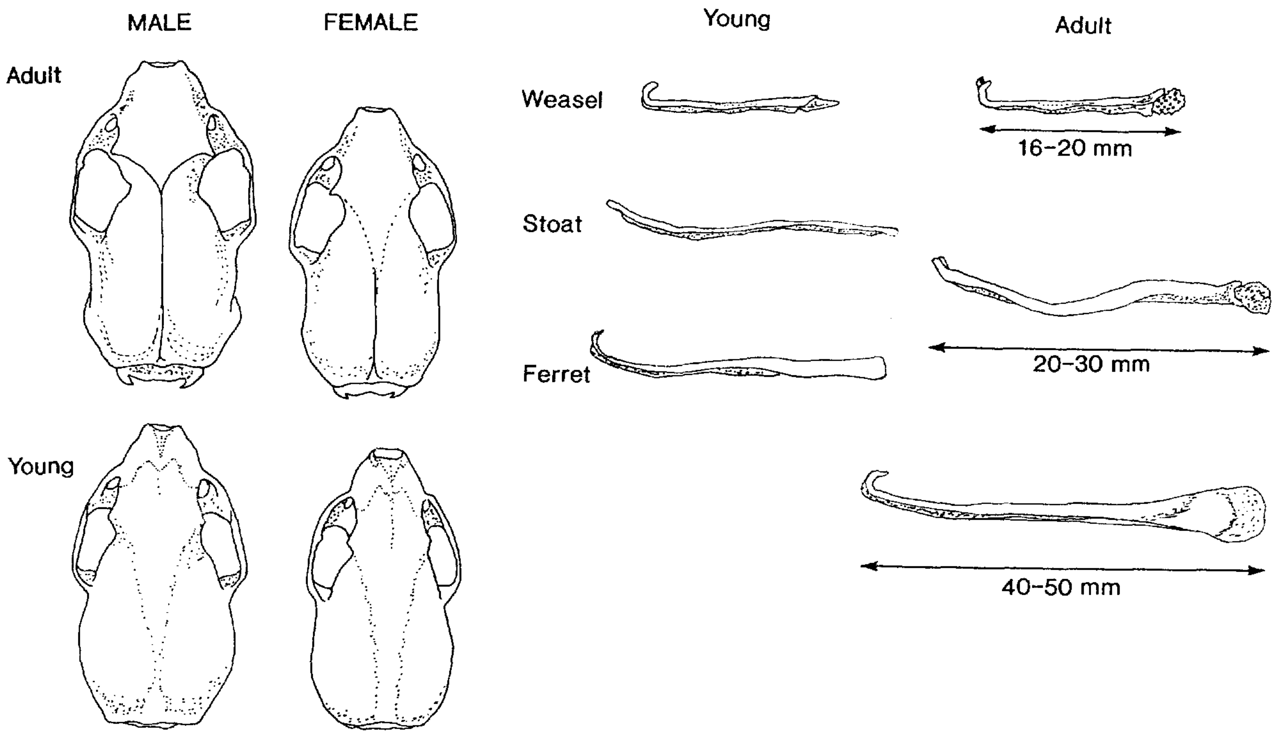

Fig. 16 **Skulls of four stoats caught In January; males *(left)*, and females** *(right)*; **adults *(top)*, and young *(bottom)*. Bacula of weasel *(top)*, stoat *(centre)*, and ferret *(bottom)*; young *(left)*, and adult** *(right)*. (C.M. **King)**

review of age determination in stoats, both live and dead, see King (1991). For more detailed advice contact any of the authors or the Department of Conservation.

5.12 Assessing the effectiveness of trapping

The effectiveness of trapping can be judged only by the response of the native species or populations being managed, not from predator capture rates. It is possible to remove a large number of predators without reducinc the predation rate on a threatened species. Therefore, it is important to have a suitable, preferably quantitative, method of monitoring the effects of trap ping before embarking on a control programme - for example, comparinc breeding success of a protected species in trapped and untrapped areas See Part 1, section 7 (King 1994).

5.13 Conclusions on Fenn trapping

There is still considerable work to be done in developing effective method: for controlling mustelids. Potential areas for development include finding ef. fective baits and lures, better tunnel designs and layouts, and alternatives tc trapping, e.g., poisons or chemosterilants.

Meanwhile, this guide outlines effective trapping methods for monitoring of localised control of mustelids using presently available technology.

Every trapper should always bear in mind that a predator trapping programme is of no use, and a waste of limited resources, if it kills predators withou benefiting any threatened species.

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