

Crisp Environmental Research into Miniature Identification Tagging (CERMIT)

Characteristics of a successful Small Animal Marker

- Easy to apply to large populations
- Causes little or no trauma to insect when applied
- Detectable without killing the insect
- Persists in the insect/community
- Has no adverse effects on the behaviour/movement of the insect

General Problems

- Animals may be more vulnerable to predation
- Regular handling methods result in lots of stress for the insects and thereby high mortality rates
- Their application generally has an impact on the behaviour and movement of the in the period after tagging so can be a problem if trying to study natural behaviour of animals as is usually the case
- Some may not be suitable on underwater animals

Types of Animal Markers/Tags

Wire Ties /Clips/Rings

This tag is a small piece of wire or metal strip that is fixed onto part of the animal's body manually. The process may require the animal to undergo anaesthetic. The tag can then be identified when the animal is recaptured. Many versions of the tag used on medium and large sized animals will be numbered to allow researchers to identify which individual they have recaptured.

- Retention – reasonable but varies with species
- Cost – minimal

- Application – difficult to attach (insects have to undergo anaesthetic) impractical with a large group of small animals
- Hazards – abrasion, additional mass affects the animals ability to compete
- Detection success – medium
- Death required? – no
- Suitable Animals – turtles, invertebrates, birds, huge range of species

Paints & Dyes

A technique used mainly on insects where a coloured substance is either sprayed directly onto the insect or onto its food source where it is later ingested by the insects. The dye or paint will then be identified when insects are recaptured and killed.

- Retention – low to medium
- Cost – minimal to low
- Application – ingested or sprayed externally so fairly easy to mark large numbers
- Hazards – often toxic to the animal
- Detection success – often low due to small quantities of dyes
- Death required? – yes
- Suitable Animals – invertebrates

Panjet Marking

In this method tattoo pigment is injected into an area of the skin of a fish (which are the main targets of this technique). The research team can then identify fish by whether or not they have the crude tattoo providing it hasn't been obscured by natural pigment.

- Retention – low to medium depending on the species
- Cost – low, mostly
- Application – dye or tattoo pigments injected into an area of the animal's cells, difficult to mark right area and not penetrate too far into the animal
- Hazards – mild damage to tissue
- Detection success – poor with species that are naturally very colourful but there is more success with, for example, silver coloured fish
- Death required? – no
- Suitable Animals – fish

External Inks

Animal is marked with a pen or similar implement, simply marking it with ink.

- Retention – medium, depending on species and ink quality
- Cost – low, e.g. \$6.10 for 1 pen from www.beeworks.com , i.e. 100s or 1000s of marks
- Application – difficult as animal has to be caught and mechanically marked
- Hazards – minimal
- Detection success – low, especially on colourful animals
- Death required? – sometimes, depending on size of species
- Suitable Animals – invertebrates, reptiles, large range of species

Pollen/Spores

The one tag which occurs naturally. Insects and other small animals ingest or carry pollen and spores by visiting flowers as part of their natural behaviour. The specific pollen and spores they carry provides information about which plants they visit and therefore their range. Pollen or spores can also be planted by the researcher so that when the animal is examined and found to contain the added material it is known that the animal have visited the place where the material was added.

- Retention – low
- Cost – minimal
- Application – animal(usually insect) ingests pollen which can then be identified on the carcass, applied by chance
- Hazards – minimal
- Detection success – medium
- Death required? – often
- Suitable Animals – invertebrates

Excising/Removing Body Parts

Here, a body part of the animal is excised leaving an animal that is clearly identifiable by its lack of the body part. Usually a body part is selected that will not affect the animal's chances of survival such as clipping the ears of lambs. However, on insects this is not always possible and the researcher will commonly remove part of a leg which unfortunately has a significant negative effect on the animals health/chance of survival as it interferes with behaviour. This method could be said to be one of the more stressful for obvious reasons.

- Retention – high
- Cost – minimal

- Application – body parts are removed from each member of the sample systematically using basic tools, difficult in small animals
- Hazards – selected against as the excision makes the animal less competitive especially with small animals where the excision is a fairly significant part of their body, may be executed by members of their own species, can cause growth problems
- Detection success – medium to high
- Death required? – rarely and only with small animals
- Suitable Animals – invertebrates, reptiles, birds, huge range of species

Plastic Bee Tags

Small plastic disks that are glued to part of the body of a small animal. The discs are usually numbered so provide individual information. The colours should contrast well with the animal's skin or equivalent so that animals with tags are easily identifiable from some distance. As the name suggests, they are targeted mostly at queen bees but have been used with success on many small land animals.

- Retention – low to medium, depending on species
- Cost – quite low, \$25 for kit of 500 tags, glue & applicator from www.beeworks.com
- Application – tags glued on to animal's skin/carapace with special glue and applicator
- Hazards – glue can cause irritation in some species
- Detection success – medium
- Death required? – no
- Suitable Animals – invertebrates, reptiles, molluscs, many small animals

Rubidium Marker

Researchers label the animal's food with the rare element rubidium. This can then be detected by specialist equipment in a laboratory after the animals have been captured and killed. A suitable dose is supplied so that the added rubidium is not too low to be confused with natural rubidium levels.

- Retention – varies depending on levels absorbed
- Cost – high, due to atomic absorption spectroscopy equipment required
- Application – added to food source and ingested by the animal, suitable for underwater animals
- Hazards – minimal

- Detection success – medium but drops the closer the added levels are to natural levels of rubidium in animals
- Death required? – yes, always
- Suitable Animals – invertebrates

Radio-isotopes

In this method, radioactive isotopes of elements are applied to the animal so that a detector can later detect the radiation-emitting animals. There is a large range available with silver and phosphorus isotopes being among the more commonly used. A large period of time can be left between application and detection because of the sensitivity and longevity of the isotopes.

- Retention – high as very sensitive
- Cost – medium, mostly coming from the detection equipment
- Application – ingested or painted, very easy to apply to large groups of organisms and repeat, huge variety so plenty of choice
- Hazards – low to medium as they are generally not toxic but cause a loss of fertility and higher mortality in certain species
- Detection success – very high as they can be detected in:
 - Living insects in their environment, both visible and hidden
 - Dead insects
 - Insects consumed by predators (very useful)
 - One of the few markers that remains in insects that shed their 'skin'
 - Underwater animals
- Death required? – no
- Suitable Animals – invertebrates, large variety of animals

Passive Integrated Transponder (PIT) Tags

Small electronic tags are inserted into a body cavity of the animal and can later be read by a detector if held over the tag. The transponders contain basic information that will identify the individual animal. This is the method used to microchip pet cats and dogs.

- Retention – high as usually inserted into animal
- Cost – medium, tags cost \$5-10 each and readers cost \$300 each
- Application – inserted into body cavity or connective tissue of animal, very small (12-8mm by 3-2mm) so can be applied to a variety of animals, small and large
- Hazards – minimal if correctly sized tags are used

- Detection success – low to medium, as range of detectors is around 5-30mm but if in range then detection rates are very high
- Death required? – no
- Suitable Animals – mammals, fish, reptiles, huge range of species

Decimal Coded Wire Tags

A metal tag is inserted into the animal containing a number unique to this individual in the sample/population. The tag is then later removed and the number can be read off the tag. Unfortunately this tag can therefore only be used once realistically and it is quite difficult to remove the tag that has been inserted. A detector is used to locate tags before they are removed.

- Retention – high and lasts the life of the animal
- Cost – high, tags are cheap at \$120 for 1000 but detectors cost \$6200+ and injectors cost \$7000+, although they can be rented
- Application – coded wire tags engraved with a number are inserted into muscle, cartilage or connective tissue of the animal
- Hazards – low
- Detection success – low as tag must be removed to read number, detectors are fairly effective though
- Death required? – often
- Suitable Animals – fish, seahorses

Freeze Branding

A patch of the animal is burnt using a freezing agent such as those listed below. The animal can then be identified by the brand in the way livestock are. The best time to brand is after the animal has reached maturity so that growth does not distort the brand.

- Retention – medium, animal keeps the burn but growth can often make it near invisible
- Cost – low
- Application – one of the following freezing agents is used to burn the animal (usually fish)
 - Liquid Nitrogen
 - Compressed CO₂
 - Laser-beams
 - Dry Ice

- Freon
- Hazards – low, damaging tissue, for example
- Detection success – low to medium depending on whether the animal has grown much since branded
- Death required? – no
- Suitable Animals – fish

Satellite Tags

A type of tag that actively emits information to the researcher's computer equipment via satellite. This allows for the most accurate tracking as when the information is plotted against a map of the area the animal is travelling around, the researcher will be able to identify areas preferred by the animal and its range. The technique is only suitable for medium and large sized animals due to the weight and size of the tag.

- Retention – high
- Cost – very high, 1 basic tag and corresponding satellite time costs in excess of \$3000, a more complex tag and time costs \$6000+
- Application – tag inserted into animal or worn in a collar
- Hazards – can affect the organism's ability to compete successfully
- Detection success – very high as the tag transmits the location of the animal to the researcher's computer equipment
- Death required? – no
- Suitable Animals – large mammals, birds and lizards