Ecosystem Health and Sustainable Agriculture

Sustainable Agriculture

Editor: Christine Jakobsson
Defined by Broom (1986): *The welfare of an animal is its state as regards to its attempts to cope with its environment.*

So, what does this mean? Animals have to cope with a complex environment, such as high temperature, hunger, fear of predation. Animals have a range of means of coping with these stressors, principally through the adrenal stress response. This is the same mechanism of response – the flight or fight response – irrespective of the type of stressor. Increased respiration rate, heart rate, increased blood supply to the muscles, erection of hair, pupil dilation. These physiological changes are linked to behavioural responses that ameliorate the stressors: move to a cooler shaded area, find a food source, escape from the predator.

Stress is therefore an entirely normal response to challenges from the environment, and animals are able to cope with small amounts of stress, and with stressors from which they can escape. Stress is therefore not necessarily a cause of poor welfare, but distress does have a negative effect on welfare.

However, the animal may be unable to cope. There may be no shaded area, no food available, and flight from the predator may not be possible. The animal’s welfare, and wellbeing will then be compromised, and this leads to a chronic stress response, related to raised levels of cortisol. In this case the animal’s fitness may be reduced, it may not grow and it may fail to reproduce. We can rank the state of welfare from poor to good, using a range of measures, rather than all or nothing.

Measures that are commonly used include:

- Fertility; but some species, notably dogs, can reproduce prolifically in very poor conditions. Indeed, almost by definition domesticated animals will do so, as they have been selected to produce large numbers of offspring in captivity.
- Disease; but this, and the following two on the list, do not necessarily indicate poor conditions.
- Morbidity.
- Mortality.
- Levels of stress hormones.
- Behavioural indicators; but these may be learnt and not indicate current welfare conditions.

Individual parameters may be caused by incidental factors, unrelated to the welfare conditions prevailing on an animal unit. Measurements should be collected to produce a portfolio of evidence rather than reliance on a single measure. The first four of these are simply a matter of...
record. The capture of stress hormones is made difficult as the nature of collecting them can itself be stress-induc-
ing. However, residues can be collected from faeces and saliva as well as directly from blood.

Preferred methods of assessing welfare are behaviour-
al measures, as they are:

- Easy to use
- Non-invasive
- Non-intrusive
- Expressions of emotions
- Reflect first attempts to cope
- More sensitive than injury or disease

Behavioural measures include:

- Abnormal behaviour (Figure 42.1).
- Comparison with normal behaviour (such as time budgets). The researcher will need to know the nor-
  mal behaviour profile in order to compare differences (Figure 42.2).
- Incidents of aggressive behaviour (Figure 42.3)
- Stereotypies: repetitive patterns of behaviour with no obvious function (Figures 42.4 and 42.5).
- Increased vocalisations
- Choice tests

Problems of behavioural measures of stress:

- Not always reliable: some of the abnormal behaviours may be learnt behaviours resulting from previous stress events that are no longer extant. Example: crib-
  biting by a horse may be a learnt behaviour from a previous stable.
- Human interpretation of the cause or purpose of some of these behaviours may be inaccurate. We can guess, but our perception is limited by our human experi-
  ence.
- Individual animals will respond differently to the same source of stress. For example, individual animals have different temperature thresholds, as do individual humans.
• Stereotypies may be a method of coping with stress: Wiepkema et al. (1987) showed that veal calves performing stereotypies more often had fewer abomasal ulcers than the other calves.

However, stereotypies are often observed in animals in poor housing conditions. Broom and Johnson (1993) proposed the following assessment tool (See fact box 1).

Choice tests involve giving animals a choice between two or more environments or resources, such as offering dairy cows the choice of entering a cubicle area or a straw yard. The assumption is that the animal will choose the option that is in its best interest. Problems with choice tests include:

• The choice may satisfy some transitory need or preference. An animal may make the choice in its short-term interest at the expense of its long-term interest.
• Individual animals may have individual preferences not indicative of the group as a whole.
• Choices may change over time: age of the animal, time of day, stage of reproductive cycle.
• A choice may be preferred, but actually be poor for welfare: e.g. the choice of a sugar-rich food by rats does not indicate that these should form the diet of the housed rat.

• The choices offered are relative. They do not indicate good or poor welfare, only that one of the options may be better than the other. Both options may be good or bad for the animal’s welfare.

Choice tests can be refined to indicate the strength of preference for one option over another. This can help to determine whether a resource is a necessity or a luxury. The less favoured option can be baited with a desirable resource (often food). The favoured option can be encumbered with difficulty or unpleasantness (the length of a darkened walkway in the case of the dairy cow, or the length of a cat urine-soaked walkway in the case of the laboratory mouse). Animals can be trained to use an operant device that can be calibrated to altered levels of work required by the animal to choose one option over another.

The UK farm animal welfare council suggested five freedoms that should be satisfied for an animal to be regarded as being in a state of good welfare. These were first formulated in 1979, principally regarding farm animals, but there is a general consensus of agreement among animal welfare scientists that they are a useful guide to assessing the welfare of an animal. The five freedoms remain the basis on which the European Union frames its animal welfare policy. The five freedoms are:
1. **Freedom from hunger and thirst**, access to fresh water and a diet for full health and vigour.
2. **Freedom from discomfort**, an appropriate environment with shelter, and comfortable rest areas.
3. **Freedom from pain**, injury and disease, prevention or rapid treatment.
4. **Freedom from fear and distress**, conditions and treatment which avoid mental suffering.
5. **Freedom to express normal behaviour**, adequate space and facilities, company of animal’s own kind.

(European Commission, 2007)

More recently, Bartussek (2001) has proposed an animal needs index that uses a scoring system for a variety of factors, leading to a sum that is designed to represent a meaningful welfare assessment of housing conditions. There are five broad sections to this system of assessment:

1. Possibility of mobility
2. Social contact
3. Condition of flooring
4. Stable climate (including light and noise)
5. Quality of stockman’s care

However, this system does not seem to have been adopted much outside its native Austria.

There is a method for determining the priorities of animals for resources through measuring their motivation for access to the resources. The concept is derived from human behaviour expressed by the economic theory of demand function (Dawkins, 1983; Hursh, 1984). In the context of animal behaviour, ‘cost’ is the amount of time spent on an activity or work the animal is prepared to do to achieve the resource. For example; rats pushing a lever or chickens or mink pushing through an increasingly weighted gate to access nesting material. This demand may be described as elastic if the animal adjusts the price it is prepared to pay for differing quantities of the resource, such as space. As the amount of work, or cost, increases, the animal becomes less prepared to pay the cost in order to achieve the resource. Plotting the outcomes on a logarithmic scale produces a straight line, the demand function. Resources producing this kind of response are typically described as luxury resources. In contrast, an inelastic demand is for an essential resource, such as food. Changing the amount of work the animal has to do to achieve an essential resource has little effect – the price will continue to be paid. In addition, the expenditure an animal is prepared to make, in amount of time or work, can be used to rank the importance of a range of resources. The steepness of the demand function gradient indicates the degree of motivation. The resource may be the opportunity to perform a behavioural activ-

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**FACT BOX 1**

Relationship between stereotypies and animal welfare.

<table>
<thead>
<tr>
<th>Stereotypies</th>
<th>Welfare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occasional stereotypies caused by minor frustration</td>
<td>Very good</td>
</tr>
<tr>
<td>Stereotypies for 5% of active time</td>
<td></td>
</tr>
<tr>
<td>Stereotypies for 40% of active time</td>
<td>Very poor</td>
</tr>
</tbody>
</table>

(adapted from Broom and Johnson (1993))

Figure 42.5. Stereotypic behaviour; Nose-pressing shown by a housed dairy cow. Photo: A. Pavlenko.
ity, such as digging, swimming or even rest. Criticisms of this method include: the artificial nature of the test, the influence of prior deprivation, prior experience and external factors, including the time of day.

**Conclusions**

The welfare of animals concerns not simply stress, experienced by an animal, but its ability to manage stress, whether it be physical or mental stress. Animals in the wild and in captivity are exposed to many and varied stressors. If the stressor continues despite an animal’s efforts to remove it, we can consider the animal to be in a poor state of welfare. Welfare can be ranked; there is not simply good or bad welfare, but many gradations of wellbeing. We can measure and record many factors that can indicate poor or good welfare, and the more measures we take the more likely we are to make an accurate assessment. Behavioural measures are particularly good as they are, among other things, relatively easy to use, are (or ought to be) non-intrusive, show an animal’s first responses to cope and are sensitive. However, caution should be used with such measures as they can be misleading to a human observer. Stereotypies can also indicate poor welfare, and particularly a poor environment. Letting an animal choose from options, using a choice test, can give us clues as to the relative preference of the options offered, and this can be refined to include positive and negative outcomes to assess the strength of preference of one option over another. The five freedoms are an enduring guide to the assessment of welfare, but other systems are also in use. An index system of scoring welfare factors and deriving an overall index of welfare has been developed, though there is some doubt as to whether an animal’s welfare can be adequately expressed by a single number.
References


Chapter 42


Further reading


Benson and Rollin 2004. The well-being of farm animals

Broom and Fraser 2003. Domestic animal welfare and behaviour. 4th edition


The following journals:


Chapter 43


Further Reading


