

The science of animal welfare and its relevance to whales

DM Broom

Centre for Animal Welfare and Anthrozoology, Department of Veterinary Medicine, University of Cambridge, Madingley Road, Cambridge CB3 0ES, UK
 Email: dmb16@cam.ac.uk

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Synopsis

The welfare of animals is a major factor affecting the acceptability of human activities, and hence their sustainability, and whales are the subject of much concern because they are considered to be sentient animals. The scientific study of animal welfare has developed rapidly and now allows evaluation of the effects on whale welfare of disturbance by boats, harpoon entry, pulling whales to a boat, capture procedures, the point of unconsciousness and consequences for animals that escape. Useful data are now being collected on some aspects but recent evidence shows that, on average, during the capture and killing of whales, there is a high magnitude of poor welfare and the procedure is not humane.

Introduction

It is a widely held view in most countries that we have obligations to all animals that we use, or with which we interact, and that these obligations include avoiding or minimising poor welfare in the animals (Broom 2003, 2006; Fraser 2008). A central question, when decisions are made about whether a system for exploiting resources should be used, is whether or not the system is sustainable (Aland & Madec 2009). The fact that something is profitable and there is a demand for the product is not now sufficient reason for the continuation of production. A system or procedure is sustainable if it is acceptable now and if its effects will be acceptable in future, in particular in relation to resource availability, consequences of functioning and morality of action (Broom 2001, 2010a). Animal welfare is one of the key reasons why an activity or a system of production may not be acceptable. There are many examples of the actions of consumers and the general public in boycotting the products of companies or countries whose actions are thought to be morally wrong (Bennett *et al* 2002).

Several species of whales and dolphins have been demonstrated by experimental studies to have the characteristics of

sentient animals and their pain and adrenal systems function in the same way as those of other mammals (Reiss & Marino 2001; Desportes *et al* 2007; Broom 2007a, 2010b). Hence, it would seem reasonable to assume that all cetaceans are sentient.

The development of animal welfare science

Animal welfare science has developed rapidly in recent years. Welfare refers to a characteristic of the individual animal rather than something given to the animal by people (Duncan 1981). Broom (1986) defined the welfare of an individual as its state as regards its attempts to cope with its environment. It has been emphasised (Duncan 1981; Broom 1988, 1991a,b; Broom & Johnson 2000; Fraser 2008) that welfare can be measured scientifically, independently of any moral considerations. Once the welfare has been objectively assessed, using such measures, ethical decisions can be taken about what is to be done about it. The definition refers to a characteristic of the individual at the time, ie how well it is faring (Broom & Fraser 2007; Broom 2008). This state of the individual will vary on a scale from very good to very poor. Welfare will be poor if there is difficulty in coping or failure to cope so that the individual is harmed. One or more coping strategies may be used to attempt to cope with a particular challenge so a wide range of measures of welfare may be needed to assess welfare.

Feelings, such as pain, fear and pleasure, are often a part of a coping strategy and they are a key part of welfare (Duncan & Petherick 1991; Broom 1991b, 1998). They are adaptive aspects of an individual's biology which must have evolved to help in survival just as aspects of anatomy, physiology and behaviour have evolved. Fear and pain can play an important role in the most urgent coping responses, such as avoidance of predator attack or risk of immediate injury. Coping with pathology is necessary if welfare is to be good so health is an important part of the broader concept of welfare, not

something separate (Dawkins 1980; Webster 1994; Broom 2006; Broom & Fraser 2007). When considering how to assess the welfare of animals it is necessary to start with knowledge of the biology of the animal and of all of its needs. It is more useful to consider the needs of animals of a given species, using scientific information about them, than to use the more vague concept of freedoms.

Welfare can be assessed using one or more of an array of measures, including those of strength of avoidance and extent of other behavioural responses, physiological responses and pathologies (Broom & Johnson 2000; Broom & Fraser 2007; Fraser 2008). There are differences between welfare indicators for short- and long-term problems. Short-term measures like heart rate and plasma cortisol concentration are appropriate for assessing welfare during handling or transport but not during long-term living conditions. Some measures of behaviour, immune system function and disease state are more appropriate for long-term problems. Welfare over longer periods is sometimes referred to as quality of life (Broom 2007b). Measures of good and poor welfare include a wide range of other physiological indicators and behavioural indicators of pleasure, aversion and the extent of problems encountered. In addition, measures of immunosuppression, disease prevalence, body damage, brain function, ability to grow or breed and life expectancy are used.

We can find out much about what animals need by measuring how hard an individual will work for a resource or to avoid an adverse impact. Animals will learn to travel distances, lift weights, operate levers, or undergo unpleasant experiences in order to achieve objectives so their actions can be used as measures of motivational strength. Terminology used in motivational strength estimation is similar to that used in micro-economics. Reference is made to: resources, demand, price, income, price elasticity of demand and the consumer surplus (Kirkden *et al* 2003).

The magnitude of good or poor welfare is a function of the intensity of effect and the duration (Broom 2001). The extensive literature on the effects of handling, transport, stunning and killing of animals (Broom & Fraser 2007; Broom 2008) is relevant to whales. In addition to evaluation of whale welfare during whaling, the impact of whale watching on whale welfare also requires study (Higham & Lusseau 2007).

Measurable welfare during whaling

The assessment of whale welfare can be carried out using many of the measures mentioned above to assess the effects of disturbance by humans, fear engendered by pursuit or perceived imminent capture, pain resulting from tissue damage or other tissue-modifying conditions, and procedures that lead to unconsciousness and death. These topics are described briefly here whilst the substantial literature on hunting and killing methods is reviewed by Mitchell *et al* (1986) and by Kestin (2001) and Bass and Brakes (2013, this issue), who also describe some of the impact on whales.

- Disturbance and chasing by boats can lead to fear, exhaustion, social disruption, and perhaps to immunosuppression and increased disease. Measures of welfare during transport

and in pre-slaughter handling can be used to evaluate these components of poor welfare (Broom & Fraser 2007; Broom 2008). There are publications showing that whales sometimes ignore ship noise but they do respond to stimuli that may be associated with being chased (Nowacek *et al* 2004). There is little direct evidence in relation to whaling but the sonic output from whaling boats is likely to disturb whales and whales are known to change behaviour in response to boat noise (Nowacek *et al* 2007). Many other studies of whale responses to noise have been carried out, including, for example, ways of minimising the risk of whale entanglement in nets (Goodson *et al* 1994).

- Harpoon entry into tissues may involve a point with a barb or an explosive that detonates, usually after the harpoon has entered the body (Øen 1995a,b; Blix *et al* 2000). Both will result in tissue damage and, unless the animal is rendered instantly unconscious, severe pain but the duration will vary greatly and can be measured (Knudsen & Øen 2003; Gales *et al* 2007). The large literature on the assessment of pain and other poor welfare as a result of injury is relevant here. There is some evidence concerning the duration of the period from impact until unconsciousness or death (Øen *et al* 1995a,b). Recent collection of data in Norway on this interval, presented as International Whaling Commission papers (see Bass & Brakes [2013]), indicates that some whales die or become unconscious within one minute of impact but there is doubt about how many short and long intervals there are. A grenade harpoon has to strike in a small area in order that the animal will be immobilised (Knowles & Butterworth 2006; Ishikawa & Shigemune 2008). If it is not immobilised, the magnitude of poor welfare will be very high because the extensive injury means a high intensity and the duration can be many minutes or hours or longer.

- The effects of the period of pull on the line attached to the harpoon will be fear when the whale is not able to control its movements, the extra pain when pulled and the fear and distress associated with the perceived probability of capture. The duration of the period when the line is being pulled can be measured. The pain and fear could be measured using monitoring devices but this is not necessary as it is known that it will be considerable. However, the cognitive ability of whales is certainly sufficient for: (i) awareness of increasing proximity to the ship; and (ii) awareness of greater risk of capture when close to the ship.

- The procedures at capture will have adverse effects that will be very substantial (Swarbrick 2001). The delay after any hoisting, or gaffing with large hooks inserted into the flesh, or electric lancing, or shooting but before unconsciousness can be measured. There is much information about the effects of procedures at slaughter in farmed animals. There is some information about such effects in animals trapped and shot on land. However, little is known about the effects of capture on whales. It is at this time that scientific data on welfare could be readily collected. Even without good data, extremely poor welfare can be logically assumed because of the pain and stress involved.

- There are some difficulties in identifying exactly when a captured whale is unconscious and when it is dead. However, the methodology for this is available in the scientific literature. Jolly (1986), Butterworth *et al* (2004), Butterworth (2005) and Knudsen (2005) review the possibilities for evaluating insensibility and death in cetaceans.
- It is also relevant to measure the severity of effect and recovery time if a whale is wounded by a harpoon but escapes. Giménez *et al* (2011) showed that the healing of small wounds took 3–140 days.

The term humane

The term 'humane', in relation to animals, means their treatment in such a way that their welfare is good to a certain high degree. The welfare is either above the threshold, in which case the treatment is humane, or it is not. Humane killing implies either that the treatment of the animals in the course of the killing procedure does not cause poor welfare, or that the procedure itself results in insensibility to pain and distress within a few seconds (Broom 1999). With present methodologies for catching whales during whaling, the extent of poor welfare during catching and killing always appears to be substantial. Indeed, the magnitude of poor welfare is much greater than that during the use of any method detailed in law for legally killing a domestic or wild animal. The whale killing procedure would be humane for very few whales.

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