Investigating criteria for insensibility and death in stranded cetaceans in New Zealand

P. Brakes*, A. Butterworth[†], M. Donoghue[‡]
(Submitted by the Government of New Zealand)

*WDCS, the Whale and Dolphin Conservation Society, PO Box 81, Lyttelton, Canterbury, New Zealand
[†]University of Bristol Clinical Veterinary Science, Langford, N Somerset, BS40 5DU, UK
[‡]Department of Conservation, PO Box 10-420, Wellington

Introduction

The Revised Action Plan on Whale Killing Methods, adopted following the 2003 Whale Killing Methods Workshop, includes the following action point:

B. Indication of insensibility and death

5) Develop better criteria for determining the onset of permanent irreversible insensibility in whales, using physiological and behavioural observations.

Resolution 2004-3 (Resolution on Whale Killing Issues) recognises that '*the IWC criteria used to determine death or irreversible insensibility are inadequate; whilst also recognising that the IWC Working Group and Workshops on Whale Killing Methods are attempting to develop criteria to more adequately determine death or irreversible insensitivity both operationally and from post mortem approaches*'[1].

This resolution further:

'REQUESTS the Working Group on Whale Killing Methods and Associated Welfare Issues to advise the Commission on:

- establishing better criteria for determining the onset of irreversible insensibility and death; …'

With the fulfilment of these objectives in mind, the Whale and Dolphin Conservation Society (WDCS) and Bristol University (United Kingdom) are working with the Department of Conservation in New Zealand, to develop a series of non-invasive tests that could be conducted on the beach during stranding events. The purpose of this research will be to provide a better understanding of various states of sensibility in stranded cetaceans and ultimately, to improve understanding of the dying process in cetaceans.

The current IWC criteria for determining death in cetaceans are:

- Relaxation of the lower jaw;
- No flipper movement;
- Sinking without active movement[2].

These criteria are not applied collectively. Instead, the use of a single criterion (such as 'no flipper movement') can be deemed to provide an adequate assessment of death by the whalers when assessing hunted cetaceans[3].

It is envisaged that the development of more accurate criteria for determining the onset of irreversible insensibility and death in cetaceans will assist:

a) the management of stranding events (in particular the triage of cetaceans during mass stranding events);
b) understanding of various states of morbidity in cetaceans; and
c) improve understanding of the dying process in hunted cetaceans and lead to the collection of more precise data on 'Time to Death' during cetacean hunts.

[1] Annual Report of the International Whaling Commission 2004. Page 67. Resolution 2004-3.
[2] IWC 1980. Report of the Workshop on Humane Killing Techniques for Whales. IWC/33/15
[3] IWC 2003. Report of the Workshop on Whale Killing Methods IWC/55/Rep 5.

This paper details:

- a draft protocol for collecting data on indices of sensibility in stranded cetaceans; and
- a proposed format for collection of these data.

Progress towards a protocol for data collection

In 2005, two Workshops were held, one in the United Kingdom and one in New Zealand, with the aim of exploring the potential for collecting and interpreting data on sensibility from stranded cetaceans. The results of these Workshops were reported to the 2005 IWC Working Group on Whale Killing Methods and Associated Welfare Issues[4].

A number of possible criteria for determining states of sensibility were assessed by the strandings experts attending these Workshops. The possible indicators which the experts considered could give the highest degree of confidence for the accurate assessment of consciousness were:

- pupillary reflex;
- corneal reflex;
- response to bright light;
- response to touch;
- stimulation around the blowhole;
- measurement of the heart rate.

In addition, rhythmic swimming activity, response to application of water around the blowhole and jaw tone were also considered credible measures, but at a lower confidence level.

Other tests which the gathered experts believed might prove valuable for determining sensibility were:

- righting reflex;
- vestibulo ocular reflex;
- respiratory rate;
- capillary refill;
- ocular temperature.

Using these tests as a basis, a draft protocol for collecting data on sensibility in cetaceans stranded on New Zealand shores has been developed (Appendix I), with an accompanying draft data collection form (Appendix II).

During the development of this protocol, primary consideration was given to the fact that the collection of these data should in no way compromise either the welfare, or the prognosis, for the animals involved in this study. In addition, the safety of the humans involved with collecting these data is also of paramount importance (these points are reiterated in the protocol documentation).

To address these two issues, it is proposed that these data will be collected in New Zealand only by one or two individuals, who must be specifically trained for this task and must carry a permit from the Department of Conservation to conduct this research.

Acknowledgements

The authors wish to acknowledge all the participants in the 2005 International Workshops on Determining Criteria for Insensibility and Death in Stranded Cetaceans (in the United Kingdom and New Zealand). We also wish to acknowledge the Department of Conservation Staff involved with the development of this protocol.

[4] Butterworth, A., Brakes, P. and Sadler, L. 2005. Report of the United Kingdom and New Zealand Workshops on determining criteria for insensibility and death in stranded cetaceans. Paper Submitted by the UK Government. IWC/57/WKM&AWI 9.

APPENDIX I

DRAFT PROTOCOL FOR ASSESSING STRANDED CETACEANS IN NEW ZEALAND

Priority
H = High value tests
M = Medium value

HUMAN & CETACEAN SAFETY

Human safety must be the first consideration during any testing - do not carry out any test which may put a person at risk.
In addition, the care of the stranded cetacean is also of paramount importance. Tests should not be conducted if they will in any way compromise the care and treatment of the cetacean.

NB. These tests are not to be conducted by the lay person. They are intended for use ONLY by professionals trained in the care of stranded cetaceans and authorized to collect these data.

INDICATOR	Description	Method for evaluation	Measurement / Range of outcomes	Frequency of recording
H Pupillary reflex	Does the animal have a pupillary reflex?	Cover the eye with a hand or wet cloth for approx 30 seconds, then, if they eye will open easily shine a small torch light into the eye and count how long it takes for the pupil to constrict. Stop if the animal shows any signs of discomfort or significant behavioural change. (Test will not work in bright sunlight; shade the eye by cupping the hand over it).	Yes/No/ Speed of pupil constricting (note it can be quite slow in cetaceans)	Initially, then every hour
H Corneal reflex	Does the animal have a corneal reflex?	With a clean wet finger, if the eye will open, touch gently the corner of the eye. The animal should blink (and in some species, withdraw the eyeball, pulling the eye back a little into the socket)	Yes/No/Sluggish/Erratic Note: it can be sluggish or even erratic in a very weak or unconscious animal	Initially, then every hour
H Response to bright light	Does the animal respond to bright light?	In the darkness (night stranding) or after the head has been shaded with a wet towel (avoid blowhole), does the animal show a response (movement, blinking, vocalization) when a torch is directed toward the eyes. This is distinct from pupillary reflex and relates to how the 'whole animal' responds.	Yes/No Description of response	Initially, then every hour

H Response to touch	Does the animal respond to touch?	Touch the animal in an area that has not been contacted during the stranding work, e.g. close to the blowhole, side of the face. Note whether the animal shows any movement, blinking or vocalization.	Yes/No/actual response – if it changes as time goes on, does it become more or less pronounced? Note the location that was touched	Initially, then every hour
H Stimulation around blowhole	Does that animal respond to a blunt object stimulus around the blowhole?	Use your thumb to press gently around the blowhole – does the animal 'chuff', or squeak or open and close the blowhole.	Yes/No/record any response and see if it changes as time goes on	Initially, then every hour
H Heart rate[5]	What is the heart rate, as measured with a stethoscope?	If you can hear it, record number of beats in 20 or 30 seconds and then multiply to give bpm (beats / min)	Beats per minute (depending on the size of the cetacean, if the rate is very low, then beats in 5 minutes may be better)	Initially, then every hour, or after some activity (moving, rolling)
M Rhythmic swimming activity	Is rhythmic swimming detectable when immersed in water?	Only relevant during re-float, but if show rhythmic tail movements are visible when re-floated record this, and describe if these movements increase or weaken as time goes on	Yes / No/rate (movements per 20 seconds converted to swimming movements per minute) Is the cetacean free swimming or being assisted?	When first re-floated then every 20 minutes

[5] Note that it is expected that heart rate and respiration rate may be influenced by both the stranding situation and by the application of some of these tests. It is intended that some individuals will act as a control, with only heart rate or respiration rate data being collected for these animals. For other individuals recording the time at which each test is conducted should also assist in evaluating any correlation between changes in heart rate or respiration rate associated with the application of a specific test.

M Application of water around blow hole	Does the blowhole react to the application of water?	Clean sea water dripped onto the blowhole. **NOTE: only a couple of drops**[6]. Does this elicit a response. In rain, or in the surf, the animals may blow the water out of the blowhole depression in a small blow before the main exhalation and inhalation**.** **IMPORTANT: Do not pour any water into an open blowhole, or pour in water during the blow**.	Yes / No/ Does the animal clear water accumulated in the blowhole depression before full expiration?	Initially, then every 2 hours
M Jaw tone	Does the jaw have muscle tone?	**CARE**: Taking extreme care, push down gently on the 'chin' and assess the animal's resistance to you pushing. Score it as Hard/Medium/No resistance A truly unconscious animal will not resist whilst a weakened animal may have a variable response.	Hard/Medium/No resistance	Initially then every 2 hours
H Righting reflex	Does the animal display a righting reflex?	**CARE**: During re-floatation, roll the animal nearly ¼ to one side. **WATCH the FLUKE** - if the righting reflex is good, the animal will use its tail to right itself.	Yes – active twisting and fluke flapping / No	When everyone is prepared and safe (not near the tail) during the re-float. **CARE** -Do not attempt in rough water, or where there is

[6] Use only a couple of drops, DO NOT keeping dropping water in until a response is elicited.

				any risk to humans.
M Vestibulo-ocular reflex	Does the animal have a vestibulo-ocular reflex?	Most easily done in water during re-float. Roll the animal about 45º (1/8 turn) and watch the eyes from the front. They should stay fixed horizontal for the first part of the roll and only after a degree of roll then move with the animal. If they roll fixed with the animal right from the start then record this.	Yes – stay horizontal for a part of the roll / No – stay fixed with the animal as it rolls If the animal swims away as soon as it reaches the water please make a note of this.	When safe to do so during the re-float. **CARE** - may induce righting reflex.
H Respiratory rate	What is the respiratory rate?	From blowhole activity, record the number of respirations over 1, 5, or 10 minutes, depending on species. Convert this to breaths per minute (can be a fraction for large species e.g. 0.4 breaths per min = 1 breath in 2.5 minutes)	Breaths per minute (as this measurement is universally recognized in other animals)	Initially, then every 15 or 30 minutes depending on whether you have enough people to do all the tasks. Record resp. rate if you change anything e.g. wetting animal, rolling, moving, re-float etc.
M Capillary refill (CRT)	What is the capillary refill time?	CARE – Gently squeeze the lip, or if accessible, the tongue. The tissues will 'blanch' (go pale) and then go pink as they refill with blood. Record	Time in seconds for tissue to return to same colour as surrounding tissue.	When you can safely first do this, do not put personnel at

		time from release of the squeeze until the tissues are the same colour as those around them. For pigmented (black, blue or brown tissues, this test can be difficult to conduct). Very cold conditions may artificially slow down the CRT as blood is diverted away from tissues to preserve heat.		risk. Then every hour.
H Ocular temperature	What is the temperature of the surface of the eye?	Using IR thermometer, point this at the clean (not too much mucous) open eye. Without touching the eye, move the thermometer from the side of the eye toward the middle of the eye, and record the **MAXIMUM** temperature you see on the screen. **DO NOT** touch the eye with the thermometer, and **DO NOT** use the laser pointer on the thermometer if it has one (Cover it with tape). Do not conduct this test in hot sunlight or you will simply record the temperature of the hot 'skin'[7]	Temperature in degrees Celsius	Initially, then every hour

[7] This is one of the reasons for keeping a record of the air temperature.

APPENDIX II

DATA COLLECTION FORM - ASSESSING STRANDED CETACEANS IN NEW ZEALAND

Before starting data collection, PLEASE ENSURE you have read, and understood, the protocol which provides details of how to measure and record these indicators.

NB. These tests are not to be conducted by the lay person. They are intended for use ONLY by professionals trained in the care of stranded cetaceans and authorized to collect these data.

DATE		**Name of data recorder**		
Organisation				
Number of cetaceans in stranding event:				
Location of stranding event: **Time at which stranded cetacean was first reported:**				
Species:				
Male/Female	**Lactating female** ☐	**Calf** ☐		**Length:**
Identifier[8]:				
Location on the beach:				
Comments on condition:				
Describe the reason why this individual was selected for data recording:				
Weather conditions: **Air Temperature:**				

[8] If this animal is part of a mass stranding, please provide information for the purpose of identifying the individual during each session of data recording

INDICATOR	**TIME of recording**	**RESULT**[9]
H Pupillary Reflex		yes ☐ no ☐ speed:
		yes ☐ no ☐ speed:
		yes ☐ no ☐ speed:
		yes ☐ no ☐ speed:
		yes ☐ no ☐ speed:
H Corneal Reflex		yes ☐ no ☐ If yes – sluggish or erratic
		yes ☐ no ☐ If yes – sluggish or erratic
		yes ☐ no ☐ If yes – sluggish or erratic
		yes ☐ no ☐ If yes – sluggish or erratic
		yes ☐ no ☐ If yes – sluggish or erratic
H Response to bright light		yes ☐ no ☐ Description of response:
		yes ☐ no ☐ Description of response:
		yes ☐ no ☐ Description of response:
		yes ☐ no ☐ Description of response:
		yes ☐ no ☐ Description of response:
H Response to touch		yes ☐ no ☐ Actual response: If it changes as time goes on, does it become more or less pronounced? Location touched[10]:
		yes ☐ no ☐ Actual response:

[9] Please circle the response or provide details as requested in the protocol
[10] Where possible the location tested for response to touch should be standardized for each animal.

		If it changes as time goes on, does it become more or less pronounced? Location touched:
		yes ☐ no ☐ Actual response: If it changes as time goes on, does it become more or less pronounced? Location touched:
		yes ☐ no ☐ Actual response: If it changes as time goes on, does it become more or less pronounced? Location touched:
		yes ☐ no ☐ Actual response: If it changes as time goes on, does it become more or less pronounced? Location touched:
H Stimulation around blowhole		yes ☐ no ☐ Details of response:
		yes ☐ no ☐ Details of response:
		yes ☐ no ☐ Details of response:
		yes ☐ no ☐ Details of response:
		yes ☐ no ☐ Details of response:
H Heart Rate		bpm
		bpm
		bpm
		bpm
		bpm
M Rhythmic swimming activity		yes ☐ no ☐ Rate[11]: Free swimming / Assisted[12]
		yes ☐ no ☐ Rate:

[11] Movements per 20 seconds, converted to swimming movements per minute (see protocol).
[12] Circle either 'Free Swimming' or 'Assisted'

		Free swimming / Assisted
		yes ☐ no ☐ Rate: Free swimming / Assisted
		yes ☐ no ☐ Rate: Free swimming / Assisted
		yes ☐ no ☐ Rate: Free swimming / Assisted
M Application of water around blowhole		Reaction: yes ☐ no ☐ Does the animal clear water accumulated in the blowhole depression before full expiration? yes ☐ no ☐
		Reaction: yes ☐ no ☐ Does the animal clear water accumulated in the blowhole depression before full expiration? yes ☐ no ☐
		Reaction: yes ☐ no ☐ Does the animal clear water accumulated in the blowhole depression before full expiration? yes ☐ no ☐
		Reaction: yes ☐ no ☐ Does the animal clear water accumulated in the blowhole depression before full expiration? yes ☐ no ☐
		Reaction: yes ☐ no ☐ Does the animal clear water accumulated in the blowhole depression before full expiration? yes ☐ no ☐
M Jaw Tone		Hard ☐ Medium ☐ No resistance ☐
		Hard ☐ Medium ☐ No resistance ☐
		Hard ☐ Medium ☐ No resistance ☐
		Hard ☐ Medium ☐ No resistance ☐
		Hard ☐ Medium ☐ No resistance ☐
H Righting Reflex		Yes – active twisting and fluke flapping ☐ No ☐
M Vestibulo-ocular Reflex		Yes (stay horizontal for a part of the roll) ☐ No (stay fixed with the animal as it rolls) ☐
H Respiratory Rate		Breaths per minute
		Breaths per minute
		Breaths per minute
		Breaths per minute
		Breaths per minute

		Breaths per minute
		Breaths per minute
		Breaths per minute
		Breaths per minute
		Breaths per minute
M Capillary Refill		Time for refill (seconds)
		Time for refill (seconds)
		Time for refill (seconds)
		Time for refill (seconds)
		Time for refill (seconds)
H Ocular temperature		Temperature °C
		Temperature °C
		Temperature °C
		Temperature °C
		Temperature °C