Agenda Item 5.3	Review of New Information on other Matters Relevant for Small Cetacean Conservation Responses to Hazards
Document Inf.5.3.b	**Report of the IWC Workshop on Euthanasia Protocols to Optimize Welfare Concerns for Stranded Cetaceans**
Action Requested	• Take note
Submitted by	IWC

NOTE:
DELEGATES ARE KINDLY REMINDED
TO BRING THEIR OWN COPIES OF DOCUMENTS TO THE MEETING

Report of the IWC Workshop on Euthanasia Protocols to Optimize Welfare Concerns for Stranded Cetaceans

Submitted by Norway and UK

Members: Jepson (Chair), Amaira, Bjørge, Brockington, Butterworth, Campbell, Clarke, Coughran, Deaville, Donovan, Gísladóttir, Gooding, Gray, Grogan, Gulland, Harms, Jones, Kiernan, Koen, Kolesnikovas, Marcondes, Mattila, Meyer, Moore, Øen, Reiss, Rowles, Rundall, Simmonds, Stede, Uhart, Wilson, Yamada.

Recommendations of the Report

- The workshop **stresses** that **human safety** should always be considered paramount.
- The workshop **recommended** that the **humaneness** should be the first criteria for any euthanasia method, rather than concerns over aesthetics or public acceptance, although also important in the bigger picture when managing euthanasia. A humane death will often involve the very shortest time to death, but not always if pre-sedation is undertaken to provide anxiolysis and analgesia (AVMA 2013). Other criteria for the chosen method of euthanasia include availability of equipment and drugs, existing knowledge/expertise, and relevant legal/regulatory framework (including cultural, political, aboriginal, socio-economic differences between countries).
- The workshop **recommended** several chemical and physical techniques for euthanasia of large beached whales, including chemical sedation followed by potassium chloride (KCl) intra-cardiac injection for baleen whales (Harms et al 2014) and high calibre ballistics and explosives (cranial implosion technique) (Coughran et al 2012) for baleen and sperm whales.
- The workshop **strongly recommends** that euthanasia of cetaceans should not be conducted by untrained personnel, as this may endanger humans and increase the suffering of the animals.
- The workshop **recommended** that in order to ensure the safety of response personnel, attempts at euthanasia of beached whales should not be conducted when a whale is in surf and should be conducted only when a whale has been stabilized or is above the tide line.
- All euthanasia methods should be **tested on dead animals** first, to develop methodological expertise and obtain correct anatomical knowledge (e.g. via necropsies on strandings).
- The workshop **recommended** that for chemical methods, removal of the injection site to limit risk of disposal and potential for relay toxicity is a minimum requirement. Where barbiturates have been used, the entire carcass should be disposed of where scavengers cannot access it.
- The workshop **recommends** that IWC member nations refine existing or develop new incident response protocols based on the principles and guidelines found in this report.

- The Workshop **recommends**, for each event, the collection of appropriate data, full documentation of the event and the sharing of experiences/data to refine decisions and situation handling in the future. This process should include information on both successes and failures; the latter can be extremely informative in developing improvements and preventing mistakes being repeated.
- The workshop **recommends** the addition of a number of 'outcome' fields to the existing IWC National Progress report database for live strandings: released/rescued; euthanized (method categories as in Table 3); no intervention.
- The Workshop noted the value of establishing a voluntary group of experts (contact list) that can be consulted by the IWC and others to: (1) provide advice on euthanasia protocols and methods to relevant authorities; (2) provide objective information to the media if requested and (3) assist the IWC Secretariat in populating the IWC website. The Workshop **recommends** that this list be maintained by the IWC Secretariat.
- The Workshop noted the great potential of the IWC to facilitate work on live strandings and euthanasia techniques, similar to the approach developed for disentanglement (IWC, 2013). It therefore **recommends** the establishment of a live stranding response component of the IWC website with a layered capacity. It also **encourages** IWC countries to facilitate the exchange of information, expertise, technology and training.
- With respect to data gaps, the workshop **agrees** that more work is needed on the environmental persistence and potential effects of some chemical methods and **encourages** this research and provision of information. The Workshop **notes** the importance of composting as a safe and environmentally positive means of disposal of cetacean carcases and it **encourages** national and local authorities to facilitate this method of disposal where appropriate.
- The Workshop recognised the effectiveness of penthrite grenades and **encourages** the development of a darting-gun type delivery system that it is suitable for beached animals and may also be appropriate for entangled whales at sea. It **requests** that a progress report on this topic is provided to the 2014 Annual Meeting of the IWC.
- Related to this, the Workshop **endorses** a previous Workshop recommendation (IWC, 2012) concerning the need to develop methods for euthanasia of cetaceans at sea (entangled or otherwise requiring human intervention). It **agrees** that this may be facilitated by the holding of a future technical Workshop and **requests** that this be considered further at the 2014 Annual Meeting.
- At several places in this report, the Workshop highlighted difficulties with mass stranding events. It therefore **recommends** that the IWC consider holding or facilitating the holding of a future Workshop on mass stranding events, including management, social, welfare and euthanasia considerations.

Report of the IWC Workshop on Euthanasia Protocols to Optimize Welfare Concerns for Stranded Cetaceans

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1 INTRODUCTORY ITEMS

The meeting was held at the Institute of Zoology (Zoological Society of London), Regent's Park, London NW1 4RY, UK from 11-13 September 2013. **The list of participants is given as Annex A**.

1.1 Welcoming remarks

Paul Jepson, Reader at the host site (Institute of Zoology) welcomed the participants to the Workshop on behalf of the convenors, the United Kingdom and Norway.

1.2 Background

Deaville presented an overview of euthanasia and live strandings in the UK, highlighting that this is an emerging issue for the UK and other countries. The UK has a well-developed volunteer-led network that responds to live strandings and is currently able to euthanize small to medium sized cetaceans relatively routinely. However, there are no current means of effective euthanasia for large stranded whales and the UK has also seen an increasing number of large cetacean live strandings in recent years.

Coughran commented that the recovery in the humpback whale population off Western Australia and their seasonal migration has led to an increased likelihood of these animals coming ashore due to natural and human induced causes (Bannister *et al.* 1996). There has been an increase in humpback whale strandings in Western Australia with multiple live and dead animals washing ashore in populated areas.

The Workshop **recognised** that the issue of how to deal with large stranded whales is a common problem for many coastal states. A key objective of the Workshop will be to provide practical advice on how to deal with such occurrences in a local context.

2 APPOINTMENT OF CHAIR AND RAPPORTEURS

2.1 Appointment of Chair

Paul Jepson (UK) was appointed chair of the meeting.

2.2 Appointment of rapporteurs

Deaville, Gray and Rundall were appointed rapporteurs for the meeting, assisted by Donovan and Jepson.

3 REVIEW AND ADOPT AGENDA

The adopted agenda is given as Annex B.

4 REVIEW OF AVAILABLE DOCUMENTS

Barco *et al.* (2012); Coughran (2012); Harms *et al.* (2014) and Moore *et al.* (2010) were reviewed at the Workshop. Other documents available for the information of the participants are listed in Annex C.

5 OBJECTIVES FOR THE WORKSHOP

The aim of the Workshop is to bring together international experts to inform guidelines on the best welfare outcome when cetaceans strand. In the light of lessons learned from the IWC's work on entanglement and entanglement response, the Workshop will compare and contrast the various euthanasia methods used worldwide and look at ways of improving efficiency, safety of personnel and when or if to intervene (including, potentially, a decision tree and reviewing triage techniques). It will make recommendations as appropriate.

Specific objectives are to:-

- improve the evidence base for future assessments of when and how to euthanize stranded cetaceans to optimise animal welfare, using the most effective technologies available and taking into account different circumstances (e.g. economic, logistical and available expertise);
- identify how to improve the efficiency and quality of information/data generated by large whale stranding events, including lessons that can be learned from them;
- focus on biological considerations and technological measurements taking into account the decisions that need to be considered such as health and safety, logistics, physical - both location and species, triage at Mass Stranding Events (MSEs), and existing protocols/guidelines;
- generate a list of techniques (established protocols) for each method of euthanasia (chemical, ballistics, explosives, etc.);
- provide advice on how to manage different situations in the context of the media and the general public.

6 CURRENT RAPID KILLING AND EUTHANASIA TECHNIQUES (BEACHED CETACEANS)

6.1 Review relevant information from IWC - Maui Workshop

The Workshop reviewed the relevant aspects of the 2010 IWC Workshop on *the Welfare Issues Associated with the Entanglement of Large Whales*, held in Hawaii (IWC, 2012). That Workshop had agreed that most stranded baleen whales are in a terminal condition and that under most circumstances, (and always in areas of surf), it is both inhumane to the whale and dangerous to response personnel to attempt to refloat and release a stranded large whale. If the whale does not refloat on its own after one tidal cycle, euthanasia should be considered as the most humane option. The Workshop had also **recommended** that in order to ensure the safety of response personnel, attempts at euthanasia should not be conducted when a whale is in surf and should be conducted only when a whale has been stabilized or is above the tide line.

The present Workshop reviewed the matrices of relevant existing methods for euthanizing large whales at sea or stranded on the beach developed at the Hawaii Workshop (IWC, 2012, table 6). It noted that several methods for euthanizing stranded large whales had been developed or improved since then, but there had been no significant advancements for methods to euthanize at sea. These matters are discussed further below.

6.2 Definition of euthanasia

A new definition of euthanasia was adopted by the American Veterinary Medical Association in 2013: *the use of humane techniques to induce the most rapid and painless and distress-free death possible (AVMA 2013)*. The Workshop **agreed** to this definition.

6.3 Chemical euthanasia

When considering chemical euthanasia, it must be remembered that the size of the animal also necessitates large quantities of euthanasia agents.

6.3.1 Sedatives

A comprehensive list of sedative chemical agents (drugs) used as part of euthanasia protocols was compiled during the Workshop (Table 1). This included a summary of the drug's effects, doses, routes of administration, cetacean species for which they have been used (with references) and an assessment of risks for human individuals and the environment, including risk of "relay toxicity" (see Item 6.3.5 and Table 1). Sedatives are generally used to sedate an animal prior to physical and chemical methods of euthanasia including exsanguination (Table 3).

6.3.2 Lethal chemicals

A comprehensive list of lethal chemical agents used as part of euthanasia protocols was also compiled during the Workshop (Table 1). This included a summary of the drug's effects, doses, routes of administration, cetacean species

used (with references) and an assessment of risks for human individuals and environmental risks including relay toxicity (see Item 6.3.5).

6.3.3 Injection techniques/equipment

The safe euthanasia of live stranded cetaceans is one of the most challenging tasks in all marine mammal stranding events. The experiences of the Virginia Aquarium Stranding Response Program and other colleagues in the US Marine Mammal Stranding Network, as well as the general lack of information and guidance publicly available, inspired a two year collaborative John H. Prescott grant project in the US (Barco *et al.* 2012).

Harms presented the results of this project to the Workshop. The project developed recommendations for US stranding networks to facilitate the euthanasia of stranded cetaceans when release or rehabilitation is not an option. It developed standardised methods of data collection for cetacean euthanasia events, collected pertinent historic data from stranding networks nationwide, and compiled a review of grey and peer reviewed published euthanasia literature. Informational materials were also developed on general and safety recommendations for stranded cetacean euthanasia, euthanasia options matrices for large and small cetaceans, a summary of effective euthanasia methods species-specific length-weight equations and graphs, species-specific observations for stranded cetacean euthanasia, common needle lengths and routes, aggregate historic drug doses and pentobarbital dosages for commonly encountered species, small cetacean illustrations for ballistics, injection and exsanguinations, and cetacean euthanasia record and instructions for standardised recording of euthanasia events. These materials are included in an appendix to the paper as a stand-alone document to aid responders during cetacean euthanasia events.

Many of the recommendations for use of specific drugs for sedation or euthanasia within this report (Table 1) were sourced from Barco *et al.* (2012). The Workshop also noted the need to **correct** an error in the literature review in Barco *et al.* (2012) in relation to the Greenland rifle whale hunt with a long time-to-death (TTD) being confused with the Norwegian minke whale hunt using penthrite grenades where TTDs were mostly very short/instantaneous.

The Workshop **highly commended** the extensive and thorough review of euthanasia methods, drugs, dosages and risks associated with chemical and other methods of euthanasia compiled in the Barco *et al.* (2012) report.

Harms also presented chemical sedation followed by lethal intracardiac injection of potassium chloride (KCl method) using a purpose-built long (up to 103cm) industrial needle (Harms *et al.*, 2014). This technique was used successfully in four baleen whales cases (see Item 6.3.4). The workshop **agreed** that KCl without prior sedation was unacceptable for routine euthanasia due to welfare issues related to the high potential for severe pain and distress. The workshop was divided on whether KCl without prior sedation might be considered as a method for euthanasia *in extremis*.

There is variation between countries and methods in terms of costs for chemical euthanasia. For example, the sedatives in the KCl method alone are significantly more expensive in the UK than in the US – partly because the actual drug concentration for one of the commercially available sedatives is quite different between US and the UK. This means that effectively there is a need to buy more of the drug (by volume) in the UK to make the correct "dose" – and this adds significantly to the cost in the UK. Some drugs are just not available in some countries. For this reason, costs were not included for each chemical euthanasia technique listed in Table 1. However, some example costs were presented and discussed including US$1,000 for the long, industrial-grade steel intra-cardiac needle and US$500 for the three sedatives (Midazolam, Acepromazine and Xylazine) with each whale using the KCl with chemical sedation in the US (Harms et al 2014). A southern right whale in Brazil euthanized with a combination of xylazine (2%), ketamine (10%), T-61 and KCl was estimated to cost US$5,295 (Kolesnikovas et al. 2012).

Table 1

Drugs for potential use in large whale euthanasia. Note the volumes of drugs used make them all a potential human health concern

Drug	Effect				Usage, approx. dosage	Species used on (reference)	Concerns		Comments
	Sedative/ hypnotic	Analgesic	Muscle relaxation	Cardiac arrest			Human hazards	Ecotoxicity/ Relay toxicity	
Potassium chloride (KCl)	No	No	No	High	Intracardiac (IC) or intravenous (IV) ideal, intraperitoneal (IP) works, AFTER sedation/analgesia (1-2 mmol/kg)	Fin, Humpback , Minke, Southern Right Whale (Daoust & Ortenburger 2001; Harms *et al.* 2014; Barco *et al.* Kolesnikovas *et al.* 2012)	None	None	Cheap, readily available, sold as water softener (use heat to dissolve fully)
Pentobarbital and Pentobarbital/ Phenytoin combinations	High	High at anesthetic dose	Medium	High	IV, IC, IP, in blow hole (IN; Dunn 2006), may follow sedation with a range of drugs to enable IV, IP access 60-200 mg/kg	Humpback, Gray, S. Right, Fin, (Barco *et al.* 2012, Greer *et al.*, 2001)	Low, although toxic if IV or ingested	High. (Eckel et al, Peschka et al) (Bischoff et al.2011) Composting destroys (Schwartz *et al.* 2013)	Terminal convulsions may occur without previous sedation; these have been controlled with muscle paralytics in land mammals
Diazepam	High (<Midazolam)	No	High (>Midazolam)	Low	Sedation to allow IV access. Intramuscular (IM) or IV, 0.2 mg/kg	(Barco *et al.* 2012)	Low	Low	Most effective IV. Readily available in most veterinary clinics
Midazolam	High	No	High	Low	Sedation prior to barbiturate, IM, IV; Good premedication. 0.2-1 mg/kg	(Barco *et al.* 2012)	Low	Low	More effective than Diazepam IM. Effective amnesiac
Acepromazine	High	Low	Medium	Low	Sedation prior to barbiturate, 1 mg/kg	(Barco *et al.* 2012)	Low	Low	Readily available in most veterinary clinics
Detomidine	High	Medium	Medium	Low	Sedation prior to barbiturate, 0.2 mg/kg	(Barco et al 2012)	Low	Low	Expensive, rarely available if not a zoo/aquarium. No human reversal agent available.
Medetomidine or dexmedetomidine	High	Medium	Medium	Low	Sedation prior to barbiturate, 0.2 mg/kg (half dose with dexmedetomidine	(Barco et al 2012)	Low	Low	Readily available in most veterinary clinics in U.S.A. No human reversal agent available
Xylazine	High	Medium	Medium	Low	Sedation prior to barbiturate IV. IM or IV 0.5-1 mg/kg, repeat as needed	Gray, Fin, S.Right Whales (Daoust & Ortenburger	Low	Low	Readily available in most veterinary clinics. Excitability reported but could be behavioral rather

Drug	Effect				Usage, approx. dosage	Species used on (reference)	Concerns		Comments
	Sedative/ hypnotic	Analgesic	Muscle relaxation	Cardiac arrest			Human hazards	Ecotoxicity/ Relay toxicity	
						2001;Kolesnikovas *et al.* 2012)			than reflex (Greer et al 2001)
Meperidine	Medium	Good	Low	Low	Sedation prior to IV drug usage IM 3 mg/kg		Low	Low	Not available in some countries
Etorphine	High	Medium	Low	High	IM without previous sedation, 0.5 ml "LA Immobilon" ® per 1.5 m of cetacean	Greenwood and Taylor, 1980; RSPCA 1997; Barnett *et al.*, 1999)	High	High	Not readily available in some countries; requires special license/permits – controlled substance
Carfentanil	High	Medium	Low	High			High	High	Not reported as euthanasia agent for cetaceans, but effective anesthetic in walrus, likely to be effective; expensive; controlled substance
Pancuronium, Succinyl-choline	No	No	Paralysis	Secondary to paralysis	IV following anesthesia		Medium	Low	Used in land mammals following anesthesia in combination with pentobarbital to minimize muscle movements
Ketamine	High	Low to medium	Low	Medium	IM 3 mg/kg	(Barco *et al.* 2012)	Low	Low	Cheap, readily available in most veterinary clinics; controlled substance in some countries
Telazol (Tiletamine HCl and Zolazepam HCl)	High	Low to medium	Low	Medium	IM 5 mg/kg	(Barco *et al.* 2012)	Low	Low	Used in captive small cetaceans prior to IV pentobarbital
Isoflurane	High	Medium	Medium	Medium	Inhalant	(Barco *et al.* 2012)	Medium	Low	Might be useful IC, difficult to deliver effectively as inhalant with large volume needed
T-61(embutramide with narcotic action mebezonium paralytic)	Medium	Medium	Medium	High	0.5 mg/Kg xylazine (IM); 2.47 mg/Kg ketamine (IM); 750 mL of T-61® (IC); 10,000 mL of a 1 mmol KCl solution (IC)	(Dunn 2006, Daoust & Orten-burger 2001, Kolesnikovas *et al.* 2012)	Medium	Medium	Paralysis may occur prior to loss of consciousness; pre-euthanasia sedation recommended

[1] 'Relay toxicity' is the risk of toxicity to scavenging domestic animals or wildlife from drug residues that remain within a cetacean carcass that has been chemically sedated or euthanized.

6.3.4 Examples of euthanasia using chemical agents

Throughout the Workshop, a number of case studies involving the euthanasia of stranded cetaceans was presented and discussed. These cases not only focussed on methods and techniques for euthanasia that were deemed successful, but also included cases where, for one reason or another, the outcomes were suboptimal but from which important lessons could be learnt.

To set the scene, Moore presented the case of a difficult live stranded humpback whale from 2010. Over a four day period, a live male humpback was managed on a high surf beach. Length was estimated in the surf at 6.5m. On this basis, the following approach resulted. In order to tranquilize the animal and gain access to the tail to tow it out of the surf, a mixture of sedative was administered by remote intramuscular injection on the third day. Deep sedation resulted, but the loss of a loaded dart in the surf halted operations. The animal appeared apnoeic but on the following morning weak respirations were observed. Using a .577 rifle, three round-nose rounds were dispatched, using the New Zealand DOC guidelines for landmarks to target the brainstem. The animal remained alive. Euthanasia solution was then administered into the ventral abdomen and the retrobulbar plexus. The last respiration was noted 45 minutes later. At necropsy, the animal was measured at 9.4m. Ballistic damage was found to have sheared away from the braincase, despite accurate targeting. The carcass was buried in a landfill. Three weeks later a dog consumed a small portion of the carcass that had been lost in the sand at the necropsy site and entered into a coma before recovering several days later (Bischoff *et al.*, 2011). Lessons learnt from this case included:

(1) length must be accurately measured with a tape at the outset – in-surf estimation is inadequate and often leads to serious underestimation of length and hence is unsuitable as a basis for management decisions;
(2) heavy sedation of a robust whale is not necessarily lethal;
(3) shooting a 9.3m humpback whale with .577 soft nosed bullets is inappropriate (see Item 6.4.1);
(4) remote delivery of drugs carries a significant risk of dart loss with resultant potential human health risks;
(5) pentobarbital euthanasia carries a significant relay toxicity risk - injection sites should be carefully marked and excised for careful suitable disposal and carcasses must be disposed of appropriately;
(6) hind-sight suggests that this case could perhaps have been best managed by education of the general public about the potential human safety risks that management of this case in surf represented, and that perhaps the animal should have been simply observed until pentobarbital or sedation/KCl could have been administered safely.

A number of additional difficult euthanasia cases were presented and discussed by a number of attendees from a wide range of countries and oceanic regions. For these cases often the outcome was suboptimal and the time to death was often prolonged. Many of these difficult cases had features in common:

(1) marked underestimation of actual body length for whales located in the surf;
(2) inadequate provision of chemical agents or physical methods (often due to underestimation of body length);
(3) animals being partially suspended in some seawater (e.g. harbour or lagoon) so that the whale was not totally stranded under its own body weight (being partially submerged means that death due to stranding might be markedly prolonged compared to a large whale being stranded and subjected to its full body weight);
(4) a degree of progression where a range of (often inadequate) euthanasia methods were tried but the time to death was prolonged;
(5) unrealistic expectations from the media putting intense pressure on stranding responders to rescue cetaceans where rescue was not a viable option.

The Workshop **agreed** that important lessons should be learnt from these difficult cases. It is precisely these cases more than any others that provide the most powerful incentives for new and improved techniques to be developed.

For example, in response to some of these difficult cases, a new euthanasia technique for stranded mysticetes using readily available, relatively inexpensive, pre-anaesthetic and anaesthetic drugs (midazolam, acepromazine, xylazine) followed by saturated KCl delivered via custom-made needles and a low cost basic pressurised canister has been used in three juvenile humpback whales and a minke whale calf (Harms *et al.*, 2014). Harms presented these cases individually and discussed them with the Workshop. The new KCl method provided effective euthanasia in all four baleen whale cases so far deployed, while moderating personnel exposure to hazardous situations and minimizing drug residues of concern for relay toxicity.

The Workshop **commended** the work that had been done in the USA to develop and successfully implement this new KCl delivery technique. It also **recognised** the potential for this technique to be developed in other countries outside the USA.

Jepson presented four live stranded UK northern bottlenose whales of which two were euthanized with etorphine according to the UK guidelines as described in the 7th edition of the BDMLR Marine Mammal Medic Handbook (Barnett, Knight and Stevens 2013). One of the non-euthanized cases appeared to convulse and then "die" but came

"back to life" approximately one hour later – indicating that deep-diving cetacean species can mimic a dive-reflex and exhibit a prolonged period of apnoea while stranded and this can be mistaken for death.

6.3.5 Safety

All techniques for sedation and euthanasia of stranded cetaceans come with associated risk. Risks include harm to human individual(s), risks to the general public and risks to the environment. Part of the risk of using chemical agents in stranded cetaceans includes the risk of relay toxicity (e.g. Bischoff *et al*., 2011). Pentobarbital is also an environmental concern because of its stability and long persistence in aquatic environments – as was the case with the humpback whale from 2010 that was presented by Moore (see Item 6.3.4). The various risks (human, domestic animal/wildlife and environmental) of the different chemical agents used for cetacean sedation or euthanasia are listed in Table 1.

6.4 Physical euthanasia

6.4.1 Ballistics (and see Item 6.5.3)

A list of current physical euthanasia protocols for larger whales using ballistics was compiled. This included a summary of the method, timing, effects, species used (with references) and an assessment of capital and consumable costs and an assessment of the risks for human operators and wider environment concerns (Table 2). Protocols for testing the ballistics properties of any particular firearm-projectile pairing have been well described (Thali *et al*., 2002).

6.4.1.1 TYPES AND CALIBRE OF RIFLES

Meyer presented on euthanasia using ballistics for South Africa, noting that use of ballistics is probably the most appropriate technique for cetaceans less than around 8m in his country; the South African Stranding Response Plan suggests that ballistics are only recommended for cetaceans ≤ 8.0 m. He put forward a number of suggestions with respect to suitable calibre rifles and bullet grains based on the size range of smaller cetacean species that strand along the South African coastline. While there may be considerable overlap of appropriate small calibre rifles in smaller species, he suggested that the euthanasia of dolphins was best suited to .22 Hornet 45 grain soft tipped bullets. Larger dolphins and medium sized toothed whales such as pygmy sperm whales, pygmy killer and Risso's dolphin require .303 British 174 grain, soft tip ammunition. Pilot whales, false-killer whales, killer whales and beaked whales require .300 Win Mag 180 grain, soft or solid tipped hunting rounds. Neonate baleen whales (humpback and right whales) are euthanized using .300 Win Mag, 180 grain to .30-06 Springfield calibre weapons and 180 grain solid tipped hunting rounds.

However, he also noted that there had been cases where humpback whales as large as 12.3m were successfully euthanized by ballistics in South Africa. Criteria such as sectional density (SD) muzzle energy (ME), momentum value (MV) and knockout (KO) values submitted by C Snyman, a big game hunter, had been compared to specific makes and calibre rifles between .375 to .577 and recommendations were made in the South African guidelines in order of priority for both right and humpback whales. It was suggested that with euthanasia of the larger whales, ballistics should be confined to 300–500 grain, round-headed, full metal jacket bullets, In the case of right whales where a .577 calibre rifle was not available he recommended the use of the .460 Weatherby using a 500 grain round headed full metal jacket rounds (firing twice repeatedly into the same hole). As noted earlier in this report, in many cases reported whales in the water and on the beach tended to be larger than estimated sizes, resulting in procedures and processes that may not have been attempted if initially correctly measured. It should be emphasized that whales should only be euthanized if the marksman has a thorough knowledge of skull morphology which differs by species or if the marksman is being supervised by a person who has gained that knowledge during necropsies.

Coughran presented on a safe, consistent and efficient method of euthanasia for cetaceans <6m in Western Australia using firearms and ammunition that are readily available. To date, they have not encountered a species that has required the use of the larger than .458 calibre. He noted weapons larger than .458 calibre are not common and may, by virtue of limited availability within existing agency arsenals, be therefore unworkable. A key issue is to be able demonstrate the effectiveness of a commonly available firearm-ammunition combination on a wide range of species and size range of animals. The more recently developed hydrostatically stabilised projectiles consistently achieved successful results for euthanasia over the older round-nosed and full metal jacket projectiles. Such bullets create cavitation and push the core into the target with a very stable trajectory and impact. He reported that of the nine cases examined to date, consistent results were obtained from the pairing of .300 and .308 calibre with hydrostatically stabilised projectiles.

Campbell presented information on the sperm whale euthanasia device (SWED). The SWED is a modified Russian WWII 14.5mm anti-tank weapon used for sperm whale euthanasia in New Zealand where it has been successfully used on multiple occasions. The standard operating procedure involves the SWED being hand-held and normally fires three rounds concurrently into the sperm whale. The projectiles do not go through the animal and the SWED uses a single shot rather than a magazine - all safety features. The SWED is fired very close to animal (i.e. a couple of metres away). The SWED is specifically used for sperm whales and is not recommended for baleen whales. Costs of the

SWED are estimated at 10NZD a round and approximately 2,000 NZD for the weapon (via Russia). The shock wave of the bullets impact is thought to be sufficient to kill the sperm whale.

Grogan presented on the role of the RSPCA for cetacean euthanasia in the UK. The RSPCA is a voluntary organisation with approximately 500 officers around the UK. They carry a variety of equipment for euthanasia of animal species (captive bolt, shotgun, slaughter pistol, pentobarbitone sodium), but not all officers are trained in all techniques or have access to all equipment. At present, most RSPCA officers carry a .22 captive bolt and either a .32 Taurus/Cash pistol or a .38 Smith and Wesson pistol. Most will also carry pentobarbital solution (PBS). The only reason they would not carry PBS or the firearm is that they have yet to complete their training. The organisation also has eleven 12-bore shotguns located with certain officers around the country, all of whom have firearms licences to allow them to use solid slugs. It was a 12-bore shotgun with solid slug that was used with the pilot whale in Wales (UK, see Item 6.4.1.4). The RSPCA agrees that dolphins and porpoises can be dispatched with either PBS or pistol. It does not yet have any additional guidelines relating to the euthanasia of large cetaceans with firearms.

The physical methods used for shooting large cetaceans are summarised in Table 2.

6.4.1.2 PROCEDURES

The ballistic procedures currently used for shooting large cetaceans are summarised in Table 2.

6.4.1.3 VARIABLES AND CONSTRAINTS (ANIMAL SIZE, POSITION, LOCATION IN SURF/LAND, ETC.)

In any euthanasia event it is essential to take local conditions, expertise, laws and availability of equipment into account. Variables and constraints were discussed within the context of the various presentations and individual case reports; an overall summary of issues to be considered with respect to euthanasia approaches is given under Item 9.

6.4.1.4 EXAMPLES

Meyer began the discussion of the use of ballistic methods for large (up to 12.3m body length) baleen whale euthanasia by presenting three cases comprising two humpback whales and a Sei whale from South Africa. Two of these cases were considered successful. The third case was a humpback whale where conservation officers initially under-estimated body length (it had initially been estimated at 6m but when measured at necropsy it was 8.39m). The marksman was requested to stand in front, firing slightly from above, aiming 10cm behind the blowhole at a 45° angle (firing twice repeatedly down the same hole) using a .375 calibre weapon with full metal jackets. These instructions appeared to be followed but this did not euthanize the whale. After further consultation, further shots were fired into the head close to the site of the first shot. In total 12 shots, were fired into the head in an attempt to destroy the brain, and a further 3 laterally aimed for the heart. Shooting was unsuccessful and, at night, the whale drowned during the next high tide. The position and the trajectory of the bullet holes were examined using dowel sticks. Major cranial bone damage was found but when this bone was removed the cranium below was undamaged. During the necropsy, the box of ammunition was handed over indicating that the cartridges were in fact inappropriate (Super X H&H Magnum silver tip cartridges manufactured by Winchester, with a muzzle velocity of 2550 foot/second and muzzle energy of 4330 foot pounds). It is possible that, given the correct total length an alternative decision of euthanasia may have been chosen and it is important that the length be determined accurately during a stranding. PME indicated the area of the head recommended to be targeted was correct, and the absence of intact bullets in the whales head indicate that these disintegrated on contact with the bone. They did however deliver sufficient energy to break-up a proportion of the cranium. It is also possible, that had a number of shots been fired repeatedly at the specified site and angle, even using soft-tipped bullets, that they may have penetrated the skull. The recommendation of a .375 calibre firearm firing full metal jackets would likely have led to successful euthanasia. All of this indicates with greater emphasis the importance of following specified instructions and using specified equipment.

Table 2

Physical methods for potential use in larger whale euthanasia

Name	Effect/ Timing	Method	Species used on for euthanasia (reference)	Concerns		Comments	Cost Estimate Capital/ Disposable
				Human hazards	Environmental hazards		
Implosion	Cerebral pressure maceration/ Instant	Stabilize body, pyramidal charge, sandbags, detonate.	Humpback, right whale (Coughran 2012)	Explosion	Collateral damage to buildings	Need licensed shot firer	£0/£300
Ballistics	Brain and or spinal cord trauma/ Instant assuming good aim	Target brain or cervical cord, using landmarks	Pilot, orca, small humpbacks, false killer, minke	Overshoot and ricochet		<6 m (could be bigger).	£1500/£5
Sperm Whale Euthanasia Device (SWED)	Brain trauma / Instant assuming good aim	Lateral or ventral	Sperm	Recoil	None	Limited skill and equipment availability	£4500/£10
Explosive grenade	Cerebral, cervical and thoracic trauma/ depends on aim	Harpoon cannon 50 or 60 mm with penthrite grenade	None yet		None	Unavailable in many regions	£?/£?
Darting gun with explosive grenade	Cerebral, cervical and thoracic trauma/ depends on aim	Hand held darting gun with penthrite grenade	None yet		None	Unavailable in many regions	£?/£?
Exsanguination	Blood loss/ slow	Cardiac or axilla safest and fastest.	Sperm, right, pilot (Harms 2014)	Animal reaction - tail worst	None	Slow	£30/£0
Spinal lance	Decerebration/ cerebral function not lost immediately	Hand held behind blowhole into foramen magnum to sever spinal cord and vessels	None yet	Animal reaction	None	Used in Faroese pilot whale hunts but does not destroy brain	£?/£0

As discussed under Item 6.4.1.1, Coughran presented cases from Australia where ballistics are routinely used to euthanize whales <6m in body length, including those euthanized with hydrostatically stabilised bullets. Woodleigh® bullets are hydrostatically stabilised non-deforming solid bullets. These projectiles are constructed from copper-alloy (see Thomas, 2013) and have been developed to allow deep tissue penetration in large, thick boned game species. These projectiles were chosen on the basis of blunt-nosed non-deforming projectiles having previously been shown to successfully penetrate cetacean craniums (Øen and Knudsen, 2007) while shotgun solids, expanding projectiles and pointed-nosed projectiles have proven unreliable (Blackmore *et al.*, 1995; IWC, 2000) (Hampton et al in prep).

Grogan presented two dolphins and a pilot whale. In December 2011 a striped dolphin was stranded near to Milford Haven. This dolphin was emaciated but had been re floated by rescuers and subsequently stranded a second time. The animal was shot with a slaughter pistol using a single round (.32 ammunition) through the open blow hole at a 45 degree angle facing the tail and at point blank range. The officer who performed the operation was quite concerned about the procedure but the PM report stated that the animal died instantly. In comparison, the same RSPCA officer was asked to attend another dolphin that had stranded at Port Talbot in the spring of 2012. Again this dolphin was emaciated and the decision was taken to euthanize the animal. This was done by a vet with pentobarbital solution (PBS) into the vein in the tail, but this method appeared to this officer to take longer than shooting to kill the animal.

Pilot whale, Milford Haven, 2012 was around 5m long and had beached at Milford Haven in Wales. The whale was lulling around in about 1.25 metres of water and seemed "very distressed". It was agreed that euthanasia was the best

option and the animal was shot with a shotgun at point blank range through the blow hole with a solid 12 gauge slug. Two shots one after each other and then a third, with the angle varied on each shot. The operator was standing in the water. In hindsight a shot from the boat alongside the whale would have been preferred, but the necropsy confirmed the animal had been euthanized effectively.

Another successful UK euthanasia case involved a stranded 4.87m long juvenile female minke whale in Scotland in 2013, which was shot with a single shot Blaser deer and moose stalking rifle with 6mm by 65mm, 129 pullet exploding projectile.

6.4.1.5 SAFETY

As with chemical agents, all ballistic techniques for euthanasia of stranded cetaceans come with associated risk. Risks include harm to human individual(s), risks to the general public and risks to the environment. The various risks (human, domestic animal/wildlife and environmental) of the different ballistic methods used for cetacean euthanasia are summarised in Table 2.

6.4.2 Explosives

6.4.2.1 TYPES OF EXPLOSIVES, EXAMPLES OF PROCEDURE

Coughran summarised Coughran *et al*. (2012), which presented information on a safe, effective method of euthanasia for large beached humpback whales using a cranial implosion technique to achieve the quickest time to death currently available to operational staff from the Western Australian Department of Parks and Wildlife (DPaW).Initial triage evaluation of a beached live large whale presents many difficult management considerations; an injured or weak, non-responsive whale cannot simply be dragged out to sea. If left unmanaged once washed ashore, such whales could attract sharks and increase the likelihood of shark attacks on humans. Doing nothing is rarely a desirable option in Western Australia unless the animal is moribund and likely to die in a short time frame. Experience has shown that some whales may in fact take weeks to die because their accrued fat reserves enable them to survive without eating for extended periods, despite being too weak to swim and feed. If a whale is likely to suffer for an extended period of time then euthanasia must be considered. The DPaW Ethics Committee is fully appraised of such processes and obtaining endorsement from that Committee's is an essential part of the management process. Audits are undertaken to ensure the humane handling of all events. The basic pathways for managers are rarely straightforward, however. For example, the management process can be vulnerable to complication by human emotion and unrealistic expectations (particularly from the media) that continually work against open systems based learning processes that are much needed in this field. Cultural sensitivities are also a potentially important factor for consideration prior to euthanasia (e.g. Aboriginal cultural practices).

However the fundamental challenge relates to the technical difficulty of euthanasia of an animal of such sheer size. Chemical and small ballistic methods are considered inappropriate in Australia for the humane destruction of larger species such as baleen whales (Blackmore *et al.* 1997). In Western Australia the Department of Parks and Wildlife (DPaW), formally the Department of Environment and Conservation (DEC), is responsible for the administration of the *Wildlife Conservation Act 1950*; managing issues relevant to fauna as defined under that Act, which includes whales (cetaceans). In this capacity, DPaW has adopted the Australian Inter-Service Incident Management System (AIIMS), which provides a total systems approach to all incident management involving risk. The Police Department is responsible for the critical issues of public safety that emanate from public proximity to powerful animals and from the use of explosives, and local government authorities are responsible for public health issues and are therefore always involved in the management of each whale beaching incident. In Western Australia, a shot-firer's licence, issued under the provisions of the *Explosives and Dangerous Goods Act 1961*, is required to handle and use explosives and the use of explosives involves considerable expertise, for which DPaW relies heavily on outside personnel and agencies, including the military. More details of the actual euthanasia process are summarised under Item 6.4.2.4 below

Meyer presented on the use of explosive euthanasia methods for large whales in South Africa. The national authority (the Department of Environmental Affairs) is assisted with large whale euthanasia throughout the country by the South African Police and local Disaster Management groups. Human safety is paramount and only suitably qualified and active police explosive unit members with experience in large whale euthanasia or having practiced on large whale carcases are permitted to undertake implosions.

Key factors in the decision making process include species, location, size of the animal, especially the structure and thickness of blubber, muscle and skull. The most common species involved are adult southern right whales and humpback whales; suggested charge sizes are 6kg for southern right whales and 4kg for humpback whales. Since *Conepak CP40*[1], the preferred explosive, degrades over time, Meyers noted that the police have recently replaced this product with PE 4, a military explosive hand packed into *Conepak* casings. Electrical detonators have been replaced with water proof *Allen Vanguard shock tube initiators* to eliminate risk concerns over static electricity and radio interference. As elsewhere, key factors in a successful event are:

[1] http://www.oricaminingservices.com/

(1) stabilisation of the whale;

(2) amount of charges;

(3) position and placement of charges;

(4) conveying of information and reasons for euthanasia to the public; and

(5) safety issues.

In calm conditions sandbagged charges are held in place with two weighted ropes. In high energy areas or if animal partly in water, 4 small lines with fish hooks and weighted sandbags are used to hold charges in place. Public/media and vehicles are moved to a safe distance using City law enforcement officers and the public are kept informed by the incident controller (via loudhailer if necessary). Police also inform local residents if houses are nearby, to e.g. open windows to avoid air blast (over-blast pressure wave) damage. An audible warning and countdown are given prior to the blast.

Six case histories were considered (see Item 6.3.2.4) and discussed and possible improvements suggested where appropriate.

A comprehensive list of euthanasia protocols using explosives was compiled. This included a summary of the method, timing, effects, species used (with references) and an assessment of capital and consumable costs and an assessment of the risks for human operators and wider environment concerns (Table 2).

6.4.2.2 PROCEDURES

The technique for peri-cranial implosion currently used for euthanasia of large cetaceans is summarised in Table 2 and described in detail in Coughran *et al.* (2012).

6.4.2.3 VARIABLES AND CONSTRAINTS (ANIMAL SIZE, POSITION, LOCATION IN SURF/LAND, ETC.)

Variables and constraints were discussed within the context of the various presentations and individual case reports (see Items 6.4.2.1 and 6.4.2.4).

6.4.2.4 EXAMPLES

Coughran presented cases from Western Australia where commercial grade directional charges (cranial implosion) are routinely used to euthanize whales >6 metres in body length. The cranial implosion technique is described in detail in (Coughran *et al.*, 2012). He showed a photo of the baleen whale skull illustrating that the optimal position for explosives in baleen whales is a dorsal position where the skull is relatively thinner than the lateral route.

Some focus was placed on an example of a 9.5m humpback whale which entered Albany harbour, became lodged on a sand bank and was only fully exposed at low tide. The team felt that it was too active to intervene safely. When it became sufficiently moribund after two weeks, a decision was reached to intervene. The explosive charge was successfully placed on the lateral side of the head (this was the only stable platform available for location of the explosives in this case) and detonated. One unexpected problem associated with case 2 described in Coughran *et al* 2012 was a low-altitude media helicopter overflight that risked premature explosion of the detonator via RF signal; yet again this emphasises the importance of managing the public and the media.

Coughran also presented the first trial of the cranial implosion technique on a toothed whale – a dead 10.8m sperm whale that had stranded in Western Australia in August 2013. The approach followed Coughran *et al.* (2012). The whale was in a lateral position and the explosive charge was placed 60cm directly posterior to the left eye. The total charge consisted of 22 sticks of 125 gram Powergel Magnum explosive secured with rope and sandbags. The sticks were taped together to form a pyramid and two detonators were used. The charge, which was detonated safely once all personnel were at a safe distance, created a 0.5m x 0.8m elliptical deficit in the skin and blubber. There was full thickness penetration of the posterior lateral aspect of the left side of the head with severe fracturing to the skull and massive trauma to the cranial structures. The massive destruction to all local cranial structures confirmed that instantaneous insensibility and death would have resulted in a live animal. He concluded that the positioning of the explosive charge was ideal for a sperm whale. This method of lateral placement of explosive charges was also deemed appropriate for public and operator safety. A trial of this technique on a live stranded toothed whale would be considered ethical based on the findings of this post-mortem study. The method is likely to provide the most rapid death of all options currently available in Australia for the euthanasia of large stranded toothed whales.

As with all euthanasia methods, Coughran **emphasised** the need to **test methods on dead animals** first to develop methodological expertise and obtain correct anatomical knowledge (e.g. necropsies on strandings). The use of sandbags (or water bags) to assist the focus of the implosion was recommended, care must be taken to ensure sandbags filled with sand do not contain rock to avoid rocks becoming projectiles on detonation. It was noted that in Australia, unlike South Africa, stranding responders are only able to obtain civilian grade explosives that are cheaper but less effective than military grade.

Meyer presented information on six successful cranial implosion cases in South Africa during a 12 year period (August 2001 - 2013), comprising four humpback whales and two southern right whales using formed (directional) explosives charges. The latter a 10.4 m right whale (sub adult female) and neonate forms the only two records of right whales at the workshop euthanized using explosives.

Amaira presented information on unexploded ordnance disposal by the Royal Navy in the UK. The Royal Navy have assets/teams around the UK to dispose of ordnance on a planned and reactive basis. They have a variety of tools/equipment available including a user-filled shaped charge which could be used for cranial implosion euthanasia technique in the UK. The Royal Navy also possess other potential methods for large whale euthanasia including a range of powerful ballistics. The Royal Navy also operate under a recognised legal framework for beach ordnance disposal, which could be applied to site-management for whale euthanasia. The authority to deploy these methods would need to come from another lead agency (yet to be identified in the UK). The lead authority would be responsible for environmental control and press liaison.

The Workshop **commended** the **progress** that had been made with the various **physical methods of euthanasia**.

6.4.2.5 SAFETY AND OTHER CONSTRAINTS

All explosive techniques for euthanasia of stranded cetaceans come with associated risk. Risks include harm to human individual(s), risks to the general public and risks to the environment. The various risks of the different explosive methods used for cetacean euthanasia are summarised in Table 2.

6.5 Relevant whaling tools and techniques

Considerable work has been carried out in several countries to improve weapons used for whaling in the last decades. Øen presented a detailed and historical overview of much of this work.

6.5.1 Exsanguination

Old style whaling often relied on exsanguination to achieve death of the animal. Harms presented a case of a northern right whale that stranded on offshore sand banks where access was only possible by helicopter at low tide. Over a two day period a cocktail of several drugs (meperidine, acepromazine, midazolam, medetomidine) was injected (intramuscular and retrobulbar) in addition to intranasal administration of acepromazine and isoflurane. Death was finally achieved by exsanguination via a deep cut to caudal peduncle. The time to death after the cut was 64 minutes and the euthanasia attempt was therefore considered unsatisfactory.

Yamada provided background on dealing with cetacean strandings in Japan where there is no formal national or prefectural policy on cetacean euthanasia. He described the difficulties he experienced in obtaining chemical agents to humanely euthanize cetaceans. He presented a case history on a single stranded sperm whale neonate that was euthanized. The animal was exsanguinated via cardiac puncture with a preceding dose of chloroform, which was the only available chemical material for relief, through the airway expecting an anesthetic effect to reduce the distress. Time-to-death was estimated to be approximately 18mins.

The Workshop **agreed** that exsanguination could be considered as a method for euthanasia *in extremis*, but is not recommended routinely due to the welfare issues related to potentially prolonged times-to-death (Table 3).

6.5.2 Penthrite grenade

Øen presented on the use of supersonic explosive penthrite grenades developed for and used in the hunt of large cetaceans of various species in Greenland, Iceland, Japan, Norway and USA (Alaska). Except for the fin whale hunt in Iceland (which uses a larger gun) the grenades are delivered with small type whaling harpoon guns or hand held Darting guns (Alaska). The penthrite charges vary by species and operation but are relatively small (22g, 30g, 45g and 100g).

Penthrite detonates at a very high speed creating series of excess (very high) and negative (sub) pressure waves that travel extremely fast through the body. These alternating pressure waves causes severe and fatal neuro-trauma and intra-cerebral bleedings and have a devastating effect also on other live tissues. Penthrite has been shown to be highly effective to kill whales. When the target is immobile like an entangled or stranded whale a 100% instant kill can probably be assured. The hand-held darting gun used by Alaskan Eskimos would probably be most useful and effective penthrite delivery system to euthanize both large stranded and entangled whales but needs some further development. Using penthrite, the grenade should be directed to the chest or neck area. These weapons are probably the most rapid and effective tools for entangled and stranded whale euthanasia in countries and regions where penthrite grenades and delivery weapons already exist (Greenland, Iceland, Japan, Norway and USA (Alaska)).

6.5.3 Firearms (and see Item 6.4.1)

Øen presented information on studies and practical experience on the use of rifle bullets in whale hunts that can assist in developing euthanasia techniques for stranded or entangled animals; the objective was to determine/develop equipment that led to specific terminal ballistic characteristics. Different bullets are used for several types of hunt of

various species. Small cetaceans such as white whales, narwhals, pilot and killer whales are regularly hunted using rifles. For euthanasia of cetaceans up to the size of a pilot whale, he recommended use of soft pointed or full jacket bullets with minimum calibre .30-06. Large calibre rifles of .375 and .458 with round nose full-jacket bullets (and see Item 6.4.1) have been demonstrated to be very effective to euthanize minke whales and also a 12.5m stranded male sperm whale. However, as water has a braking effect on bullets, shots should never be directed to body parts that are under water. The shot should be directed at the brain or upper neck to secure instant death.

In organs with no room for expansion like the brain, the sudden energy transformation from a passing projectile will cause an almost explosive rise in the internal pressure and the brain therefore might be almost totally damaged ('Krönlein' shots). Successful use of rifle depends largely upon the gunner knowing where to aim the shot. Figures and anatomical maps showing the position of the brain and higher neck in relation to external features like flippers, eyes, blowhole etc., have been prepared at the Norwegian School of Veterinary Science for minke whale hunters. Similar diagrams/maps are also needed for other cetacean species where the rifle can be recommended for euthanasia.

6.5.4 Lance

Øen described the use of the spinal lance in conjunction with a ball-pointed blowhole hook for small cetacean hunts in the Faroe Islands, where the lance is used to sever the spine and disrupt the vascular perfusion to the brain. He noted that there had been considerable work on improving the techniques used in the Faroe Islands with the North Atlantic Marine Mammal Commission. The use of the new 74 cm long spinal lance is now mandatory in the Faroe Islands. The Workshop **agreed** that this approach was not suitable for large whales. Given its terms of reference, the Workshop did not discuss small cetacean euthanasia methods.

6.6 Other euthanasia and rapid killing techniques

Methods of euthanasia via asphyxiation with argon gas or water (drowning) were discussed. Butterworth noted that argon gas is used for euthanasia in domestic animals but none of the workshop participants had any experience of actually using it in any cetacean species. In the absence of any data or personal experience the workshop **agreed** that it could **not be recommended** as a viable and effective method for euthanasia of stranded cetaceans.

7 CARCASS DISPOSAL

The Workshop spent relatively little time on this particular item. It noted that a range of carcass disposal methods exist including beach burial, landfill burial, disposal at sea, incineration, rendering and composting. There is considerable variation in methods between countries, partly as a result of legal requirements and availability of equipment. The Workshop **stressed** that the use of chemical euthanasia options may preclude some methods. It was noted that in the UK, chemical euthanasia usually renders incineration the only allowable option. The Workshop **recommended** that for chemical methods, removal of the injection site to limit risk of disposal and potential for relay toxicity is a minimum requirement. It noted that disposal of carcases after the use of chemical agents may be particularly problematic in some environmentally sensitive areas (e.g. aquaculture and Marine Protected Areas).

The Workshop also noted that burial at sea can introduce risks associated with shark scavenging (e.g. off South Africa). Leeching of oil or exposure of body parts can also be an issue with burial on beaches with soft substrate. In the USA, composting is felt to be a good method of carcass disposal (Schwarz et al 2013). The Workshop highlighted the need to respect any cultural factors in carcase disposal such as that relating to indigenous communities (e.g. in New Zealand, Australia and Hawaii).

8 NEEDS AND CONSTRAINTS IN VARIOUS ENVIRONMENTS

8.1 Consideration of responses in mass vs. single strandings

Gísladóttir described the background to live stranding responses in Iceland with an emphasis on two examples of difficult mass stranding events of smaller cetaceans occurring in 2013. There are guidelines provided in a national response plan for strandings in Iceland but there is relatively little training or a formal chain of command.

The first event involved six killer whales, two of them young calves, stranded on a sandy beach in bad weather and heavy surf. The responders found one adult and one calf already dead, managed to refloat one adult whale and one calf although their ultimate fate is unknown, and successfully euthanized the remaining two using a .416 cal hunting rifle.

The second event involved an unknown number (50-300 approx.) of pilot whales which entered a harbour during a bad storm. A large number of the whales stranded: some dead, some moribund and some alive. Members of the public tried to rescue or, where not possible, euthanize the whales. Some members of the public took meat from the dead animals. Methods used for euthanasia were not followed according to the guidelines in the national response plan, with most of them exsanguinated without sedation. The great difficulties in managing such a large event were stressed.

The Workshop recognised the particular difficulties associated with mass strandings. Reiss and Simmonds presented a short review on the social, behavioural, communicative and cognitive aspects of stranded cetacean rescue and euthanasia scenarios. They suggested that there is a potential for stress or distress in stranded cetaceans in close proximity to others that are euthanized during mass stranding events. They noted that this matter would benefit from further consideration relating to mass stranding events and the likely effect on conspecifics of distressed individuals in the shallows or on the shore.

The Workshop **agreed** that there was merit in holding a subsequent Workshop, perhaps under the auspices of the IWC, which could consider the specific management, social, welfare and euthanasia aspects of cetacean mass stranding events.

8.2 Lack of training or resources

The Workshop **recognised** the need to learn and practice new and existing euthanasia techniques on large dead cetaceans prior to the use in live stranded cetaceans. Gaining experience is not easy as thankfully live stranding events are relatively rare. The Workshop also recognised the difficulties of setting up schemes in countries with long and sparsely populated coastlines and in developing countries where resources are rare. Despite the difficulties, the Workshop **strongly recommends** that euthanasia of cetaceans should not be conducted by untrained personnel, as this may endanger humans and increase the suffering of the animals.

8.3 Cultural factors

The Workshop **agreed** that local cultural factors must be carefully considered as part of an effective euthanasia management plan.

9 DECISION TREE AND RECOMMENDED TECHNIQUE MATRIX: GUIDELINES AND PRINCIPLES

As noted at the Maui Workshop (IWC, 2012), the development of any 'decision tree' should be regarded as a dynamic process that is refined based on shared experiences and increased data collection and analyses. The present Workshop recognised that while there may be generic guidelines, each case needs to be treated on an individual basis and decisions taken will depend on a large number of factors related to human safety and the welfare of the animal or animals involved. The Workshop **stresses** that human safety should always be considered paramount, as is the case with disentanglement efforts (IWC, 2013). The key components/decision points can be summarised as follows (note that these are not mutually exclusive and some components will take place simultaneously):

- taking an informed decision as to the appropriate course of action once a live stranding has been reported;
- if the decision is taken that euthanasia is an appropriate response, what method should be used;
- manage public expectations and behaviour, providing as full information as possible on the process being undertaken;
- collection of appropriate data, full documentation of all aspects of an event and the sharing of experiences/data to refine decisions and situation handling in the future.

In the sections below, the Workshop highlights some of the major factors that should be considered under each of these headings. It **notes** that local legal, cultural and logistical/financial considerations may be very different and that it is not possible to develop a single definitive decision tree. The Workshop **stresses** the need to understand and recognise the many cultural, political and socio-economic differences that exist between (and within) countries that will influence the availability and choice of euthanasia techniques.

With respect to the overall process, experience has shown that it is extremely important for countries/organisations to proactively establish an incident response protocol so that when live strandings are reported, appropriate agencies and organisations are aware and understand their roles and responsibilities. The Workshop **recognises** the need for the development of collaboration between national and provincial/state authorities, the military and police, scientific institutions and rescue organisations in dealing with stranding events, noting the benefit of pre-emptive clear delineation of responsibilities and a decision framework.

The Workshop **recommends** that IWC member nations refine existing or develop new incident response protocols based on the principles and guidelines found in this report. To assist in this process, collaboration with other relevant organisations is **encouraged** e.g. the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic Sea (ACCOBAMS) and the Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS)**.** IWC countries with existing protocols are **encouraged** to submit them to the Commission for inclusion on the IWC website (see below) to provide examples

for those without protocols to assist in their development; the question of translation of protocols into various languages should be considered by the Commission.

As noted under Item 8.1, for a number of reasons, mass strandings represent considerably more difficulties both from the point of view of logistics and from an animal welfare perspective. The Workshop did not have the time or data to fully address this issue and this is discussed further under recommendations for future work.

9.1 Taking an informed decision as to the appropriate course of action once a live stranding has been reported

The Workshop agreed that while successful rescue is the ideal outcome for live stranded large whales, in most cases, rescue will be difficult, if not impossible. Rescue attempts, however well-intended, may subject animals to significant stress and pain; they should only be undertaken under the supervision of trained personnel and ideally after a full evaluation by experienced veterinarians. It is essential to manage the expectations of all involved including potential rescuers as well as the public and media. In deciding whether or not euthanasia is the appropriate response, several factors need to be considered, of which human safety is paramount, followed by the welfare of the animal. In any cetacean stranding event, precautions against zoonoses (a disease or infection that is naturally transmissible from vertebrate animals to humans and vice-versa) must be taken.

As noted in previous IWC Workshops (IWC, 2012; 2013), any decision to euthanize should be based on a careful scientific and practical evaluation of an individual situation, not perceived or actual public pressure. It is important that all involved are aware of who has the final responsibility for the decision. Key factors involved in making the decision whether to attempt rescue, carry out euthanasia (which may occur after rescue attempts have failed as well as being the initial decision) or allowing the animal to die (with palliative care, if possible) can be summarised as:

(1) An evaluation (ideally by an experienced veterinarian) of the health status of the animal or animals, the likely prognosis and the level of suffering;

(2) Local environmental conditions (including ease of access, substrate, weather);

(3) Factors relevant to public health and safety; and

(4) Availability of expertise and equipment.

The Workshop **recognises** that taking such a decision will often be difficult and involve a complex risk assessment. It is important to try to ensure that ideally before and certainly once a decision has been taken, the public and media are informed of the process and any decisions, and that all agencies and organisations involved provide the necessary support to the decision maker. The Workshop offers the following more specific advice.

(1) Wherever conditions preclude adequate human safety (including personnel involved in potential rescue and/or euthanasia), management of the beach and public until and if conditions change should be the priority, while letting nature take its course for the whale.
(2) High surf, difficult boat or vehicle access, tidal range, rocky area and sharks all reduce the chance of re-floatation. Animals trapped swimming in a lagoon have a better prognosis compared to those that are beached. Repetitive strandings worsen the prognosis.
(3) Beached large whales have a fundamentally poor prognosis that worsens with time; large live stranded whales are less likely to survive than smaller ones although there is species variability. Large whales are not suitable candidates for rehabilitation facilities. Dependent calves and neonates will not survive without a mother. In mass strandings, the mother may be difficult to identify.
(4) Poor prognostic indicators include: poor body condition, demeanour, cyamid proliferation, weak respiration, abnormal haematology or serum chemistry, chronic entanglement, physical injuries such as propeller wounds, blunt trauma, spinal deviation, extensive blistering, peeling, and scavenger damage. Apparently healthy animals may still have a very poor prognosis given prevailing conditions.
(5) After failure to refloat after two high tides, prognosis is very poor. At this time, plans in place for euthanasia should be implemented.
(6) Without suitable resources including the availability of sufficient expertise and equipment, rescue or euthanasia may not be practical.

9.2 If the decision is taken that euthanasia is an appropriate response, choosing an appropriate method

If, after careful consideration of the above factors the decision is made that euthanasia is in principle the most appropriate response, then a number of factors must be taken into account. As discussed earlier in the report, several methods to achieve as rapid and painless a death as possible have been developed and the strengths and weaknesses of these are summarised in Tables 1-3; not all of these will be available in each country or region for legal, cultural, logistical or financial reasons. The Workshop **stressed** that euthanasia **must not** be carried out by untrained personnel.

A decision whether or not to incorporate sedation/relaxants into the euthanasia process must also be taken based on availability, logistics (including expertise) and the welfare of the animal. However, it is strongly suggested that it is attempted for chemical euthanasia methods.

Tables 1-3 represent a valuable summary of the appropriate tools and information on factors needed in the decision-making process. In terms of individual decisions, the **most important factors** are:

(1) Whether the appropriate expertise and equipment can be brought to the scene in an appropriate timescale;

(2) Whether human safety (of the personnel undertaking euthanasia as well as people in the vicinity of the event) can be guaranteed;

(3) Factors related to the safe disposal of the carcass.

As noted under Item 9.1, it may be decided that it is not possible to safely and effectively euthanize an animal and that applying palliative care until the animal dies, if possible, may be the appropriate course of action.

Table 3

Assessment of methods for potential use in stranded baleen, beaked and sperm whale euthanasia. [N.B. Assumption of effective use and appropriate mitigation in all methods]

Method	Time to Death	Potential for pain & distress Low/medium/high	Level of mitigation required for human safety Low/medium/high	Level of mitigation required for environmental safety Low/medium/high
Pre-medication + KCl	Minutes	Low	Low	Medium
Pre-medication + Pentobarbital	Minutes	Low	Low	High
Pentobarbital	Minutes	Low	Medium	High
Ballistics	Instant	Low	High	Low
Implosion	Instant	Low	High	Low[3]
Sperm Whale Euthanasia Device (SWED)	Instant	Low	Medium	Low
Explosive grenade[1]	Instant	Low	Medium	Low
Darting gun with explosive grenade[2]	Seconds	Low-medium	Medium	Low
Pre-medication + exsanguination	Many minutes	Low	Medium	Medium

[1]Only in water
[2]Needs modification for safe use on beach
[3]If no habitation in vicinity

9.3 Managing public expectations and behaviour

Strandings and euthanasia protocols must consider the issue of public safety. The issue of managing public expectations and behaviour has been shown to be of great importance for any live stranding event. Clearly, numbers of 'spectators' at an event will depend on several factors including ease of access and weather; however, numbers of 'virtual' spectators can be enormous given modern communications and media. It is clearly important to try to provide as much clear information as possible in a timely manner to the public and media, on the decision making process as well as the rationale behind the course of action chosen and the practical action being taken. While the precise way in which this is handled will depend on local conditions, it is important to determine who will provide the information and how, in line with the incident response protocol. Live stranding events that lead to euthanasia in accessible areas normally involve the police in some countries.

The Workshop **stresses** that having internationally agreed principles and guidelines such as those incorporated in this report that are made publicly available will greatly assist in providing information to the public and in managing expectations; while not an easy message to communicate, being able to explain a decision process that may not result in rescue attempts is vital.

This issue is considered further under Item 10.

9.4 Data collection, documentation and training

The Workshop recognised that live stranding events are relatively rare; determining and evaluating appropriate responses including different euthanasia approaches is thus difficult with low sample sizes and multiple affecting

factors. It therefore **stresses** the need, for each event, for the collection of appropriate data, full documentation of all aspects of an event and the sharing of experiences/data to refine decisions and situation handling in the future. This process has begun at the present Workshop and all participants recognised the great value of the information provided on both successes and failures; the latter can be extremely informative in developing improvements and preventing mistakes being repeated. A number of data collection and reporting protocols exist in different countries. Based on protocols available to the Workshop and expertise within the group, a broad template was developed to assist future data collection and reporting efforts; this is given as Annex C and the Workshop **recommends** the broad template outlined. As discussed below, it also **recommends** that the IWC facilitates the exchange of information amongst experts (see Item 10.1 below), including continuing to publish relevant papers in the *Journal of Cetacean Research and Management* (e.g. Coughran *et al.*, 2012; Øen and Knudsen, 2007).

The Workshop also **recommends** the addition of a number of 'outcome' fields to the existing IWC National Progress report database for live strandings: released/rescued; euthanized (method categories as in Table 3); no intervention.

The Workshop **stresses** the great importance of practise and training for both existing and potentially new techniques. Many of the advances that have been made to date have involved experimentation and training with dead animals and the Workshop **recommends** that this continues; it does not recommend proceeding to work on live strandings without first gaining experience on dead animals.

Finally, the importance of post-mortem examination of animals that have been euthanized is **emphasised** where this is possible. Information from such examinations is essential to evaluate and refine different techniques.

9.5 Contact list of cetacean euthanasia experts

The Workshop noted the value of establishing a voluntary group of experts that can be consulted by the IWC and others to: (1) provide advice on protocols and methods to relevant authorities; (2) provide objective information to the media if requested and (3) assist the IWC Secretariat in populating the IWC website. The Workshop **recommends** that this list be maintained by the IWC Secretariat.

10 DISSEMINATION OF PRINCIPLES AND GUIDELINES AND OTHER MATERIALS DEVELOPED

10.1 Through the IWC

The Workshop noted the great potential of the IWC to facilitate work on live strandings and euthanasia techniques. It noted that the approach developed with disentanglement provides a valuable model (IWC, 2013). It therefore **recommends** the establishment of a live stranding response component of the IWC website with a layered capacity which includes:

> (a) a public component that provides a broad overview of the issue and highlights the principles, including the need for responses to be overseen in all cases by experts, and guidelines, links to existing strandings and euthanasia protocols;
>
> (b) a public but more scientific component that summarises the available approaches and data with links to relevant reports and publications which will be of relevance to marine mammal scientists, veterinarians and pathologists; and
>
> (c) a secure section for accredited experts that *inter alia* allows exchange of ideas and data, including provision of information, requests for advice, the ability for discussion of particular events and situations and the collation of practical guides/schematics for application of various euthanasia techniques.

The Workshop noted that an improved public component of the website and dissemination of the principles and guidelines will also assist local scientists and veterinarians in the provision of information during events.

The Workshop also **stresses** the extreme importance of training and exchange of expertise. It **encourages** IWC countries to facilitate the exchange of information, expertise, technology and training.

10.2 Interfacing with the public

10.2.1 Communicating with scientists

The Workshop recognised the importance of disseminating information to other relevant scientists including veterinarians, animal welfare experts and marine mammal biologists. It suggested that this could be achieved by presenting information to the relevant professional bodies (e.g. Society for Marine Mammalogy; European Cetacean Society; International Association for Aquatic Animal Medicine). It also noted the value of the scientific component of the IWC website (Item 10.1 (b) above) in this regard.

10.2.2 Media

A large whale stranding presents a complex problem as it raises issues of animal welfare, public safety and personal safety (of public officials), and is usually the subject of intense public concern and interest and of extensive media scrutiny. The Workshop recognised the importance of dealing with local and national media that will vary from region to region. It **agrees** that the improvements to the IWC website proposed above will assist greatly in adding an international perspective that can be used by local responders. It also noted the challenges that arise out of the widespread use of social media including Facebook, YouTube and Twitter. The list of experts discussed under Item 9.4 can play a role in informing the media; while they would not formally be speaking on behalf of the IWC, it was **agreed** that it was appropriate for the Secretariat to provide names of appropriate experts in response to media enquiries.

10.2.3 General public (e.g. key messages, avenues to communicate)

The Workshop **agrees** that it was important to ensure that the public (and the media) are provided with concise and accurate information about live strandings of large whales, which may have suffered critical internal injuries when beached even if externally they appear 'healthy'. One common reason for euthanasia of an immovable healthy animal is if it is lying on its side, and it is starting to drown as the tide returns. Failure to communicate the basis for such a decision can lead to substantive online criticism. The website(s) of response organisation(s) are a valuable channel of both background material and situation updates, and should keep pace with other channels of public and media communication. As noted under Item 9.1, rescue is the least likely outcome and rescue attempts may increase the suffering of animal before it dies. Euthanasia is often the most suitable response from an animal welfare perspective and human safety is paramount. However, euthanasia of such large animals is normally difficult and may not always be possible. Methods available fall under three categories: chemical, ballistics and explosives. Which is most appropriate and practical will depend on local circumstances and efforts should only be undertaken by trained experts. Cetacean brains are extremely well protected and while use of explosives may appear to be extreme, with appropriate expertise and explosive power, it is extremely effective for large animals.

11 DATA GAPS, PROMISING RESEARCH AND FUTURE DIRECTIONS

With respect to data gaps, the Workshop referred to its recommendations above on data collection and exchange (e.g. see Items 9 and 10). Tables 1-3 summarise what is known about methods but the Workshop **agrees** that more work is needed on the environmental persistence and potential effects of some chemical methods and **encourages** this research and provision of information. The Workshop **notes** the importance of composting as a safe and environmentally positive means of disposal of cetacean carcases (Schwarz *et al*. 2013); it **encourages** national and local authorities to facilitate this method of disposal where appropriate.

The Workshop recognised the effectiveness of penthrite and **encourages** the development of a darting-gun type delivery system that it is suitable for beached animals and may also be appropriate for entangled whales at sea. It **requests** that a progress report is provided to the 2014 Annual Meeting of the IWC.

Related to this, the Workshop **endorses** a previous Workshop recommendation (IWC, 2012) concerning the need to develop methods for euthanasia of cetaceans at sea (entangled or otherwise requiring human intervention). It **agrees** that this may be facilitated by the holding of a future technical Workshop and **requests** that this be considered further at the 2014 Annual Meeting.

At several places in this report, the Workshop highlighted difficulties with mass stranding events. It therefore **recommends** that the IWC consider holding or facilitating the holding of a future Workshop on mass strandings events, including management, social, welfare and euthanasia considerations

12 OTHER

13 REVIEW AND ADOPT REPORT

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Annex A

List of Participants

Attendee	Country	Affiliation
Kevin Amaira	UK	Royal Navy
Arne Bjørge	Norway	Institute of Marine Research
Simon Brockington	UK	International Whaling Commission
Andrew Butterworth	UK	Bristol Veterinary School
Jim Campbell	New Zealand	Department of Conservation
Nicola Clarke	UK	Defra
Doug Coughran	Australia	Department of Parks and Wildlife
Rob Deaville	UK	Institute of Zoology
Greg Donovan	UK	International Whaling Commission
Sigríður Gísladóttir	Iceland	Office of Animal Health and Welfare
Nigel Gooding	UK	Defra
Jim Gray	UK	Defra
Adam Grogan	UK	RSPCA
Frances Gulland	USA	Marine Mammal Centre
Craig Harms	USA	North Carolina State University/Center for Marine Sciences and Technology
Paul Jepson	UK	Institute of Zoology
Rod Jones	UK	Royal Navy
Paul Kiernan	Ireland	Irish Whale and Dolphin Group
Pieter Koen	South Africa	Veterinary Services, Department of Agriculture
Cristiane Kolesnikovas	Brazil	Associação R3 Animal
Milton Marcondes	Brazil	Instituto Baleia Jubarte
David Mattila	USA	Centre for Coastal Studies Science/International Whaling Commission
Michael Moore	USA	Woods Hole Oceanographic Institution
Mike Meyer	South Africa	Department of Environmental Affairs, Oceans & Coasts
Egil Øen	Norway	Wildlife Management Service
Diana Reiss	USA	Hunter College, CUNY
Teri Rowles	USA	NMFS Office of Protected Resources
Emma Rundall	UK	Defra
Mark Simmonds	UK	Humane Society International
Michael Stede	Germany	Institute for Fish and Fishery Products
Marcy Uhart	Argentina	University of California
Kate Wilson	UK	International Whaling Commission
Tadasu Yamada	Japan	National Museum of Nature and Science

Annex B

Agenda

1. Introduction (Jepson)
2. Nominate Chair and Rapporteur
3. Review and Adopt Agenda
4. Review available documents
5. Overview of existing decisions, actions and obstacles, scene setting
6. Current rapid killing and euthanasia techniques (beached cetaceans)
    - 6.1. Review relevant information from IWC - Maui Workshop
    - 6.2. Chemical euthanasia
        - 6.2.1. Sedatives
        - 6.2.2. Lethal chemicals
        - 6.2.3. Injection techniques/equipment
        - 6.2.4. Examples
        - 6.2.5. Safety
    - 6.3. Physical euthanasia
        - 6.3.1. Ballistics
            - 6.3.1.1. Types and calibre of rifles
            - 6.3.1.2. Procedures
            - 6.3.1.3. Variables and constraints (animal size, position, location in surf/land, etc)
            - 6.3.1.4. Examples
            - 6.3.1.5. Safety
        - 6.3.2. Explosives
            - 6.3.2.1. Types of explosives, examples of procedure
                - 6.3.2.1.1. Australia
                - 6.3.2.1.2. South Africa
            - 6.3.2.2. Safety and other constraints
    - 6.4. Relevant whaling tools and techniques
        - 6.4.1. Exsanguination
        - 6.4.2. Penthrite grenade
        - 6.4.3. Others
    - 6.5. Other euthanasia and rapid killing techniques
        - 6.5.1. Examples
        - 6.5.2. Safety and other constraints
7. Carcass disposal
    - 7.1. Without chemical
    - 7.2. With chemical
    - 7.3. Sensitive areas (eg MPAs, turtle breeding areas and bather safety)
8. Needs and constraints in various environments
    - 8.1. Consideration of responses in mass vs single strandings
    - 8.2. Remoteness
    - 8.3. Lack of training or resources
    - 8.4. Cultural factors
9. Develop decision and recommended technique matrix
    - 9.1. Principles and Guidelines for data needed for decision points
    - 9.2. If decision is to euthanise, Principles and Guidelines for most humane killing
    - 9.3. Recommended Principles and Guidelines for best documentation in order to improve the decision matrix
    - 9.4. Contact list of cetacean euthanasia experts
10. Dissemination of Principles and Guidelines and other materials developed
    - 10.1. Through IWC (web, Stranding coordinators list, entanglement capacity building).
    - 10.2. Links to Governments
    - 10.3. Interfacing with the public
        - 10.3.1. Communicating with marine mammal biologists
        - 10.3.2. Liaison with other interest groups
        - 10.3.3. Media
        - 10.3.4. General public (e.g. key messages, avenues to communicate)
11. Data gaps, promising research and future directions
12. Other
13. Review and adopt report

Annex C

Example Cetacean Euthanasia Recording Template

Field Number: _____ Species: _____ Date: _____
Length _____ cm straight / curved, weight _____ kg actual / estimated
Euthanising Agency: _____ Initial Report Time: _____ Time of Arrival: _____
Officiating Veterinarian: _____ Lead Responder: _____
Location Description (Circle)**:** Marsh/mudflat Beach In surf Still/shallow water Bar/shoal other _____

Decision to perform euthanasia authorized by _____ and reason for euthanasia: _____

Pre-euthanasia Data Time taken:

Heart rate	_____beats/1 min	**Attitude**	Alert Lethargic Non-responsive
Resp. rate; exudate	_____breaths/ ____ min; Y N	**Body position**	Upright Left side up Right side up
Resp. character	Strong Weak Regular Irregular Other	**Eyes** (Open/Closed)	Palpebral reflex- Y / N Menace reflex- Y / N
Body condition	Robust Normal Thin Emaciated	**Movement**	None Arch Fluke Swim Tremble Other
Body temp. (°F °C)	Skin @ _____ Warm Cool	**Other:***(describe in comments)* Vocalize Vomit Feces Urine Lesions	

Method of Euthanasia: **Pre-euthanasia Sedation** **Chemical Method** **Non-Chemical Method (describe)**

(Circle all that apply)

Agent 1 (Agent may be chemical or nonchemical):

Location of animal for administration of Agent 1 (Circle)**:** Water Shore Vehicle Facility Other

Time of delivery		**Heart rate**	_____/1 min
Agent (drug & conc., or device)		**Resp. rate**	_____breaths / _____ min
Amount/size/type /caliber		**Resp. character**	Strong Weak Regular Irregular
Route (injections)	IM IV IP IH IC Other	**Attitude at time of delivery**	Alert Lethargic Non-responsive
Delivery site on body			
Response to agent			

Agent 2:

Time of delivery		**Heart rate**	_____/1 min
Agent (drug & conc., or device)		**Resp. rate**	_____breaths / _____ min
Amount/size/type /caliber		**Resp. character**	Strong Weak Regular Irregular
Route (injections)	IM IV IP IH IC Other	**Attitude at time of delivery**	Alert Lethargic Non-responsive
Delivery site on body			
Response to agent			

Agent 3:

Time of delivery		**Heart rate**	_____/1 min
Agent (drug & conc., or device)		**Resp. rate**	_____breaths / _____ min
Amount/size/type /caliber		**Resp. character**	Strong Weak Regular Irregular
Route (injections)	IM IV IP IH IC Other	**Attitude at time of delivery**	Alert Lethargic Non-responsive
Delivery site on body			
Response to agent			

Agent4:

Time of delivery		**Heart rate**	_____/1 min
Agent (drug & conc., or device)		**Resp. rate**	_____breaths / _____ min
Amount/size/type /caliber		**Resp. character**	Strong Weak Regular Irregular
Route (injections)	IM IV IP IH IC Other	**Attitude at time of delivery**	Alert Lethargic Non-responsive
Delivery site on body			
Response to agent			

Use additional data sheets if needed for further comments or if more than 4 agents were used

Post Euthanasia Data:

Time of death		**Carcass necropsied**	Y N
How determined		**Carcass disposal method**	Bury Landfill Render Other

Modified from Barco SG, Walton WJ, Harms CA, George RH, D'Eri LR, Swingle WM. 2012. Collaborative development of recommendations for euthanasia of stranded cetaceans. Final report to NOAA/NMFS for John H. Prescott Award #NA09NMF4390212. VAQF Scientific Report 2012-06. Virginia Beach, VA. 183 pp.

Comments/Diagrams/Photos:

On a scale of 1 – 5, how do you assess this euthanasia event? very poorly 1 2 3 4 5 very well

Circle any areas where problems occurred, and elaborate here or on separate page:

- ○ Personnel/public safety
- ○ Animal response/behavior
- ○ Drug/tool availability
- ○ Disposal
- ○ Media/public response
- ○ Other (explain)

Instructions for Completing the Cetacean Euthanasia Record

Overview

This form is modified from Barco SG, Walton WJ, Harms CA, George RH, D'Eri LR, Swingle WM. 2012. Collaborative development of recommendations for euthanasia of stranded cetaceans. Final report to NOAA/NMFS for John H. Prescott Award #NA09NMF4390212. VAQF Scientific Report 2012-06. Virginia Beach, VA. 183 pp. It has been adapted to accommodate both regions where chemical means of euthanasia are more prevalent, and regions where physical means are more widely used. It has also been somewhat simplified to facilitate field use. It was developed during an IWC Workshop on Euthanasia Protocols to Optimize Welfare Concerns for Stranded Cetaceans, held in London 11 – 13 September 2013, with input from an international panel of cetacean stranding responders. This form may be used directly, or as a model for developing region-specific forms, to encourage collection of pertinent data surrounding cetacean stranding events that can be used to improve procedures, protocols, and methods for reducing animal suffering when euthanasia is selected as the best course of action.

Identification Section

Field Number: Unique identifying number originally assigned to the animal by responder/responding organization.
Species: Genus and species and/or common name of animal.
Date: Date that the euthanasia was performed.
Euthanising Agency: Name of the lead Stranding Organization or agency performing the euthanasia.
Initial Report Time: Time of the earliest known report of the animal to the responding agency.
Time of Arrival: Time of arrival on scene by the responding agency.
Officiating Veterinarian: Name of veterinarian performing or consulting on the euthanasia.
Lead Responder: Name of authorized person supervising the event. This will generally be the lead on-site representative of the responding agency.
Location Description: Circle the most accurate description of the stranding location.

Use **Comments** section and extra pages to expand on any section requiring further explanation.

Decision to perform euthanasia authorized by _____ and reason for euthanasia _____: enter the name of the individual and regulatory authority who authorized the euthanasia, and document factors that lead to the euthanasia decision (*example: severe, injury, species, size, age, logistics, etc.*)

Pre-Euthanasia Data Section

Pre-euthanasia data time taken: record the time of initial examination

Heart rate: record the number of heart beats in 1 minute as determined by palpation, auscultation, or ECG.

Resp. rate; exudate (Respiratory rate: respiratory exudate): record the number of breaths per unit time (usually 3 – 5 minutes). Circle Y if respiratory exudate is observed around the blowhole and write description in comments section (example: clear, foam, blood; circle N if no respiratory exudate is observed.

Resp. character (Respiratory character): the quality, depth, ease of breaths. Circle the most accurate descriptions regarding strength and regularity:

- ***Strong***: normal forceful breaths, brisk opening and closing of blowhole
- ***Weak***: depressed or shallow respirations, sluggish opening and closing of blowhole
- ***Regular***: normal breathing pattern
- ***Irregular***: abnormal breathing pattern (example: periods of tachypnea)
- ***Other***: abnormal sounds, open blowhole, etc.

Body condition: Circle most accurate description of the animal's nutritional status.

- ***Robust***: appears heavy and healthy
- ***Normal***: appears lean but healthy
- ***Thin***: appears overly lean but not with severe boney prominences
- ***Emaciated***: boney prominences evident, markedly concave epaxial musculature, prominent neck depression, ribs obvious

Body temp.: If actual body temperature measured, record degrees Fahrenheit or Celsius.

- ***Skin @ _____***: describe anatomical location used to assess skin temperature: circle Warm or Cool to touch

Attitude: the animals behavior/activity (or lack therof). Circle the most accurate description:

- ***Alert***: animal is alert and aware: follows movement with eyes
- ***Lethargic***: animal is sluggish or inactive, eyes closed, little reaction to touch/sound
- ***Non-responsive***: animal does not react to stimuli

Body position: the position of the animal's body upon initial discovery. Circle the most accurate description:

- ***Upright***: laying on ventrum, ventral recumbency
- ***Left side up***: laying on right side, right lateral recumbency
- ***Right side up***: laying on left side: left lateral recumbency

Eyes (Open/Closed): circle one that is most appropriate

- ***Palpebral reflex***: eyelids close/blink when gently touched at the medial or lateral canthus (corner) of the animal's eye. Circle **Y** if response present, **N** if no response.
- ***Menace reflex***: eyelids close/blink when finger or hand is abruptly moved towards the animal's open eye. Circle **Y** if response present, **N** if no response.

Movement: Circle all appropriate observations:

- ***None***: no movement observed
- ***Arch***: head and flukes bowing or curving dorsally, simultaneously
- ***Fluke***: flukes fluttering or slapping
- ***Swim***: rhythmic moving of body as if swimming in water
- ***Tremble***: shivering or quivering
- ***Other***: if other movements observed (example: seizures, lateral flexing), circle "other" and describe in comments section.

Other: Circle any other observations and describe in comments section.

Method of Euthanasia: Circle all that apply.

Pre-euthanasia sedation: circle if chemical agent(s) administered to the animal prior to euthanasia, including tranquilizers, sedatives, hypnotics, analgesics and/or anesthetics (examples: midazolam, diazepam, acepromazine, ketamine, tiletamine-zolazepam, xylazine, medetomidine, meperidine)

Chemical method: circle if chemical agent(s) administered to euthanise the animal

Non-chemical method: circle if euthanasia method included the use of non-chemical methods, and describe (examples: ballistics including type of firearm and ammunition used, cranial implosion including munitions used, exsanguination including type of equipment used and anatomical location)

Agent # Sections

"Agent" may refer either to chemical or physical means of euthanasia. Four agent boxes are provided. Use additional data sheets as needed.

Location of animal during administration of Agent #1: circle most appropriate answer. If this changes, write in for subsequent agents.

Time of admin. (administration): record the time that the agent was administered.

Drug and conc. (concentration) or device: for chemical sedation or euthanasia, record the name of the drug and its concentration; for physical euthanasia, record the device used.

Amount/size/type/caliber: for chemical sedation or euthanasia, record the volume of drug used; for physical euthanasia, record pertinent details fully describing the device used.

Route (injections): for injections, circle the most appropriate answer(s):

- ***IM (intramuscular):*** into the muscle
- ***IV (intravenous):*** into the vein
- ***IP (intraperitoneal):*** into the peritoneal cavity
- ***IH (intrahepatic):*** into the liver
- ***IC (intracardiac):*** into the heart or great vessels in direct proximity to heart.

Delivery site on body: describe the body position where injection, gunshot, implosion, lance or knife was applied.

Response to agent: Did the animal respond to agent or not? And if so, describe how (example: animal becomes more sedate/agitated, heart rate or respiratory rate increase or decrease), and approximately over what time course the changes occurred.

Heart rate, Respiratory rate, Respiratory character, and ***Attitude at time of delivery***: as described above for ***Pre-euthanasia Section***.

Post-euthanasia Data Section

Time of death: record time that the animal was presumed deceased.

How determined: record method(s) used to determine death of the animal (examples: no heart beat detected by palpation, auscultation, ECG, or movement of needle used to deliver IC drugs; no respirations for a specified period of time, no palpebral reflex, total loss of responsiveness, rigor mortis, etc.).

Carcass necropsied: circle **Y** if animal was necropsied, **N** if carcass was not necropsied.

Carcass disposal method: circle appropriate response

- ***Bury***: carcass placed in ground and covered
- ***Landfill***: carcass taken to landfill
- ***Render***: carcass melted down by rendering facility
- ***Other***: examples: sunk, towed, incinerated, chemically dissolved, composted, etc.

Comments and Observations Section

Indicate, on a scale of 1 to 5 with 1 being worst case and 5 being best case, how the euthanasia proceeded.
From the list provided, check any areas where you had concerns about the event, and elaborate in the comment area.
Also use this section or additional pages to document details and/or explanations regarding the event that may not be captured in other documents. Information may include

- weather or other environmental conditions,
- comments on the outcome of the event,
- details and/or a timeline of reactions to specific agents,
- safety issues,
- other personnel observations or comments