# Guidelines for the Treatment of Marine Mammals in Field Research

The guidelines provided here are intended to reflect internationally acceptable and scientifically valid approaches to the handling and treatment of marine mammals in field research that are supported by the Society for Marine Mammalogy. As far as possible, the guidelines represent the ethical standards of the international marine mammal scientific community and define the values that characterise researchers belonging to a responsible professional society. These guidelines are to be an invaluable resource for researchers and Animal Ethics Committees throughout the world. They are included below in plain text, but are also available as a PDF here.

**GUIDELINES FOR THE TREATMENT OF MARINE MAMMALS IN FIELD RESEARCH**
The Society for Marine Mammalogy

Background
Marine mammals are studied in the field in order to improve peoples' understanding of their behaviour, physiology, life history and ecology. The level of scientific interest, whether motivated by conservation, economics, management, or scientific enquiry, continues to grow and this has led to the use of an increasingly broad and sophisticated suite of research tools which add to scientists' capacity to collect novel data in the wild. Important results from research activities are published in internationally peer reviewed journals, such as Marine Mammal Science, and contribute to the international development of the science that underpins the conservation and management of marine mammals and the ecosystems to which they belong.

Research on marine mammals, like that on other vertebrates, raises important issues of animal welfare and ethics, and, until recently, these issues have received insufficient holistic attention within the community of scientists who work with marine mammals (Bekoff 2002; Gales et al 2003). Scientists from many countries and cultures conduct research on marine mammals. Thus research is conducted within the context of a complex mixture of motivations, ethical values and legislative controls. While this diversity influences any global discussion of marine mammal welfare and ethics, there remain some fundamental scientific and ethical tenets that span cultural and legal relativity. Those tenets form the basis of this document. The guidelines presented here are intended to reflect internationally acceptable scientifically valid approaches to the handling and treatment of marine mammals in field research; they are supported by the Society for Marine Mammalogy (hereafter referred to as "the Society" or SMM"). As far as possible, the guidelines represent the ethical standards of the international marine mammal scientific community and define the values that characterise researchers belonging to a responsible professional society. They provide an invaluable resource for Animal Ethics Committees throughout the world.

In order to maintain focus and relevance the guidelines are a living document that will be regularly updated to incorporate the changing views and values of the Society as well as the technological and developmental advances we make. The guidelines are a demonstration that the Society is actively committed to the advancement of scientific ethics, and this should add to the confidence of the public and administrative authorities that research published by our members is conducted using "best practices" designed to maximise scientific quality while minimizing potential negative impacts to our study animals. The guidelines should supplement existing national or institutional requirements and guidelines. Although the guidelines focus primarily on the treatment and handling of marine mammals in the field, they are broadly applicable in principle to research procedures used on marine mammals in facilities as well.

It is implicit in the guidelines that scientists conduct their field studies to maximise the quality and value of the data collected, and that 'scientific merit' is addressed as projects are: (1) designed and planned within institutions (or by individuals); and (2) during the process of attracting funds, obtaining permits and other resources necessary to support the project. It is also expected that 'scientific merit' is thoughtfully balanced

by the need to ensure the protection of the welfare of study animals and other components of their populations and ecosystems. The guidelines have been developed by the Society and are published annually in the Society's journal, Marine Mammal Science. The Society is the largest international association representing the marine mammal research community. An ad hoc working group consisting of ten members from eight countries was appointed by the Society Board to produce a draft guidelines document for consideration by the Board, after which it was brought forward to the full Society membership for a vote in December 2007. Membership to the Society assumes an endorsement of the Society's guidelines. Authors wishing to submit their work to Marine Mammal Science are expected to comply with the principles of the guidelines, and non-members contributing the Journal are strongly urged to comply with the guidelines.

## 1. LEGAL

Marine mammal research projects are scrutinised at many stages during the process of project development, grant application, and legal compliance in most countries. However, the mechanisms and nature of these assessments vary greatly. Legal compliance usually consists of two forms of oversight. In the first category, welfare and ethical concerns may be considered explicitly by animal-care and use or welfare and animal-ethics committees. These committees generally operate under national animal welfare legislation at an institutional level. They monitor the welfare of individual animals used in scientific studies, most commonly in relation to laboratory research or commercial food-production. Welfare issues relating to the scientific use of free-ranging species are often less well-represented in the relevant legislation, and marine mammal researchers may interact with committees that have vague and confusing approaches to assessing their work. Scientists are usually, but not always, required to obtain approval from their relevant institutional animal-care committee prior to conducting any animal studies.

The second level of legal compliance relating to most marine mammal research is comprised of the various state or national level agencies that administer legislation and regulations related to marine mammals.

Other acts that cover threatened species, protected areas, hunting regulations and public health may also apply in some countries and circumstances. Recently, in some countries, ethical considerations of research have extended from individual animal welfare issues to environmental ethics, and in particular, the conduct of research in protected and environmentally sensitive areas. Marine mammal research often occurs in such areas (e.g. World Heritage Areas, Marine Parks and Reserves) and such legislation adds a further layer of review for some field-based research. The goal of the current Society guidelines is to provide an international, ethical framework for marine mammal research, acknowledging that no single national legislative framework or institutional requirement can be applied to all research on all species in all areas. These guidelines assume that researchers will fully comply with the applicable national, regional, and local legal requirements including those of their institution and national government or of the government responsible for the animals used for the field research.

## 2. COMPLIANCE

It is beyond the role and capacity of the Society or the Editor(s) of Marine Mammal Science to verify or enforce compliance with legal obligations. It is, however, within the Society,'s interest to promote adherence to the principles of these Guidelines and ethical standards through reliance upon transparent self-regulation, authors submitting a manuscript to Marine Mammal Science will be asked to affirm that they have considered and upheld the ethical principles and guidelines of the Society, as outlined below.

## 3. PRINCIPLES OF RESEARCH DESIGN

Researchers should ask questions that are substantive and interesting and then design and conduct studies that can reasonably address those questions, while minimizing potential negative impacts to the individual animal(s) used, the population to which the animals belong and the ecosystem in which the study is conducted. Designing a field study requires many thoughtful decisions, including selection of animals, research techniques, timing and duration of the research, sample size and statistical power desired from the results. Some decisions may have to be made without full knowledge of the potential impacts to the animals. Where uncertainty is great, investigators should undertake pilot studies prior to full research so that informed decisions can be made before larger numbers of animals are involved.

### 3.1. Species, age and sex class of research animals

For studies where the potential level of impact is expected to be significant, researchers should select species that are not at conservation risk and whose behaviour best suits the research. This is particularly the case where novel equipment or tools are being tested, for which the potential level of impact might be consequential. Where threatened or endangered species are the subject of study, the work should improve or have the potential to improve, in some way, the conservation status of this species. For any species, the deciding question for investigators whose work could possibly negatively impact individuals or populations should be 'do we really need to know this about this particular species?'

The vulnerability of an animal to disturbance will often vary with its age, sex, reproductive status, social situation and level of exposure to human activities. Researchers should strive to minimize the potential for disturbance by selecting animals that will be least impacted by the disturbance, while still satisfying the requirements of the research design. In particular, researchers should minimize potential disruption of critical social bonds, particularly those of mothers and dependent young.

### 3.2. Location and timing of research

Site selection and timing of research can dramatically affect the scale and nature of potential disturbance. Vulnerability to disturbance is often more acute during the breeding season, during some behavioural states or in certain habitat types (water depths, etc.). Within the constraints of the research, the timing and location of the work should be selected to minimize the potential for disturbance.

### 3.3. Sample size

Rigorous scientific design requires a sample size that provides sufficient statistical power to test the hypothesis at hand. If more than the required number of animals are used in a study, then some animals maybe unnecessarily disturbed or impacted. If too few animals are used and a statistically meaningful result is not possible, then animals may be disturbed or impacted without a defendable scientific outcome. Researchers should determine the appropriate number of animals required to achieve the desired level of statistical power and use the minimum number required to answer the questions posed by the research.

Access to free-ranging marine mammals is often difficult and expensive and achieving an adequate sample size can be problematic. In such cases, researchers may face the choice of not conducting the study, or arguing a case for reduced statistical power by accepting a smaller sample size. The basis for such decisions should incorporate a balance of science, ethics and logistics.

### 3.4. Research procedures and equipment

Researchers studying marine mammals have an increasingly powerful and broad suite of tools and approaches available to them for their research. The techniques vary in the degree of invasiveness as well as in the types and quality of data they provide. For example, a researcher investigating blubber volume of a marine mammal can use a range of techniques including the full dissection of blubber from a carcass, ultrasonic fat measurements, measurements of electrical bio-impedance or isotope dilution on restrained animals.

The selection of some research methods may not directly affect the derived data, but may be relevant to the welfare of the research subject. When restraint is required for a procedure on a pinniped, for example, the investigator can choose among physical restraint, mild sedation accompanied by physical restraint, chemical restraint using intra-muscular anaesthetics or anaesthesia using inhalation gas.

Many factors affect a researcher's choice of field technique. These include the aims of the research, economics, logistics, availability of expertise, legal requirements, personal experience and ethical standards. Researchers are encouraged to choose techniques that minimize potential impacts to or disturbance of the animals, while still delivering data sufficient to satisfy the aims of the research. Researchers should also maintain familiarity with the current scientific literature to ensure they are aware of the 'state-of-the-art' research techniques that could provide good data, with minimal consequence to the animals.

3.5. Training of researchers

Most animal handling and sampling techniques conducted in the field with marine mammals require skill and experience, even for routine procedures such as restraint and blood collection. Inexperience in such techniques generally reduces the quality of data collected, may impinge on the welfare of the animal (e.g. increased handling times, injury or death), increases the risk to handlers, and may also affect the outcome of the research (e.g. higher tag loss, unrepresentative data). Principal investigators should ensure that any activities that might affect animal welfare are directly supervised or conducted by personnel with sufficient experience to ensure the disturbance to the animal is minimized.

4. PROCEDURES

A broad range of field procedures is discussed below. The intent of these guidelines is to help researchers select and update the most efficient and humane techniques for their studies and where possible to further improve the techniques. The general principles of minimizing duration and potential for negative effects apply to all procedures. Once a researcher has become comfortable with the use of a particular procedure that works well, there is an inevitable inertia to changing to new techniques. By keeping these guidelines updated and current, Society members are encouraged to continually assess their techniques against those in the guidelines and to routinely incorporate changes and improvements where appropriate.

4.1. Observational studies of animal behaviour

Observational (non-contact) studies of marine mammals are not assessed by all animal care committees as they may not be regarded as potentially impinging on animal welfare. However, research that uses procedures such as prolonged boat-based focal-follow techniques or photo-identification techniques have the capacity to cause disturbance and change in animal behaviour and may, therefore, have someimpacts. Such effects are difficult to quantify, but researchers are encouraged to consider the potential effects of such chronic, low-grade or cumulative disturbance on their research subjects.

4.2. Animal Collection

The collection of marine mammals can be dangerous to both the animal and researcher. The published literature is regularly updated with new and improved collection techniques. It is in the interest of the researcher to ensure that the impact of any collection is minimized, thus ensuring the animal is released in good condition and that samples and data collected are representative.

On land, small marine mammals, such as some otariid and phocid pups, can be reasonably safely collected by hand by experienced researchers, although injury risks to animals and handlers remain. For medium-sized pinnipeds collections are generally undertaken with hand-held hoop nets, or less commonly with throw nets. Nets should be clean, non-abrasive, and minimize the risk of injury, particularly to the animal,'s eyes and teeth. Once in the net, the animal should be able to breathe easily. Handling is generally facilitated if the animal's vision is obscured. Vision obscuring covers are commonly used for the collection of Weddell seals (Stirling 1966).Restraints, usually applied via a pole, are occasionally used to collect seals from dense aggregations. When used on small, easily handled animals such as pups, the duration of restraint on the neck should be very brief. Some researchers use this technique to collect larger animals, such as adult female sea lions. In such cases the duration of the potential to constrict the animal's airway should be minimized, and the technique should not be used with a view to subdue the animal as a result of compromising breathing. The collection of marine mammals in the water is considerably more difficult and presents higher safety risks to both animals and researchers. A wide range of techniques are utilised, including systems of breakaway hoopnets or encircling barrier nets for dolphins, floating cages for pinnipeds, net traps for sea otters and sea lions, and leaping from a boat and grabbing the tail flukes of dugongs or belugas in shallow water. These techniques are developed to best deal with the target species and the environmental characteristics of the location where the collection is to take place. As noted above, experience is essential when using such techniques, to minimize the potential risk to animals and researchers.

As collection systems are often species and site specific, it is not the intention of these guidelines to restrict collection options to a single solution. Rather, acceptable collection systems should satisfy the following general criteria:

The duration of pursuit should be as short as possible.
The number of attempts to collect a particular animal should be limited.
The disturbance to non-target animals should be minimized.
During collection on land the animal,'s airways should be unobstructed and the airway should be visually monitored to detect problems should they arise.
During in-watercollection, the animal should be able to breath at will, with unimpeded access to the surface; respiration rate should be monitored carefully.
Where animals are collected in cages or enclosures, the animal(s) should be observed at all times and the time spent within the enclosure should be minimized.
Potential intrinsic and extrinsic stressors to the animal should be assessed, minimized and monitored (e.g. thermal stress, physical trauma from collection in inappropriately rough terrain, vulnerability from physiological state such as pregnancy or moult).

As new, improved collection methods are developed researchers are encouraged to publish them, including accounts of problems that were encountered, and best means for addressing same, to ensure that such information is widely available for other researchers.

4.3. Animal Restraint
Once an animal has been collected it is generally restrained physically, often with the assistance of chemical sedatives and anaesthetics.

4.3.1. Physical Restraint
Marine mammal researchers use a wide range of equipment specially designed and developed to physically restrain particular taxa. These include restraint cages and restraint boards for pinnipeds and slings for small cetaceans. The degree to which equipment has become specialised reflects the particular difficulties of handing marine mammals and wide range of problems that can arise. As with collection techniques, this specialised area is continuously developing, and any technique or equipment should satisfy the following criteria:

Restraint should be the minimum level required to conduct the procedure safely and humanely.
The system of restraint should allow rapid, safe release of the animal in the event of problems.
The animal's airways should not be obstructed during restraint and the respiration rate should be carefully monitored throughout the procedure.
The procedure should minimize post-restraint behavioural effects.
Avoid thermal stress to the animal by keeping it wet and cool.

4.3.2. Chemical Restraint
The choice for a researcher to opt for physical restraint or a combination of physical and chemical restraint is not straightforward. For example, if a pinniped is relatively small and can be readily restrained physically, then when should some form of tranquilisation or anaesthesia be incorporated? While this decision is simple if analgesia is required for an invasive or surgical procedure, it is more complex if the tranquilisation or anaesthesia might be considered solely to reduce the stress to the animal. As a general guide, sedation or an anaesthetic should be considered if it reduces the overall impact or risk of the restraint to the animal or is vital (e.g. with polar bears) for safety of the research team. Particular care should be taken before using chemical restraint to remotely collect pinnipeds or polar bears that might flee into the water. More specifically, some form of anaesthesia or analgesia should be used when:

The researcher considers it desirable to relieve anxiety attendant with the procedure.
The animal cannot be safely restrained without sedation or anaesthesia.
Potentially painful procedures are to be conducted which require analgesia (e.g. tooth extraction).
The overall duration of the restraint would be substantially shortened if chemical restraint was included (e.g. through limiting the struggling of the animal some procedures can be conducted more efficiently)
The animal is able to recover from the effects of the sedation or anaesthesia safely post-restraint.

Techniques of tranquilisation and anaesthesia have developed rapidly through improvements in drug and equipment performance under field conditions. Methods of reliably delivering intra-muscular drugs through remote injection techniques such as blowpipes and pneumatic guns have coincided with the development of new drug options which provide wider margins of safety, and have reduced unwanted side-effects. Similarly, the advantages offered by inhalation drugs, such as isoflurane, are now available for researchers working with free-ranging marine mammals. Researchers have published widely on the techniques being developed, and this has led to improvements in field techniques and reduced mortality and unwanted side-effects. In many cases, consequences of the more sophisticated drugs and equipment are increases in costs and requirements for specialised veterinary assistance. Drug and technique choices should be based on:

The laws that apply to the researcher in relation to drug use.
A drug delivery system that causes the least possible disturbance and stress to the animal, while still maximising the efficiency and consistency of drug delivery (e.g. a dart system that routinely achieves intra-muscular injections).
Selection of tested and proven drugs for the target species, or a drug that is most likely to be effective with that species (i.e. widest margin of safety and least side effects, particularly cardiac or respiratory depression, or thermoregulatory effects.) Drugs that have effective reversal agents should always be considered.
A drug that has a rapid, predictable and smooth effect leading to efficient anaesthetic induction, or time to maximum effect.
Drugs that lead to rapid, predictable and smooth recovery with or without reversal agents.
Drugs that have the least post-recovery effects on behaviour.
Drugs and techniques should be chosen that offer the best options for reversal if unexpected problems arise during the anaesthesia.

4.4. Tagging, marking and photographic recognition
Tagging is a widely used methodology required in studies for which age and/or longitudinal observations are required. Tagging is generally used when natural markings cannot be used reliably to identify individuals. The use of external, plastic tags (often livestock ear tags), spaghetti tags, bleach and paint marking or hot or cold branding have changed little over the past few decades. The use of implantable, inert transponder tags is a newer technique that has been widely used in circumstances where animals can be resampled at close range with transponder scanners.

Tagging and marking of marine mammals can most appropriately be used if:

Natural markings cannot be used to satisfy the needs of the research.
The tag or artificial markings provide sufficient readability and persistence to satisfy the aims of the research (e.g. issues of tag/mark loss).
The potential or likely effects of the application of the tag or mark (e.g. pain, wound healing, disturbance) are trivial, short-lived and do not affect the behaviour or survival of the animal (e.g. potential or likely effects on locomotion or energy budget).
Where large numbers of animals are to be marked (e.g. tagging a cohort of pups), disturbance should be minimized, keeping the procedure as brief as possible.
In circumstances where natural markings are used (e.g. patterns on the ventral flukes of humpback whales), efforts to photograph the marks should limit disturbance to the target animal and nearby conspecifics as much as possible.

4.5. Attachment of equipment
Whereas the development of identification tags has not changed appreciably in the past decade or two, developments in electronics, memory and processors have led to the rapid development of a wide array of powerful archiving and transmitting tags, including dive data-loggers, camera systems and environment sensors. In parallel with developments of the tags themselves, improvements in the techniques of attachment and retrieval have increased the taxa and opportunities available for studies using tags. Typically, the size of the tags and the choice of attachment techniques have relied upon the judgement of the researcher and whatever formal evaluation processes apply to that researcher (e.g. animal care

committees). To date there has been little research evaluation of the effects of tag attachment, or an empirical approach to setting limits to the mass, dimension, shape, attachment type or deployment period of tags. Instrument effects on some marine mammals have included acute and chronic changes in behaviour, increased energetic costs (particularly of swimming), burn injuries from exothermic glues, penetrative injuries from attachment components, and in extreme circumstances the death of instrumented animals. Researchers are encouraged to conduct and publish studies of the short- and long-term effects of these tags.

In general terms transmitting or archival tags should:

Sample the parameters they are designed to record with minimal effects on the behaviour of tagged individuals.
Be attached in the least invasive practical manner.
Be of a size, construction and design so as to cause negligible energetic costs to the animal.
Not render the animal more exposed to predators or by-catch.
Be able to be retrieved, or released from the animal in a predictable manner and in a timeframe appropriate for the research and to ensure the impacts to the animal are minor.
In the case of penetrative attachments, wound healing should be predictable and relatively brief and have no more than a trivial impact to the animal.
In some cases it is possible to monitor individuals after release; such monitoring, where feasible, should be encouraged to provide important information on the welfare and behaviour of tagged animals. In other cases, such as with the use of penetrative tags on whales, access to the animal for post-deployment assessment may not be possible. In all cases, researchers are encouraged to publish their results and share their expertise and experience to reduce the overall development time of appropriate tags and minimize any unnecessary animal research.

4.6. Blood and tissue sampling
Remote and direct sampling of marine mammal tissues are widely used techniques for a range of molecular studies. Techniques for superficial, remote biopsies (skin and blubber) are widely published, particularly for cetaceans, and although some problems have been reported (including an extreme example of death of a dolphin), most studies conducted by experienced scientists have encountered few problems. Projectile biopsy systems should:

Be thoroughly tested using a carcass of the study animal or similar species to optimise power and penetration before being used in the field.
Be of an appropriate power for the projectile to penetrate and sample to a specified, predictable and repeatable tissue depth.
Sample sufficient tissue for the research needs.
Minimize the potential to introduce infection at the biopsy site.
Produce small, clean wounds that heal readily.
Sample from a distance that minimizes the disturbance to the target animal.
For deeper tissue samples (e.g. muscle biopsies) good quality surgical procedures should be followed to minimize infection risk and maximise wound healing. Local or general anaesthesia should be used for any painful or prolonged procedure. These procedures should be carried out only by experienced researchers trained in the particular technique.

4.7. Controlled exposure research
As research in marine mammal science is becoming more sophisticated an increasing body of work involves the controlled exposure of animals to potential stressors such as noise, disease or contaminants. Such research can provide critical quantitative data that link cause and effect, but they can also be high risk, controversial and attract a high level of public scrutiny.

The principles in balancing ethics and science in research is no different to any other procedure, and researchers are encouraged to ensure their design accounts for uncertainty in the scale and nature of the

effects of exposure to the stressor dose, and includes measures by which they can objectively judge if an exposure dose should be reduced or terminated.

4.8. Lethal studies
Lethal research involves the killing of marine mammals specifically for the acquisition of samples or data for scientific research. This procedure is controversial and the laws that apply internationally vary greatly. For publication of lethal studies in Marine Mammal Science any such work must have been legally conducted by the researcher (i.e., must conform to the laws of the country where the research was conducted). More generally:

Researchers should use alternative non-lethal procedures when they are available and satisfy the objectives of the research.
Animals should be killed in the most humane and rapid method available.
Any population or stock-scale impacts should be minimized through prudent selection of animals (e.g. avoidance of reproductive females if possible) and sample size.
Where possible on-going activities outside the research community (e.g. hunting, by-catches, strandings) should be utilized as a source of material for scientific studies of marine mammals.

From: http://www.marinemammalscience.org/about-us/ethics/marine-mammal-treatment-guidelines/