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## **Individual recognition of elephant seals at Sea Lion Island**

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A core aspect of the long term research project on southern elephant seals (*Mirounga leonina*) carried out from 1995 by the ESRG at Sea Lion Island (Falkland Islands) is the intensive marking of seals. To permit long term recognition, seals are marked using cattle tags. To permit easy and fast recognition during each breeding season, temporary marks that can be read from distance are put in place by writing names or codes using hair dye or bleach. The purpose of this report is to briefly explain the rationale of marking, to describe the methods, and to explore the ethical implications of the marking plan.

### **Rationale**

The importance of individual identification in wildlife studies is firmly established. It is now clear that the biological phenomena that are observed at population and species level largely depends on the balance of costs and benefits of individual tactics and strategies (Sutherland 1996). This evidence spans the whole area of scientific research on wildlife, from evolutionary biology (Rose and Lauder 1996), to ethology (Altmann and Altmann 2003), to conservation (Baillie 2001). Therefore, the safe identification of the animals under study is crucial to the advancement of science. Our research project carried out at Sea Lion Island is focused on sexual selection, mating tactics, breeding strategies and the evolution of life histories, problems in which the collection of longitudinal data on recognized individuals is of paramount importance (Clutton-Brock 1988). Intensive marking of elephant seals permitted us to achieve valuable scientific results in fields as diverse as population viability (Galimberti et al. 2001), sexual behaviour (Galimberti et al. 2000 a), animal communication (Sanvito and Galimberti 2003), and genetics (Fabiani et al. 2004).

Individual identification of animals can be achieved using natural marks (Bateson 1977), but the effectiveness of this method is strongly constrained by the external morphology of the species, and by the number of animals to be identified (Vincent et al. 2001). Due to their anatomical adaptation to aquatic life, seals are not an ideal taxon for the application of recognition by natural marks, lacking conspicuous morphological features that may be used for safe identification. Moreover, land breeding seals, including elephant seals, concentrate in large and dense groups of many individuals, and this obviously increase the risk of unreliable identification. For the same reasons, photo-identification, which is widely used for cetaceans, is difficult to apply to seals, and has been shown to produce biases (Forcada and Aguilar 2000).

Artificial marking is widely applied in the study of elephant seals, and Antarctic seals at large (Erickson et al. 1993). Most elephant seal population currently studied around the world are target of marking plans, and, to our best knowledge, natural marks identification is not used at all. The adoption of intensive marking plans is, in fact, one of the landmarks in the development of the best studies on seals (e.g., Pistorius and Bester 2002), which, in turn, are a key aspect in the assessment and conservation of marine leaving resources (Laws, 1993). Mark-resight studies are one of the top priorities of the research on Antarctic seals set up by the “Expert Group on Seals” of the SCAR Life Sciences Standing Scientific Group.

## **Methods**

We are using two main marking procedures: tagging, for long term recognition, and dye marking, for temporary identification. We are trying to mark as many individuals as possible. A correct identification of almost all individuals of the population permits to avoid sampling bias, to reduce the mistakes in data collection and recording, and to improve the reliability of parameter estimation. For example, the very accurate estimate of the number of females hauled out on SLI permits to achieve a good power in detection of population trends notwithstanding the small size of the population (Galimberti 2002). This means that, thanks to the intensive markings, it should be possible to detect variations in population size and structure with much more confidence than without it. This, obviously, has a paramount importance for the conservation of the population, which is, in turn, an important component of the Falklands biodiversity.

### **Tagging**

About 99% of the females and 100% of the males of the population are marked by cattle tags (Jumbo Rototag, Dalton Supplies Ltd, <http://www.dalton.co.uk>). The same tags are applied to almost all pups produced each season. The Rototag is the standard tag for elephant seal marking

(Erickson et al. 1993), due to the small size and footprint (length = 45 mm; weight  $\approx$  2 grams), that reduce loss rate (Testa and Rothery 1992). The tags are placed in the inter-digital web of the rear flippers and each individual is at least double-tagged. Double tagging is fundamental to reduce the risk of lack of recognition in following seasons, and to estimate tag loss rates. In the study population tag loss rate is very low (likelihood to lose two tags = 0.36% for females, 0.37% for males). Obviously, the loss of all marks by an individual means to lose all his data from the previous seasons and to introduce a bias in parameter estimates.

### Dye marking

We paint an identification code on animals' backs and flanks using commercial black hair dye in order to have a fast and easy recognition of individuals. We also use hair bleach, but its performance is not very good because of the cold and wet weather. Samples of marks and pictures of the dye-marking procedure are available on our web site (<http://www.eleseal.org>). We mark with hair dye all breeding males, and 70-85% of the breeding females in our study area. We do not mark with dye individuals that come to the island only for moulting. In the past we marked pups with hair bleach when they are weighed at birth, but the sub-project requiring pup marking is now completed.

### Alternative marking methods

Along the years we tested various alternatives to the marking methods that we are currently applying. We kept a database of information, sketches, and pictures of natural wounds and scars, to check if they can be used to help the long term recognition of individuals. The method can be potentially useful for male recognition, because, quite often, male fights produce wounds. Contrary to our expectations, the large blubber stratum and the effectiveness of the healing process renders the method barely applicable to elephant seals. Just in very few cases large wounds in fact resulted in scars that can be recognized in the long term. We also tested the photo-identification method, concentrating on male faces. We took from close distance a large amount of pictures of male heads for morphometric studies, and we tried to use them for individual recognition using both manual and semi-automatic procedures, with scarce results.

Regarding electronic devices, our experience gave mixed results. In 1997, we tested passive implanted transponders on a large sample of weaned pups, and on a small samples of adult males (Galimberti et al. 2000 b). PITs were an effective and reliable method to mark seals, but they presented many drawbacks. Apart from the huge cost (10-15 times of the cost of a tag) they were difficult to put in place, and to be read. Even the most powerful PIT readers, that are bulky and cumbersome to carry around, needs to be placed at few centimetres from the animal skin to be able

to read the transponder. Therefore, PITs are an effective backup method for long term recognition, and can be the ideal way to check reliability of tags because their loss risk is almost null, but they are not a viable alternative as main marking method. To our best knowledge, there is no current electronic identification system that can operate from the distance, and guarantee a cheap and effective recognition of a large number of animals. Moreover, the deployment of electronic devices on the animals usually requires chemical restraint, posing serious practical and ethical problems if to be applied to a large number of individuals.

### **Impact of marking**

Marking is always carried out without any kind of chemical or physical restraint of the animals, by simply approaching them from the back while they are resting. We are in fact proud of our capability to mark such a large number of animals, notwithstanding the small field team and without any adverse effect on the animals. This effectiveness is achieved because of the peculiar behaviour of elephant seals, that permits experienced people to approach them at close distance without risks for both the operator and the animal.

In the vast majority of individuals, tagging produces just a brief reaction (a few seconds) and a very small pain, although animal pain is obviously difficult to assess (Bateson 1991). Tagging may produce a wound in the inter-digital membrane and a local infection, but this rarely happens in our population, as showed by the very low tag loss rate (a bad tag, that produce local infection, tend to pass through the hole and get lost). After many years of continuous tagging (more than 15000 tags put in place) we have no indication of any adverse effect of the procedure. In general, tagging of seals seems to be a harmless procedure, that has no effect on their survival rate (Testa and Rothery 1992). This seems confirmed by the lack of any variation in the demography of the population before and after the beginning of our research (Galimberti and Boitani 1999).

We understand that dye marks could be criticized from an esthetical point of view, but we firmly reject any objection on the scientific and ethical ground. If the basic principle of research is accepted, i.e. animals should be recognized, dye marks are a very effective way to reduce disturbance on animals. A dye mark permits the sure recognition of animals from distance, reducing the need to come close and read the tag. Marks are put with a minimum disturbance to the animal, approaching it from the back, and the best marks are put without waking-up the subject, not during the approach nor after it, to have a clearly readable mark and a safe setting of the dye. The use of dye and bleach tested for human hairs exclude any risk of toxicity. Moreover, dye marks last just for a few weeks or months, and even the best marks disappear with the moult.

## **Conclusion**

Intensive marking is crucial for the development of the research on elephant seals of Sea Lion Island. Marking of elephant seals is proving a very effective way to get detailed information about the individual life histories and breeding strategies. The resulting database of information about the morphology, ecology, behaviour, and genetics of individually recognized seals has few analogues in elephant seal studies, and mammals studies at large. Marking in elephant seals, although invasive, produce a very limited, and short term impact on animal welfare. The ethical balance between the benefits obtained by marking and its costs is, therefore, exceptionally positive. The combination of tags and dye marks is, currently, the optimal solution for elephant seals identification, and there is no viable alternative, nor it is likely that one there will be in the next future.

Research, obviously, doesn't work in a vacuum. Therefore, the impact of marking on non-research use of wild areas should be kept in mind. We agree that dye marks are sometimes not very pleasant to see, although they permit even to the casual observer to recognize the animals. Therefore, laypeople can appreciate the "personality" of the various individuals, a rare experience with wild animals, very difficult to try elsewhere. This is, in our opinion, an added value of the research, and for Sea Lion Island. From the very beginning of the research we tried to make clear that the dye marks have crucial role of in our research, and that to not be able to mark means to not be able to carry out the research. In our effort to make the project compatible with the other activities carried out on the island we moved along two lines:

- We are leaving one of the three seal breeding areas of Sea Lion Island as much free from dye marks as possible. In this area we are not putting dye marks at all, although seals are wild animals and we can't control their movements among areas. Movements of females are quite limited, and, therefore, most females in this area don't carry marks. The lack of dye-marking in one of the breeding areas is a significant cost for the research, but we are more than happy to sustain this cost to improve the visiting experience of tourists.
- We are trying to provide information to the visitors, to help understand the background and rationale of marking, although this is becoming a more difficult task because of the large increase of short term visitors. There is room for improvement here, and we shall do every effort to make people better understand the rationale of what we are doing.

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