

## **Elephant seals of Sea Lion Island: a long-term research project**

### *Executive summary 2018*

Sea Lion Island shelters the main breeding colony of **southern elephant seals** (*Mirounga leonina*) in the **Falkland Islands**. Every year, during the three months of the breeding season (September-November) about 620 females come to land to give birth to a single pup. They spend on land a mean of 27 days. After giving birth, each female suckles her pup for about 23 days, mates, and then weans the pup. The mother and the pup will never meet again. Males come to land before the arrival of the first female, and compete for mating. Females form large groups, called “harems”, of up to 120 females, and males compete to get control of one of them, with acoustic displays, visual threats and fights. After the breeding season, both males and females return to sea for feeding. They remain at sea for the rest of the year, apart from a three-week period in which they come again to land for the moult of the skin and fur. Elephant seals fast while they are on land, losing a large percentage of their weight (up to 35% for females and 50% for males).

In **1995** we began a long-term research project on the elephant seals of Sea Lion Island, to study the behavioural ecology of the population. We carried on the project for **23 years** until now. We used a number of different techniques to collect data on various aspects of elephant seal biology: 1) we marked animals using cattle tags, hair dye marks, and electronic devices, to estimate survival, fecundity, breeding success and lifespan; 2) we counted and identified all breeding individuals every day of each breeding season, to estimate the population trend; 3) we mapped the position of individuals and harems using GPS receivers and laser telemetry devices, to study the spatial structure of the population and its relationship with social behaviour and genetics; 4) we observed the social interactions to study agonistic and mating behaviour, and to estimate dominance, mating success and female harassment rate; 5) we recorded the vocalizations of males, females and pups to study vocal communication; 6) we measured size of adult individuals using photogrammetry, to study growth and the effect of size on social behaviour; 7) we weighed and measured pups at birth and weaning to monitor population health and study parental investment; 8) we collected various kinds of biological samples to study genetics, hormones, physiology, and exposure to pathogens. Further information on the research project goals and methods can be found on our website, [www.eleseal.org](http://www.eleseal.org).

Sea Lion Island is a small and localized population of elephant seals and, therefore, represents an ideal situation to collect accurate long term information on marked individuals. Our research greatly improved the knowledge of the demography and dynamics of the population, and we are producing annual estimate of population trends that should serve as guidance for the establishment of conservation policies. Our long term mark-resight study is providing estimates of vital statistics of the cohorts of seals, and this should permit us to estimate the effect of global and oceanographic changes on seals survival. For the male segment of the population we already have full life tables of nine cohorts, while for the female segment we have full life tables of two cohorts. We studied the agonistic behaviour of males, showing the very high degree of linearity of dominance hierarchies, which determine a strict regulation of access to breeding females and, in turn, produce the highest level of inequality in male mating success ever observed in a vertebrate

population. We studied the mating behaviour, demonstrating the important role of male herding in the formation of harems, and the effect of male harassment in the evolution of female breeding strategies. We used microsatellite molecular markers to demonstrate that mating success is a very good index of actual genetic paternity, and to show that harem holders sire most pups. We used the same markers to investigate the effect of female kinship on the social system. We investigated the role of vocal communication in male competition, suggesting the presence of population specific vocalizations (dialects), providing evidences of vocal learning of young males from mature harem holders, and demonstrating that males can use the frequency structure of vocalizations of other males to assess their size and age. We investigated the structure and function of the most extravagant male trait, the proboscis, showing that it is related to sound emission and may have a cheating function in the process of male assessment through the vocalizations. We analyzed the genetics of the population, and we showed that the population, although almost isolated from a demographic point of view, is anyway a part of the gene flow operating in the South Georgia stock.

In recent years, we focused our research on matters related to the assessment of the population status and health. We carried on: 1) the demographic study to improve our estimate of the population trend; 2) the mark-resight study to determine variation in survival, 3) the monitoring of weight of pups at weaning, that is an excellent index of female access to resources, 4) the study of blood cortisol to get physiological measures on individual and population stress. Moreover, we carried out a project to track at sea breeding females during the post-breeding migration. We deployed satellite tags on a total of 24 females.. This project gave for the first time information about the feeding areas of Sea Lion Island seals, and revealed that, contrary to expectations, most females forage close to the Falklands coast and, therefore, are potentially more exposed than expected to local threats, including commercial fishing and oil exploration. More recently, we deployed on females time-depth recorders to study their diving and feeding patterns. Lastly, we increased our effort to monitor the health of the population through the study of pathogens. We are producing the only recent data on southern elephant seal blood biochemistry and haematology, that will provide reference values for individual health assessment, and we have identified the exposure of the population to a pathogenic bacteria, *Leptospira* spp., that often produce epidemics in pinniped populations.

Sea Lion Island is the premiere destination for nature oriented tourism in the Falklands. It is therefore of particular interest that we have been able to carry out a long term research on a large, very visible, animal species in such a place. Various aspects of our field research may potentially have a negative impact on the visitors of the island: our dye marks, although temporary, have a great visual impact; tags, although not so visible, are permanently on the seals; we handle animals, and some of the procedure that we use are quite invasive. Notwithstanding this, reactions to our research are overall very positive, complaints are rare, and many visitors show a great interest in what we do, and why we do it, when they see us working in the field. The constant exposure to the general public has been a great help for us, because it compelled us to do a very close scrutiny of the rationale and protocol of our field work procedures. All together, Sea Lion Island is the demonstration that, through good management policies, nature oriented tourism, conservation and scientific research can live and prosper together even in a small island.

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