Southern elephant seal migration and Antarctic sea ice

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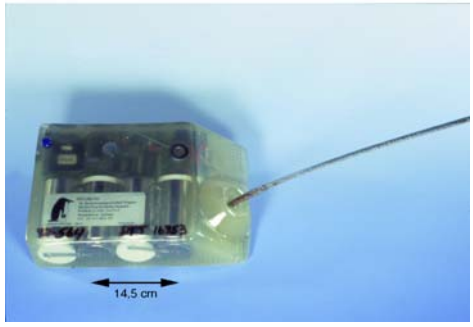
Objective

Satellite telemetry was used to investigate the migratory behaviour of southern elephant seals (*Mirounga leonina*). The seal studies were part of the German-Argentinean cooperation project and carried out at Stranger Point on King George Island between September 1996 and February 1997. Stranger Point (62°14'S; 58°40'W) is the southernmost breeding site of elephant seals. Elephant seals are able to dive to depths in excess of 1500 m and feed on squid and fish. The objective of this study was to identify the wintering areas and feeding grounds of elephant seals of this true Antarctic breeding colony. The results can potentially be compared between years or sites, in order to monitor differences in migratory and foraging behaviour that can be attributed to environmental changes in physical parameters (e.g. sea ice distribution) or to human impact on prey resources of these top predators.

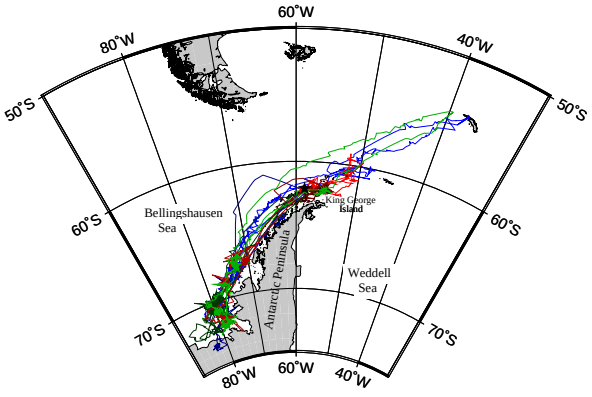


Satellite-linked dive recorder. Two types of ARGOS (CLS/Service Argos, Toulouse, France) transmitters were used in this study: 1) Satellite transmitters (ST-10 Telonics, Mesa, AZ, USA) are designed to provide the seals' at-sea locations. 2) In addition to transmissions of locations, satellite-linked dive recorders (SDR T-6 Wildlife Computers, Redmond, WA, USA) also process data on dive depths in the form of histograms. The histograms are encoded into messages and transmitted to a polar-orbiting satellite. The accessed data provide the horizontal extent of the seals' migrations and the distribution of their dive depths.

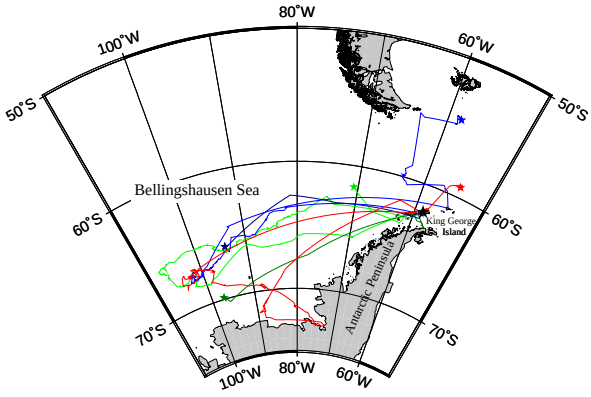
Field methods

Adult female elephant seal with satellite-linked dive recorder (SDR). SDRs were glued to the hair on the backs of 7 two month-old juveniles and on the heads of 13 moulted cows. To attach the instruments, seals were sedated with a combination of ketamine, xylazin, and diazepam. The initial doses of the drugs were either administered by hand (juveniles) or by a dart gun (adults) with automatically evacuating syringes. To maintain an immobilization of 1.5 to 3 h, small additional doses of ketamine and/or diazepam were administered by hand while the transmitters were being attached and the epoxy resin allowed to set.

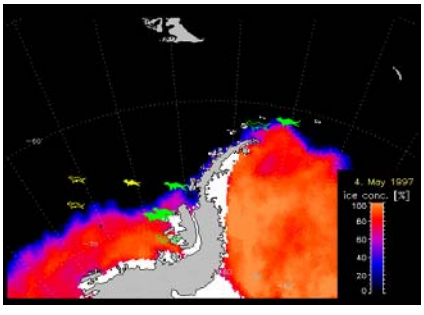
Results and Discussion



Movements of 13 adult female elephant seals. Start at King George Island in January 1997. The cows migrated to the southwest, following the continental shelf margin of the Antarctic Peninsula as far as 90°W. The seals remained for six months in the Bellingshausen Sea west of Alexander Island. In August/September most of the seals returned to King George Island. Two cows were tracked until they reached their breeding site at King George Island resp. Livingston Island in October. Five cows (SDRs failed at sea) were later sighted at King George Island and the transmitters removed. Two cows migrated far north-eastward to the South Atlantic. They crossed the Scotia Arc and reached South Georgia in October where they hauled out for three weeks. Last locations were received in March 1998.



Movements of 7 juvenile elephant seals. Start at King George Island in December 1996. The animals left King George Island 2 to 14 days after the deployment of transmitters and generally moved south-westward. Weaners migrated directly to the ice free area of the De Gerlache sea mountains. The maximal extent of their range was 67°S and 108°W, i. e. some 3000 km far off King George Island. With increasing ice cover in mid April the juveniles again migrated northward reaching the area of the South Shetlands at the beginning of June. One juvenile reached the Patagonian Shelf in early September and was then tracked until November.



Computer animation: To obtain a comprehensive picture of the seal's foraging activity in its three-dimensional marine environment the data need to be interpreted in the context of both biological and physical parameters. In our first attempt, a computer animation was developed to relate the animals behaviour to sea ice cover. A QuickTime (Apple Computer, Inc.) animation shows the tracks of the satellite tagged elephant seals in conjunction with seasonal changes in sea ice cover in the Antarctic Peninsula region from December 1996 – March 1998. The data of ice concentration are derived from the Special Sensor Microwave/Imager (SSM/I). The animation will be implemented in the homepage of the Alfred Wegener Institute (**http://www.awi-bremerhaven.de**). Juvenile elephant seals avoided the sea ice. However, adults frequented the marginal sea ice zone or even remained in pack ice areas with up to 90% ice concentration. We therefore propose the habitat of southern elephant seals to be more closely associated with the pack ice zone than previously assumed.

The information system **PANGAEA** (Paleonetwork for Geological and Environmental Data) of the Alfred Wegener Institute. The database contains selected data from WOCE and JGOFS as well as the GEBCO charts. PANGAEA guarantees longtime storage of the data in consistent formats and provides easy access for the scientific community via the World Wide Web (**http://www.pangaea.de**). The Atlas of the Southern Ocean will also be incorporated to analyse our data in relation to a fine-meshed network of hydrographic data (e.g. CTD-profiles). PANGAEA allows us to visualise the tracking and dive data of seals in relation to hydrographic and bathymetric features "en route".

Poster presented at

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Meeting of the SCAR-Group of Specialists on Seals, XXV SCAR & COMNAP Meetings, Concepcion, Jul. 1998
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