

# Movements of adult male Southern Elephant Seals from King George Island observed by satellite telemetry

S. Ramdohr<sup>(1)</sup>, J. Plötz<sup>(1)</sup>, H. Bornemann<sup>(1)</sup>, L. Sellmann<sup>(2)</sup>, F. Niederjaspert<sup>(3)</sup>, H. Hellmer<sup>(4)</sup>, T. Martin<sup>(5)</sup>, A. Carlini<sup>(6)</sup>, M.N. Bester<sup>(7)</sup>,  
 (1) FB Benthische Ökosysteme, AWI; (2) Bremerhavener Innovations- und Gründerzentrum; (3) FB Geosystem, AWI; (4) FB Klimasystem, AWI; (5) Inst. Für Meereskunde, Kiel; (6) Instituto Antartico Argentino, Buenos Aires; (7) Mammal Research Institute, University of Pretoria



## Objective

Satellite telemetry was used to study the migratory behaviour of adult male southern elephant seals (*Mirounga leonina*) during the winter season. The males' migration routes were then compared with those of previous tracking studies on females and weaned pups (Bornemann et al. 2000). The overall aim of the study is to identify the seals' feeding areas in the Antarctic Ocean with consideration to abiotic factors such as sea ice coverage. The field work on males was carried out from March to May 2000 after their annual moult at the southernmost breeding colony of southern elephant seals on King George Island (62°14'S; 58°40'W), South Shetland Islands. The studies were designed as an interdisciplinary project, and were part of the German-Argentinian-South African cooperation within the APIS<sup>1</sup> program of SCAR<sup>2</sup>.

## Methods

### Satellite-linked transmitters

Satellite transmitters (SDR T-6 Wildlife Computers, Redmond, WA, USA) were designed for adult elephant seals suited for a max depth of 2000m. The units were started in March/April 2000. The seals' at-sea locations were calculated by polar-orbiting satellites, and were tracked by the ARGOS System (CLS/Service Argos, Toulouse, France) for up to 12 months until March/April 2001.

### Sea ice coverage

Daily data of sea ice coverage were obtained from the Special Sensor Microwave/Imager (SSM/I) of the Defence Meteorological Satellite Program (DMSP).

### Attachment of instruments

The transmitters were glued to the hair after the annual moult using quick setting epoxy (Ciba Geigy, CH). Therefore, the males were immobilized remotely with LA Immobilon<sup>TM</sup> (atorphine/acepromazine) and ketamine (Ramdohr et al. 2001).

### Bathymetry/hydrographic data

Bathymetric data of the Southern Weddell Sea derived from the AWI-BCWS (Bathymetric Charts of the Weddell Sea, Ocean Ice, and Atmosphere).

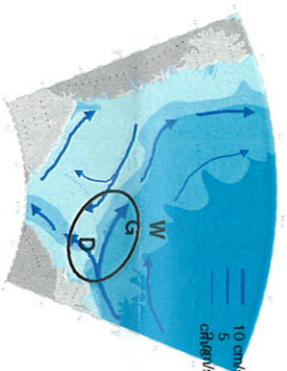
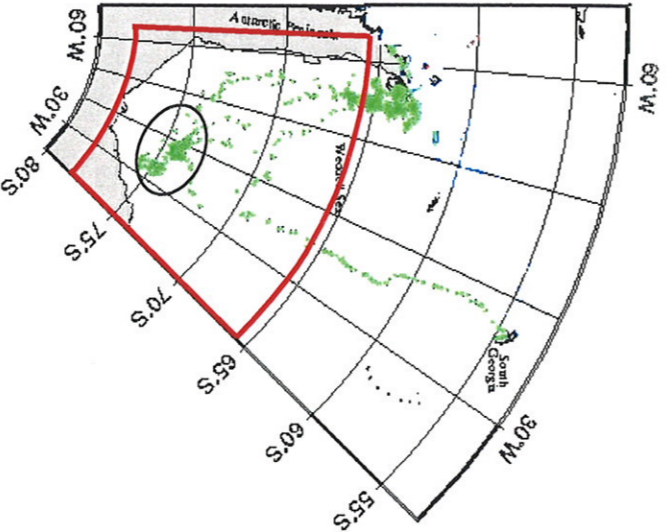
The scheme of the ocean currents in the Southern Weddell Sea is based on a numerical ocean circulation model for the Weddell Sea (BRiOS1.1), with a resolution of 7 km near the southern continental shelf break.

## adult males

### Movements of 14 males (green dots)

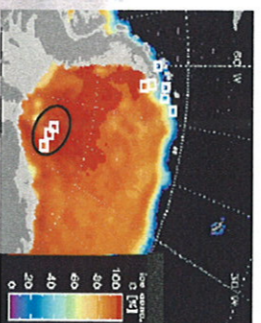
Males followed the shelf margin east of the Antarctic Peninsula reaching in their southernmost positions in the interior pack ice of the Southern Weddell Sea (red inset) in May/June, where they centered their foraging activities for several months in close proximity to the outflow of cold water from the Fichner Trough. This region corresponds to the Halley Bay Divergence (D) of the Antarctic coastal current which forms the southern limb of the Weddell Gyre.

In August, they returned to King George Island for breeding. One male migrated to South Georgia. Last locations were received in March 2001.



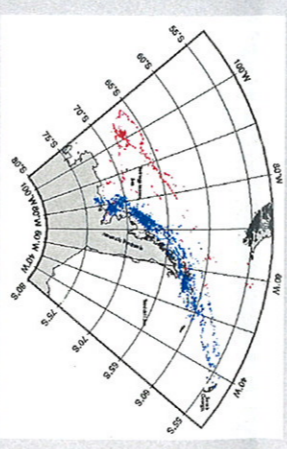
### Bathymetry/Hydrography of the Southern Weddell Sea

The Halley Bay Divergence (D) results from the topographically induced bifurcation of the coastal current which represents the southern limb of the Weddell Gyre (WG) in the Southern Weddell Sea. Upwellings in this area cause vertical transport of organic material.



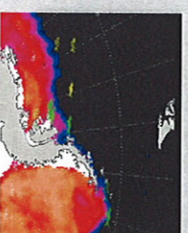
Sea ice coverage  
 Males (□) in relation to sea ice coverage in May/June

## Previous studies on females and weaned pups



**Movements of 7 weaned pups (red dots)** During their first trip they migrated westward into the Pacific sector of the Antarctic Ocean to the ice-free areas of the De Gerlache sea mountains (67°S-108°W).

**Movements of 13 adult females (blue dots)** During winter, they migrated mainly to the southwest, following the continental shelf of the Antarctic Peninsula into dense pack ice areas.



Sea ice coverage  
 Females (green) and weaned pups (yellow) in relation to sea ice coverage in May/June.

## Discussion

To obtain a comprehensive picture of the seal's migratory behaviour in their marine environment the data need to be interpreted in the context of both biological and physical parameters. The migration routes differed considerably from those of females and juveniles. While weaned pups avoided the sea ice, adults frequented the marginal sea ice zone (females) or even entered inner pack ice areas of the Southern Weddell Sea with up to 95% sea ice concentration (males). Upwellings beneath the Halley Bay Divergence cause vertical transport of organic material which may stimulate the trophic activity through the entire foodweb thus providing prey for top predators. Those remote areas seem therefore to be attractive for seals despite complete darkness and cold during the Antarctic winter. It needs to be verified whether such separation of juveniles, females and males is maintained within and between years.



### PANGAEA

The information system PANGAEA (Paleonekwork for Geological and Environmental Data) of the Alfred Wegener Institute, PANGAEA provides longtime storage of the data in consistent formats and allows 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 time-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".

<sup>1</sup>APIS: Antarctic Pack Ice Seals

<sup>2</sup>SCAR: Scientific Committee of Antarctic Research. Interdisciplinary committee of the International Council for Science (ICSU).

### Cooperation:

Mammal Research Institute, University of Pretoria  
 Instituto Antartico Argentino, Buenos Aires  
 Institut für Meereskunde, Kiel

### related publications

Bornemann et al. (2000)  
 Plötz et al. (2001)  
 Ramdohr et al. (2001)  
 Carlini et al. (2001)