Some like it cold: Southern elephant seal dive behaviour responses to changes in water temperature

T. McIntyre[1]*, I.J. Ansorge[2], M.N. Bester[1], H. Bornemann[3], J. Plötz[3] and C.A. Tosh[1]

1. Mammal Research Institute, Dept. Zoology and Entomology, University of Pretoria, South Africa.
2. Marine Research Institute, Dept. Oceanography, University of Cape Town, South Africa.
3. Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany.

E-mail: tmcintyre@zoology.up.ac.za

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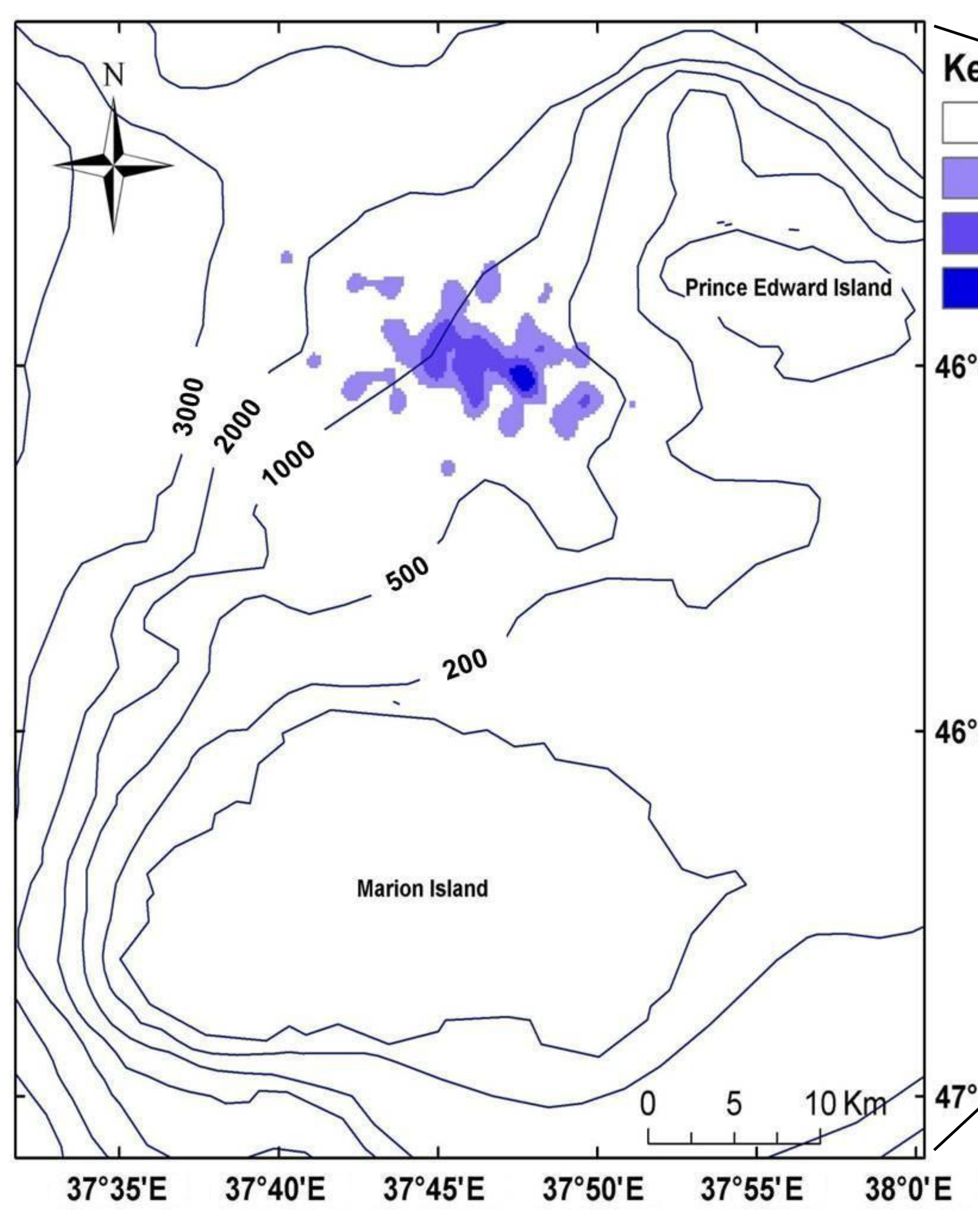
BACKGROUND & OBJECTIVES

- Changes in dive behaviour of elephant seals are attributed to (a) dive location, (b) body condition, (c) increases in physical fitness and muscle oxygen storage capacity, (d) reproductive condition, and (e) changes in prey (Bennet *et al*. 2001);
- We investigated changes in dive behaviour of a sub-adult male southern elephant seal in relation to changes in ocean temperature associated with the movements of a cold-core eddy.

MATERIALS & METHODS

- Satellite-relay data loggers (SRDLs) were deployed on southern elephant seals at Marion Island, as part of the Marine Mammal Exploration of the Oceans Pole to Pole (MEOP) project (see McIntyre *et al.* (in press) for deployment details and dive behaviour results);
- Satellite altimetry data (AVISO), sea surface temperature data (MODIS) and bathymetry (GEBCO) data were obtained for the localised area of concentrated activity by a sub-adult male seal.



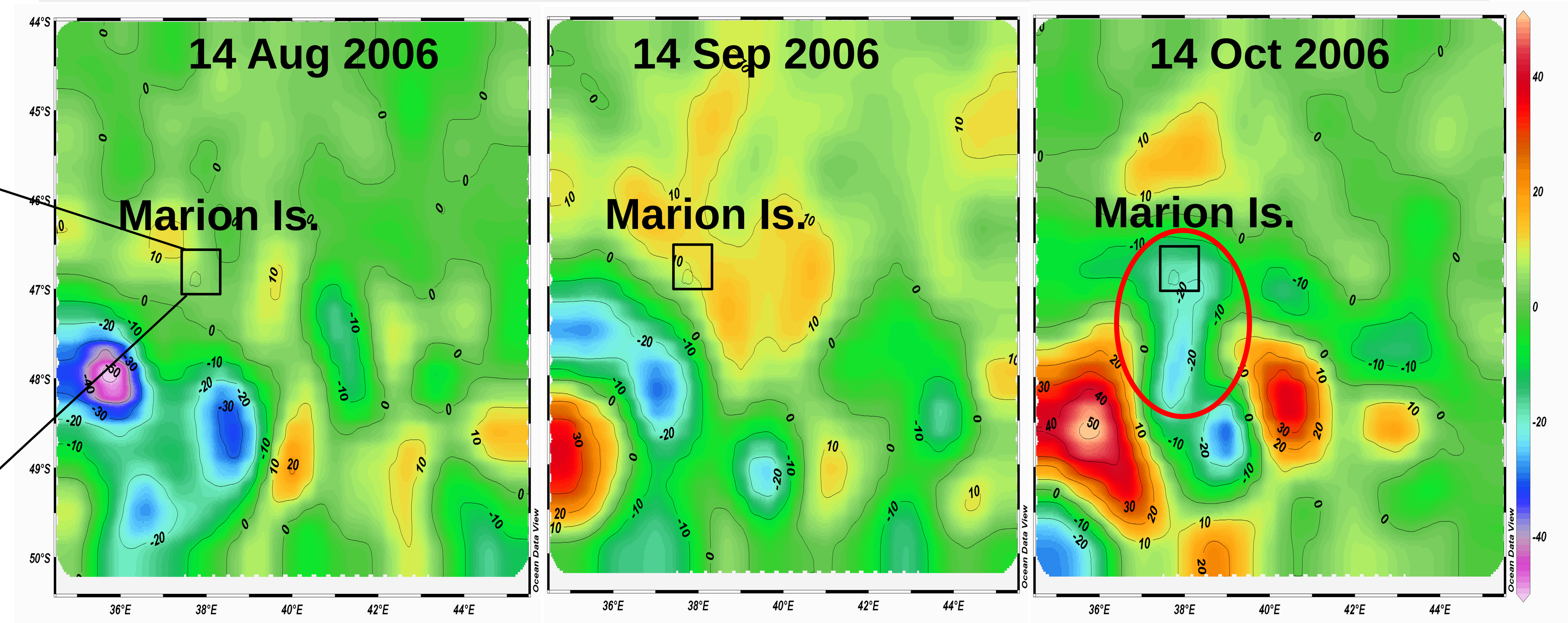


Figure 1: Satellite altimetry images of the study area indicating the presence of a cold, cyclonic eddy (encircled) over the area of restricted movement (inset) during October 2006. Warm, anti-cyclonic (red) and cold, cyclonic (blue) eddies were present to the south of the study area.

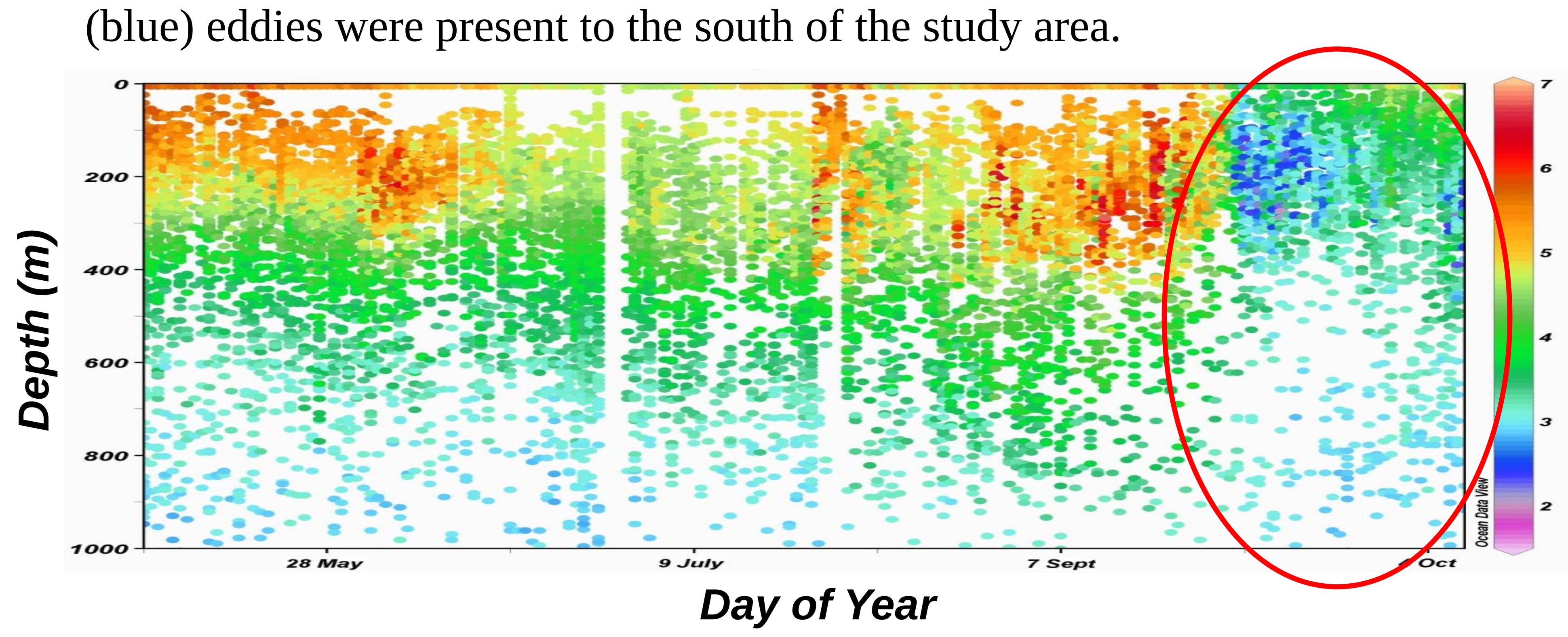


Figure 2: *In situ* temperature profiles recorded by the animal-borne SRDL indicating a decrease in temperatures from late September 2006.

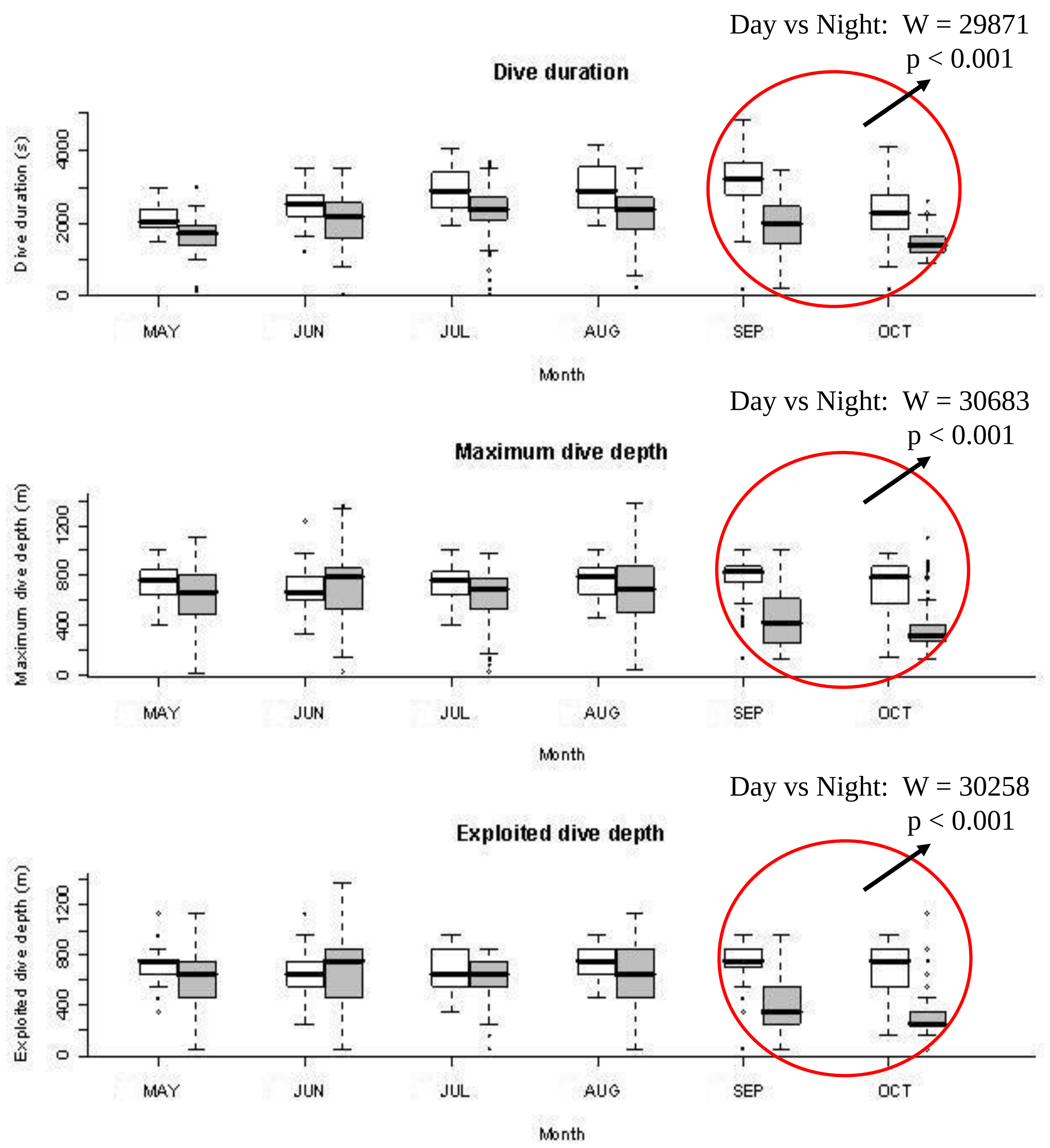


Figure 3: Summary boxplots of dive behaviour throughout the study period. Shaded boxplots = night-time dives; unshaded boxplots = day-time dives. Plots for September and October 2006 are encircled.

RESULTS

- The study animal concentrated his foraging effort from May to October 2006 in a small area north of Marion Island, and in close proximity to Prince Edward Island (Fig. 1);
- One cold, cyclonic eddy moved through the study area from late September until the end of October 2006, resulting in substantial decreases in water temperature (Fig. 2);
- *In situ* temperature data, obtained from the deployed SRDL, were significantly correlated with MODIS sea surface temperature estimates;
- Dive durations of the study animal gradually increased throughout the migration, but decreased in October 2006 (Fig. 3). Dives tended to be shorter at night, though a diel pattern was most apparent during September and October 2006;
- Day-time maximum dive depths were consistent throughout the six month period (Fig. 3). Night-time maximum dive depths were similar to day-time maximum dive depths between May and August, but became substantially shallower in September and October. Exploited dive depths displayed a similar pattern.

DISCUSSION

- During the first four months of the foraging migration (May to August) the seal did not display any diel variation in dive behaviour. The bathymetry of the estimated locations, in conjunction with the recorded dive depths, indicate that the seal likely foraged on benthic prey for this period of time.
- The seal abruptly changed to a pattern showing diel variation in maximum- and exploited dive depths during September and October 2006. This period coincided with the intrusion of a cold, cyclonic feature into the study area, likely bringing with it an alternative (and preferred) prey selection for the study animal. This indicated a likely change of prey choice to vertically migrating species (Jonker & Bester 1994).
- Our results illustrate plasticity in foraging strategies of southern elephant seals.

References

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- McIntyre, T. *et al. Pol Biol* in press. DOI 10.1007/s00300-010-0782-3

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