ARESSA THEME III: Biodiversity: Responses to Earth System Variability

Population ecology of pinnipeds at the Prince Edward Islands

Marthán N. Bester[1], Pierre A. Pistorius[1], Gordon J.G. Hofmeyr[1], Clive R. McMahon[2], Stephen P. Kirkman[1], Aswianewi B. Makhado[1] and Harry R. Burton[2]

[1]Mammal Research Institute, Department of Zoology & Entomology, University of Pretoria, Pretoria 0002, South Africa; [2]Australian Antarctic Division, Kingston 7050 Tasmania, Australia

The Southern Ocean plays a critical role in global climate and the demography and population abundances of apex predators are directly influenced by the availability of prey. To elucidate effects of climate change on sub-Antarctic ecosystems we investigated the population dynamics[1,2] and foraging ecology[3-5] of Antarctic and Subantarctic fur seals and southern elephant seals at the Prince Edward Islands, in comparison with other island ecosystems[6]. The declining southern elephant seal population stabilised in the mid-1990s concomitant with an increase in pup weaning mass which suggests improved food availability to their mothers[6]. As a result age at first reproduction decreased and age specific fecundity and adult female survival increased[1]. Both the fur seal populations increased exponentially, the Subantarctic fur seal population approaching carrying capacity[2], and they feed almost exclusively on the same species of myctophid fish in similar proportions, with little annual variation in pup growth rates, feeding trip durations and onshore attendance patterns of their mothers[4,5]. Satellite tracked immature southern elephant seals spend most of their time upstream of Marion Island during winter. Post-moulting adult females range some 2122-3133 km to the APF, to inter-frontal zones south of it and to the Antarctic Continental Shelf. Post-breeding adult females remain within about 1500 km from Marion Island at the outer edge of their feeding range, largely within inter-frontal zones south of the APF, and between the STC and the SAF. Post-breeding adult males behave similarly but during the post-moulting period males travel far and wide within a latitudinal belt of approximately 15° (40°S–55°S) primarily westward. Adults occasionally dive to depths in excess of 1900 m and primarily execute foraging dives between 300-600 m presumably following vertically migrating prey. Future work should continue tracking the demography and condition of the southern elephant seal population and their killer whale predators[7] through direct counts, mark-recapture and photogrammetry; monitoring the population growth, attendance patterns, pup growth rates and diet of the fur seal populations; satellite track both elephant seals and fur seals at sea to reconcile their foraging areas with oceanographic and bathymetric characteristics in a changing environment, and in the context of conservation[8].

1. Pistorius, P.A., Bester, M.N., Lewis, M.N., Taylor, F.E., Campagna, C. & Kirkman, S.P. Adult female survival, population trend, and the implications of early primiparity in a capital breeder, the southern elephant seal (*Mirounga leonina*). *J. Zool., Lond.* **263**, 107-119 (2004).
2. Hofmeyr, G.J.G., Bester, M.N., Makhado, A.B. & Pistorius, P.A. Population changes in Subantarctic and Antarctic fur seals at Marion Island. *S. Afr. J. Wildl. Res.* **36**, 55-68 (2006).

3. Jonker, F.C. & Bester, M.N. Seasonal movements and foraging areas of adult southern female elephant seals, *Mirounga leonina*, from Marion Island. *Antarct. Sci.* **10**, 21-30 (1998).
4. Kirkman, S.P., Bester, M.N., Hofmeyr, G.J.G., Pistorius, P.A. & Makhado, A.B. Pup growth and maternal attendance patterns in Subantarctic fur seals. *Afr. Zool.* **37**, 13-19 (2002).
5. Klages, N.T.W. & Bester, M.N. The fish prey of fur seals *Arctocephalus* spp. at subantarctic Marion Island. *Marine Biol.* **131**, 559-566 (1998).
6. McMahon, C.R., Burton, H.R. & Bester, M.N. A demographic comparison of two southern elephant seal populations. *J. Anim. Ecol.* **72**, 61-74 (2003).
7. Keith, M., Bester, M.N., Bartlett, P.A. & Baker, D. Killer whales (*Orcinus orca*) at Marion Island, Southern Ocean. *Afr. Zool.* **36**, 163-175 (2001).
8. Lombard, A.T., Reyers, B., Schonegevel, L.Y., Cooper, J., Smith-Adao, L.B., Nel, D.C., Froneman, P.W., Ansorge, I.J., Bester, M.N., Tosh, C.A., Strauss, T., Akkers, T., Gon, O., Leslie, R.W. & Chown, S.L. Conserving pattern and process in the Southern Ocean: designing a Marine Protected Area for the Prince Edward Islands. *Antarct. Sci.* **19**, 39-54 (2007).