

Remote sensing imagery as a tool for monitoring the abundance of selected marine animal species within the Antarctic Specially Protected, Managed and Important Bird and Biodiversity Areas

Abstract

The Antarctic, contrary to the common misconception that it is completely isolated from all stressors, is in fact facing a number of threats to its globally unique natural values. Effective collaboration between the scientific advisory body and the Antarctic political structures responsible for determining the future of the white continent necessitates a rigorous scientific approach to formulating specific objectives. This approach should be designed to provide Antarctic decision-makers with the robust data and conclusions essential for making informed policy decisions. In designing the research that forms the basis of this dissertation, the guiding idea was the premise of targeted environmental monitoring. This is defined by its integration with conservation practice, design and implementation based on *a priori* hypotheses and related models of system response to management.

The principal objective of this study is to propose methodologies for the monitoring of selected species of Antarctic animals utilising remote sensing technologies and automated object detection algorithms. The four publications included in this thesis present the results of the following specific objectives: (1) to propose a procedure for monitoring populations of southern giant petrels (*Macronectes giganteus*) using remotely piloted aircraft systems (RPASs); (2) to assess the suitability of World-View-3 satellite imagery at 31 cm resolution for monitoring the breeding population of southern elephant seal (*Mirounga leonina*); (3) to evaluate the feasibility of utilising RPASs for the purpose of conducting bird sanctuary (Important Bird and Biodiversity Areas (IBAs)) inventories; (4) to assess the efficacy of the YOLO machine learning model in the automatic detection and enumeration of Antarctic shag (*Leucocarbo bransfieldensis*) nests on georeferenced aerial mosaics. The remote sensing methodologies employed in this dissertation can be disseminated for the purpose of conducting inventories of Antarctic areas of natural value and special management needs.

Keywords:

remote sensing; satellite and aerial imagery; wildlife monitoring; the Antarctic; wildlife conservation; machine learning; automatic object detection