Mapping Application for Penguin Populations and Predicted Dynamics (MAPPPD)

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Programme Website
http://www.penguinmap.com/

Project Description
This project represents a NASA-funded collaborative effort (PI: Dr. Heather Lynch (Stony Brook University), Co-I: Dr. Mathew Schwaller (NASA)) to develop a decision-support application for Antarctic stakeholders that: (1) will automate the interpretation of high- and medium-resolution satellite imagery for estimating the abundance and distribution of penguins in Antarctica, and (2) will integrate these data into scalable abundance estimates at any user-defined spatial scale. The Phase-1 pilot study to develop the core methods and a prototype browser-based application ends in January 2015, and we are currently in the process of applying for Phase-2 funding that would provide three additional years of support for further development and transition to our primary partner organization, the U.S. non-governmental organization Oceanites, Inc. (PI: Ron Naveen).

Increased availability of satellite imagery for the Antarctic provides new opportunities for monitoring Antarctic biology, but poses unique challenges for data synthesis and interpretation. Our work in Phase-1 of this award developed the mechanisms by which such increased volumes of raw data may be transformed into knowledge of Adélie penguin distribution and abundance that can be used for conservation and management. In Phase-2 we plan to scale these tools to three other penguin species with substantial Antarctic breeding populations: the emperor penguin (Aptenodytes forsteri), the gentoo penguin (Pygoscelis papua) and the chinstrap penguin (P. antarcticus). Furthermore, we plan to extend the retrieval of abundance and distribution through a 30-year record of satellite observations in Antarctica, starting in 1984 with Landsat 4. Additional development of the user-interface will ensure that it is accessible and can be easily used by both the scientific and non-scientific Antarctic communities. The expected result is a flexible all-purpose tool for managing, interpreting, and visualizing the abundance and distribution of penguins in Antarctica.

The prototype Mapping Application for Penguin Populations and Projected Dynamics (MAPPPD) application creates, organizes, and displays data on the abundance and distribution of penguin species at spatial and temporal scales commensurate with other remote observing systems in Antarctica, allowing for smooth interoperability across the physical and biological realms. This directly addresses the need for 'broad-scale measurements of key variables'; in fact, the SOOS Initial Science and Implementation Strategy explicitly lists "distribution and abundance of key species" as well as "top predator abundance" and "distribution" as being "[h]igh-priority variables". MAPPPD provides a regional and continental-scale context for additional observation on Antarctic biology, such as those stemming from animal-borne instruments or opportunistic records of species occurrence, and thus provides a key dataset to understand the impact of global change on Southern Ocean ecosystems (SOOS Theme #6). Moreover, the use of remote sensing to track the abundance and distribution of penguins expands the options for understanding Antarctic biology, includes the integration of data coming from direct surveys, and naturally complements the work already underway with animal sensors. The MAPPPD application adds value to SOOS's commitment to information delivery. While our work has clear benefits for integration with fundamental science and long-term monitoring, our work is focused on

delivering objective, transparent, fully-sourced policy-ready information to Antarctic stakeholders.

Project Timeline
2015 - 2018

Key deliverables
The key deliverable of this project is a browser-based application, which may be found at:
http://www.penguinmap.com/
This website will be hosted by Oceanites, Inc. with links to access provided by Antarctic data and information portals such as the Antarctic Environments Portal.

Funding
NASA funding has been provided to develop a pilot, and funding is being sought for Phase-2 development.

Data Management
Our application generates new data through the interpretation of satellite imagery and aggregates data in a modelling and prediction framework. Data generated through our application will be available through the application itself, and will follow all the best practices outlined in the SOOS Data Policy. Validation and improvements to the interpretation algorithm will be ongoing, especially as new sensors go online, and we will publish these validation studies in the peer reviewed literature as quickly as is feasible, and notify the SOOS community of any changes to our interpretation algorithms. Datasets aggregated from other sources (e.g., the literature, 3rd-party contributed data) will be clearly cited and linked to the original source. One of the goals of this project is to create transparency for penguin abundance data and ensure that all data in the public domain is traceable to its original source. We are happy to submit our data to additional databases (e.g., GBIF, SCAR-MarBIN) as suggested by the SOOS Scientific Committee. (NB: Some of our data will have been derived from commercial imagery subject to strict licensing controls. This imagery cannot be made available to SOOS community, although the MAPPPD application will provide all relevant metadata along with the penguin abundance/location information.)