

**BIOLOGICAL MONITORING ASSISTED WITH CARTOGRAPHY  
"FIELD ATLAS"**

Hernán Torres E., Orlando Cifuentes A. y José Valencia

*Centro de Estudios Espaciales  
Universidad de Chile  
Arturo Prat 1171, Casilla 411-3  
Santiago, CHILE  
Fono-Fax (56-2) 555 33 71*

**ABSTRACT**

The Faculty of Sciences of the Universidad de Chile and the Chilean Antarctic Institute (Instituto Antártico Chileno - INACH) has been conducting eco-biological studies for several years as part of a joint project: "Ecology of Three Species of Penguins". Recently, a very much needed intermediate objective was achieved: To represent the reproductive behavior of the species through cartographic tools.

The new perspective offered by the cartographic tools will allow a better understanding of the status and trends shown by the penguin population in the Antarctic Continent. Also, the localization and geographic distribution data of the nesting sites will simplify the monitoring of the alterations within the Antarctic Territory.

The cartographic tools created will be used to standardize the data collection allowing the interannual comparison systematically. This paper presents the data collection and methodology to produce a "Field Atlas" that scientists will use in the next data collection campaign.

**I. INTRODUCTION**

Chilian Antarctic Institute Project 040 "Ecology of Three Species of Penguins" introduced monitoring of breeding group behaviour in one of the most important Antarctic colonies, in order to understand fluctuations produced in the population of these species. Ardley colony (62° 13' S, 58° 54' W. Albert 1981) lies at 500 mts. from the east of Fildes Peninsula, Maxwell Bay, King George Island, South Shetland Island; 1km. from Chilean President Frey and Russian Bellinshausen Bases; and from 700 mts. from The Great Chinese Wall.

Penguin importance is in its bio-indicator condition of the Antarctic ecosystem. This status, recognized by the Scientific Committee for Antarctic Resources (SCAR), gives to these birds a great importance in record delivery of validation to models, not only to Antarctic, but also to many countries, specially, to Chile whose ecosystem is directly linked to this continent.

Participation of researchers from the Center for Spatial Studies and collaboration of the Chilean enterprise "CIENTEC, Scientific Tools" (Leica agent), has permitted to collect the necessary data for "biological monitoring assisted with cartographic tools", through the design and application of a Field Atlas.

The Atlas principal aim is to systematize and facilitate data capture related with distribution of penguin breeding groups.

## 2. HISTORICAL BACKGROUNDS

On July 7<sup>th</sup> 1494, Castile and Portugal Kings, using property right given by papal bull of May 3<sup>rd</sup> and 4<sup>th</sup> and of September 26<sup>th</sup> 1493, affably agreed to divide land discovered in 1492 (Orrego, F. Martinic, M 1977). Unknowingly, Antarctic and Chilean future of the new world was being decided.

In 1539, jurisdictional and supreme power emanated from Castilian Laws gave Terra Australis government to Pedro Sancho de la Hoz. Land boundaries were Strait of Magellan coastal line and South Pole. Public deed, on August 12<sup>th</sup> 1540, transferred these rights to the Captain of Chilean Conquest Mr. Pedro de Valdivia. After Valdivia's death, Royal Letters Patent of September 29<sup>th</sup> 1554 and May 29<sup>th</sup> 1555, gave Province of Chile, Atacama Desert, Patagonia, and Terra Australis jurisdiction to Jerónimo de Alderete, taking from 27° south latitude to South Pole.

In 1603, Admiral Gabriel de Castilla shipped from Valparaiso (principal Chilean port) to make Chilean coastal line recognition. He arrived to 64° south latitude, seeing Antarctic lands for first time. In 1761, Governor Manuel de Amat and Junient, doing Chilean Kingdom description, consigned geographical and historical ownership of the southern islands to his jurisdiction. Above mentioned events were reinforced in Nootka Sound Treaty in 1790 (Spain - England) where it was acknowledged, in Spain favor, geographical pre-existence of southern lands.

Rapidly, discovered lands became the scenery of the bloodiest hunting of seals, sea wolfs and cetaceans. This activity has been diminishing up to now with some exceptions protected by "scientific studies" which results we begin to have doubts about.

On the other hand, Chile, signer country of Antarctic Treaty, promised to increasing scientific knowledge and, in 1991 when Chile subscribed Environmental Preservation Protocol (Madrid - Spain), promised to protecting Antarctic environment from man-made disturbance and taking care of the continent and its resources. This Protocol was ratified with President Eduardo Frei Ruiz-Tagle's signature in Punta Arenas on April 3<sup>rd</sup> 1995.

Since its beginnings, Universidad de Chile has taken a preponderant role in Chilean scientific activities and Antarctic has not been the exception. In 1958, our university had already an active participation in settlements next to Bernardo O'Higgins Base which belongs to the Army. Due to these activities, the University managed Gabriel González Videla Scientific Base from 1960 to 1963 (Cabrera et. al., 1992).

Because of nearness to President Frei Base, in Ardley exists large data of work. Fauna monitoring of the area for more than ten years is a proof of this. On October 1992, this activity was strengthened by the study period establishment. In October and February of this year, almost the totality of the three local penguin-species reproductive cycle was included.

For these reasons, main project researchers planned a Field Atlas elaboration which joined general and specific aspects of the area, in order to standardize methods used in eco-biological data collection to give in-field researchers, thesicians and project assistants graphic elements that permit them to have a spacial view of the studied area and ecosystem. Only with a spatial variable introduction, an effective Antarctic and adjacent seas management, through the use of sea and land monitoring, will be possible.

### 3. METHODOLOGY

Due to Antarctic continent characteristics, it exists cartographic works of some places only; Fieldes Bay (where Ardley is) is one of those. Nevertheless, we needed base generation at a bigger scale than the existing one (1:10.000 in edition from Brazil and Germany) in order to develop a biological monitoring with cartographic tools. For this reason, our main efforts were to capture representative data of penguin breeding group relieve and distribution.

In general terms, applied methodology has three phases:

#### a. Record Collection

Collection had two main orientations biblio-photography and spatial view of the area (cartography, satellite images) and in-field data which joined the preceding ones, giving a particular characteristic to the work.

In relation to bibliographic data, Chilean Antarctic Institute (INACH) and universitarian libraries were exhaustive revised, in order to optimize international contribution. Photographical materials were obtained, principally, from researchers and also from INACH.

As it was mention above, cartographic bases of the area were deficient for biological monitoring aims; nevertheless, collected material was a valuable contribution to general view elaboration.

#### b. Material Selection

Most of the time, material selection is a difficult task; however in this opportunity, original aim was rigorously followed to obtain a cartographic tool that could facilitate and contribute to biological data collection of penguin breeding colony. This would give a general view of the area, ecosystem and Antarctic continent, in order to permit students or researchers to obtain, in their first trip, enough data to evaluate characteristical situations of field activities in such a special place.

In some way, selected material permits specialized reserchers, as well as turists, to develop a global view which it is called "spatial" in geographical sciences.

#### c. Tentative Elaboration of Content

Tentative elaboration of content was previous experiences results in Antarctic fields, where, through the contact with biologists, ecologists, physicists, geologists, it was possible to detect existing relationships and the lack of "spatial view" in each study.

For that reason, it was determined that the following themes should be included: General view of Chilean Antarctic Continent (Chile claims sovereignty over a continent portion and we can give up to our national pretension despite our scientific - man condition), flora and fauna, geology and history.

#### d. Atlas Prototype Design

In Atlas prototype design, three aspects were considered: cartographic bases (existing ones and the ones which should be elaborated), cartographic and diagramatic design. All these elements aim to give a "personality" to the product which must be a motivating element for spatial view application in eco-biological analysis and proposal, principally.

## 6. BIBLIOGRAPHY

Aguayo, A., J. Capella, H. Torres, R. Jaña y D. Torres, 1992. Progreso en el estudio ecológico del lobo fino antártico, Arctocephalus gazella, en cabo Shirreff, isla Livingston, Antártica. Bol. Antárt. Chileno 11 : 12 - 14.

Albert, F.G. 1981. Geographic Names of the Antarctic. National Science Foundation, 959 pp.

Burroughs, P. A. 1986. Principles of Geographical Information System for Land Resources Assessment. Monograph on Soil and Resources Survey. Clarendon Press. Oxford. 193 pp.

Escobar, M. & Pinochet, A. Atlas Antártico, Instituto Profesional de Santiago, 1991.

Ibañez, V. Cartografía temática del continente antártico y territorio chileno antártico. Universidad de Chile, 1977.

Libault, A. 1975. Geocartografía. Ed. Nacional, Ed. da Universidade de São Paulo.

Margalef, R. 1986. Ecología. Ed. Omega, Barcelona.

Mäusbacher, R., Die jungquartäre Relief-und Klimageschichte im Bereich der Fildeshalbinsel Süd-Shetland Inseln, Antarktis, 1991.

Torres, H., Levantamiento aerofotogramétrico urbano escala 1:1000, Instituto Profesional de Santiago, 1991.

Torres, H. & J. Valencia, El estudio de la ecología de tres especies de pingüinos y su relación con la cartografía y los sistemas de información geográfica, III Congreso Internacional Ciencias de la Tierra, Instituto Geográfico Militar, Santiago, Chile. (en prensa)

Valencia, J. & M. Salaberry, Censo de pingüinos en isla Ardley (Shetland del Sur) Ser. Cient. INACH 30: 93-96, 1983.

#### 4. PROJECT RESULTS

Atlas final presentation answers to the following scheme:

- a. Work presentation in charge of: Oscar Pinochet de la Barra, Director of Chilean Antarctic Institute; Eduardo Díaz Araya, Director of Center for Spatial Studies; and José Valencia, Project Prime Researcher.
- b. Three-continental Chilean View, emphasizing present and future of country ocean.
- c. General Aspects of Antarctic Territory, historical aspects and Antarctic Treaty.
- d. Chile, Antarctic Country, localization and distribution of research bases and project.
- e. Ardley, general and specific aspects of the work carried out.
- f. Sector projections and future studies.
- g. Gratefulness.

Biological, flora, fauna, and geological themes were developed from a specialist view and Atlas authors, trying to satisfy the widest range of users.

No doubt, the objective will be strengthened when community uses this work in their activities. From now, we are evaluating necessary corrections that permit us to satisfy our desire.

#### 5. GRATEFULNESS

We wish to thank to Chilean Antarctic Institute, Chilean Air Force, Universidad de Chile, Center for Spatial Studies, Project FI - 13 and CIENTEC: Scientific Tools Enterprise. Without the collaboration of all these institutions, this work could not have been developed.

Institutions are important, but people are much more important. On behalf of all anonymous people who work in these institutions, whose effort may never be rewarded, we wish to thank to Raúl Aguilera, Juan Martínez, Mónica Ramos y Ramón Pinto.

Field Researchers were: Juan Capella, Fernando Luchsinger, Claudia Godoy y Hernán Torres.