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# Antarctic Affairs

**Table of contents**

MESSAGE FROM THE MANAGING EDITOR 3  

ASOC PROLOGUE 4  

ARTICLES:  


Eugenia Moreira, Manuel Novillo and Esteban Barrera Oro. *Antarctic Fish: The Importance of Research Programs in Coastal Waters* 13  

Pablo Fontana and Andrés Levinson. *Following the Film Footprints of Antarctica: A Comprehensive Project for the Rescue of Argentine Antarctic Cinema* 26  


EDITORIAL NOTE:  


CONTRIBUTORS 49  

RULES OF PUBLICATION 53
Dear readers,

Welcome to the ninth volume of the Journal of Antarctic Affairs. This edition is especially composed of South American authors who have dedicated their careers to the study of Antarctica from various disciplines, including biology, history, physics, archaeology, and international relations.

María Fernanda Cerdá contributes the opening article of this edition. She presents the results of an experiment where anthocyanins from the ceibo flower were used to assemble DSSC solar panels and install them at the Uruguayan Antarctic base, Artigas. Cerdá highlights that the panels demonstrated stability and the ability to generate electricity from artificial light, demonstrating the potential to expand the energy matrix of the bases using discarded natural resources.

In the second article, Eugenia Moreira, Manuel Novillo, and Esteban Barrera Oro emphasize the importance of increasing knowledge about Antarctic ichthyofauna to develop conservation measures in a scenario of climate change and constant pressure from commercial fisheries. Moreira, Novillo, and Barrera Oro detail how research programs in coastal in-shore waters provide valuable information to complement the understanding of species’ life cycles and their role in the ecosystem.

Pablo Fontana and Andrés Levinson provide a brief overview of the most notable titles in Argentine Antarctic cinematography, which is part of the “Comprehensive Rescue Project of Argentine Antarctic Cinema.” These films have incalculable value as they encapsulate images that are a fundamental part of Antarctic memory.

In the fourth article, Diego Aguirrezábal, Bruno Gentile, and Gaspar González critically analyze the processes of memory structuration using archaeology as a tool to contrast written history. Through the investigation of material evidence, the authors interpret the transformations of the landscape of the South Shetland Islands, demonstrating that archaeology encompasses not only tangible elements but also incorporates intangible information to enrich its interpretation.

Finally, in an editorial note, Mariano Aguas discusses the strategic importance of Antarctica and how countries can employ soft power in their foreign policies. He discusses its utility in terms of influence, persuasion, attraction, legitimacy, cooperation, conflict resolution, and global public opinion.

To end, I would like to express gratitude to all the authors, translators, and members of the Editorial Board who contributed to the realization of this edition of Antarctic Affairs.

Juan José Lucci
The scientific work carried out by researchers from South America has been fundamental in advancing knowledge on various Antarctic topics. Through their national Antarctic programs and universities, numerous lines of research have been developed, encompassing subjects such as oceanography, biology, history, environment, and political analysis, among others.

The countries in the region play an important role not only in scientific development but also in promoting the conservation of Antarctica, both on land and in the marine environment. They have established strong cooperative relationships that reinforce the nature and spirit of the Antarctic Treaty.

The results of these works have provided valuable inputs in discussions at the Committee for Environmental Protection (CEP), the Antarctic Treaty Consultative Meetings (ATCM), and the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). An example of this is the joint proposal by Argentina and Chile to create a marine protected area in the Antarctic Peninsula Zone (Domain 1 in CCAMLR terminology), which was developed over six years of collaborative work involving researchers from both countries.

The relationship between scientists from these countries and civil society through non-governmental organizations has strengthened over time. Nowadays, there is an excellent and close relationship that allows continuous interaction, benefiting not only the dissemination of research results but also the conservation efforts for Antarctica.

The Antarctic and Southern Ocean Coalition (ASOC), an institution that brings together non-governmental organizations interested in Antarctic conservation, celebrates this relationship as it optimizes efforts to generate new knowledge and conserve this region.

In this edition of Antarctic Affairs, we wanted to provide space for researchers from the region to disseminate some of their scientific work. The number of existing works is countless, and it would be impossible to cover them all in a single journal edition. Therefore, these publications represent only a small sample of ongoing research. We hope that these articles serve as an example of the work being carried out in South America regarding Antarctica.

Dr. Rodolfo Werner*
Editor

* Advisor to The Pew Charitable Trusts and the Antarctic and Southern Ocean Coalition (ASOC); Member of the Board and scientific advisor of the Antarctic Wildlife Research Fund; Director of the Advisory Council of Fundación Agenda Antártica; Guest speaker for Lindblad Expeditions/National Geographic.
Exploring Alternative Energy Sources for Antarctic Stations: Integration of Solar Panels into Building Infrastructure

María Fernanda Cerdá

Abstract

The dye present in dye-sensitized solar cells (DSSC) is responsible for converting sunlight into an electron flow. These pigments can be extracted from natural sources, providing a means to utilize typically lost or discarded resources, such as algae deposited on the coast or unmarketable fruits. By using anthocyanins extracted from the flower of the ceibo tree (Erythrina crista-galli), two small panels were assembled and installed at the Artigas Antarctic Scientific Base, allowing for remote evaluation of their performance over a period of 19 months. Located inside a room behind a window, the panels demonstrated excellent stability during the evaluation period. They were also able to generate electrical energy from artificial light sources near the installation area and had the capacity to produce electricity during the low-radiation winter months, where snow could potentially play a significant role by functioning as a large mirror. This research describes an interesting advancement in expanding the energy matrix of the Antarctic bases by utilizing typically discarded natural resources to potentially play a relevant role.

Keywords

Anthocyanins, Photovoltaics, Renewable energy
INTRODUCTION

Solar cells based on the use of pigments (known as DSSC, an acronym for Dye-Sensitized Solar Cells or Graetzel cells) were first reported in the 1990s (O’Regan et al., 1991). Since their discovery, they have garnered significant interest, as evidenced by numerous reports in the literature and their application in various fields, including personal devices, greenhouses, and building integration (Bandara et al., 2022; Pirrone et al., 2022; Fagiolari et al., 2022; Barichello et al., 2021; Muñoz et al., 2021). Their energy conversion efficiency has continuously improved, reaching values of up to 34% under ambient radiation conditions of 1000 lux (Zhang et al., 2021). However, the use of natural pigments, although less efficient than synthetic ones, remains appealing given their low cost and widespread availability. Additionally, they offer an alternative application for resources that are discarded or go to waste, such as algae deposited on coastal or river shores and unmarketable fruits.

In a DSSC, the pigment deposited on the photoanode plays a crucial role in capturing sunlight and converting it into an electron flow. In our laboratory, we have evaluated numerous compounds found in nature for their use in DSSCs, many of which were obtained from algae and bacteria collected on King George Island (Cerdá, 2022; De Bon et al., 2022; Gonzalez et al., 2022; Marizcurrena et al., 2021; Cerdá et al., 2020; Yañuk et al., 2020; Montagni et al., 2018; Enciso et al., 2017). Among these, anthocyanins derived from the ceibo flower have allowed us to assemble the most efficient cells yet. These cells have been selected for the construction of the panels installed at the BCAA.

DSSCs possess a crucial characteristic that sets them apart from traditional silicon-based cells: their translucency, enabling the passage of light through them. This feature allows for their installation in windows, meaning they are integrated into the building structure.

![Figure 1. DSSC panels on the windows of the Swiss Convention Center, located in the city of Lausanne.](image)
The installation of this technology in Antarctic stations deserves consideration. These panels could contribute to diversification of the energy matrix by better harnessing solar light, particularly during the winter months when traditional silicon panels either shut down or significantly reduce production (sometimes due to snow coverage). An outdoor photovoltaic panel in a region like Antarctica will inevitably be covered by snowfall, preventing sunlight from reaching it. However, this is not the case with DSSC panels since they are installed within buildings, providing energy to the enclosed space, and protecting it from harsh weather conditions. Additionally, these panels can be assembled using pigments obtained from the surrounding environment. Moreover, if natural pigments are used, low temperatures at the location help preserve the colorants (Szadkowski et al., 2022; Ahn et al., 2014).

RESULTS AND DISCUSSION

In our laboratory, we have explored various natural-origin pigments/dyes which can be grouped according to their structural characteristics, such as proteins, carotenoids, xanthophylls, indoles, and anthocyanins. We have observed a significant correlation between the size of the evaluated molecule and cell efficiency, as electrode surface coverage is crucial.

Our best results reached an efficiency of 0.7% using anthocyanins from the ceibo flower. For this reason, individual cells were first assembled using the ethanol-extracted anthocyanins, purified, and then applied to the photoanode. Finally, the cells were sealed and individually evaluated; the most efficient were selected for panel assembly.

\[\text{Figure 2. Assembly schematic of one of the panels (taken from Cerdá, 2022).}\]
The primary objective of this study was to assess the feasibility of utilizing these devices in Antarctica and analyze their stability and operational characteristics. Therefore, opaque materials were used for panel construction as they incurred a lower cost. While the technology’s main appeal lies in its ability to allow the passage of light, the required materials (as shown in Figure 3) are much more expensive.

The panels were installed near a window at the Artigas Antarctic Scientific Base (parallel to it and oriented NW) and connected to an ARDUINO device that allowed remote monitoring of their generated power values over time. One panel (named KD12, panel area 9 cm²) was fully monitored, yielding voltage and current intensity data. In the case of current intensity, voltage data were measured on one of the ARDUINO board channels from a circuit containing an external resistance of 5.5 k ohms. The collected data were compared with those from a reference monocrystalline silicon solar sensor (area 15 cm²) connected to the same ARDUINO board as the KD12 panel. Through this, and by considering the irradiance values measured over time, the performance of the DSSC panel could be compared to that of the silicon sensor over the same period.

The trend in radiation received by the equipment was in line with expectations: it is minimal in the winter months (June/July) and highest in the summer months (December/January). A similar occurrence was found with the silicon sensor’s data generation, where the peaks occurred during periods of maximum radiation. However, the power generated by the DSSC panel did not follow the same trend. As shown in Figure 4, the power generated by the DSSC panel (KD12) was independent of the incident radiation.
Figure 4. Data of power generated by the DSSC panel (KD12), along with radiation data measured by a pyranometer and generated by silicon panels during the 19 months of monitoring (taken from Cerdá, 2022).

Upon examination of the data presented in Table 1, in June/2019 and December/January of that year, the generated power behaves as expected in clear accordance with the received radiation. However, this does not occur in the following winter, where during the months of June and July/2020, precisely the opposite happened: the panel maintained its generation capacity, to the extent where its energy conversion efficiency (PCE) was among the highest measured values.

<table>
<thead>
<tr>
<th>Month</th>
<th>Average power mW</th>
<th>Maximum voltage V</th>
<th>PCE %</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 19</td>
<td>0.0021</td>
<td>0.19</td>
<td>0.0054</td>
</tr>
<tr>
<td>Dec. 19</td>
<td>0.024</td>
<td>0.49</td>
<td>0.0031</td>
</tr>
<tr>
<td>January 20</td>
<td>0.024</td>
<td>0.47</td>
<td>0.0032</td>
</tr>
<tr>
<td>June 20</td>
<td>0.031</td>
<td>0.48</td>
<td>0.0774</td>
</tr>
<tr>
<td>July 20</td>
<td>0.045</td>
<td>0.52</td>
<td>0.0462</td>
</tr>
</tbody>
</table>

Table 1. Average powers calculated from the data generated by the KD12 panel, alongside data of maximum average voltage (taken from Cerdá, 2022).
To assess this observation, it was necessary to consider the influence of other factors, such as the presence of snow or artificial light near the window where the panel was installed. These hypotheses were reinforced by measurements taken in our laboratory in the city of Montevideo. On one hand, the device showed an interesting power generation capacity when illuminated with artificial light. On the other hand, its performance was measured during the winter in our city, where the average temperature is 10°C but where snowfall is never recorded. Under these conditions, with low radiation (natural light) of 60 W/m², the KD12 panel was able to generate 0.005 mW of power with a maximum measured voltage of 0.20 V. Further research is necessary to confirm the hypothesis.

The comparison of the DSSC panel’s behavior with that of monocrystalline silicon is also interesting. Firstly, in contrast to the reaction with DSSC, the silicon sensor showed no response when illuminated with artificial light. The artificial light from the light fixtures has a lower intensity than sunlight, especially when originating from external fixtures located near the window where both panels were installed. Furthermore, the spectrum (i.e., the range of energies involved) significantly differs to that of natural light.

The small silicon panel was only able to generate voltage when irradiance values exceeded 100 W/m². This difference in sensitivity could have interesting practical consequences.

CONCLUSIONS

The DSSC panel constructed using ceibo flower extracts was able to generate power and voltage values throughout the evaluation period while maintaining conversion efficiency levels. This operational stability is crucial when considering the potential application of this technology to diversify the energy matrix in Antarctic bases.

This type of panel demonstrated an apparent capability in utilizing artificial lighting sources located in its proximity. Additionally, there were indications that it could harness light reflected by the snow, resulting in a higher power generation than expected, based solely on the irradiance measured by an external pyranometer.

Lastly, it is estimated that the panel’s location in a low-temperature zone and behind a glass surface may have contributed to stability maintenance of the pigments used. Since these pigments are of a natural origin, exposure to high temperatures and UV radiation (filtered in this case by the window glass) can lead to their degradation.

The observed results warrant further investigation into the potential of DSSC panels as energy harvesters in extreme conditions, such as the Antarctic environment.

ACKNOWLEDGMENTS

We would like to express our gratitude to the personnel of the Uruguayan Antarctic Institute for their assistance in transporting, installing, and caring for the panel. We also acknowledge the support of PEDECIBA and ANII, as we are researchers affiliated with both programs.
References


Cerdá M.F. (2022) Dyes from the Southern Lands: An Alternative or a Dream?, Solar, 2, 519-539. DOI: 10.3390/solar2040031

Cerdá M.F. (2022) A small-sized DSSC panel based on the Uruguayan national flower dye tested at the Antarctic Artigas Base, EPJ Photovolta., 13, 2-11. DOI: 10.1051/epjpv/2021015


ABSTRACT

Antarctic fish are an exploitable living resource in one of the most remote regions of the planet. Despite efforts to conserve certain sectors of the Southern Ocean, as well as some of the most emblematic fish species, the pressure from commercial fisheries remains constant. In this context, obtaining knowledge about Antarctic ichthyofauna is crucial to provide new insights that contribute to the development of conservation measures for the Antarctic ecosystem in a changing environment, such as the problematic context of climate change. Research programs in coastal or “inshore” waters provide valuable information to complement the understanding of species’ life cycles and their role in the ecosystem.

KEYWORDS

Antarctic Ichthyology, Fishery Resources, Trophic Ecology, Reproductive Ecology, CCAMLR
INTRODUCTION

The Ichthyofauna of the Southern Ocean is composed of only 374 species belonging to 50 families. Of these, 88% of the species are endemic, meaning they exclusively inhabit Antarctic waters. This vast marine area, representing 10% of the world’s oceans, hosts 1.3% of the world’s ichthyofauna. Considering that half of all vertebrates are fish, and there are at least 36,000 fish species worldwide distributed over 482 families (Fricke et al., 2022), the Antarctic ichthyofauna is not as diverse as one might expect given the size and age of the Antarctic marine ecosystem. The dominant group in terms of abundance and biomass is an endemic group of coastal demersal fish, the Suborder Notothenioidei (commonly known as notothenioids), consisting of 140 fish species, of which 110 inhabit Antarctic and subantarctic waters (Eastman and Eakin, 2021).

The presence of pelagic fish in the Antarctic marine ecosystem is limited. Pelagic ichthyofauna is mainly mesopelagic and is represented in terms of diversity and biomass by the family Myctophidae (lanternfish) and within the Suborder Notothenioidei by the species Pleuragramma antarcticum and cryopelagic species of the genus Trematomus. Pelagic species are ecologically important within the Antarctic food web as they serve as important prey for certain top predators, whether they are divers or not.

Within the notothenioids, some species from the families Nototheniidae and Channichthyidae were the target of commercial fisheries in the 1970s and 1980s (Kock et al., 2007; Collins et al., 2010). Commercial fishing began around South Georgia in the late 1960s and then expanded to the South Orkney Islands and South Shetland Islands in the Atlantic sector and around the Kerguelen Islands in the Indian sector in the 1970s-1980s (Kock, 1992). Later, mainly in the 1990s, fishing expanded into the Ross Sea in the Pacific sector. Commercial fishing was carried out for numerous species, with the main target species being the notothenioid Notothenia rossii, the icefish Champsocephalus gunnari, and as bycatch, the notothenioid Gobionotothen gibberifrons and other notothenioids. The impact of commercial fishing on the populations of these species made the activity economically unviable by 1985 (CCRVMA, 1986; Kock, 1992).

Fish and Antarctic krill, Euphausia superba, are currently the only resources commercially exploited in the Southern Ocean. Other marine resources that have been commercialized include the Antarctic king crab Paralomis spinosissima and the squid Martialia hyadesi, but historically, their direct impact on the ecosystem has been much smaller than that of the fishery for fish.

Since the establishment of the Convention for the Conservation of Antarctic Marine Living Resources (CCRVMA), conservation measures have been adopted to promote the recovery of overexploited fish species. Currently, commercial fishing in the Atlantic sector is limited to the area around South Georgia, Shag Rocks, and to a lesser extent, the South Sandwich Islands, targeting the black hake Dissostichus eleginoides and the crocodile icefish Champsocephalus gunnari. On the other hand, it is known that in the directed krill fishery, which is limited but not prohibited, fish in early stages of life are caught; it is paradoxical that adult fish of several species are currently protected but not their larvae and juveniles (CCRVMA, 2013, 2014).

In 1983, and subsequently in collaboration with the National Council of Scientific and Technical
Research (CONICET), the Ichthyology Project of the Argentine Antarctic Institute (IAA) began to assess the status of the coastal fish community in Caleta Potter (CP), where the ichthyofaunal composition is similar to that of the coastal areas of all the South Shetland Islands (SSI). The results of this long-term assessment showed a particular decline in species that were subjected to fishing activity (Barrera-Oro et al., 2017). These findings contributed to the CCRVMA adopting a series of management strategies, including the establishment of a closed area to commercial fishing for fish in the South Shetland Islands (Subarea 48.1 of the CCRVMA) from 1990 to the present (Kock, 1992; CCRVMA, 2021), in an attempt to promote the recovery of these and other overexploited resources. Caleta Potter (62° 14’S and 58° 40’W) is a coastal locality located on King George Island and is part of the South Shetland Islands archipelago, located north of the Antarctic Peninsula (AP) in the southern Atlantic sector (Fig. 1). Along the shore of Caleta Potter lies the Argentine Scientific Base “Carlini” (formerly known as “Jubany”), which hosts the largest number of Argentine Antarctic scientific projects and is recognized for its numerous contributions to Antarctic science (Wiencke et al., 1998, 2008).

![Figure 1. Overview of the South Shetland Islands and the Antarctic Peninsula, with an enlargement of the study/sampling site at Potter Cove, 25 de Mayo Island/King George Island.](image_url)
The IAA Ichthyology Project has addressed various aspects of the biology of nototheniooids in the Scotia Arc since its inception, with most of its research conducted in Caleta Potter. Unlike the deeper waters of the continental shelf (starting from depths of 200 m), where fish research cruises operate with bottom or semipelagic trawl nets, the fishing gear used to capture demersal fish in the shallow waters of CP (up to 110-120 m) has included fixed gillnets (trammel nets and set nets), hook lines, and traps. In general, research vessels do not have access to fish sampling in the inshore waters of Antarctica (coastal areas, coves, and shallow fjords) because the seafloor is not suitable. There, trammel nets have proven to be the best gear; their advantages include capturing fish in a short time, causing minimal damage to benthic organisms, insignificant bycatch of benthic organisms, and ease of operation from inflatable boats. As a passive sampling device, catches depend solely on the activity of fish, which is assumed to reflect the size of the population.

The project aims to contribute to scientific knowledge about the general ecology and evolution of species and the variations in abundance and population structure of those that have been commercialized and whose recovery time is unknown, as well as those that are potentially exploitable. Within this framework, and considering the limited knowledge of Antarctic fish, several lines of research have been developed, which have a direct application to the conservation and sustainable exploitation of ichthyofaunal resources regulated by the CCRVMA.

**THE FISH OF CALETA POTTER**

The most common species in Caleta Potter are notothenioids that spend part or all of their life cycle in inshore waters, although some of them also inhabit the deeper portion of the shelf to a depth range of 200-550 meters (Barrera-Oro, 2002). The nototheniids (family Nototheniidae) Notothenia coriiceps, Notothenia rossii, Nototheniops nudifrons, Trematomus newnesi, Trematomus bernacchii, and the harpagiferid (family Harpagiferidae) Harpagifer antarcticus are the most abundant species. The bathydraconid (family Bathydraconidae) Parachaenichthys charcoti, commonly known as the dragonfish, and the channichthyid Chaenocephalus aceratus (icefish) are less common species. The commercial interest in nototheniid Dissostichus mawsoni has occasionally been recorded. Gobionotothen gibberifrons was abundant in the cove, but from the years 1991-1992, its population began to decline. By 2007, the species had virtually disappeared from the cove due to a decline in the recruitment of young individuals, a result of the decline in populations that inhabited offshore waters, primarily caused by commercial fishing in the region (Barrera-Oro et al., 2000; Barrera-Oro and Marschoff, 2007; Marschoff et al., 2012; Barrera-Oro et al., 2017). In G. gibberifrons, an evident size stratification based on depth was observed; mainly juveniles and part of the adult population coexist in inshore waters (Barrera-Oro, 1989; Casaux et al., 1990; Kulesz, 1994) (Fig. 2).

**PRESENCE OF EARLY FISH LIFE STAGES IN CALETA POTTER**

The larval stages of fish represent a critical phase in their life cycle. Larvae of notothenioids have a short pelagic life and their habitat is primarily defined by topography, thermohaline gradients, and distance from the coast (Loeb et al., 1993; Koubbi et al., 2003). Kock and Kellermann (1991)
report three strategies: (1) species that produce few, large larvae with pelagic development, regardless of seasonality, (2) species that produce small larvae in large quantities with pelagic development restricted to the summer months, or (3) extending into the winter months. Larval survival is also influenced by biotic factors such as competition and predation. Lack of food is considered one of the primary causes of mortality (Koubbi et al., 2009), and it is influenced by the spatial-temporal correspondence between prey (e.g., plankton) and larvae (Cushing, 1975). The larvae of some notothenioid species feed on eggs of calanoid and cyclopoid copepods and on krill eggs in neritic spawning areas (Euphausia superba), mainly during the summer (Kellerman, 1990).

In Caleta Potter, eggs and larvae were identified not only from species that are part of the coastal fish community in their adult stages but also from species that are not common in the area. The presence of larvae from the species Harpagifer antarcticus, Psilodraco breviceps, Lepidonotothen squamifrons, Pleuragramma antarcticum, and Trematomus scotti was recorded, as well as the existence of Notothenia coriiceps eggs that hatched in the base’s aquarium (Piacentino et al., 2018, see Figure 3).

ASPECTS OF THE REPRODUCTIVE ECOLOGY OF FISH IN CALETA POTTER

Reproductive information indicates that Antarctic notothenioid fish take a long time to reach sexual maturity, after which females release a few large eggs, typically onto the substrate in simple nests or on other benthic organisms (e.g., sponges), which are fertilized by the male. A particular characteristic
of this group of fish is their parental care behavior, where the male or female guards the nest and protects the eggs from predators to increase the survival of their offspring.

While knowledge about the reproductive biology of notothenioids is extensive, the information mainly comes from scientific cruises that focused their sampling in offshore waters where the depths are greater, leaving the coastal Antarctic littoral zones relatively understudied. Studies conducted in the shallow waters of Caleta Potter macroscopically described the gonadal maturity stages of some nototheniids (Casaux et al., 1990; Barrera-Oro and Casaux, 2008), and they also documented, for the first time, the parental care behavior of the dragonfish Parachaenichthys charcoti (Barrera-Oro and Lagger, 2010; see Figure 4). In recent years, studies of the gonadal cycle of notothenioids have been conducted from a microscopic perspective, including histological techniques that allow for a more detailed examination of the reproductive process under a microscope. These studies revealed that Caleta Potter is a spawning site for some species of notothenioid fish, such as the dragonfish P. charcoti (Novillo et al., 2018), the icefish Chaenocephalus aceratus (Novillo et al., 2019), and the nototheniid Nototheniops nudifrons (Novillo et al., 2021a). Preliminary results also suggest that
this area may be a reproductive site for the nototheniid N. coriiceps, the trematomids Trematomus bernacchii, and T. newnesi. Therefore, the recorded reproductive information highlights the importance of shallow coastal areas in the reproduction of Antarctic nototheniid fish.

TROPHIC RELATIONSHIPS: THE ECOLOGICAL ROLE OF NOTOTHENIODS IN CALETA POTTER

Various aspects of the trophic ecology of nototheniid fish, including Notothenia rossii, N. coriiceps, Nototheniops nudifrons, Trematomus newnesi, T. bernacchii, and the harpagiferid Harpagifer antarcticus, were studied in Caleta Potter (compiled in Barrera-Oro, 2002, 2003; Barrera-Oro et al., 2019; Moreira, 2015; Moreira et al., 2014, 2020, 2021). Historically, this issue was addressed through the conventional study of stomach contents of individuals, while recent studies have incorporated the use of biomarkers (analysis of fatty acid profiles and stable isotopes). In these works (FSA-WG-CCRVMA 2019; Moreira et al., 2021), it became evident that the combined use of trophic biomarkers is essential to understand trophic interactions. Combining conventional stomach content analysis with fatty acids and stable isotopes allows for characterizing the diet of taxa, considering the advantages and limitations of each technique. A species’ diet can vary due to a combination of factors such as differential mechanical capacity to ingest prey during ontogeny, seasonal prey availability, and geographical origin (Kock, 1992). The purpose of these studies is not only to understand the composition of the diet and feeding habits of these fish but also to define the position of fish species in Antarctic marine food webs.

All species within a community are connected through trophic relationships. These connections are key biological interactions that determine the function and structure of an ecosystem. In inshore waters, nototheniid fish play a significant role in the flow of energy because they are the primary predators of the benthos, feeding on all organisms below their trophic level from plankton (mainly krill) to fish, as well as on zooplankton inhabiting the water column (Barrera-Oro, 2002; Moreira, 2015).

Based on the studies conducted within the project, it was revealed that gammarid amphipods constitute the main food item for fish species and sizes in Caleta Potter. Differences were also observed in the taxa consumed by these fish throughout their ontogeny. Small prey such as copepods and gastropods are consumed by the smaller fish of some species (early juveniles) but not by the larger fish (late juveniles and adults). Conversely, larger prey such as krill (LT ~ 5 cm) and fish are the primary prey items in the diet of adult and late juvenile stages of most species in Caleta Potter, with early juvenile stages having no or negligible prey. In the case of H. antarcticus, it was found that there are no substantial changes in diet based on size because the mechanical mouth capacity to ingest prey of different sizes does not vary significantly during its ontogeny, as it is a small-sized species. Although most Antarctic fish are primarily carnivorous, several of the species inhabiting Caleta Potter deliberately consume macroalgae, making them omnivorous.

To date, the biomarker approach has been used to analyze the diet of sympatric species, N. rossii and N. coriiceps. The results were inconsistent with those from conventional studies, as gammarid amphipods were not identified as the main prey for these nototheniids. None of the analyzed prey items were the primary source of lipids for both species, indicating the need to continue investigating
other food sources and evaluating the bioconversion capacity in these species.

The fish of Caleta Potter are primarily benthic demersal feeders and occupy the trophic level of secondary consumers. They hunt their prey (except for algae) and exhibit different intensities in grazing behavior. They have varying degrees of buoyancy, allowing certain species (e.g., N. rossii, Nototheniops nudifrons, Trematomus newnesi) to make incursions into the water column to feed on pelagic prey when available in the area.

Due to the importance of gammarid amphipods as prey, interspecific competition for food appears to be high. However, among generalist species with benthic feeding patterns, competition is mitigated by resource partitioning. In several studies, it was observed that different species of gammarid amphipods are preyed upon by different species of fish. The fact that they are generalist species undoubtedly provides these fish with greater trophic plasticity and, consequently, higher resilience capacity.

In inshore waters, demersal fish are an important food source for some top predators in the
Antarctic marine ecosystem. They are preyed upon by diving birds such as the Antarctic cormorant Phalacrocorax bransfieldensis and the gentoo penguin Pygoscelis papua, as well as by pinnipeds including the southern elephant seal Mirounga leonina, the leopard seal Hydrurga leptonyx, the Weddell seal Leptonychotes weddellii, and the Antarctic fur seal Arctocephalus gazella. Thus, energy flows from the benthos to the land through the actions of higher-level predators in the form of fish remains, pellets, regurgitates, and feces.

CONSIDERATIONS

The impact of climate change has had notable consequences in Antarctica, such as an increase in atmospheric and sea surface temperatures, as well as a decrease in salinity. These changes in physicochemical conditions will bring about modifications in the structure of communities. Having an in-depth understanding of trophic networks and how individuals interact with each other is essential for comprehending community structures, identifying key species, and evaluating ecosystem resilience. Understanding both trophic relationships and the reproductive ecology of fish are crucial aspects to promote successful management and conservation of their populations and ecosystems.

Studies on the impact of fisheries, combined with the general ecological information gathered over decades by the Ichthyology Project of the IAA, highlight the importance of coastal areas in the life cycle of Antarctic notothenioid fish. Particularly, the unique reproductive characteristics of notothenioids
- delayed maturation and low fecundity - make them especially susceptible to anthropogenic overexploitation. Overfishing, along with natural factors such as predation, are responsible for the inability of decimated populations to recover, as seen in the case of Gobionotothen gibberifrons in Caleta Potter. Therefore, considering the importance of reproduction as a key biological event in the life cycle of fish for their survival, there is a need to expand knowledge of the reproductive biology of Antarctic notothenioids for conservation purposes. In particular, gaining a deeper understanding of the spatial and temporal windows in which the reproduction of Antarctic notothenioid species occurs is particularly important, as protecting fish spawning areas has proven to be one of the most effective management strategies for sustainable exploitation and conservation of populations and their marine ecosystems.

Given the pressures exerted by different fishing nations for the reopening of commercial fishing in currently restricted Antarctic areas, it is relevant to deepen our knowledge about the state of fish populations inhabiting these regions, and thus provide the best available science within the framework of the CCAMLR for informed decision-making. A specific requirement is the adoption of management strategies to preserve areas for the breeding and growth of juvenile fish, in order to ensure sustainable resource exploitation. With a significant number of ichthyophagous vertebrates, the potential reopening of commercial fishing in any of the overexploited Antarctic regions would imply direct competition for resources between the fishing industry and these predators, potentially leading to a new imbalance in the ecosystem (see Anley and Blight 2009).

Argentina is one of the signatory countries of the Antarctic Treaty and actively participates in the Consultative Meeting of the Antarctic Treaty (COMNAP), the Committee for Environmental Protection (CEP), and meetings of the CCAMLR and SCAR (Scientific Committee on Antarctic Research). Our Ichthyology Project at the IAA contributes, through scientific research, to these international cooperation forums, such as the proposal for the establishment of a Marine Protected Area in the region of the Antarctic Peninsula (CCAMLR MPA Domain 1).

UPCOMING CHALLENGES

The ecological significance of the coastal environment of Caleta Potter for Antarctic notothenioids may not be an isolated case. Recently, the coastal locality of Bahía Paraíso on the Danco Coast, west of the Antarctic Peninsula, where the Argentine Scientific Base “Almirante Brown” is located (Fig. 1), was identified as a spawning site for the trematomid T. bernacchii and the harpagiferid H. antarcticus (Novillo et al., 2021, 2022). These initial findings highlight the importance of coastal environments in general in the life cycles of Antarctic notothenioid fish. Therefore, we firmly believe in the need to continue exploring other coastal areas to identify new breeding and spawning grounds for fish, in order to ensure the protection of these sites in terms of conservation and population management. Additionally, we are conducting research with an eco-physiological focus to determine the relationship between the biological processes of Antarctic fish and environmental factors, in order to understand and predict changes in the biological patterns of their populations in response to the current scenario of global warming.
ACKNOWLEDGMENTS

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REFERENCES


Kulesz, J. (1994). Seasonal biology of Notothenia gibberifrons, N. rossii and Trematomus neumiei, as well as respiration of young fish from Admiralty Bay (King George, South Shetland Islands). Pol Arch Hydrobiol 41: 79-102.


ABSTRACT

Antarctica has been the protagonist and setting for numerous Argentinean film productions, some of which are now unknown. This represents a vast audiovisual heritage of profound documentary value, allowing us to access various national representations of this continent. Here, we provide a brief overview of the most prominent titles in this cinematography, much of which has been preserved since 2018 through a joint project between the Argentine Antarctic Institute and the Pablo Ducrós Hicken Film Museum in the Autonomous City of Buenos Aires. We delve into the general aspects of this “Comprehensive Project for the Rescue of Argentinean Antarctic Cinema,” which involves the rescue, preservation, research, digitization, and accessibility of Argentine films made in Antarctica throughout the 20th century. Each film holds immeasurable value because the images captured in every frame constitute an essential part of Antarctic memory. The effort to preserve them, in a very basic sense, is about making them visible.

KEY WORDS

Antarctica, Argentina, Film, Heritage
ANTARCTICA AND ARGENTINE CINEMA

Argentine cinema, especially documentaries and current affairs films, has often turned its gaze towards Antarctica. This is not surprising, given various unique aspects of the relationship between Argentina and Antarctica. Argentina was the first country to establish a permanent presence in Antarctica on February 22, 1904, at the Laurie Island observatory in the South Orkney Islands, four decades before other nations. Argentina has maintained this continuous and uninterrupted presence in the area for over a century. Today, it is the country with the most research bases in Antarctica, one of the original twelve signatories of the Antarctic Treaty, and one of the seven nations recognized as claimants of territory under the Treaty.

The Argentine Republic administratively includes the territory it designates as Argentine Antarctica, which extends from the 25th to 74th meridians West, and from the 60th parallel South to the Geographic South Pole, as part of the Province of Tierra del Fuego, Antarctica, and South Atlantic Islands. Argentina also boasts a rich Antarctic history with epic events such as the rescue of the Swedish Antarctic Expedition in 1903 by the corvette ARA Uruguay, under the command of Lieutenant Julian Irízar, the Antarctic exploits of renowned figures like José María Sobral, José Manuel Moneta, Hernán Pujato, Mario Luis Olezza, and Edgard Leal, among many others, as well as major expeditions, including those that reached the South Pole, and continuous scientific activity for over a century.

Since the late 1940s, after formalizing its Antarctic claim in 1942, Argentine Antarctica has been included in school textbooks and official Argentine cartography, thus becoming part of the nation’s social representation of territory. Consequently, a significant portion of Argentine society had its first encounter with Antarctica during their early education. Argentine Antarctic cinema is, in some ways, a product of these issues, but it has also influenced the way Antarctica is perceived by Argentine society, serving as both a result and an agent of the nation’s Antarctic history.

RESCUING AUSTRAL CINEMA

Until a decade ago, much of the Argentine Antarctic cinema from the 20th century was relegated to institutional or private archives, far from public access, with film copies in various states of degradation, affected by processes such as vinegar syndrome, biological damage, warping, and discoloration, among other afflictions. Some of these films were at risk of being lost forever, as had happened with the earliest moving images of Argentine Antarctic cinema. In recent years, efforts have been made to reverse this situation.

One of the project’s early steps was the rescue of the film ‘Entre los hielos de las islas Orcadas,’ shot by Argentine Meteorological Service technician José Manuel Moneta in 1927, who spent four non-consecutive winters at the Laurie Island observatory in the 1920s (Moneta, 1939). Historian Andrés Levinson recovered this film as part of his work as curator of the Museum of Cinema’s archive (Levinson, 2016). This was followed by the rescue of some reels from the private collection of Argentine Army Antarctic explorer Gustavo Adolfo Giró Tapper during the rescue of family films. These reels depict dogs being dropped with supplies from an aircraft near Belgrano I Base in early
1966. In 2018, during the sale of the historic headquarters of the Argentine Antarctic Institute (IAA), one of the authors, historian Pablo Fontana, Coordinator of the Social Sciences Area of that institution, along with other IAA staff, rescued several film copies of various Antarctic films that were in that building. Subsequently, the two authors of this article decided to embark on a cooperative project between their respective institutions to comprehensively rescue all Argentine Antarctic cinema. Project members also include audio-visual technician Leandro Listorti (Museum of Cinema) and sociologist Matías Belinco (IAA), with the participation of conservation volunteers. Like much national cinema, some of these films are lost to researchers and interested audiences. Some are barely listed in inventories, and their existence is generally not confirmed. In the case of existing films, their preservation status is often unknown.

The project undertaken by both institutions under the title ‘Comprehensive Rescue of Argentine Antarctic Cinema’ aimed to reverse this situation through the rescue of Argentine heritage films shot in Antarctica during the 20th century, given their scientific, political, and cultural value. The proposal focused first on working with films recently found in various institutions, notably materials from the archives of the Argentine Antarctic Institute, the Museum of Cinema, military institution archives, and family collections, among others. Much of this footage has not been systematically reviewed or identified. The research effort involves surveying, identifying, and cataloging the material in various state and private repositories. After completing this initial survey phase, a plan for the conservation, preservation, digitization, and digital restoration of the materials was developed, establishing priorities based on the condition of each film and the available budget. Additionally, the project investigated the production, distribution, and exhibition methods of each film element to determine their origins, screenings, and their journey through time. All this information is intended for online publication and a printed catalog to facilitate public access. The films, their aesthetics, and their history will be showcased through the digitization of the most significant productions to ensure their preservation and circulation through various institutional channels, including exhibitions at festivals, meetings, web platforms, and other possible avenues. Some of the digitized films will be available on the IAA and Museum of Cinema’s YouTube channels, with more films being added as work progresses.

Through this joint effort, the research team has identified 86 Antarctic films produced between 1927 and 1985 to date. The project also conducts research to gather data and information that helps understand the context of film production and circulation. Each film holds immeasurable value because the images encapsulated in every frame constitute an essential part of Antarctic memory. In a very basic sense, the project’s goal is to make this film material known so that the public can enjoy these historically significant Antarctic films.

Most of these films show signs of the passage of time and neglect, including physical deterioration, missing sections, emulsion loss, scratches, and more. Therefore, reviewing the material to assess its physical condition, followed by preservation efforts, are necessary steps. Subsequently, the project aims to make the digitized materials accessible in high quality, along with all the information gathered about them. Some of the recovered films have already been screened, either in their film or digital format, at film festivals such as the FICMUS (International Mountain Film Festival of Ushuaia) on various occasions, in exhibitions of Antarctic films – such as in 2022 at the Kirchner Cultural Center.
in Buenos Aires – international specialist meetings, and at Antarctic bases. The project also intends to produce a series of texts written by each of the researchers involved.

ARGENTINE ANTARCTIC CINEMA

The first Argentine film dedicated to Antarctica was made in 1903 when Eugenio Py filmed the departure and arrival of the Argentine expedition aboard the cannon vessel ARA Uruguay, commanded by Lieutenant Commander Julián Irizar, during the rescue of the Swedish Antarctic Expedition led by Otto Nordenskjöld (Destéfani, 2003). Unfortunately, this material is lost, as is the film shot in 1921 by Alberto Sorianello, ‘Hacia el fin del mundo,’ a ten-minute travel diary that depicted the journey of ARA Uruguay to the South Orkney Islands to relieve the Argentine observatory staff (Levinson, 2011).

The oldest of the recovered Argentine Antarctic films today is the aforementioned ‘Entre los hielos de las islas Orcadas,’ filmed in 1927 by José Manuel Moneta. This could be considered the first cinematic document showing the scientific practice of Antarctic overwintering in a permanent station. In fact, the documentary was filmed by the Antarctic overwinterers themselves, making it a valuable source to access a representation of life in Antarctica. It reflects a particular conception of time, with certain circular characteristics rather than linear ones (Fontana, 2019). In other words, the documentary does not follow an expedition departing from a port, reaching its destination, and finally its return. Instead, it starts and ends with the same image: the changing of the guard from the outgoing to the incoming staff. The year of overwintering depicted in the documentary is just one cycle among many that repeat successively.

The Argentine meteorological and geomagnetic observatory on Laurie Island in the South Orkney Islands continued to play a central role in Argentine Antarctic cinema of the 1930s, as seen in the documentary ‘Cuatro hombres en las Orcadas’ (1939). This was because it was the only Argentine station on this continent until 1947, and it was also the only permanent station in Antarctica from any country until 1944. In 1942 and 1943, with the expeditions of the Argentine Navy ship ARA 1 de Mayo, the Antarctic Peninsula and the South Shetland Islands were included as natural settings in these documentaries.

When Argentina undertook a major Antarctic expansion in the late 1940s and the first half of the 1950s (Fontana, 2014) to establish most of the research bases, Antarctica became the subject of numerous Argentine film productions, mainly newsreels and documentaries. During those years, coinciding with the first and second presidencies of Juan Domingo Perón, eight permanent bases were established (two of them at the time the southernmost in the world), along with 23 refuges, the creation of the Argentine Antarctic Institute (IAA), and the acquisition of an icebreaker. During this period, the media coverage of Argentine Antarctic activities also increased. Antarctica appeared in weekly black and white newsreels such as ‘Sucesos argentinos’ and ‘Noticiero Panamericano,’ as well as in special features or standalone documentaries. Notable productions from that era include ‘Soberanía argentina en la Antártida’ (1947), a cinematic version of the simultaneously published book by the Ministry of Foreign Affairs and Worship; ‘Argentina Austral’ (1947), about the Summer Antarctic Campaign and the installation of the Melchior Naval Detachment; ‘Alas navales’ (1947),

Following the Film Footprints of Antarctica: Comprehensive Project for the Rescue of Argentine Antarctic Cinema
about the flight of naval aviation from the South American continent beyond the Antarctic Circle; ‘La Flota en la Antártida Argentina’ (1948), about the journey of the Argentine Fleet to Antarctica; ‘Viaje del ARA Chaco a Orcadas’ and ‘Decepción’ (1949); ‘Soberanía austral’ (1952), about the establishment of the General San Martín Base, the first Army base; ‘Vuelo austral’ (1953), about the Antarctic flights of Argentine Air Force Avro Lincoln bombers; ‘Pampa Blanca’ (1954), an IAA documentary about Antarctica; and ‘Cinco meses en los mares antárticos’ (1954), about the visit of Rear Admiral Aníbal Olivieri, Minister of the Navy, to all Antarctic outposts.

During the de facto military government of the self-proclaimed ‘Revolución Libertadora,’ we find ‘Antesala al Polo’ (1956), which reveals how the Navy regained control of the dissemination of Antarctic activity, sidelining the Army’s Antarctic presence and the figure of General Hernán Pujato, one of the key figures in Argentina’s Antarctic presence at the time. He was an advocate and the first Director of the IAA, considered too closely associated with the ousted government. During the International Geophysical Year 1957/1958, color films documenting Argentine polar activities were produced, such as the Navy’s documentary ‘Tareas antárticas’ (1957) about the IGY and an excellent documentary about the first Argentine government-sponsored tourist trip to Antarctica in 1958, ‘Turismo en la Antártida.’ Some raw footage of the interiors of the Argentine Antarctic Institute from those years was also rescued as part of this project. In 1958, even the first Argentine feature film shot in Antarctica, ‘Continente blanco,’ was released, directed by Bernard Roland with music by Astor Piazzolla. It depicted a love triangle involving two Argentine Navy officers, with scenes shot in Antarctica. Just a few years later, in 1960, the dramatic film ‘Silencio Blanco,’ an Argentine-Brazilian co-production directed by Brazilian filmmaker Geraldo Junqueira de Oliveira, was released. It is a documentary with small fictional scenes, and its voiceover narrates the adventures of an Argentine sailor participating in the Antarctic campaign, leading to a tragic ending.

The Antarctic Treaty, signed in December 1959 and ratified in June 1961, did not negatively impact Argentine film production, which continued with some intensity in the 1960s. It added more frequent references to the pillars of the treaty, such as maintaining peace and international cooperation in a continent dedicated to science. This was clearly expressed in the radio speech by Argentine President Dr. Arturo Frondizi from the Deception Naval Detachment to the entire country, broadcast through the cameras of ‘Noticiero Panamericano.’ He was the first Argentine president to visit Antarctica. Nonetheless, the epic spirit of the Heroic Age of Antarctic Exploration would not be absent from Argentine documentaries and reached its peak with the 1962 documentary ‘Operación Polo Sur,’ which recounts the Argentine Naval Aviation’s aerial expedition to the Geographic South Pole, as well as ‘Operación 90’ and ‘Marcha al límite austral de la Patria,’ both about the Argentine Army’s overland expedition to the South Pole in 1965. Here, as in the typical accounts of the Heroic Age, the narrative time of the journey to the South Pole is linearly structured, with the climax being the arrival at the South Pole.

In the 1970s, there were productions documenting Argentine actions in Antarctica, emphasizing their regular nature and the large number of Argentine bases in operation and focusing on the logistical tasks of the Armed Forces. Examples include the documentaries ‘Operación Antártida’ (1973) and ‘Patria blanca’ (1974), as well as scientific activities of the IAA. Some of these films were produced by the National Directorate of the Antarctic - Argentine Antarctic Institute (DNA-IAA), such as

Pablo Fontana and Andrés Levinson
the 1970 documentary ‘Bahía Paraíso’ with a script by the writer Haroldo Conti, who disappeared
during the last civic-military dictatorship (1976-1983). It shows the diverse scientific activities at
the Almirante Brown Scientific Station, Argentina’s main scientific hub in Antarctica at the time.
In this base, advertising for an Argentine-distilled whiskey (“Old Smuggler”) featuring DNA-IAA
scientists and technicians as protagonists was also filmed, and this is another piece of material rescued
by the project. In the same vein, but with a greater emphasis on the site’s biodiversity, the DNA-IAA
produced the documentary ‘Una visita a Caleta Armonía’ in 1985.

In the 21st century, the sixth continent continued to have some prominence on Argentine screens,
but mostly on television, such as the first episode of the fiction series ‘Cromo’ (2015) and the
documentary series ‘Antártida, Desafío Polar’ (2021), among many others. Thus, Antarctica has
been a recurring theme in Argentine cinema, practically since its inception. From the mid-1940s, it
can be said that all Argentine summer Antarctic campaigns were subjects of filming, and we hope to
rescue as many of these films as possible. However, in this overview, we have only commented on the
most notable productions, while in the catalog publication of the project, expected to be released in
2023, all identified Antarctic films and those that could be rescued will be listed.

EPILOGUE

Argentine Antarctic cinema is one of the most prolific in the world, and, in relative terms, when
considering the number of productions shot in the 20th century, it possibly has the highest
proportion of films dedicated to Antarctica. Its rescue, through the described project, allows us to
highlight its magnitude and diversity. As a historical document, it is a source of profound richness
due to the insight it provides into how the Argentine state understood and sought to have Antarctica
understood. These representations encapsulate that imagery to serve as its expression, while also
being a constitutive part of it as it is dynamically reproduced it to this day. Thus, its rescue through
the described project is also an act with implications for Antarctic imagery within Argentine society.

REFERENCES

Buenos Aires, Instituto de Publicaciones Navales.
Fontana, P. (2019). “Between the ice of the Orkney Islands: filming the beginnings of the Antarctic
overwintering tradition”. The Polar Journal 9 (2): págs. 340-357, DOI:
Ramón Areces.
ANTARCTIC ARCHAEOLOGY: THE FINAL HORIZON. SOCIAL AND SYMBOLIC CONFIGURATIONS OF THE WHITE CONTINENT

Diego Aguirrezábal, Bruno Gentile and Gaspar González

ABSTRACT

The construction processes of Antarctic history have been developed based on certain interests that have generated a clear hierarchy among different periods. As a result of this configuration, the early 19th-century process of seal hunting has been marginalized and virtually rendered invisible. In contrast, the Heroic era, characterized by the presence of prominent figures and mythological narratives, has been given a position of preeminence. Throughout this work, various conceptual elements and lines of analysis are sought to critically examine the structuring processes of memory, drawing on the contributions made by archaeology since the 1980s as a tool for contrasting written history in a context heavily influenced by national interests and narratives. Through the investigation of material evidence of human activities preserved in the present, interpretations are developed regarding the transformations of the South Shetland Islands territory as a landscape appropriated and modified according to specific interests. The aim is to present archaeology not only as a discipline that works with factual or tangible elements but also as one that articulates these with intangible information, enhancing processes of interpretation.

KEYWORDS

Antarctic History, South Shetland Islands, Seal Hunting Period, Material Culture, Conservation and Governance

32-
INTRODUCTION

In the popular imagination, Antarctica is an empty, inhospitable, extreme, hostile place. However, for at least 200 years, various groups of individuals have been drawn to this place, either for scientific interests, adventure, the desire to transcend throughout history, or simply by the need to survive in a world that has expelled them from their places of origin. In this context, this study delves into reflections regarding an ongoing research project initiated in 2021. The primary objective is to explore the surviving material artifacts that serve as evidence of the initial encounters between early nineteenth-century sea lion hunting crews and the emerging landscape they were beginning to explore, understand, and shape socially. These reflections seek to go beyond the specifically scientific disciplines and propose to analyze historical processes that have a substantial impact on the way in which we objectify the Antarctic territory today.

Classically, archaeology has been defined as a discipline that aims to interpret, with theoretical nuances, material evidence that allows us to analyze historical processes. This allows us not only to build narratives about these processes but also informs us about their social effects to build an identity. This discipline, highly powerful as a transformative tool, has been used for many decades as support for the construction and maintenance of discourses that establish hierarchies, which are perpetuated through the stratification of different interpretations. This process does not escape the evident global tendencies of knowledge production based on the delimitation of centers and peripheries. This presents certain challenges when conducting research processes from these peripheries; however, it also affords the opportunity to observe these developments from a vantage point outside the whirlwind of pursuing concrete and specific results, thus providing room for the generation of original knowledge. From this perspective, the question could be raised as to whether those who work from the periphery of global knowledge production are more likely to perceive the problems of these processes and, in archaeological terms, to observe certain elements of materiality that could be being made invisible, or at least undervalued. Thus, when discussing archaeology as a discipline, we are not merely referring to the past; instead, it exists as a discourse and material empirical reference in the present.

Based on these elements, it is understood that the production of knowledge in Antarctic territory, defined by physical and symbolic limits, presents itself as a highly productive scenario. For its complexity and political singularity, as well as for its geographical and environmental specificity, this context has enormous possibility to develop controversial processes that enhance and enrich existing debates.

This paper aims to articulate several conceptual elements pertinent to the discourse surrounding Antarctic issues. Initially, it examines the processes involved in shaping Antarctic history and how certain interests have led to the hierarchical representation of specific aspects of this history, while neglecting others. This is directly related to a specific way of objectifying a central element within Antarctic governance, which is the delimitation of the human and the non-human. Surely, the conceptual delimitation of the natural and the cultural is one of the greatest contributions that the social and human sciences can make in the coming decades in Antarctic territory, mainly linked to conservation and governance policies. In this same sense, delving into the way in which the
initial moments of human presence in this landscape have been historically made invisible and incorporating in this process the analysis of the material evidence of these occupations is a powerful tool that contributes to its complexity.

**CONSTRUCTION OF ANTARCTIC MEMORY**

For decades, the construction of narratives on Antarctic history has left aside part of the memory of this territory, characterized especially by the presence of individuals who were marginalized from modernity and the capitalist system. This is probably due to the scarcity of a critical vision that incorporates the diversity and contradictions of scientific production in Antarctica. The process of construction of Antarctic history is a field of symbolic confrontation of different identities in dispute, carried out by specific subjects and at the service of specific interests (Villarmarzo, 2018). In this sense, material culture is not composed of objects with a certain historical and social value but is shaped by entities that are the referent of that value, both at the time of their elaboration and in the present that recovers them. A substantial part of this analysis is made up of distinguishing the ways in which human groups have made use of a given environment based on the recognition of the concrete forms that these activities take spatially (Vincent García, 1991; Criado, 1993a & 1993b).

In order to analyze landscape construction processes, it is essential to acknowledge the social interaction between subjects and objects. These objects are no longer perceived solely as physical entities but as social realities. The actions undertaken by the subjects occur on objects that have already been structured based on specific indicators and relationships. These objects are thus endowed with a human presence and incorporated into the universe of material culture. The interpretation of the forms of appropriation of this landscape through the archaeological study of this material culture allows us to analyze the management of the territory of the South Shetland Islands based on human interests and their visible consequences through archaeological research.

If these processes of objectification are considered as continuous recognizable discourses, it could be argued that, from processes of deconstruction, we can access the signs that make up the discourse that would be linked to how subjects have represented certain mental processes in the space itself. Landscape, then, defined as “the sociocultural product created by the objectification, on the environment and in spatial terms, of social action of both material and imaginary character” (Criado, 1999: 5), is constructed as a continuous discourse that shows the dialectical relations of conflict that human groups develop. Territorialization processes are an essential feature of landscapes, bringing with them many other interventions, visible and invisible, imposing a way of regularizing, ordering, using and interpreting space by a community (Orejas, 1998). Power relations function as a system of control of these modifications. Approaching the way in which these empowerments of space – material, social and symbolic – are made effective will be substantial when interpreting landscapes.

**NATURE AND CULTURE AS OPPOSING CONCEPTS**

Surely, one of the topics that has generated most production in the context of Antarctic research is linked to the relationship between elements associated with what we understand as nature and those elements that we categorize as cultural: the human and the non-human. Taking this perspective on
the processes of objectification of the Antarctic landscape as a reference, the various conceptions of nature are socially constructed and vary between cultural and historical definitions (Descola, 2001). Perspectives centered on a dualistic vision of the universe should not be the determining way of interpreting the relationship between nature and culture, since they do not take into account the multiplicity of manifestations. Ignoring this diversity allows the development of reductionist analysis processes, restricting this conceptualization to pre-established categories. Any classificatory differentiation is part of the functions of a given system of signs. Therefore, this differentiation arises simply as a result of arbitrary and circumstantial linguistic facts (Heyd, 2008). In this sense then, the various conceptions of nature are indeed ideologies, and, therefore, are nothing more than the result of objectification processes based on cultural and social strategies.

Dualistic approaches between nature and culture allow an ordering based on the delimitation of contrasting attributes, and, ultimately, the construction of mythological discourses (Levi Stauss, 1968). In many cases, this perspective is accompanied by a vision where these two elements (the human and the non-human) are in conflict. This way of visualizing environmental processes seeks to reduce the burden of the human in order to conserve the non-human, losing sight of the fact that both concepts, or sets of concepts, are realized from the same socio-cultural systems. The fact that it can be said that there are objectifiable empirical referents, defined as indicators of the category nature, does not inhibit that they are socially constituted, delimited, defined and to which a determined social value is attributed (Children & Nash, 1997). Thus, space, defined as the sphere where these material, social and symbolic relations are developed, is no longer perceived as a stage where life takes place, but as a medium where social relations are produced and reproduced (Gregory & Urry, 1985). Any process of deconstruction or delimitation of this objectified social reality is not a return to its presumably pristine state, but, on the contrary, an exacerbation of its configuration based on certain specific socio-cultural standards and criteria, thus charging it with greater artificiality.

SEAL HUNTERS IN ANTARCTICA

As was pointed out at the beginning of this paper, there is currently a set of empirical and material references that confirm the presence of seal hunters in the Antarctic territory, at least since the end of the 1810s. This initial process of human occupation in Antarctica is developed in the context of the advance of the capitalist system (Senatore & Zarankin, 1999), and, therefore, under the same system of social relations. In this sense, the exploitation of marine resources in a capitalist context is a complex social phenomenon that implies an approach from social, ecological, economic, political and legal dimensions and in relation to all its geomorphological, hydrological, ecological and climatic components (Lagos, 2016). This approach necessitates a reevaluation of territorial relations and how scientific knowledge production processes and public policies have evolved, resulting in the marginalization of traditional and local knowledge which has been historically rendered invisible and excluded from discussions on conservation and management (Merlinsky et al., 2018).

The approach is based on a spatio-temporal relationship between knowledge-species-environment. In this sense, it is seen as a complex system where the social and the ecological are part of the same corpus. Not all individuals are the same, posing a continuum with diverse forms of organization and social relations established among those involved (Galván Tudela et al., 1996). It presents
different realities based on multiple characteristics, means of production, technologies used, forms of ownership, organization and labor agreements (Etchebehere et al., 2018). This activity is linked to knowledge associated with the mastery of a set of techniques that allow the social subject to reproduce (Diegues, 2004). This includes the management of the territory, hunting and fishing arts, transmission of knowledge, among others.

Since the end of the 18th century and at least during the first three decades of the 19th century, there was a period of intense development of an economic activity linked to the exploitation of marine mammals, mainly sea lions, fur seals and elephant seals, for skin and blubber. Certain processes of technological evolution that generated a substantial improvement in the products made it possible to expand the uses of these raw materials and they began to be used for the manufacture of higher quality and more expensive garments, increasing the demand from affluent sectors. At that time there was such a demand for these products that, according to calculations based on records up to 1822 of the presence of ships in the waters near the southern islands, 1,280,000 fur seals were hunted in those islands, nearly causing extinction of the species (Torres, 1977). Given the scarcity of documentary records, it is practically impossible to determine the date of arrival of the first crews for these purposes to the southern tip of America. This could be due to the fierce competition between vessels dedicated to this task in other regions of the world, which generated a deep mistrust when it came to formalizing new hunting reserves, which were intensely exploited until they became practically unproductive (Kirker, 1970).

This process of expansion of these economic activities of resource exploitation had several antecedents that can explain their beginning and development. Although part of this advance in the limits of hunting is linked to the impulse generated by the various scientific-naval expeditions organized by the European powers during the 18th century (Commodore George Anson - 1741, Commodore John Byron -1764, James Cook -1768 and 1772 and Louis Antoine de Bougainville -1765) (Pearson, 2016; Mayorga, 2016) many of the new places were discovered by the seal hunters themselves, pressured by the owners of the companies (e.g., Enderby Brothers or Daniel Bennett & Sons, both based in London), who, seeing the resources exhausted in known places, embarked on exploratory expeditions (Pearson, 2016). The nationalities of origin of these vessels were mainly England and the United States and, to a lesser extent, France. Their main markets were the ports of Canton (China) and London. Subsequently, these products were taken directly to the U.S. coast (Mayorga, 2016). The exploitation of sea lions developed in parallel with the expansion of whaling activity in southern latitudes. Thus, it was common for expeditions to be organized for the purpose of hunting whales and pinnipeds, especially considering that oil could also be extracted from all these marine mammals. This led to the qualification of these incursions as “mixed trips” (Watson, 1931: 476).

As a consequence of the decline of animal populations on the coasts of the American Southern Cone and southern islands, sea lion ships would continue to advance after the formal discovery of the South Shetland Islands by William Smith in February 1819 (Campbell, 2000), although it is likely that this process began some years earlier. Seal hunting in this new region was so intense that approximately just under 120 ships arrived during the first three years after discovery. This figure rose to 150 by 1827, extracting nearly one million pelts (Pearson, 2016). The main characteristic of fur seal exploitation activity in the Antarctic region was a low use of technology, intensive use of
labor and, consequently, a series of highly demanding processes (Dickinson, 1993). The equipment necessary to carry out hunting activities consisted of a wooden club approximately 1.5 meters long that was used to strike prey on the head. Firearms were used sparingly, due to the damage they caused to the skins (Clarke, 1887 in Mayorga, 2017). Another important element that was present was large quantities of salt that was used for the preservation and cleaning of the skins.

MATERIALITY

The archaeological record linked to these first human incursions in Antarctica has been studied in various places of the South Shetland Islands archipelago since the mid-1980s and has continued to the present (Stehberg & Cabeza, 1984, 1987; Lewis Smith & Simpson, 1987; Stehberg & Lucero, 1996; Torres & Aguayo, 1993; Stehberg, 2003, 2004; Senatore & Zarankin, 1999, 2014; Zarankin & Senatore, 2005, 2007; Pearson et al., 2010; Senatore, 2011). These investigations made it possible to advance in the location and recording of various types of archaeological sites, their functionality, their construction strategies and to achieve a periodicity for their construction and use since the early nineteenth century.

These investigations have resulted in the location of about 35 sites, located throughout the archipelago, of which more than 20 have been excavated and analyzed (Senatore, 2019; Stehberg, 2007). The similarities between the structures located on the Fildes Peninsula (Lucero & Stehberg, 1996; Stehberg & Lucero, 1996; Stehberg, 2003; Stehberg, 2007; Stehberg, 2007; Fontes, 2016; Fontes & Fernandez, 2016) and some of those analyzed on Livingston Island (Senatore & Zarankin, 1999; Zarankin & Senatore, 2005, 2007; Senatore et al., 2009; Stehberg et al., 2008) have provided substantial information associated with the spatio-temporal expansion of these strategies (Zarankin et al., 2011), which would seem to show that they respond to opportunistic criteria rather than to significantly consolidated processes of specialization (Senatore, 2018).

These works have made it possible to construct an initial model of space use strategy based on the meticulous recording of the stone structures that were built by the seal hunters (Senatore, 2018). These shelters can be observed in isolation or as groups with diverse structures, dimensions, and functions. They were mostly built by taking advantage of the structural characteristics of the geography using natural shelters, bluffs or cliffs close to the coastlines, but were rarely built on an open beach, with a few exceptions such as the Cuatro Pircas site (Stehberg & Cabeza, 1987). Also, at a general level, the structures share some construction techniques through the placement of overlapping rocks without the use of mortars or other cementing agents, the use of raw materials that are located in the same places where they would be built without displacements or the selection of specific types of rocks, as well as morphology or size. These were roofed with tarpaulins made of seal skins and other fabrics and joined by beams made of whale ribs or jaws and wood.

Currently, and within the framework of an international project, new exploratory activities are being developed along the Fildes Peninsula, which seek to locate new sites of archaeological interest, together with the incorporation of new recording technologies and conceptual frameworks that will provide more empirical information for the reinterpretation of sites already analyzed (Figure 2). Similarly, it builds upon the extensive and prolific research conducted since
the 1980s by Ruben Stehberg, which has highlighted the significant archaeological potential linked to seal hunting activities during the nineteenth century along the peninsula. Additionally, the dedication and concerns of Waldemar Fontes have been instrumental in driving forward this new research endeavor. Likewise, progress is being made in the construction of new strategies for the conservation and enhancement of the sites, mainly to reduce the possible impact of the development of tourist activity on the peninsula. The extensive accumulation of information and analysis that has been generated since the beginning of archaeological research in Antarctica has generated a maturation of the role played by the social and human sciences in the governance of the Antarctic territory. In this framework, and in light of the developments made in the framework of archaeological research, it is evident that the contribution of archaeological research is more than mere disciplinary study and impacts discussions at a global level.

6 DISCUSSION

Since the beginning of the 21st century, the Scientific Committee on Antarctic Research (SCAR) has developed a growing interest in promoting social and human research in Antarctic territory. This became evident in 2005 and then deepened in 2007-2008 with the inclusion of the “human dimension” as a central theme. In this context, archaeology as a discipline allows further investigation into occupation strategies not recorded in documents and an approach to the appropriation strategies of the Antarctic landscape. From these research processes, it
Figure 2. Geolocation of the Tóbolo 2 site, located by Ruben Stebbberg (2007) (Photo: Bruno Gentile).

is possible to analyze the management of resources by human groups, camp site conditions, and diachronic modification of the territory, among other investigations. These topics are part of some of the knowledge objectives formulated during the “Horizon Scan” process, mainly associated with the analysis of the “Human Presence in Antarctica”.

Antarctic science has been configured, since its beginnings, as a system of power relations that allows visualization of diverse processes of knowledge production. The establishment of diverse spheres of production and their role in shaping history has been predicated on the intentional concealment of the interests underlying these modern production systems. They have focused mainly on objectification, based on the contribution of empirical information, emptying of content and generation of space without social history (Troncoso, 2006). This idea, consolidated in the Antarctic Treaty, where this territory is defined as a place of science, peace, environmental protection and international cooperation, generates a scenario that eclipses many of the great contradictions and conflicts generated by the power relations implicit in the processes of modern knowledge production. Peace contexts are not a factual reality, but a subjective construction to perceive a certain order as correct, and by contrast, others as incorrect. In this sense, the political use that has been made of concepts
such as “wilderness”, places humanity in Antarctica as an exotic or exogenous element. Under this slogan it is argued that the criterion should prevail to preserve nature in a state of purity or in its original state. Under this criterion, that which is and is not reproduced should be selected, species controls should be carried out, and migratory processes of fauna should be followed, among other strategies for control of the wild. This makes it possible to put forward the idea that humanity must be subordinated to processes that take place in nature, but which are interpreted and administered by few people, in fewer places, and which generate strict intervention protocols. As Descola argues “nature being deaf and mute, it expresses itself only through authorized spokespersons” (2012: 77).

Hemmings et al. (2017) posit that Antarctica is a continent brought into existence by politicians, subject to political management, and indeed, is a catalyst for policymaking (Hemmings et al., 2017 in Senatore, 2019b). Following this line of analysis, what is the role that researchers play in this process, and moreover, what is the specific role that social science researchers should play? Research linked to the processes of construction of Antarctic territories, understood as “a space appropriated by a community, or artificially adjudicated to a community” (Sotelo, 2012: 42), are part of a set of power relations, which, ultimately, produce the Antarctic landscape.

The beginnings of Antarctic archaeology in the 1960s show a strong interest in the preservation of those structural elements linked to the Heroic period (1890–1917) (Pearson, 2011). This period is associated with the consolidation of the presence of certain nations on the Antarctic map, rather than with the interpretation of the historical processes that were taking place there (Pearson, 2011; Harrowfield, 2004; Senatore, 2019b). There is an evident process of selection, both of the material and symbolic evidence of the contexts, with the aim of generating a biased view of Antarctic history up to that time (Senatore, 2023). In spite of the fact that at the methodological level, in the 1980s a set of transformations towards a more systematic and professional archaeology were already generated, the objectives and the questions to be answered were not modified in their essence. To point out some of the aspects that we intend to argue, we will take two examples that are evidently part of the best history of the processes of seeking to build strategies for the conservation of historic sites in Antarctic territory. The formation of the United Kingdom Antarctic Heritage Trust (UKAHT), a coalition between institutions in New Zealand and the United Kingdom, has as one of its main objectives the promotion of knowledge of human history in Antarctica. However, through analysis from a critical perspective, it gave continuity to those interests to visualize and consolidate the English presence in Antarctica, perceiving it in isolation and in competition, and reducing its complexity, richness and temporal depth.

Another paradigmatic example in this sense is the Mawson's Huts Historic Site Management Plan (2013-18) developed by the Australian Antarctic Division in the 21st century. It is probably one of the best developed plans for the research, management and enhancement of Antarctic heritage as it is highly illustrative. The first paragraph of the note from the Australian Minister for Sustainability, Environment, Water, Population and Communities, which opens the Management Plan (2013-2018), argues that:

“Antarctica holds a unique place in Australia’s national identity and history. No place more fully or vividly evokes that place than the Mawson Huts, which today stand as a testament to the effort and
endurance that are central to Australian history and a hallmark of our national Antarctic program” (AAD, 2013: 5).

From this quote, a set of questions could be elaborated, but perhaps one of the most provocative would be, is it possible to generate interpretations from archaeology based on a perspective so focused on national sentiments, and if so, what kind of history is being constructed?

Taking into consideration this political and social context of knowledge production, it is the opinion of the authors of this paper that a path must be followed that incorporates a certain degree of controversy in the process of constructing Antarctic memory and raises disruptive questions in decision-making on the management and conservation of Antarctic contexts. The analysis of the landscape-territory-heritage relationship allows us to deepen the knowledge and promote the dialogue of knowledge through the recovery of different practices, knowledge and material manifestations in space. Through the identification and valuation of some elements of the material culture, it is possible to recognize a particular social landscape and seek to contribute to the co-construction of Antarctic Heritage.

REFERENCES


antropología”. In: Prat, J. & Martínez, A., Ensayos de Antropología Social, Ariel, Barcelona, 128-138.


Stehberg, R. (2007). “Historic Sites of the Northern Coast of Fildes Peninsula, King George Island (South Shetland Group)”. XXX Antarctic Treaty Consultative Meeting, New Delhi


ABSTRACT

The article addresses the strategic importance of Antarctica and how countries with interests in the region can utilize soft power in their foreign policies. Soft power is defined as a non-coercive strategy that uses diplomacy, collaboration, culture, and humanitarian aid to influence other countries. The reasons why soft power is a useful tool in international relations are discussed, including influence and persuasion, the generation of attraction and legitimacy, network building and cooperation, conflict resolution, and influence on global public opinion. It is concluded that soft power is particularly relevant in the context of national Antarctic interests due to the strategic importance of Antarctica and the challenges of its governance.

KEY WORDS

Antarctica, Conservation, Soft power, Governance
The Antarctic Ecosystem and its Conservation: An Opportunity for Better International Politics

Antarctica is a continent rich in natural resources, but it is also an environmental and scientific sanctuary of global importance. It is an uninhabited territory located at the southern end of the planet that has generated interest and concern from various countries due to its strategic significance, climate importance, and natural resource wealth.

For countries with national Antarctic interests, such as those conducting scientific research or seeking future economic exploitation opportunities, a useful foreign policy strategy within the frameworks established by the Antarctic Treaty is one that utilizes what is known in foreign policy as soft power, a highly effective strategy to promote their objectives and protect their interests.

In this context, soft power has become a key tool for influencing the opinions and actions of other countries in the Antarctic region through non-coercive means such as diplomacy, collaboration, culture, and humanitarian aid. This vision makes cooperation and scientific development possible as a public good for all of humanity, while allowing each Treaty member country to ‘gain’ in prestige and knowledge, as soft power strengthens a country’s ability to influence and persuade others through the attraction of its values, culture, foreign policy, and diplomacy.

The use of soft power is a useful tool in international relations for several reasons:

1. Influence and persuasion: soft power is based on the ability to influence and persuade other international actors through non-coercive means. This involves promoting a country’s values, ideas, norms, and culture to generate attraction and sympathy in others. Instead of imposing its will through force, a country can use soft power to win the goodwill of other countries and achieve its objectives without resorting to coercion.

2. Attraction and legitimacy: soft power helps generate attraction and legitimacy for a country on the international stage. By promoting a rich culture, democratic values, reliable institutions, economic development, freedom of expression, and respect for human rights, a country can increase its appeal and gain the trust of other countries. This can lead to increased cooperation, strategic alliances, and better mutual understanding.

3. Network building and cooperation: soft power facilitates the building of networks and cooperation between countries. By promoting educational exchanges, scholarship programs, cultural exchanges, sports events, and tourism activities, contacts and connections are established between people from different countries. These interactions can foster mutual understanding, empathy, and trust, laying the foundation for increased political, economic, and security cooperation.

4. Conflict resolution and crisis prevention: soft power can be an effective tool for conflict resolution and crisis prevention. By employing public diplomacy, strategic communication, and the promotion of shared values, a country can help reduce tensions, foster dialogue, and seek peaceful solutions. Additionally, a country with a positive reputation and a favourable image is more likely to receive international support and find neutral mediators in times of crisis.

5. Influence on global public opinion: soft power can have a significant impact on global public opinion. Through media, digital technology, and social networks, a country can disseminate its message, counter negative narratives, and gain public support worldwide. This can influence the opinions of citizens in other countries, shape the perception of a country and its leadership, and generate sympathy towards its policies and stances.
In summary, soft power is a useful tool in international relations because it allows for non-coercive influence, persuasion, and attraction of other international actors. It helps build strong relationships, foster cooperation, prevent conflicts, and have a positive impact on global public opinion. For these reasons, in the context of national Antarctic interests, soft power becomes especially relevant due to the strategic importance of Antarctica and the challenges posed by its governance.

In the best Aristotelian sense, we can call this the architectural dimension of politics, the best politics that, while respecting the rights of Treaty actors, ensures the conservation of a unique environment through strong institutions.

REFERENCES


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VOLUME IX - 2022
ANTARCTIC AFFAIRS

MARÍA FERNANDA CERDÁ
Exploring Alternative Energy Sources for Antarctic Stations: Integration of Solar Panels into Building Infrastructure
(P. 5)

EUGENIA MOREIRA, MANUEL NOVILLO AND ESTEBAN BARRERA ORO
Antarctic Fish: The Importance of Research Programs in Coastal Waters
(P. 13)

PABLO FONTANA AND ANDRÉS LEVINSON
Following the Film Footprints of Antarctica: Comprehensive Project for the Rescue of Argentine Antarctic Cinema
(P. 26)

DIEGO AGUIRREZÁBAL, BRUNO GENTILE AND GASPAR GONZÁLEZ
Antarctic Archaeology: the Final Horizon. Social and Symbolic Configurations of the White Continent
(P. 32)

MARIANO AGUAS
The Antarctic Ecosystem and its Conservation: An Opportunity for Better International Politics
(P. 45)