



2019 SMALL GRANT IN AID OF RESEARCH – ANNUAL SUMMARY REPORT

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Lek or female defense kind of polygyny? First report of circarhythms and reproductive behavior of *Otaria byronia* in the southeast Pacific.

Summary

The southeastern Pacific Coast, below parallel 40°S, is considered an important biogeographical and oceanographical area, which differs significantly from other regions of the Chilean Coast. The biological richness and complexity of the food web could imply differences in the behavioral ecology of the South American sea lion, *Otaria byronia*. Nowadays, studies on circarhythms and reproductive behavior in the species only exist in northern and central Chile. Through photographic monitoring techniques, we expect to compare daily and annual circarhythms and mating systems in two main rookeries, Punta Chaiguaco and Isla Metalqui in the austral Pacific.

Introduction

The South American sea lion (SASL), *Otaria byronia* (of Blainville, 1820), has a continuous distribution along the South American Coast, from Zorritos Bay in Perú (4°S) and Galápagos Island to Diego Ramírez Island in Chile (56°S), and along the Atlantic Coast, from Torres in Brazil (29°S) to Tierra del Fuego and Malvinas/Falkland Islands in Patagonia Argentina (Dans *et al.* 2012).

The species has a total population abundance of about 500,000 individuals (Cárdenas *et al.* 2016) and 193,000 inhabits on the Pacific Coast of Chile, distributed in four zones: northern (18-32°S), central (32-40°S), southern (40-48°S) and Magallanes (48-54°S) (Pizarro 2016).

In southern Chile, the Pacific Coast is a great insular system with profusion of gulfs, fjords and channels; a complex landscape resulting from the combined effect of tectonic processes and glaciation. This delimits the beginning of a new biogeographic, geophysic and oceanographic area (Camus 2001, Spalding *et al.* 2007) reflected in two genetic clusters of *O. byronia* at 41°S which could have unknown effects in behavior and population biology of SASL in southern Chile (Weinberger 2013).



Figure 1. Punta Chaiguaco rookery. Low Platform (yellow), High Platform (green) and High Ditch (pink).

The 85% of the SASL natality in southern Chile is concentrated in five main breeding colonies (Oliva *et al.* 2012): two islets Isla Doña Sebastiana and Isla Metalqui, two rocky islands Isla Guafo and Isla Guamblin, and one continental rookery Punta Chaiguaco, being categorized as important key rookery which must be constantly monitored (Oliva *et al.* 2008; Pizarro 2016). The access to Metalqui and Punta Chaiguaco rookery is difficult due to geographic and meteorological conditions given by the West Wind Drift current system arriving at the zone in front of Chile (40°S) (Gatica *et al.* 2009), making those very isolated places.

During the reproductive and post-reproductive period, different studies have showed large variability in the abundance of total individuals in a colony. These variations are due to the circadian (24 hours) and circannual (1 year) rhythms. Circarhythms in *O. byronia* has been described based on changes in abundance in breeding and non-breeding colonies in northern (Acevedo *et al.* 2003) and central Chile (Sepúlveda *et al.* 2001, Pavés *et al.* 2005, Sepúlveda *et al.* 2012). This variability shows the dispersal capacity of SASL during the pre-reproductive period to feed and reach reproductive colonies in order to achieve reproductive success.

Closely related to the above, the mating system of *O. byronia* is polygynous. Different authors defined kinds of mating systems: (a) males controlling females indirectly by monopolizing resources, (b) female defense and (c) males dominance polygyny (where those aggregate), this last type being able to present (c.1) explosive breeding assemblages (short breeding season highly synchronized) or (c.2) leks (less synchronized and with males remaining sexually active) (Krebs and



Davies 1991). Nowadays, *O. byronia* has been categorized largely with a female defense kind of polygyny (Acevedo *et al.* 2003, Pavés *et al.* 2005); by the other hand, studies conducted in Perú (Ballestas Islands), have demonstrated that individuals of *O. byronia* have a lek system with females moving freely inside the colony to choose their mates (Soto and Trites 2011).

At present, understanding the circarhythms patterns of *O. byronia* in two principal reproductive colonies of southern Chile, is crucial to estimate population abundance from censuses and achieve an understanding of the reproductive strategies, in order to provide new observations and conclusions for its conservation.

Objective

The general objective of this research is to obtain a continuous photographic record of a year covering the reproductive and post-reproductive period of the southern sea lion, *O. byronia* in Metalqui rookery (Chiloé Archipelago) in southern Chile. This in order to compare and describe biological and reproductive patterns among this principal rookery and Chaiguaco rookery, both with different population abundance, density, type of substrate and slope.

Preliminary Results

Results of Punta Chaiguaco rookery:

The trap cameras installed in Metalqui Island will be removed in April of 2020 after finishing the reproductive period. So, the results will be available within the next year. For this reason, we want to show the preliminary results we obtained in Punta Chaiguaco rookery, where recently recovered the cameras and analyzed the data for the reproductive period of *O. byronia*.

These preliminary results were exposed in oral presentation format in the XXXIX Congress Ciencias del Mar, organized by the Marine Sciences Society of Chile. It was carried out between May 27 - 31 (2019) in the city of Iquique, Tarapacá region, Northern Chile.

In addition, these results to be included in a manuscript to be sent to Mammalian Biology Journal.

The presentation was titled **“First report of the reproductive dynamic of South American sea lion, (*Otaria byronia*) in the colony Punta Chaiguaco, Chiloé Archipelago, southeastern Pacific”**, and the summary was:

The South American sea lion has a wide distribution in South America, presenting latitudinal asynchrony, and between the Pacific and Atlantic coast in its reproductive events. In Chile, it is reported in the northern zone (20°S) and central (38°S). In order to evaluate the existence of reproductive asynchrony, site preference, dynamics and population structure in Punta Chaiguaco (43°S), trap cameras were installed in three sites: Low Platform (LP), High Ditch (HD) and High Platform (HP), programmed to shot every hour during the day, from December 2016 to March 2017. Weekly censuses were conducted, determining its population structure (adult males, subadult males, females, juveniles and pups).

The abundance of males increased from January 6 to reach 21 ± 0.58 between February 3-11, and females from January 11, reaching 501 ± 0.72 on February 3. The highest proportion of pups was born between January 16 and 26, presenting asynchrony with the northern Chile (20°S). The preferred site to give birth was LP, showing a significantly higher abundance with respect to HD and HP ($X^2 < 0.01$). The structure and dynamics of SASL between HD and HP was similar, but differed from LP. From January 26 the abundances of the females in the HD and HP presented three maxima, 171 ± 2 and 207.7 ± 7 on February 3, 152.3 ± 3 and 230 ± 7 on March 1; and 153 ± 4 and 202.7 ± 4 on March 22, respectively. The proportion of juveniles is low (32 ± 0), being located in the HD and HP.

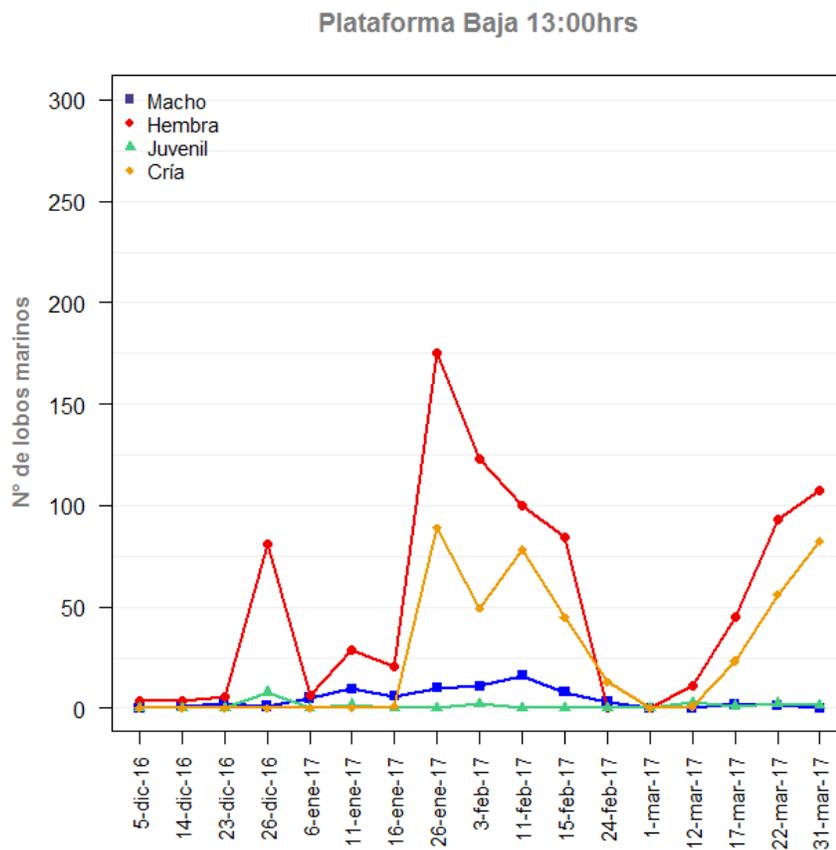


Figure 2. Number of individual by age group during reproductive period at 13:00 hrs in the site Low Platform of the Punta Chaiguaco rookery.

Plataforma en Altura 13:00hrs

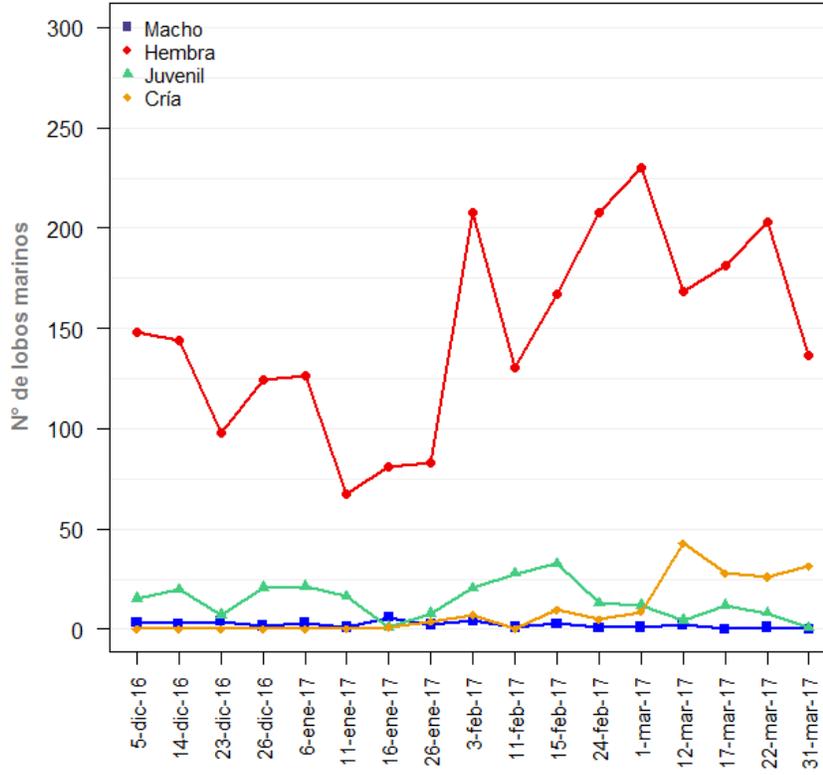


Figure 3. Number of individual by age group during reproductive period at 13:00 hrs in the site High Platform of the Punta Chaiguaco rookery.

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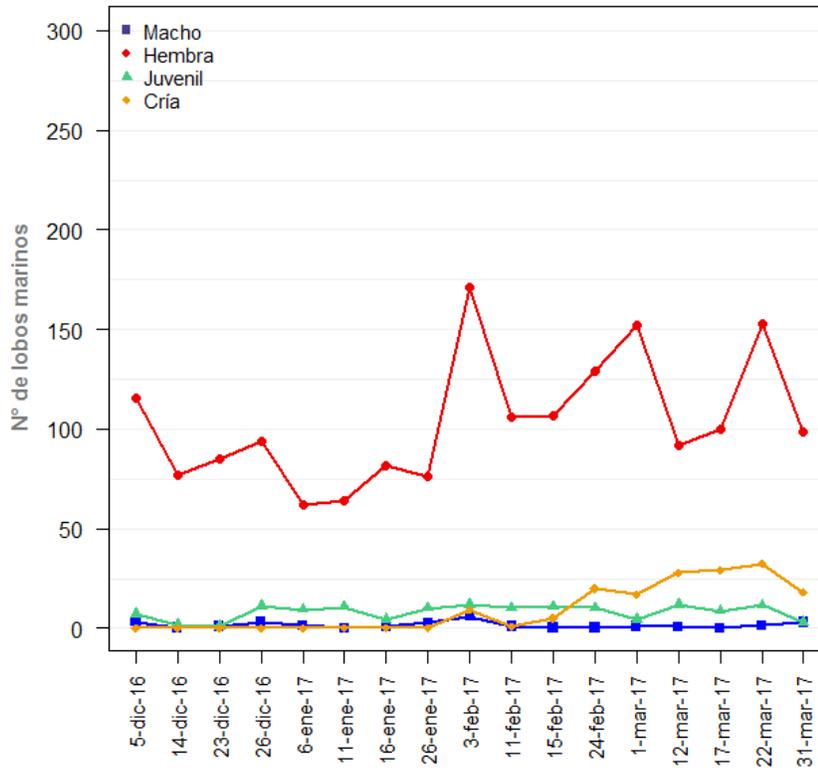


Figure 4. Number of individual by age group during reproductive period at 13:00 hrs in the site High Dich of the Punta Chaiguaco rookery.

Results of Metalqui Island rookery:

a) Trip and arriving to Metalqui Island rookery:

On April 19, 2019, at 09:00hrs the biologists Doris Oliva and René Durán traveled ninety minutes by artisanal fishing boat to arrive to Metalqui Island rookery (42°S), Chiloé Archipelago, Southern Chile.



Figure 5. Embarking by artisanal fishing boat to direction to the rookery of American sea lions in Metalqui Island.



Figure 6. Sight of Metalqui Island rookery.

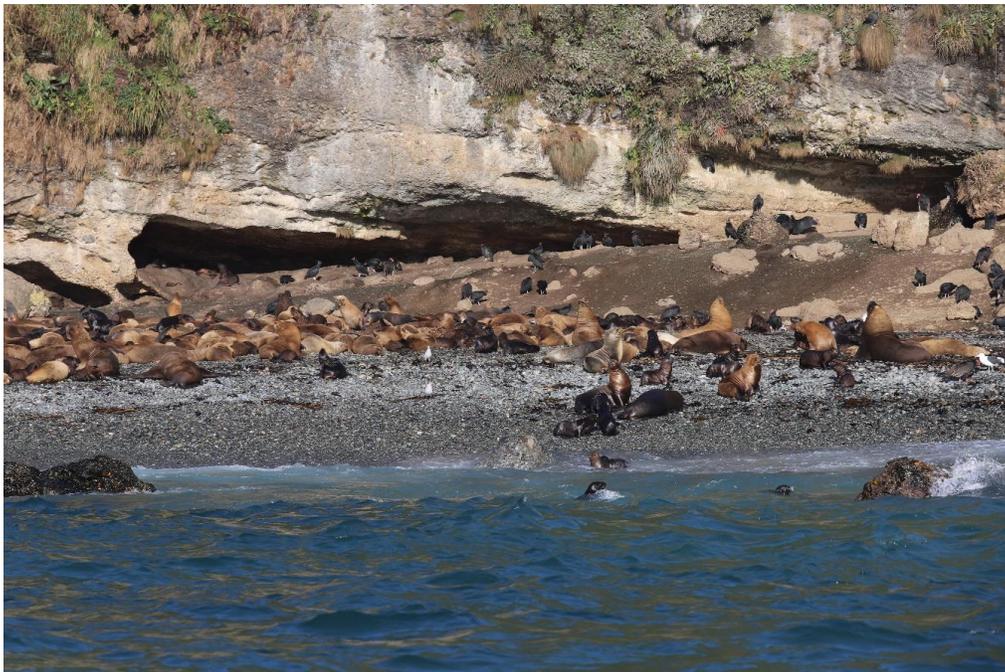


Figure 7. American sea lions on the beach of Metalqui Island rookery.

b) Installation of 4 camera traps:

The cameras were programmed to shot every 1 hour from 06:00 to 21:00hrs (during daylight) during 1 year. These will be recovered at April 2020.



Figure 8. Installation of the trap camera 1.



Figure 8. Installation of the trap camera 2.



Figure 8. Installation of the trap camera 3.



Figure 8. Installation of the trap camera 4.