



Research article

# Reproductive alterations in South American sea lion during the avian influenza H5N1 outbreak in Northern Patagonia

## Alteraciones reproductivas en el lobo marino sudamericano durante el brote de gripe aviar H5N1 en Patagonia Norte

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### RESUMEN

El lobo marino sudamericano (LMS, *Otaria flavescens*) es un pinnípedo endémico de América del Sur. Su período reproductivo es notablemente estacional y altamente sincronizado, ocurriendo durante el verano austral. Su comportamiento reproductivo ha sido ampliamente documentado; por lo tanto, cualquier observación inusual puede ser fácilmente detectada. A fines de 2022, surgió en América del Sur un brote de influenza aviar altamente patógena (HPAI) H5N1, propagándose rápidamente entre aves y mamíferos marinos, causando eventos de mortalidad masiva en LMS. En Argentina, entre agosto y noviembre de 2023, se reportaron muertes masivas y signos clínicos de HPAI en varias colonias de LMS. Este estudio documenta y cuantifica un número inusual de abortos y comportamientos reproductivos inusuales en LMS durante el brote de influenza aviar de 2023 en el norte de la Patagonia. Se registraron 73 abortos de LMS, algunos de ellos en hembras que presentaban signos clínicos de influenza aviar. Además, se documentaron comportamientos sexuales inusuales: machos reteniendo y montando hembras, cópulas, así como casos de necrofilia. Discutimos los posibles factores asociados con el fracaso reproductivo y los comportamientos anormales en pinnípedos, y sugerimos una alta probabilidad de que estén relacionados con el brote de HPAI/H5N1 en el Atlántico. Estos hallazgos destacan la necesidad de continuar investigando los efectos de enfermedades emergentes en la salud y el comportamiento de los mamíferos marinos, y subrayan la importancia del monitoreo sostenido de sus poblaciones.

**Palabras clave:** Abortos, comportamiento sexual, HPAI/H5N1, *Otaria flavescens*.

### ABSTRACT

The South American sea lion (SASL, *Otaria flavescens*) is an endemic pinniped native to South America. Its breeding period is notably seasonal and highly synchronized, occurring during the austral summer. Its breeding behavior has been extensively documented; therefore, any unusual observations warrant careful attention and monitoring. In late 2022, highly pathogenic avian influenza (HPAI) H5N1 emerged in South America, rapidly spreading among marine birds and mammals and causing mass mortality events in SASL. Between August and November 2023, mass mortalities and clinical signs consistent with HPAI were reported in several SASL colonies in Argentina. This study documents and quantifies an atypically high number of abortions and abnormal reproductive behaviors observed in SASL during the 2023 HPAI outbreak in Northern Patagonia. A total of 73 abortions events were recorded, some involving females exhibiting clinical signs of avian influenza. Additionally, unusual sexual behaviors were observed, including males retaining and mounting females outside the breeding season and instances of necrophilia documented for the first time in this species. We discuss potential factors associated with reproductive failure and abnormal behaviors in pinnipeds and suggest a high likelihood that these patterns could be related to the HPAI/H5N1 outbreak in the Atlantic. These findings underscore the need for continued research to understand the impacts of emerging diseases on marine mammal health and behavior, emphasizing the importance of sustained population monitoring.

**Keywords:** Abortions, HPAI/H5N1, *Otaria flavescens*, sexual behavior.

## INTRODUCTION

The South American sea lion (SASL, *Otaria flavescens*) is an endemic pinniped species distributed from Peru to southern Brazil (Crespo *et al.*, 2021). While some populations are recovering and recolonizing some areas, other stocks remain stable or are even declining, after a severe historical population reduction due to overhunting (Crespo *et al.*, 2021). The global population is estimated at approximately 425,000 individuals, and its conservation status is classified as Least Concern. The SASL population in Argentina exceeds 200,000 individuals and shows a positive population trend (Romero *et al.*, 2019), whereas the population in Uruguay is small and declining (Crespo *et al.*, 2021).

The SASL's breeding period is notably seasonal and highly synchronized, occurring from December to February (Campagna, 1985). Births typically occur from mid-December to early February, peaking between January 10<sup>th</sup> and 25<sup>th</sup> (Campagna, 1985). During the breeding season, adult females typically exhibit two distinct behavioral patterns: *Resisting Advances* (*non-estrus*), characterized by avoidance or aggressive displays that deter male advances, and *Receptiveness behavior* (*estrus*), marked by reduced aggression and acceptance of males approaches and mating attempts (Campagna and Le Boeuf, 1988; Pomeroy *et al.*, 2018). After the SASL adult male arrive, females seek to position themselves near established males to minimize interactions with peripheral males (Crespo *et al.*, 2021).

Territorial males assess female receptivity by "heading" them (i.e., resting their heads on potential mates' necks or bodies) (Vaz-Ferreira *et al.*, 1984; Campagna and Le Boeuf, 1988; Pomeroy *et al.*, 2018). Olfaction plays a key role in this approach, with previous records of males sniffing on potential female mates (Vaz-Ferreira *et al.*, 1984; Campagna and Le Boeuf, 1988; Pomeroy *et al.*, 2018). Breeding males also exhibit aggressive behaviors to establish and defend territories and females (Campagna, 1985; Campagna and Le Boeuf, 1988; Franco-Trecu *et al.*, 2015). Peripheral adult and sub-adult males employ alternative mating strategies, either by retaining females arriving from the sea or conducting group raids to seize females or their pups (Vaz-Ferreira *et al.*, 1984; Campagna *et al.*, 1988a, 1988b).

Females nurse their pups until entering estrus, approximately six days after giving birth (Campagna and Le Boeuf, 1988; Fernández-Juricic and Cassini, 2007). The highest proportion of females in estrus and the peak of copulation frequency occur in the third week of January (Campagna, 1985; Campagna and Le Boeuf, 1988). In northern Patagonia premature births are rare and occur

in late October or early November, with one to three cases reported per season (Schunk M. pers. comm). To our knowledge, no abortions were recorded outside the breeding season (March to late November). The breeding activity ended by the second week of February (Campagna, 1985; Campagna and Le Boeuf, 1988). From March to November, sea lions disperse to forage and rest (Lewis and Ximénez, 1983), and no breeding behaviors are observed during this period (Guzmán *et al.*, 2022).

In recent years, however, the health and survival of wildlife populations have been increasingly challenged by the emergence of infectious diseases. Among them, highly pathogenic avian influenza (HPAI) has spread to wild bird and marine mammal populations across Europe, North America and South America, causing widespread morbidity and mortality (Leguia *et al.*, 2023; Mirolo *et al.*, 2023; Puryear *et al.*, 2023; Paz *et al.* 2024; Rimondi *et al.*, 2024; Tomás *et al.*, 2024). In late 2022, HPAI caused by the H5N1 2.3.4.4b clade emerged in South America, affecting SASL for the first time. The virus rapidly spread across the species' entire distribution range, resulting in mass mortality events (Leguia *et al.*, 2023; Tomás *et al.*, 2023; Ulloa *et al.*, 2023; SENASA, 2023; de Araújo *et al.*, 2024; Plaza *et al.*, 2024; Szteren and Franco-Trecu 2024). In Argentina, mass mortalities and clinical signs associated with HPAI were reported from August to November 2023 (SENASA, 2023). During this period, some abortions were observed in SASLs (Campagna *et al.*, 2023) though they were not quantified. Therefore, the aim of this study is to document and quantify an atypically high number of abortions and changes in SASL reproductive behavior in Northern Patagonia within the context of the avian influenza outbreak.

## MATERIALS AND METHODS

The study area encompasses the northern coast of Patagonia, Argentina (Fig. 1). An observational study was carried out between August 15 and October 15, 2023 —during the avian influenza outbreak— through routine surveys of accessible coastlines and nine SASL colonies. These surveys were conducted by the authors in collaboration with personnel from the Chubut and Río Negro Stranding Networks. During the monitoring, animals exhibiting respiratory and/or neurological signs consistent with avian influenza were recorded, along with the number of dead individuals and aborted fetuses. In addition, photos and videos documenting unusual reproductive behavior were collected. These include behavior never previously observed in the region (i.e., instances of necrophilia), as

well as known behaviors occurring outside the expected timeframe of the reproductive season (i.e., males retaining and mounting females).

Females showing clinical signs were monitored daily, as they are typically pregnant during this time of year. When possible, aborting females were observed over several days to confirm the presence of respiratory and neurological clinical signs. The presence of fetuses in the nine colonies at Natural Protected areas was monitored and recorded daily by park rangers, considering only directly observed abortions or very fresh carcasses. Each fresh fetus was monitored to determine whether it was scavenged or washed by the tide. Fetuses showing signs of decomposition or having been scavenged were excluded from the analysis to prevent duplicate counts on consecutive days. Municipal personnel recorded and removed fetuses found on public beaches within the study area, in accordance with the local stranded animal response protocol for proper final disposition.

## RESULTS

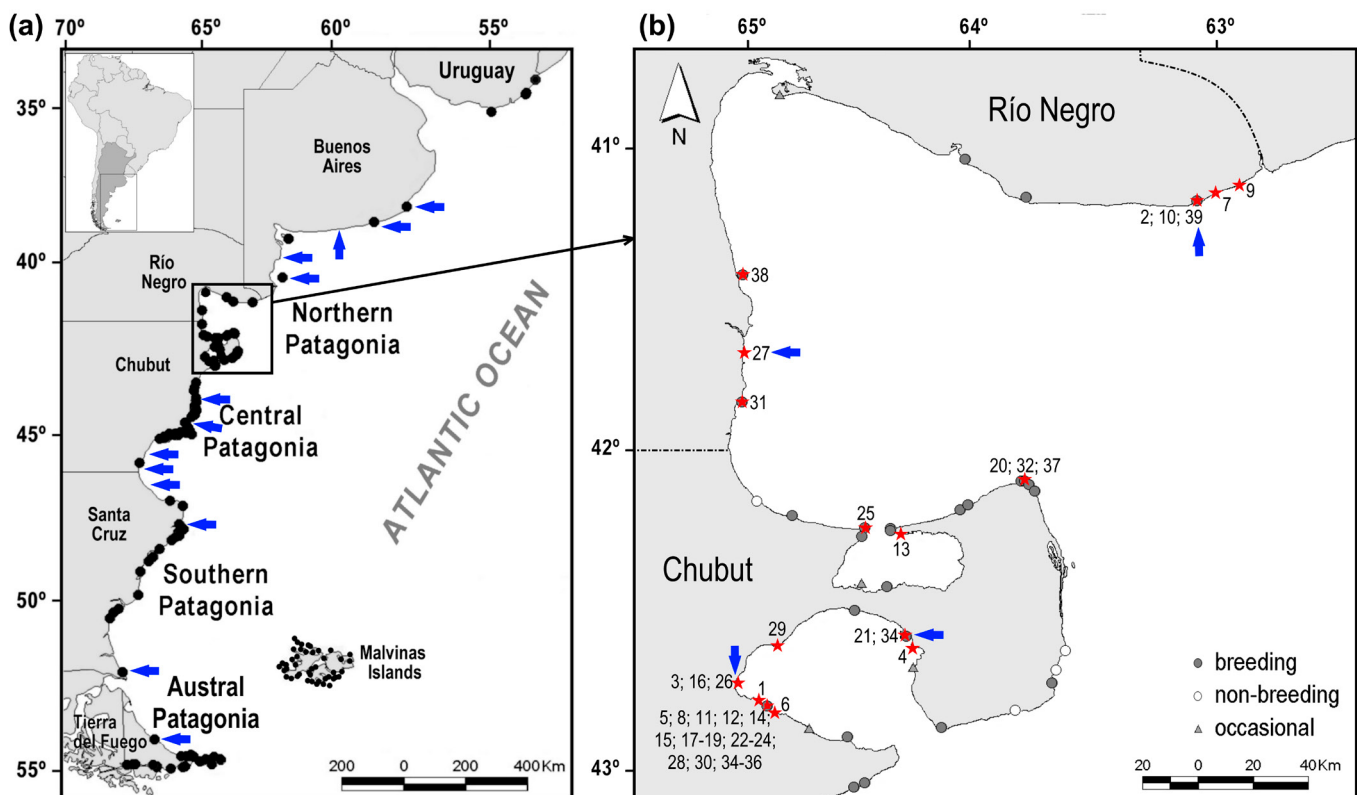
### Reproductive failure

A total of 73 reproductive failure events were recorded in Northern Patagonia, including 16 aborting females and

57 solitary fetuses (Table 1, Fig. 1, 2). Solitary fetuses were reported during field surveys, with 32 (56.14 %) found in Chubut Province and 25 (43.86 %) in Río Negro province. The first report came from scuba divers who found three SASL fetuses on the seafloor near Punta Loma colony (Fig. 1, 2).

Aborting females include those directly observed losing a fetus or with signs of recent spontaneous abortion (e.g., presence of a collapsed amniotic sac). Eleven of these females exhibited neurological and respiratory clinical signs consistent with avian influenza, such as incoordination, paralysis, disorientation, tremors, seizures, dyspnoea, and profuse ocular, nasal, and oral secretions (Gamarra-Toledo *et al.*, 2023; Rimondi *et al.*, 2024) (Table 1, Fig. 1, 2). On the other hand, four females aborted without exhibiting any clinical signs. In the few cases where post-abortion monitoring was feasible, one female died, while the others remained alive for two to five days before returning to the sea (Table 1). The ultimate fate of these individuals remains unknown.

Of the 46 records from Chubut, 23 occurred in Punta Loma colony (Fig. 1, Record 5), ten in Punta Pirámide colony (Fig. 1, Record 21), two in Punta Quiroga colony (Fig. 1, Record 25), three in Punta Norte colony (Fig. 1, Record 20), and one in Punta Buenos Aires colony (Fig. 1, Record 13) (Table 1). Of the 27 records in Río Negro, ten fetuses were reported in the Punta Bermeja colony (Fig. 1, Record 2), one



**Figure 1.** a) Current distribution of *Otaria flavescens* colonies along the Atlantic coast. The square highlights the studied area in Northern Patagonia. b) Detail of SASL colonies in Northern Patagonia, with red stars indicating records of fetus/abortions (Records in Table 1), and blue arrows indicating sites where HPAI was confirmed in SASL in Argentina (Rimondi *et al.* 2024; SENASA 2023).

**Table 1.** Records of aborting females and/or solitary fetuses of South American sea lions in Northern Patagonia (Fig. 1), with details of date, location, quantity, comments, and photos (Fig. 2). Symptoms refer to clinical signs consistent with avian influenza (see Results section).

Record	Date	Location	Province	Solitary fetus	Aborting female without symptoms	Aborting female with symptoms	Sub total	Comments	Photos
1	15/8/2023	at the bottom of the sea in front of Punta Loma colony	Chubut	3			3	found by scubadivers	Fig. 2 a-c
2	24/8/2023	Punta Bermeja colony	Río Negro	1			1		
3	25/8/2023	on a platform on the Puerto Madryn dock	Chubut	1			1		Fig. 2 g
4	26/8/2023	near Puerto Pirámide beach	Chubut	1			1		Fig. 2 d
5	28/8/2023	Punta Loma colony	Chubut			1	1	female with inflamed eyes	
6	29/8/2023	near Punta Loma colony	Chubut			1	1	female was seen for 4 days, then she went to the sea	Fig. 2 i
7	29/8/2023	La Lobería beach	Río Negro		1		1		Fig. 2 f
8	30/8/2023	Punta Loma colony	Chubut	1			1		
9	21-31/8/2023	El Cóndor beach	Río Negro	9			9		
10	25-31/8/2023	Punta Bermeja colony	Río Negro	8			8	one of the fetuses tested positive for the H5N1 virus (Rimondi <i>et al.</i> , 2024)	
11	3/9/2023	Punta Loma colony	Chubut			1	1	female aborted and remained next to the fetus	
12	5/9/2023	Punta Loma colony	Chubut			1	1	a subadult male was seen holding and copulating the female. Then she died, and necrophilia was observed	Fig. 3
13	9/9/2023	Punta Buenos Aires colony	Chubut	1			1		
14	10/9/2023	Punta Loma colony	Chubut			1	1	female aborted and remained next to the fetus	
15	11/9/2023	Punta Loma colony	Chubut			1	1	female aborted and remained next to the fetus	
16	11/9/2023	on a platform on the Puerto Madryn dock	Chubut		1		1	female went to sea after abortion	Fig. 2 h
17	12/9/2023	Punta Loma colony	Chubut	1			1		
18	13/9/2023	Punta Loma colony	Chubut	1			1		
19	14/9/2023	Punta Loma colony	Chubut	2		1	3		
20	14/9/2023	Punta Norte colony	Chubut	1			1		
21	15/9/2023	Punta Pirámide colony	Chubut	9			9		
22	17/9/2023	Punta Loma colony	Chubut	1			1		
23	18/9/2023	Punta Loma colony	Chubut			1	1		
24	21/9/2023	Punta Loma colony	Chubut			1	1		
25	21/9/2023	Punta Quiroga Colony	Chubut	2			2		
26	22/9/2023	on a platform on the Puerto Madryn dock	Chubut			1	1	female was seen with the sac and placenta, not the fetus.	
27	24/9/2023	Playas Doradas beach	Río Negro			1	1	female died 5 days later	Fig. 2 e
28	24/9/2023	Punta Loma colony	Chubut	1			1		
29	25/9/2023	Punta Ameghino	Chubut		1		1	four hours later a subadult male was seen holding the female	
30	26/9/2023	Punta Loma colony	Chubut	1			1		
31	27/9/2023	Los Hornitos colony	Río Negro	1			1		
32	29/9/2023	Punta Norte colony	Chubut			1	1		
33	1/10/2023	Rada Tilly beach	Chubut		1		1		
34	2/10/2023	Punta Pirámide colony	Chubut	1			1		
35	4/10/2023	Punta Loma colony	Chubut	2			2		
36	5/10/2023	Punta Loma colony	Chubut	2			2		
37	7/10/2023	Punta Norte colony	Chubut	1			1		
38	10/10/2023	Islote Lobos colony	Río Negro	5			5		
39	12/10/2023	Punta Bermeja colony	Río Negro	1			1		
TOTAL				57	4	12	73		





**Figure 2.** Pictures depicting reproductive failures recorded in northern Patagonia, Argentina. a-c: three fetuses lie at the bottom of the sea in front of Punta Loma colony (Fig. 1, Record 1); d: fetus in the vicinity of Puerto Pirámide beach (Fig. 1, Record 4); e: female with her fetus (still inside the sac) on Playas Doradas (Fig. 1, Record 27); f: female with her fetus on La Lobería (Fig. 1, Record 7); g: fetus on a platform on the Puerto Madryn dock (Fig. 1, Record 3); h: female with her fetus (still inside the sac) on a platform on the Puerto Madryn dock (Fig. 1, Record 16); i: female with her fetus (still inside the sac) in the vicinity of Punta Loma colony from drone survey (Fig. 1, Record 6).





**Figure 3.** Sequence of unusual reproductive behaviors observed at Punta Loma colony (Chubut, Argentina). a-c: male retaining female for several days; d: detail of secretions in the female's eyes and mouth; e-f: male holding a dead female; g-h: male moving the female's body; i: male copulating the female's inert body; j: male retaining the deteriorated body of the dead female.

in Los Hornitos colony (Fig. 1, Record 31) and five in Islote Lobos colony (Fig. 1, Record 38) (Table 1). The remaining abortions (24.7 %) occurred outside SASL colonies, in areas not typically used as haul-out. Abortions recorded within colonies mostly occurred at haul-out sites where the number of sea lions increased outside the breeding season (March to November). All recorded fetuses were small and hairless (Fig. 2), distinguishing them from premature births, which were born larger and covered in lanugo hair.

### Unusual behavioral observations

Between August and September, five adult and sub-adult SASL males from Punta Norte (Fig. 1, Record 20), Punta Pirámide (Fig. 1, Record 21) and Punta Loma (Fig. 1, Record 5) colonies exhibited unusual reproductive behaviors; retaining, mounting, and in some cases copulating with females. Additionally, some females displayed receptivity, allowing mounting attempts males.

Another unusual behavior was documented at Punta Loma colony (Fig. 1, Record 12), where a sub-adult male spent several days holding and resting beside an aborting female (Table 1, Record 12) and even made several attempts at copulation. The female aborted on September 5<sup>th</sup> and showed clinical signs consistent with HPAI infection. She died five days after the abortion, on September 10<sup>th</sup>. Remarkably, the male continued to hold her lifeless body for three additional days, until September 13<sup>th</sup>. During this time, he moved the female's body to different locations on the beach by grasping her back with his mouth, defended her from other males, and repeatedly mounted and attempted to copulate (Fig. 3). This observed behavior began with the mounting and attempted copulation of a live, symptomatic adult female and culminated in necrophilic acts.

## DISCUSSION

### Reproductive failure

Northern Patagonia –particularly the natural protected areas within this region –has been historically monitored since the 1980s, with no abortions previously reported outside the breeding season. Our study documents an exceptional abortion event between August and October 2023, in comparison with historical records over the last 40 years in the same region.

Reproductive failure or increased abortion rates in sea lions have been associated with decreased prey availability due to extreme climate anomalies (Soto *et al.*, 2004), marine biotoxins (Goldstein *et al.*, 2009; Torres *et al.*, 2023), organic and inorganic pollutants (González *et al.*, 2021), and infectious diseases (Gulland *et al.*, 2018). While extreme climate anomalies are determinants of sea lion survivorship in the Pacific Ocean; however, those oceanographic conditions are less intense in the Atlantic (Heredia *et al.*,

2022). Furthermore, domoic acid was not detected in the study area during the HPAI outbreak period (Ministerio de Salud de la Provincia del Chubut, 2023, Oehrens Kissner *et al.*, 2023). Regarding pollutants, marine mammals from the Southern Hemisphere typically exhibit lower concentrations of anthropogenic pollutants than their Northern Hemisphere counterparts (González *et al.*, 2021). This difference may partially reflect the limited number of studies on the effects of pollutants on Southern Hemisphere species (Schaap *et al.*, 2023; Vainberg and Abakumov, 2025). Additionally, contaminant levels in marine mammals from Southwestern Atlantic Ocean remain well below the thresholds associated with adverse sub-lethal or lethal effects (Crespo *et al.*, 2010; González *et al.*, 2021).

Infectious diseases –caused by bacterial, viral, protozoal, and fungal agents– have been associated with premature parturition, stillbirth, abortions, perinatal mortality and perinatal multiple hemorrhage syndrome in pinnipeds (Gulland *et al.*, 2018; Esquible *et al.*, 2019; Torres *et al.*, 2023). During the South American HPAI outbreak, some abortions were reported in SASL in Peru (Gamarra-Toledo *et al.*, 2023), and two studies detected high virus loads in aborted fetuses using molecular techniques (Leguia *et al.*, 2023; Rimondi *et al.*, 2024). A recent study detected avian influenza viral antigens in the placenta and fetus of a pregnant SASL that died during the outbreak at the Punta Loma colony, providing evidence of vertical transmission of the virus (Fiorito *et al.*, 2025). Additionally, the virus was also associated with an unprecedented mortality event among southern elephant seals (*Mirounga leonina*) at Península Valdés, where 96% of pups born and 50% of adult females died (Campagna *et al.*, 2023, 2025), and with evidence that supports mammal-to-mammal transmission and occasional mammal-to-bird spillover (Uhart *et al.*, 2024).

Although no samples from aborted fetuses were tested in this study, we cannot confirm that all reported cases were caused by the influenza virus. However, under the official protocol of the Argentine Animal Health Service (SENASA), once the HPAI virus is confirmed in a specific area and species, subsequent mortality is attributed to the virus based on epidemiological linkage without testing (SENASA, 2023). In this case, SENASA confirmed the virus in a sample from one SASL fetus (Table 1, Record 10), as well as from several juvenile and adult SASLs that died in the study area during the outbreak (Fig. 1; Rimondi *et al.*, 2024; SENASA, 2023). In addition, several pregnant females exhibited clinical signs consistent with avian influenza (Table 1, Fig. 1; SENASA, 2023), and one pregnant female underwent postmortem examination, resulting in positive findings for HPAI in the placenta and fetal organs (Fiorito *et al.*, 2025). Although alternative causes of abortions were not ruled out, we considered it is highly likely that the unusual abortion event documented along the northern Patagonia coast is associated with the ongoing HPAI outbreak occurring in the Atlantic.

Influenza viruses have been associated with abortions in other species, such as pigs (Kothalawala *et al.*, 2006). Evidence also suggest that avian influenza (H5N1) can cross the placental barrier and infect the fetus in humans: of six documented cases in pregnant woman affected by this virus, four resulted in maternal death, and two in spontaneous abortions (Le *et al.*, 2019). An experimental study using a BALB/c mice model (i.e., laboratory-bred mouse for animal experimentation) found that H5N1 viruses could be vertically transmitted to the fetus through the placenta (Xu *et al.*, 2011). Furthermore, the study suggests that pregnant mice could partially eliminate the virus during abortion or preterm delivery (Xu *et al.*, 2011). These findings raise the question of whether abortions could serve as a mechanism to reduce viral load and potentially increase maternal survival. Further research is essential to better understand the impact of this emerging virus on the health and reproductive outcomes of wild marine mammal populations.

Considering the number of SASL deaths reported by province during the HPAI outbreak, the number of recorded abortions and fetuses over a three-months period represent 9.5 % of the reported cases in Chubut ( $n = 485$ ; F. Bersano y A. Jones pers. comm.) and 1.8 % in Río Negro ( $n = 1469$ ; Secretaría de Ambiente y Cambio Climático de Río Negro, 2023). However, systematic surveys throughout the entire area have not been feasible due to the vast extent of the region and logistical constraints. Therefore, documented cases associated with avian influenza mortality likely represent only a small fraction of actual events occurring along the broader Argentinean coast.

### Unusual behavioral observations

In the Atlantic, common reproductive behaviors in SASLs are observed in January, when estrus and copulation peaks occur. Outside the breeding season, no retention, mating, or copulation behavior have previously not been observed. In the Pacific, one off-seasonal mating behavior was reported in a couple of SASLs in early September, with premature abortion suggested as one of several potential causal reason (Guzmán *et al.*, 2022).

In pinnipeds, postpartum estrus is characterized by elevated estradiol concentrations, followed by a rise in progesterone levels after ovulation (Sattler and Polasek, 2017). Therefore, the unusual behaviors observed on SASLs could be attributed to the initiation of the hormonal cascade, leading to ovulation and estrus. Males may detect these physiological cues and respond with reproductive behaviors, outside the breeding season. This suggests that both female estrus cycle and male reproductive behavior were disrupted this year in the context of HPAI outbreak. Such disruption of reproductive behavior caused by HPAI can lead to consequences in the maintenance of a pinniped population, as has recently been shown in southern elephant seals at Península Valdés (Campagna *et al.* 2025).

Regarding necrophilic behavior, this is the first documented instance of such behavior in SASLs. During the summer, sub-adult SASL males sometimes exhibit an alternative mating strategy involving the abduction of pups, occasionally attempting to mount them, although copulation does not occur (Campagna *et al.*, 1988b). These males interact with pups in ways similar to how adult males behaves towards females that resist copulation (i.e., holding the body's flanks with their fore flippers; Campagna *et al.*, 1988b). Inexperience with females, stimulus generalization, and high levels of sexual arousal in a stimulating environment may lead sub-adult males to direct their behavior towards inappropriate targets (Campagna *et al.*, 1988b).

Although it is challenging to definitively attribute these abnormal behaviors to the recent HPAI/H5N1 outbreak, it is well established that viral infection can cause neuronal dysfunction, resulting in a wide range of behavioral abnormalities (Tomonaga, 2004; Bortolato and Godar, 2010; Das and Basu, 2011). These abnormalities may affect various behavioral domains, including locomotor activity, learning, memory, aggression, and social interactions (Tomonaga, 2004). Additionally, in other species influenza viruses have been shown to influence behavior (Beraki *et al.*, 2005; Hosseini *et al.*, 2018). Therefore, continued research and long-term monitoring are essential to assess the impact in the context of this emerging HPAI/H5N1 virus on marine mammal behavior and population health.

### CONCLUSION

The records presented in this observational study overlap both spatially and temporally with confirmed detections of HPAI/H5N1 in the studied population. Based on these findings, it is likely that several key vital parameters –such as birth rate, survival rate, and fecundity– as well as the reproductive behavior and population abundance, may be impacted by the 2023 HPAI outbreak in the coming years. Accordingly, the next critical step is to evaluate the long-term effects of this emerging disease on the SASL population.

### AUTHOR'S PARTICIPATION

M.F.G. conceived and designed the study, received and compiled reports from stranding Networks, park rangers, and citizens, participated in field data collection, performed the analyses, prepared the figures, and wrote the manuscript. A.S.D. and C.D.F. participated in field data collection and contributed to manuscript writing and critical revision.

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## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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