

# A Juan Fernández Fur Seal (*Arctocephalus philippii*, Peters, 1866) in the Galápagos Islands: Insights from the First Anecdotal Observation in the Last Century

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The Juan Fernández fur seal (*Arctocephalus philippii*) is a pinniped species endemic to Chile, inhabiting the Juan Fernández Archipelago (i.e., Robinson Crusoe, Santa Clara, and Alejandro Selkirk Islands) and Desventuradas Islands (i.e., San Félix and San Ambrosio Islands) (Aurioles-Gamboa, 2015; Osman & Moreno, 2017; Aurioles-Gamboa & Trillmich, 2018). This species recently has been observed and recorded in marine and coastal regions outside its normal distribution range along the southeastern tropical Pacific (Table 1). The vagrant behaviour and occasional presence of this fur seal species have been observed along the

Pacific coast of South America and oceanic islands, including Colombia, Galápagos Islands, Ecuador, Perú, and on Chile’s mainland coast, as reported elsewhere (Majluf & Reyes, 1989; Merlen, 1995; Reeves et al., 2002; Alava & Salazar, 2006; Avila et al., 2014; Aurioles-Gamboa, 2015; Jefferson et al., 2015; Alava & Aurioles-Gamboa, 2017; Aurioles-Gamboa & Trillmich, 2018; Páez-Rosas et al., 2020; Alava et al., 2021).

The sighting of this species in Punta San Juan (Perú) (Majluf & Reyes, 1989), for instance, was considered as the northern limit of its occurrence (Aurioles-Gamboa, 2015). El Niño–Southern

**Table 1.** Documented observations of the Juan Fernández fur seal (*Arctocephalus philippii*) in the southeastern tropical Pacific, including the Galápagos Archipelago, Colombia, and Perú, from 1973 to 2019

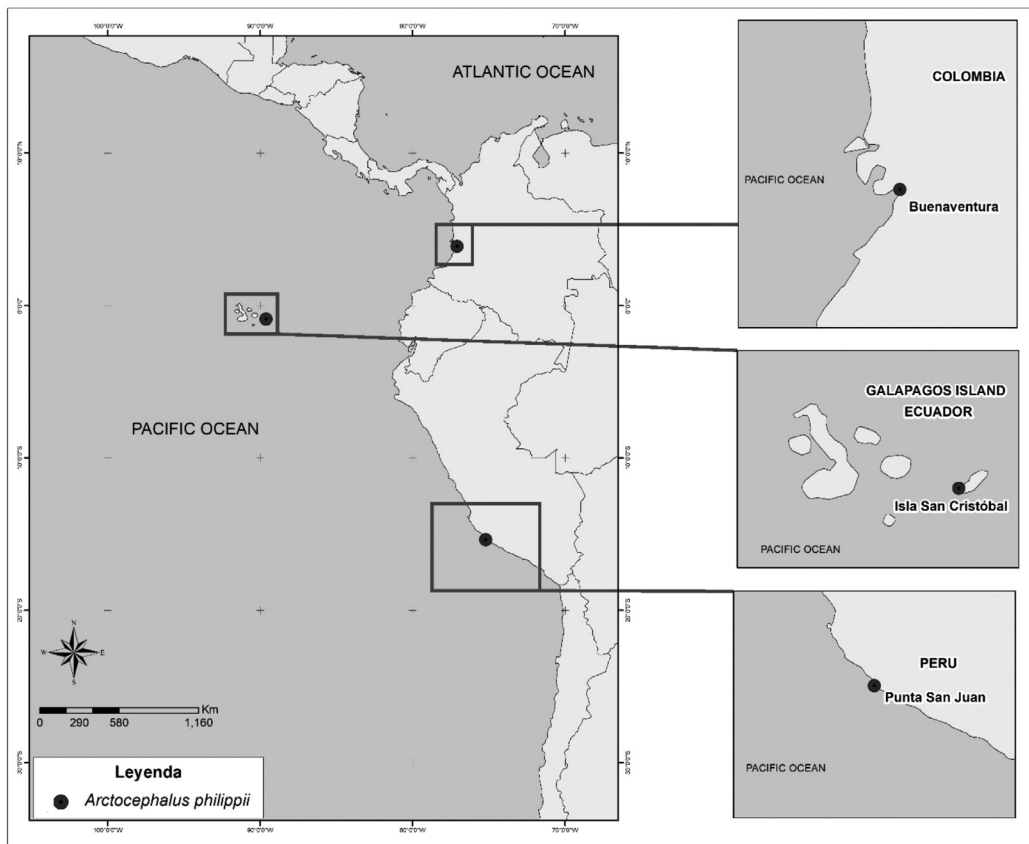
Records in chronological order	Date	Location	Geographical coordinates	Age/sex category (number of fur seals [n])	Body condition	Source/reference
1	1973 to 1984	Punta San Juan, Perú	15° 21' 59" S, 75° 11' 31" W	Adult or juvenile males (n = 10–15)	N/A	Majluf & Reyes, 1989
2	1986	San Cristóbal Island southwestern coast, Galápagos Islands, Ecuador	0° 54' S, 89° 36' W	Presumably an adult male (n = 1)	Apparent good body condition	Merlen, 1995; this study
3	4 July 2007	San Francisco (local beach), Puerto Buenaventura, Colombia	3° 53' N, 77° 4' W	Adult male (n = 1)	Poor body condition (emaciated)	Avila et al., 2014
4	24 June 2019	Playa de Oro, Puerto Baquerizo Moreno, San Cristóbal Island, Galápagos Islands, Ecuador	0° 54' S, 89° 36' W	Subadult male (n = 1)	Good body condition	Páez-Rosas et al., 2020

Oscillation (ENSO) events and ocean warming are considered to be the environmental, density-independent factors influencing the long dispersion and extralimital records of vagrant Juan Fernández fur seals (Avila et al., 2014; Auriolos-Gamboa, 2015; Páez-Rosas et al., 2020; Table 1). Observations of tropical and subtropical pinniped species outside their normal home ranges are becoming the norm in the southeastern tropical Pacific (Alava & Auriolos-Gamboa, 2017).

Páez-Rosas et al. (2020) recently reported an observation of Juan Fernández and Guadalupe (*Arctocephalus philippii townsendi*) fur seals in the Galápagos Islands as unprecedented records attributed to the incidence of cold marine currents (e.g., Humboldt Current) or anomalous oceanographic events (e.g., ENSO events). Notwithstanding, the Juan Fernández fur seal as a single identified species was observed previously in the Galápagos Islands in the last century by Merlen (1995). Thus, this species is not a new visitor to the islands.

Herein, we provide further insights on this first opportunistic observation based on a rigorous examination of the original photo of this species from the late 1900s, deposited in the Charles Darwin Research Station Library by the second author (GM) in the 1980s, to complement the recent sightings of an individual of this species genetically identified by Páez-Rosas et al. (2020). Doing so, we also contribute with more details on the extralimital records, movement, and behavioral ecology of this fur seal species subjected to the influence of changing oceans and regional climate change in the southeastern tropical Pacific Ocean.

In 1986, an unidentified fur seal was observed on the rocky lava shore of the southwestern coast of San Cristóbal Island close to Puerto Baquerizo Moreno ( $0^{\circ} 54' S$ ,  $89^{\circ} 36' W$ ; Figure 1), one of the main populated islands of the Galápagos Archipelago. According to the external description and examination of the archived photo (see black and white illustration shown in Figure 2),



**Figure 1.** Map of the Galápagos Archipelago showing the location of the anecdotal observation of the Juan Fernández fur seal (*Arctocephalus philippii*) on the southwestern coast of San Cristóbal Island in 1986, and other recent sightings of this species in Perú (Punta San Juan) and Colombia (Buenaventura), as reported in Table 1



**Figure 2.** Illustration of a Juan Fernández fur seal observed on the southwestern coast of San Cristobal Island, based on the original black and white photograph taken by the second author (GM) and archived in the Charles Darwin Station Library (Puerto Ayora, Santa Cruz Island, Galápagos Islands). Artwork courtesy of N. Alava Calle.

the otariid was identified as a Juan Fernández fur seal and exhibited a dark brown coloration with a mane from the top of the head to the top of the shoulders; however, it was not possible to visualize the golden yellow to tan-tipped guard hairs in this photo. Of particular attention was the long, slender, and pointed snout or muzzle with a distinctive bulbous rhinarium, and the head shape (Figure 2), which is a characteristic trait for this species that has the longest snout among southern fur seal species (Reeves et al., 2002; Jefferson et al., 2015; Aurióles-Gamboa & Trillmich, 2018). Based on this unique trait, the animal in question did not exhibit morphological features matching those of the two well-known endemic otariids, the Galápagos sea lions (*Zalophus wollebaekii*) and the Galápagos fur seal (*Arctocephalus galapagoensis*), which indeed lack the long, slender, and pointed snout observed in *A. philippii*.

Still, the animal resembles and is comparable to its closest and more similar relative, the Guadalupe fur seal, mainly found in the Northern Hemisphere. While the snout of *A. townsendi* is also pointed, it shows a tapering muzzle that appears slightly upturned, with the nostrils pointing downward at an angle, a feature not observed on the snout of *A. philippii*. Moreover, *A. philippii*

possess a short hind flipper compared to the moderately long hind flippers of *A. townsendi*.

Despite the complexity to discriminate morphologically the Juan Fernández fur seal from the Guadalupe fur seal, the former can be distinguished from other fur seals by the shape of the head, snout length and shape, and fur coloration differences (Reeves et al., 2002; Jefferson et al., 2015; Aurióles-Gamboa & Trillmich, 2018).

Based on exhaustive inspection of the original photo in comparison with Figure 2 in Páez-Rosas et al. (2020), we assert that our observation was the first northernmost record prior to the sighting of an emaciated individual in Colombia by Avila et al. (2014), and well before the second record for the Galápagos Islands (Páez-Rosas et al., 2020). Some other unconfirmed sightings and anecdotal records have been informed for Ecuador's continental coast (J. J. Alava, pers. obs., March 2021; Alava et al., 2021).

Ongoing changing ocean conditions driven by regional climate changes could be prompting the expansion and behavioral movement of non-native pinniped species to remote, oceanic islands of the southeastern Pacific Ocean (Alava et al., 2022). Density-dependent factors, such as increasing population growth rate, and density-independent

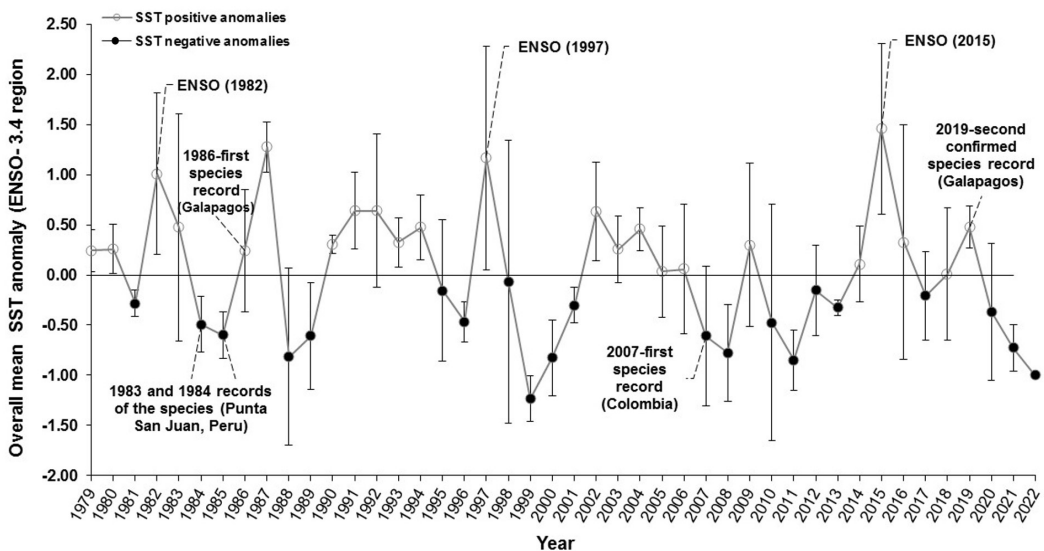
factors, such as the influence of the Humboldt Current during cold conditions, ENSO events, and ocean warming due to global climate change triggering these long dispersals (Alava & Carvajal, 2005; Elorriaga-Verplancken et al., 2016; Páez-Rosas et al., 2017, 2018, 2020; Avila et al., 2021; Rosero & Alava, 2021; Alava et al., 2022), should be considered to explain the unusual occurrence of this species in regions far from its home ranges.

As it stands, the individual recorded in 1986 by Merlen (1995) occurred during cold and warm periods that exhibited negative and low to moderate positive sea surface temperature (SST) anomalies (i.e., mean Oceanic Niño Index [ONI]-SST anomaly:  $0.242 \pm 0.61$  [SD], ranging from -0.5 to 1.2; Figure 3) 4 y after one of the strongest El Niño episodes in 1982, which dramatically affected the endemic pinniped species of the Galápagos Islands (Merlen, 1995; Alava & Salazar, 2006; Alava & Auriolles-Gamboa, 2017). Similarly, the recent sightings of June 2019 were associated with the influence of the cold Humboldt Current (Páez-Rosas et al., 2020), with low positive SST anomalies (i.e., mean ONI-SST anomaly:  $0.475 \pm 0.21$  [SD], ranging from 0.1 to 0.7), following 4 y after the third, strong 2015 ENSO event (Figure 3).

These observations underscore the propagated post-impact force of intense and recurrent ENSO events alternated with negative (i.e., La Niña

events) or low-moderate positive SST anomalies, likely influencing the extralimital distribution of this pinniped species and the availability of its main preys in the southeastern tropical Pacific Ocean in the face of a changing ocean (Alava et al., 2022). However, our understanding is limited regarding the mobile or vagrant behavior of *A. philippii* in tandem with its sensitivity and vulnerability to the accumulative impacts of climate change, affecting marine mammals (Albouy et al., 2020), and the increasing frequency of El Niño in recent decades (e.g., Freund et al., 2019), ultimately affecting changes in food supply or prey distribution and nutritional status.

The Juan Fernández fur seal was intensively hunted in the past with such a high magnitude that this species was very close to extinction (Auriolles-Gamboa, 2015; Osman & Moreno, 2017). It was estimated that at least 3,870,170 individuals were captured during commercial exploitation from 1687 to 1898, leading some to believe this species extinct by 1900 (King, 1964; Maxwell et al., 1967; Hubbs & Norris, 1971; Torres, 1987a, 1987b) as a consequence of the vast hunting exploitation (Osman & Moreno, 2017). In 1965, Bahamonde (1966) reported the presence of small colonies on Alejandro Selkirk and Robinson Crusoe Islands, announcing that the species was not extinguished and had been rediscovered. Its capture and



**Figure 3.** Records of the Juan Fernández fur seal plotted in combination with the overall annual average of SST anomalies (i.e., the Oceanic Niño Index [ONI]) in the El Niño 3.4 Region (i.e., 3-mo running mean of *ERSST*, Version 5, SST anomalies in the El Niño 3.4 Region; Huang et al., 2017; [https://origin.cpc.ncep.noaa.gov/products/analysis\\_monitoring/ensostuff/ONI\\_v5.php](https://origin.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ONI_v5.php)), based on centered 30-y base periods in the Eastern Tropical Pacific from January 1979 until May 2022. Warm (e.g., El Niño events) and cold (e.g., La Niña episodes) periods are represented by white and black circles, respectively. The error bars are standard deviations (SD) to show the variability of the ONI-SST anomaly data.

exploitation has been prohibited in Chile since 1965 (Aguayo, 1979), and full protection status was extended to all *Arctocephalus* species in 1978 (Torres, 1987b).

The Juan Fernández fur seal was “Near Threatened” according to the criteria of the International Union for Conservation of Nature’s *Red List of Threatened Species* until 2008 (Aurioles & Trillmich, 2008) when a population ranging from 12,000 to 18,000 individuals was reported (Aurioles & Trillmich, 2008; Aurioles-Gamboa, 2015; Jefferson et al., 2015). As the population is reaching stability and gradually increasing with a population size of 32,278 individuals, not including females performing foraging trips and juveniles (Osman & Moreno, 2017), the species is currently listed as of “Least Concern,” according to the last IUCN assessment (Aurioles-Gamboa & Trillmich, 2018).

While there are scarce field data to suggest that an increase of this species’ population would be a contributing factor to the dispersion of vagrant individuals, questions linger about the environmental stressors and climatic events affecting this species and its habitat (Avila et al., 2014; Aurioles-Gamboa, 2015; Aurioles-Gamboa & Trillmich, 2018; Páez-Rosas et al., 2020). Searching previous pinniped anecdotic records and historical data is essential to obtain reliable knowledge of past and current intrinsic and extrinsic factors affecting their population dynamics. As highlighted by Rosero & Alava (2021), local unreported records and knowledge in combination with systematic field and scientific observations can serve to propose and recommend management strategies for the conservation and protection of threatened, non-native roaming pinniped species that temporarily arrive or visit Ecuadorian waters, including the Galápagos Islands.

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