THERYA NOTES 2024, Vol. 5 : 216-222 DOI: 10.12933/therya_notes-24-175 ISSN 2954-3614

New sightings of southern elephant seals (*Mirounga leonina*) in México: Citizen science and wildlife dispersion

Nuevos avistamientos de elefantes marinos del sur (*Mirounga leonina*) en México: Ciencia ciudadana y dispersión de vida silvestre

Isai David Barba-Acuña[1*], Juan Pablo Gallo-Reynoso[1], José Ángel Ortega-Borchardt[1], Manuel Muñoz-Espinoza[2], Claudia J. Hernández-Camacho[3], Elena B. Eder[4], Lynda Dobbin-Turner[5], and Christian Casillas-Angón[6]

[1]Centro de Investigación en Alimentación y Desarrollo, A. C. Unidad Guaymas. Carretera al Varadero Nacional km 6.6, C. P. 85480, Guaymas. Sonora, México. E-mail: isai.barba@ciad.mx (IDB-A); jpgallo@ciad.mx (JPG-R); jangelortegab@gmail.com (JÁO-B).
[2]Grupo Lobos. Ejido Rodolfo Campodónico, H. Caborca. Sonora, México. E-mail: munozespinozamanuel77@gmail.com (MM-E).
[3]Centro Interdisciplinario de Ciencias Marinas, Instituto Politécnico Nacional. Playa Palo de Santa Rita, C. P. 23096, La Paz. Baja California Sur, México. E-mail: jcamacho@ipn.mx (CJH-C).
[4]Centro para el Estudio de Sistemas Marinos (CESIMAR-CONICET). Boulevard Brown 2915, C. P. U9120ACD, Puerto Madryn. Chubut, Argentina. E-mail: lebder@gmail.com (EBE).
[5]Longbow Lake. Storm Bay Road, 22-15. C. P. P0X 1H0. Ontario, Canadá. E-mail: dadiva47@gmail.com (LD-T).
[6]Comité de Atención a Fauna Silvestre. Calle río azul, C. P. 70989, Huatulco. Oaxaca, México. E-mail: chris.casillas@hotmail.com (CC-A).
*Corresponding author

The southern elephant seal (*Mirounga leonina*) has a circumpolar distribution in the southern hemisphere. However, recent observations have documented this species in several locations across the northern hemisphere. With the integration of citizen science, we report 3 new records of this species in México. Photographs, videos, and information on elephant seals were collected with the collaboration of citizens (fishermen and photographers) on the Gulf of California and the southern Mexican Pacific coast. Data regarding the date, time, geographic location, and general behavior of the elephant seal were obtained from these sightings. The species, sex, and age category of the pinnipeds were identified based on external morphological characteristics. Three sightings of different southern elephant seal individuals were recorded on the Pacific Ocean coasts of México. In February 2021, a juvenile male was observed in Bahías de Huatulco, Oaxaca. In May 2022, a subadult male was sighted in San Jorge Bay, Sonora. In February 2023, another subadult male was observed in the Gulf of Santa Clara, Sonora. We documented 3 extralimital sightings of the southern elephant seal, with one being this species' northernmost record in the Pacific Ocean. These records contribute to our understanding of the dispersal patterns of southern elephant seals and highlight the importance of citizen science in advancing knowledge of marine mammal distributions.

Key words: Climate change; dispersal; migration; pinniped; vagrant individual.

El elefante marino del sur (*Mirounga leonina*) tiene una distribución circumpolar en el hemisferio sur. Sin embargo, observaciones recientes han documentado esta especie en varios lugares del hemisferio norte. Con la integración de la ciencia ciudadana, se reportan 3 nuevos registros de esta especie en México. Se recopilaron fotografías, videos e información de elefantes marinos con la colaboración de ciudadanos (pescadores y fotógrafas) en el Golfo de California y la costa sur del Pacífico mexicano. De los avistamientos se obtuvo información sobre la fecha, hora, ubicación geográfica y comportamiento general del elefante marino. La especie, sexo y categoría de edad de los pinnípedos se identificaron con base en características morfológicas externas. Se registraron 3 avistamientos de individuos diferentes de elefante marino del sur en las costas del océano Pacifico de México. En febrero de 2021 se observó un macho juvenil en Bahías de Huatulco, Oaxaca. En mayo de 2022 se avistó un macho subadulto en la Bahía de San Jorge, Sonora. En febrero de 2023 se observó otro macho subadulto en el Golfo de Santa Clara, Sonora. Documentamos 3 avistamientos extralimitales del elefante marino del sur, uno de los cuales es el registro más septentrional de esta especie en el Océano Pacífico. Estos registros contribuyen a la comprensión de los patrones de dispersión de los elefantes marinos del sur y resaltan la importancia de la ciencia ciudadana para avanzar en el conocimiento de las distribuciones de los mamíferos marinos.

Palabras clave: Cambio climático; dispersión; individuos solitarios; migración; pinnípedos.

Citizen science in marine mammal monitoring and scientific research has experienced a notable increase in recent years. This growing trend highlights the significant contribution of citizen science to enhancing our understanding of marine mammal diversity and distribution (García-Cegarra *et al.* 2021; Adamantopoulou *et al.* 2022). Additionally, citizen science generates valuable data in remote and inaccessible areas that researchers have difficulty accessing, thus contributing to identifying existing threats to marine mammals (Curtis *et al.* 2021). Furthermore, citizen science has proven to be a relevant and reliable tool for monitoring species distribution and recording the presence of pinni-

peds and other marine mammals in various regions worldwide (Sayer *et al.* 2019; Kelly *et al.* 2020).

Unusual records of live pinnipeds sighted beyond their previously known distribution range have increased in recent decades (Milmann *et al.* 2019; Bester *et al.* 2022; De Weerdt *et al.* 2024). México is home to 4 pinniped species: the California sea lion (*Zalophus californianus*), the Guadalupe fur seal (*Arctocephalus townsendi*), the northern elephant seal (*Mirounga angustirostris*), and the Pacific harbor seal (*Phoca vitulina richardii*) (Gallo-Reynoso *et al.* 2010; Schramm and Heckel 2021; Barba-Acuña *et al.* 2022). Additional records of various pinniped species from regions beyond their usual range have been observed along the shores of the Mexican Pacific. These species mentioned come from both the northern and southern hemispheres, including the Steller sea lion (*Eumetopias jubatus*; Gallo-Reynoso *et al.* 2020), South American fur seal (*A. australis*; Villegas-Zurita *et al.* 2016), Galapagos fur seal (*A. galapagoensis*; Aurioles-Gamboa *et al.* 2004; Tamayo-Millán *et al.* 2021), Galapagos sea lion (*Z. wollebaeki*; Elorriaga-Verplancken *et al.* 2022), South American sea lion (*Otaria flavescens*; Ceballos *et al.* 2010; Gallo-Reynoso *et al.* 2020), and Southern elephant seal (*M. leonina*; Elorriaga-Verplancken *et al.* 2020; Alava *et al.* 2022; Cerillo-Espinosa *et al.* 2023; Romero-Tenorio *et al.* 2023).

Elephant seals (*M. leonina* and *M. angustirostris*) are the largest phocids and exhibit the most remarkable sexual dimorphism of all marine mammals (Lewis and Eder 2021). These 2 large phocids have antipodal distributions. The range of the northern elephant seal (*M. angustirostris*) includes islands and coastal areas of California, United States, and Baja California, México (Lowry *et al.* 2014). However, the southern elephant seal (*M. leonina*) has a circumpolar distribution in the southern hemisphere, with most colonies primarily located on sub-Antarctic islands (Hindell *et al.* 2016). Additionally, there are established colonies on Península de Valdés, Argentina (Campagna and Lewis 1992), and emerging colonies on the coast of Chile (Acevedo *et al.* 2016; Capella *et al.* 2017; Sepúlveda *et al.* 2018; Cárcamo *et al.* 2019).

Elephant seals undertake long-distance migrations from their breeding grounds to their foraging areas (Lewis and Eder 2021; Robinson *et al.* 2012), generally exhibiting philopatry to their breeding grounds (Le Boeuf *et al.* 2019; Chua *et al.* 2022). Extralimital records beyond their typical distribution range indicate extensive dispersal capabilities (Lewis *et al.* 2006; Páez-Rosas *et al.* 2018). This study presents 3 new records of the southern elephant seal: 1 in the southern Mexican Pacific and 2 in the Gulf of California. These records were obtained through citizen science, with one representing the northernmost record for the species to date.

Photographs and videos of elephant seals were collected with the collaboration of fishermen and photographers along different coasts of México. These photos and videos were taken opportunistically and shared via social media to the first author of this manuscript. Collecting wildlife sightings and data through citizen science provides speed, data accuracy, and cost-effectiveness (Dickinson *et al.* 2012; Fulton *et al.* 2019; Monzón-Alvarado *et al.* 2020). Muñoz-Espinoza, a fisherman and participant in the biological monitoring group "Grupo Lobos," which monitors California sea lions (*Zalophus californianus*), ospreys (*Pandion haliaetus*), and other seabirds in San Jorge Bay since 2013, contacted the first author to provide a video and photographs of an individual observed in San Jorge Bay, Sonora. C. Casillas-Angón, a photographer, captured photographs of an individual on the Oaxaca coast. Additionally, the fisherman F. Pérez-Tapia and the photographer L. Dobbin-Turner photographed an individual in the Gulf of Santa Clara, Sonora. The photographers were contacted to obtain supplementary details about the records, such as the date, time of the sighting, exact geographic coordinates, and the behavior exhibited by the elephant seal. Additional photographs were requested, and we chose the best photograph from each of the 3 sightings to highlight the distinctive characteristics of the species and determine its sex and age category.

The taxonomic and sexual identification of the 3 elephant seals observed in Oaxaca and Sonora was determined by the authors of this manuscript. Four authors have conducted biological research with the northern elephant seal in México, and one author with the southern elephant seal in Argentina. For the species identification, we considered external morphological characteristics, the neck-to-head size ratio, and the size and shape of the proboscis (Alava *et al.* 2022; Romero-Tenorio *et al.* 2023). Compared to northern elephant seals of the same age class, the proboscis of the southern elephant seal is shorter and smaller (Galimberti *et al.* 2019; Lewis and Eder 2021). The phenology of *M. leonina* was also considered to categorize the molt stage of the individuals (Páez-Rosas *et al.* 2018; Lewis and Eder 2021).

Our results add 3 new sightings of southern elephant seals (*Mirounga leonina*) in the northern hemisphere, documented between 2021 and 2023 in the southern Mexican Pacific and the Gulf of California (Figure 1). The first southern elephant seal individual was observed and photographed by a citizen at Pescadores Beach, Tangolunda, Bahías de Huatulco, Oaxaca (15º 49' 24.9" N, 95º 57' 56.8" W), on February 3, 2021, at 11:00 hr. Based on the absence of a discernible gular shield, this individual was identified as a male juvenile, approximately 4 years old. The individual was determined to be a male by observing the umbilicus and the penile fold in the ventral area (Figure 2a). The individual was in molting stage, as evidenced by the pieces of old fur still attached to its skin (Figure 2a). This juvenile was observed conducting thermoregulatory behavior (defined by throwing sand on its body with its fore flippers; Figure 2b).

The second individual, identified as a subadult male (Figure 3a), was sighted by a fisherman during the biological monitoring activities of "Grupo Lobos" in Campodónico,

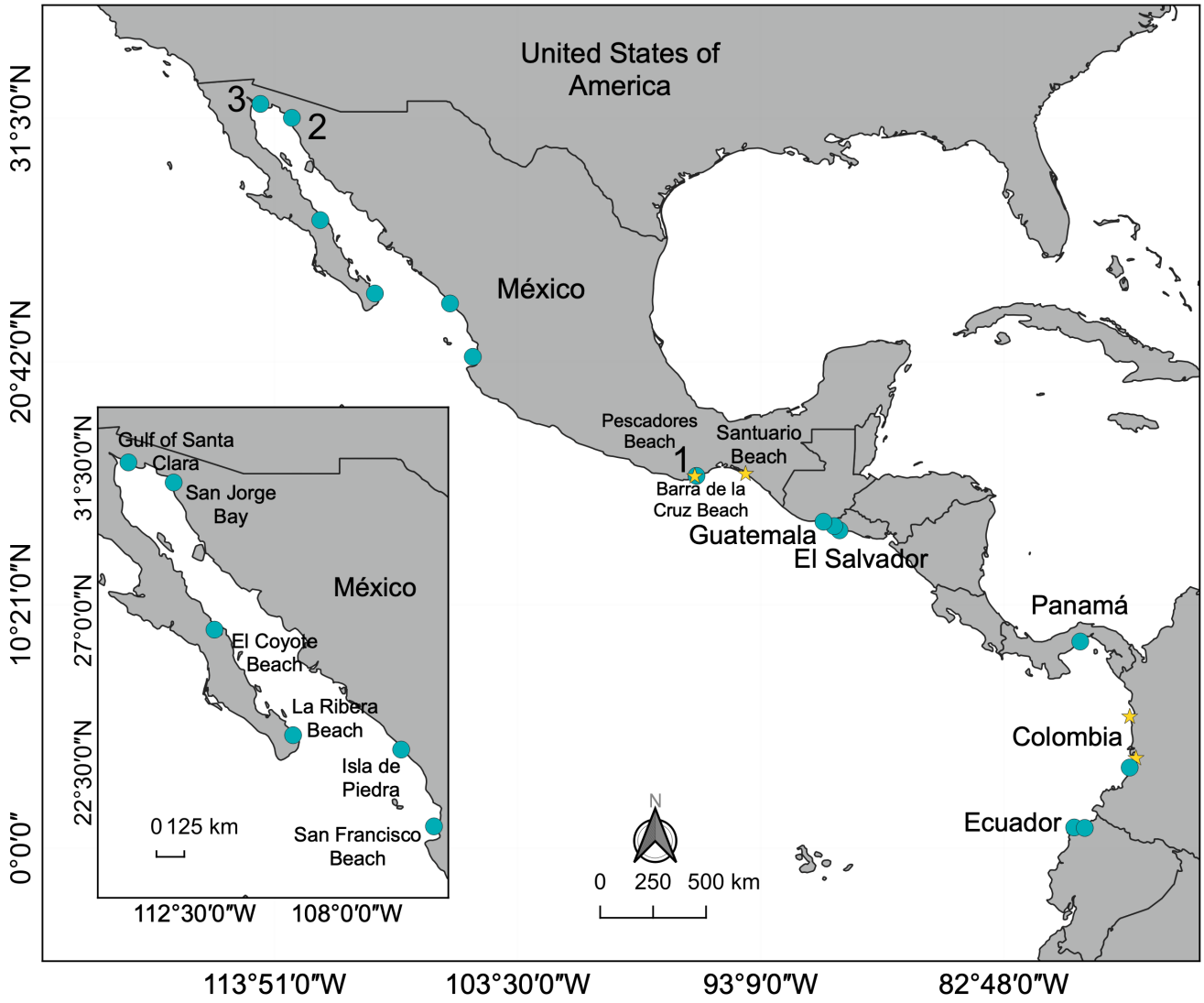

Figure 1. Southern elephant seal (*Mirounga leonina*) record sites in the Pacific Ocean. Turquoise dots represent subadult males and yellow stars represent juvenile males. Number 1 represents a juvenile male sighted in Pescadores Beach, Oaxaca in 2021. Numbers 2 and 3 represent subadult males sighted in San Jorge Bay and the Gulf of Santa Clara (Sonora), in 2022 and 2023, respectively. Other records from México, Central, and South America are denoted on the map (Páez-Rosas *et al.* 2018; Redwood and Félix 2018; Elorriaga-Verplancken *et al.* 2020; Ávila *et al.* 2021; Alava *et al.* 2022; López *et al.* 2022; Cerillo-Espinosa *et al.* 2023; Romero-Tenorio *et al.* 2023).

San Jorge Bay, Sonora (31° 04' 16" N, 113° 06' 59.8" W) on May 6, 2022, at 13:00 hr. The individual was seen with no evidence of molting. On the monitoring outing the next day (May 7, around 08:00 hr), the individual was not observed at the location.

The third individual was photographed and recorded by a fisherman in the Gulf of Santa Clara (Sonora coast), located at the Upper tip of the Gulf of California, on February 24, 2023. Based on its body size and distinctive nose, it was identified as a subadult male. The significant lack of scarring on its neck suggests that it may not yet be an active breeder. It was observed at approximately 11:00 hr, roughly 8 km from the fishing community (31° 38' 42.8" N, 114° 25' 48.5" W). Later, at approximately 19:00 hr, the individual was observed 4 km further north (31° 39' 53.9" N, 114° 27' 20.8" W; F. Pérez-Tapia pers. comm., February 24, 2023). The individual was observed entering tidal sea ponds to thermoregulate. From February 25 to 27, the individual was no longer observed in the area. However, on February 28, it was sighted and photographed by a citizen further north (Figura 3b). It was considered the same individual due to a visible and distinct scar on the proboscis (Figure 3c).

Southern elephant seals exhibit congregations during the molting season (November through March) and the breeding season (August through November), maintaining relatively high site fidelity during their annual life cycle (Lewis and Eder 2021). The subadult male individual from the Gulf of Santa Clara, observed in February 2023, appeared to be in very good body condition, suggesting recent successful foraging trips. Its skin displayed a light yellowish-beige color characteristic of old fur (Lewis and Eder 2021), with minimal evidence of molting at the foreback hind flippers, suggesting it may have hauled out to initiate its annual molting. The subadult individual observed in San Jorge Bay in May 2022 was seen with no evidence of molting. This sighting occurred when subadult males of the species typically undertake their foraging trips post-molt, as the molting period for adult and subadult males

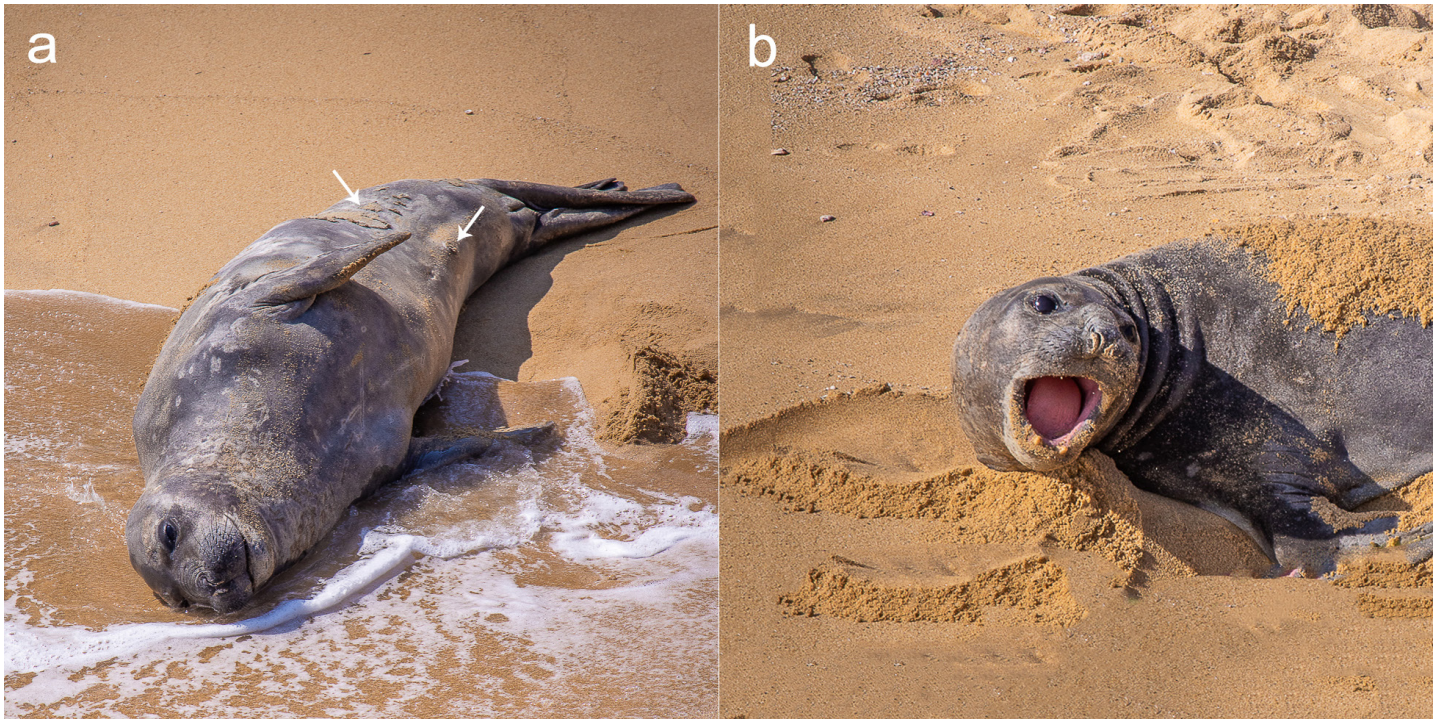

Figure 2. Southern elephant seal (*Mirounga leonina*) juvenile male observed on Pescadores Beach, Oaxaca, in 2021. a) The ventral zone of the umbilicus and the penile fold and shedding of fur in the rear dorsal area are visible. b) Typical folds of the nose of *M. leonina*. Photography: C. Casillas-Angón. Images available at isai.barba@ciad.mx.

occurs between January and March (Lewis *et al.* 2006; Lewis and Eder 2021). Juvenile and subadult males are regarded as broad vagrants by several authors (Lewis *et al.* 2006; Páez-Rosas *et al.* 2018; Lewis and Eder 2021).

The dispersal of vagrant individuals of *M. leonina* has been reported across a wide range of latitudes of the Atlantic, Indian, and Pacific Oceans (Lewis *et al.* 2006; Elorriaga-Verplancken *et al.* 2020; de Vos 2021; Lewis and Eder 2021). In the southern hemisphere of the Pacific Ocean, the dispersal of some individuals has been observed along the coasts of Chile (Cárcamo *et al.* 2019), Perú (Acevedo *et al.* 2016), and Ecuador (Alava and Carvajal 2005; Félix 2018; Rosero and Alava 2021), including the oceanic islands of Pascua, Juan Fernández, and Galápagos (Aguayo-Lobo *et al.* 1995; Acevedo *et al.* 2016). Additionally, there are records of the southern elephant seal in the northern hemisphere of the Pacific Ocean. They have been recorded in Ecuador (Páez-Rosas *et al.* 2018), Colombia (Ávila *et al.* 2021), Panamá (Redwood and Félix 2018), El Salvador (Alava *et al.* 2022; López *et al.* 2022), Guatemala (Alava *et al.* 2022), and México (Elorriaga-Verplancken *et al.* 2020; Alava *et al.* 2022; Cerillo-Espinosa *et al.* 2023; Romero-Tenorio *et al.* 2023).

The most recent reports of extralimital records of the southern elephant seal in the northern region were documented at 2 locations in Baja California Sur, México (Elorriaga-Verplancken *et al.* 2020; Alava *et al.* 2022). Our observation in the Gulf of Santa Clara (Sonora) extends approximately 600 to 1,000 km north of these locations, making it the current northernmost record for the southern elephant seal in the Pacific Ocean. The southernmost breeding colony of this species in the Pacific Ocean was recorded in Almirante Montt Gulf, Chile (Capella *et al.* 2017). The straight-line distance from that colony to the recorded site in the Gulf of Santa Clara is approximately 10,100 km, suggesting that the subadult male recorded in this region could have traveled this distance. This could represent one of the most extended transhemispheric dispersal movements recorded for a pinniped (Lewis and Eder 2021; Sousa-Lima *et al.* 2022), but significant research is required to prove this hypothesis. Changes in the marine environment can influence the movements and feeding strategies of southern elephant seals, potentially driving long-range migrations and displacement of individuals to optimize foraging efficiency in response to shifting environmental conditions (Oosthuizen *et al.* 2011; Ávila *et al.* 2021; Chua *et al.* 2022).

The northward expansion and extralimital dispersal of *M. leonina* in the Pacific Ocean have been attributed to environmental changes, particularly in seawater temperature linked to climatic-oceanographic variations associated with "La Niña" cold event in the southeast Pacific (Páez-Rosas *et al.* 2018; Redwood and Félix 2018; Ávila *et al.* 2021). Our sightings in February 2021 in Oaxaca, and in May 2022 and February 2023 in Sonora also coincide with a La Niña event. However, extralimital records have been observed in non-La Niña conditions, such as September 2019 (Elorriaga-Verplancken *et al.* 2020). Other factors, including marine currents (López *et al.* 2022) and environmental and climate change factors (*e.g.*, ocean heat waves, changes in primary productivity, increased sea surface temperature, and prey availability), may influence the extralimital dispersal of *M. leonina* and the plausible exploitation of potentially suitable habitat niches (Alava *et al.* 2022). Additionally, the increase in specific southern elephant seal populations in

Figure 3. a) Southern elephant seal (*Mirounga leonina*) subadult male observed at San Jorge Bay, in the northeastern Gulf of California, in 2022. The individual appears to be in good body condition and recently molted. Photography: M. Muñoz-Espinoza. b) Southern elephant seal subadult male observed in the Gulf of Santa Clara, upper Gulf of California, in 2023. Fur coloration denotes a pre-molt individual. c) Displaying a threat vocalization. Photography: L. Dobbin-Turner. Images available at isai.barba@ciad.mx.

circumpolar regions cannot be disregarded as a factor influencing extralimital dispersal, especially among non-adult individuals, due to the potential for new feeding areas in emerging environmental niches (Alava *et al.* 2022). Monitoring these individuals through GPS/satellite tracking and tagging could help us understand their movements, colonies of origin, and habitat utilization during changing marine environmental conditions (Lewis *et al.* 2006; Páez-Rosas *et al.* 2018).

Extralimital records of marine species outside their usual distribution range, obtained through citizen science, provide valuable insights into ecosystem changes and the recovery of previously exploited species (Adamantopoulou *et al.* 2022; Cranswick *et al.* 2022). Combining data generated with citizen science with expert analyses and interpretations in marine mammal research is increasingly common and can expand sources of knowledge, generate accurate data, and foster collaboration (Lodi and Tardin 2018; Wood *et al.* 2021). These extralimital records of *M. leonina* in México contribute significantly to our understanding of the dispersal behavior of this pinniped species in the Pacific Ocean. They highlight the potential of citizen science in fostering collaboration to enhance our knowledge of the distribution of marine mammals and other top predators, which may be considered sentinels of the ocean in the context of progressing climate change.

Acknowledgements

Special thanks to "Grupo Lobos" of the Campodónico community for their support in monitoring wildlife on the northeastern coast of the Gulf of California. The authors acknowledge L. Armenta-Méndez from CIAD and ECO-GRANDE A. C. for providing training on monitoring ospreys to "Grupo Lobos". Thanks to CONANP and CEDO for addi-

tional monitoring training provided to "Grupo Lobos". We thank F. Pérez-Tapia for sharing photographs and videos of the subadult male from the Gulf of Santa Clara for better identification and the reviewers whose comments improved this note. M. E. Sánchez-Salazar edited the English manuscript.

Literature cited

Acevedo, J., *et al*. 2016. Review of the current distribution of southern elephant seals in the eastern South Pacific. New Zealand Journal of Marine and Freshwater Research 50:240-258.

Adamantopoulou, S., *et al*. 2022. Citizen science indicates significant range recovery and defines new conservation priorities for Earth's most endangered pinniped in Greece. Animal Conservation 26:115-125.

Aguayo-Lobo, A., *et al*. 1995. Primer registro del elefante marino del sur, *Mirounga leonina*, en la Isla de Pascua, Chile. Serie Científica INACH 45:123-129.

Alava, J. J., and R. Carvajal. 2005. First records of elephant seals on the Guayaquil Gulf, Ecuador: on the ocurrence of either a *Mirounga leonina* or *M. angustirostris*. Latin American Journal of Aquatic Mammals 4:195-198.

Alava, J. J., *et al*. 2022. Southern elephant seals (*Mirounga leonina*) in the Galapagos Islands and the Eastern Tropical Pacific amid ocean environmental changes: Towards a habitat suitability index. Aquatic Mammals 48:418-431.

Aurioles-Gamboa, D., Y. Schramm, and S. Mesnick. 2004. Galapagos fur seals, *Arctocephalus galapagoensis*, in Mexico. Latin American Journal of Aquatic Mammals 3:77-80.

Ávila, I. C., G. A. Trujillo, and J. J. Alava. 2021. Primeros registros de elefantes marinos en el Pacífico colombiano: ¿Elefantes marinos del sur, *Mirounga leonina*? Caldasia 43:408-411.

Barba-Acuña, I. D., *et al*. 2022. Population assessment and feeding ecology on a new colony of the Guadalupe fur seal (*Arctocephalus philippii townsendi*) on Farallón de San Ignacio Island, Gulf of California, Mexico. Marine Mammal Science 38:1710-1718.

Bester, M. N., G. J. G. Hofmeyr, and P. A. Bartlett. 2022. Dispersion of a southern elephant seal *Mirounga leonina* to Possession Island, Namibia. Polar Biology 45:951-958.

Campagna, C., and M. Lewis. 1992. Growth and distribution of a southern elephant seal colony. Marine Mammal Science 8:387-396.

Capella, J., *et al*. 2017. Nueva colonia reproductiva de foca elefante del sur *Mirounga leonina* (Linnaeus 1758) (Phocidae) en el sur de Chile. Anales Instituto Patagonia 45:87-92.

Cárcamo, D., *et al*. 2019. Are southern elephant seals re-invading mid-latitude grounds? New sightings and first birth records off the Chilean Coast. Polar Biology 42:433-440.

Ceballos, G., *et al*. 2010. Extralimital distribution of Galapagos (*Zalophus wollebaeki*) and northern (*Eumetopias jubatus*) sea lions in Mexico. Aquatic Mammals 36:188-194.

Cerillo-Espinosa, P., *et al*. 2023. Molecular identification of a southern elephant seal (*Mirounga leonina*) from the Nayarit Coast, Mexico. Aquatic Mammals 49:248-255.

Chua, M., *et al*. 2022. Movements of southern elephant seals (*Mirounga leonina*) from Davis Base, Antarctica: Combining population genetics and tracking data. Polar Biology 45:1163-1174.

Cranswick, A. S., *et al*. 2022. Social media and citizen science records are important for the management of rarely sighted whales. Ocean & Coastal Management 226:106271.

Curtis, S., *et al*. 2021. Entanglement of Cape fur seals (*Arctocephalus pusillus pusillus*) at colonies in central Namibia. Marine Pollution Bulletin 171:112759.

de Vos, A. 2021. First record of a southern elephant seal (*Mirounga leonina*) in Sri Lankan waters. Marine Biodiversity Records 14:5.

De Weerdt, J., E. A. Ramos, and T. A. Acosta-Pachón. 2024. First records of pinnipeds (Otariidae) along the Pacific Coast of Nicaragua. Aquatic Mammals 50:1-7.

Dickinson, J. L., *et al*. 2012. The current state of citizen science as a tool for ecological research and public engagement. Frontiers in Ecology and the Environment 10:291-297.

Elorriaga-Verplancken, F. R., *et al*. 2020. Southern elephant seal (*Mirounga leonina*) in the Gulf of California: Genetic confirmation of the northernmost record to date. Aquatic Mammals 46:137-145.

Elorriaga-Verplancken, F. R., *et al*. 2022. Northernmost record of Galapagos sea lion (*Zalophus wollebaeki*: Sightings along the Mexican Central Pacific and the Gulf of California during La Niña conditions. Aquatic Mammals 46:478-484.

Félix, F. 2018. Un elefante marino del sur (*Mirounga leonina*) en el estuario interior del Golfo de Guayaquil; Lecciones de un evento inusual. Acta Oceanográfica Del Pacífico 22:45-53.

Fulton, S., *et al*. 2019. Untapped potential of citizen science in Mexican small-scale fisheries. Frontiers in Marine Science 6:517.

Galimberti, F., *et al*. 2019. "Nose-metrics" of wild southern elephant seal (*Mirounga leonina*) males using image analysis and geometric morphometrics. Journal of Zoological Systematics and Evolutionary Research 57:710-720.

Gallo-Reynoso, J. P., M. O. Maravilla-Chávez, and C. J. Navarro-Serment. 2010. New records of non-resident pinnipeds from the Gulf of California, Mexico. Revista Mexicana de Biodiversidad 81:209-213.

Gallo-Reynoso, J. P., *et al*. 2020. Steller sea lions (*Eumetopias jubatus*) along the Western Coast of Mexico. Aquatic Mammals 46:411-416.

García-Cegarra, A. M., F. Toro, and V. Gonzalez-Borasca. 2021. Citizen science as a tool to assess cetacean diversity in the Atacama Desert coast. Ocean and Coastal Management 213:105858.

Hindell, M. A., *et al*. 2016. Circumpolar habitat use in the southern elephant seal: Implications for foraging success and population trajectories. Ecosphere 7:1-27.

Kelly, R., *et al*. 2020. Citizen science and marine conservation: a global review. Philosophical Transactions of the Royal Society B: Biological Sciences 375:20190461.

Le Boeuf, B., R. Condit, and J. Reiter. 2019. Lifetime reproductive success of northern elephant seals (*Mirounga angustirostris*). Canadian Journal of Zoology 97:1203-1217.

Lewis, M., *et al*. 2006. Southern elephant seals north of the Antarctic Polar Front. Antarctic Science 18:213-221.

Lewis, M., and E. B. Eder. 2021. Southern elephant seal (*Mirounga leonina*, Linnaeus 1758). Pp. 165-190 *in* Ecology and Conservation of Pinnipeds in Latin America (Heckel, G., and Y. Schramm, eds.). Springer Nature Switzerland AG. Cham, Switzerland.

Lodi, L., and R. Tardin. 2018. Citizen science contributes to the understanding of the occurrence and distribution of cetaceans in southeastern Brazil – A case study. Ocean & Coastal Management 158:45-55.

López, W. A., *et al*. 2022. Ocurrencia del "elefante marino del sur" *Mirounga leonina* Linnaeus, 1758 (Carnivora: Pinnipedia: Phocidae) en la costa de El Salvador. Revista Minerva 5:11-20.

Lowry, M. S., *et al*. 2014. Abundance, distribution, and population growth of the northern elephant seal (*Mirounga angustirostris*) in the United States from 1991 to 2010. Aquatic Mammals 40:20-31.

Milmann, L., *et al*. 2019. Far away from home: presence of fur seal (*Arctocephalus* sp.) in the equatorial Atlantic Ocean. Polar Biology 42:817-822.

Monzón-Alvarado, C. M., A. Zamora-Rendon, and A, Vázquez-Pérez. 2020. Integrating public participation in knowledge generation processes: Evidence from citizen science initiatives in Mexico. Environmental Science and Policy 114:230-241.

Oosthuizen, W. C., *et al*. 2011. Dispersal and dispersion of southern elephant seals in the Kerguelen province, Southern Ocean. Antarctic Science 23:567-577.

Páez-Rosas, D., *et al*. 2018. Southern elephant seal vagrants in Ecuador: A symptom of La Niña events? Marine Biodiversity Records 11:1-8.

Redwood, S. D., and F. Félix. 2018. The most northerly record of a southern elephant seal (*Mirounga leonina*) in the Pacific Ocean at the Island of Taboga, Gulf of Panama, Panama. Aquatic Mammals 44:13-18.

Robinson, P. W., *et al*. 2012. Foraging behavior and success of a mesopelagic predator in the Northeast Pacific Ocean: Insights from a data-rich species, the northern elephant seal. PLoS One 7:e36728.

Romero-Tenorio, A., *et al*. 2023. Records of southern elephant seals (*Mirounga leonina*) in the southern Mexican Pacific. Latin American Journal of Aquatic Mammals 18:207-211.

Rosero, P., and J. J. Alava. 2021. Dos décadas de avistamientos del elefante marino del sur en Ecuador: Recomendaciones para el manejo de pinnípedos vagabundos. Mammalia Aequatorialis 3:85-96.

Sayer, S., *et al*. 2019. Pinnipeds, people and photo identification: The implications of grey seal movements for effective management of the species. Journal of the Marine Biological Association of the United Kingdom 99:1221-1230.

Schramm, y., and G. Heckel. 2021. Pacific harbor seal (*Phoca vitulina richardii,* Gray 1864). Pp. 209-231 *in* Ecology and Conservation of Pinnipeds in Latin America (Heckel, G., and Y. Schramm, eds.). Springer Nature Switzerland AG. Cham, Switzerland.

Sepúlveda, M., *et al*. 2018. Sighting of a southern elephant seal *Mirounga leonina* in the Toltén river, southern Chile. Revista de Biologia Marina y Oceanografia 53:375-380.

Sousa-Lima, R. S., *et al*. 2022. Sub-Antarctic fur seal, *Arctocephalus tropicalis*, crossing hemispheres far offshore at São Pedro and São Paulo archipelago, Brazil. Polar Biology 45:1145-1149.

Tamayo-Millán, C. J., *et al*. 2021. Molecular identification of the first Galapagos fur seal (*Arctocephalus galapagoensis*) reported on the central coast of Oaxaca. Ciencias Marinas 47:201-209.

Villegas-Zurita, F., F. R. Elorriaga-Verplancken, and F. Castillejos-Moguel. 2016. First report of a South American fur seal (*Arctocephalus australis*) in Mexico. Aquatic Mammals 42:42-46.

Wood, S., *et al*. 2021. Accuracy and precision of citizen scientist animal counts from drone imagery. PLoS One 16:e0244040.

Associated editor: Nicté Ordóñez Garza.
Submitted: March 9, 2024; Reviewed: July 16, 2024.
Accepted: August 6, 2024; Published on line: August 21, 2024.