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GALAPAGOS FUR SEALS, *ARCTOCEPHALUS GALAPAGOENSIS*, IN MEXICO

David Aurioles-Gamboa[1], Yolanda Schramm[2] and Sarah Mesnick[3].

The pinnipeds inhabiting Mexican waters include the California sea lion (*Zalophus californianus*), the Guadalupe fur seal (*Arctocephalus townsendi*), the northern elephant seal (*Mirounga angustirostris*) and the harbor seal (*Phoca vitulina richardsi*), all of which are present on the northwestern coast of the country (Aurioles-Gamboa, 1993). The only pinniped on the east coast of Mexico was the Caribbean monk seal (*Monachus tropicalis*), which went extinct during the first half of the twentieth century (Le Boeuf *et al.*, 1986). Most of the research effort on Mexican pinnipeds has been focused in the Gulf of California and some islands on the west coast of the Baja California peninsula (Aurioles-Gamboa, 1993). Extensive areas of the coast remain unmonitored, however, mainly because they do not hold seal or sea lion rookeries or haul out sites. Here, we report the presence of two fur seals, found at two distinct sites along the Pacific coast of southern Mexico (Figure 1).

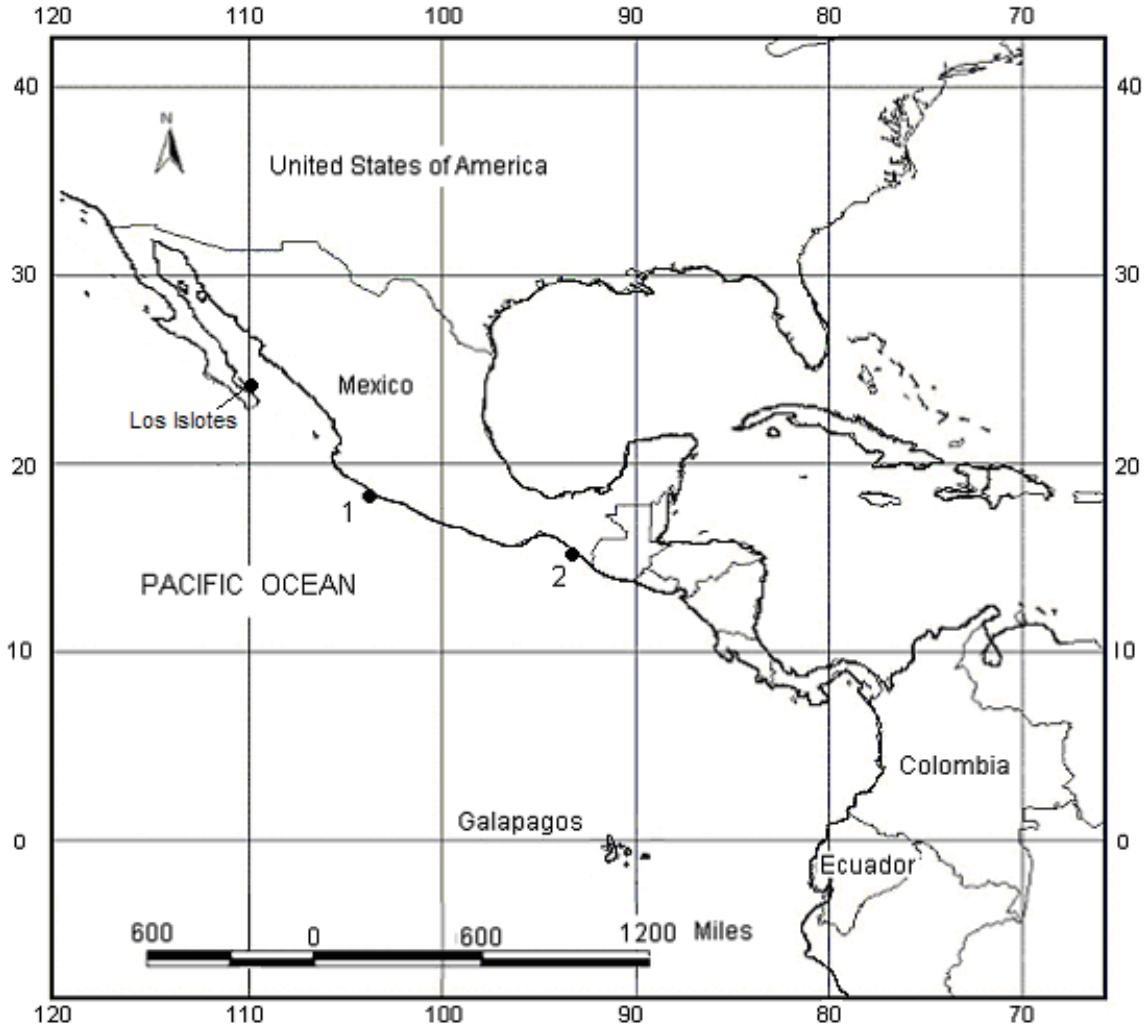

Figure 1. Locations of the two Galapagos fur seals *Arctocephalus galapagoensis,* captured in Mexico.

[1] Centro Interdisciplinario de Ciencias Marinas, Instituto Politécnico Nacional. Ave. IPN s/n, Colonia Playa Palo de Santa Rita, La Paz B.C.S.C.P. 23000. Current address Long Marine Laboratory, University of Santa Cruz, CA 95064 USA.
[2] Universidad Autónoma de Baja California, Facultad de Ciencias Marinas, Km 103 Carretera Tijuana-Ensenada, Ensenada, Baja California, 22800 México.
[3] Protected Resources Division, Southwest Fisheries Science Center, National Marine Fisheries Service, NOAA, 8604 La Jolla Shores Drive, La Jolla, CA 92037 USA.
Center for Marine Biodiversity and Conservation, Scripps Institution of Oceanography, University of California San Diego, La Jolla, CA 92093 USA.

The animals were first considered to be as Guadalupe fur seals (*Arctocephalus townsendi*) but were subsequently identified as Galapagos fur seals (*Arctocephalus galapagoensis*) after re-examination of the shape of the head and muzzle (Figures 2C and D). The two animals were females, similar in color, size, head and muzzle shape, which is shorter and less pointed in the Galapagos (Figures 2A to 2D) than the Guadalupe fur seal (Figures 2E and F).

The first specimen (# 1 in Figure 1; C in Figure 2) was found in an emaciated condition on a beach near Zihuatanejo, Guerrero (17º38'N; 101º36'W), on 28 April 1997. A veterinarian nursed the animal for almost two months. During this time her weight increased from 20kg to 35kg (Aurioles-Gamboa *et al*., 1999). Because the veterinarian believed the animal was a California sea lion (*Zalophus californianus*), the animal was sent by airplane

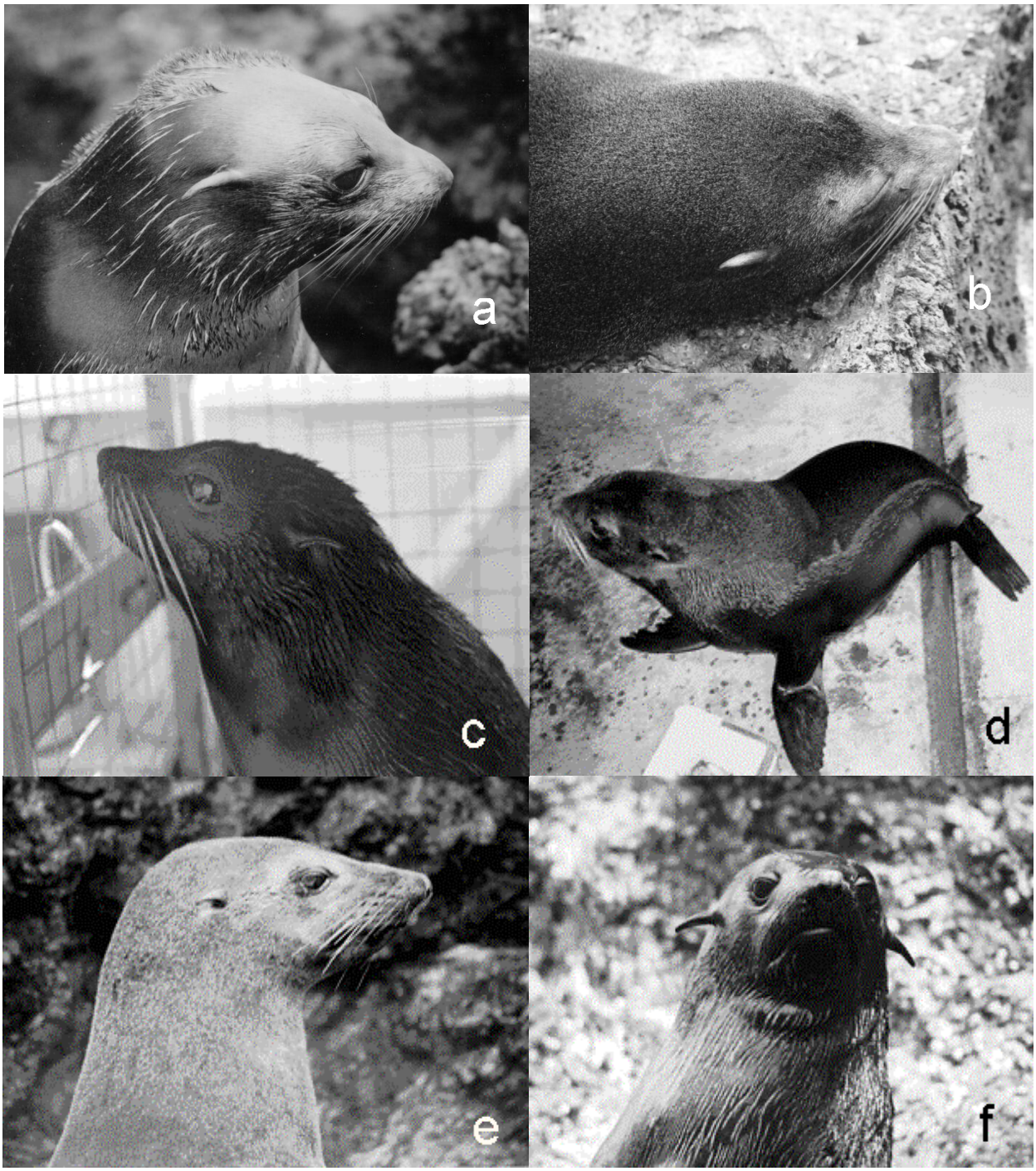

Figure 2. Galapagos and Guadalupe fur seals; a and b are *Arctocephalus galapagoensis* from Galapagos Islands; (c, d) *A. galapagoensis* from Mexico; (e, f) *A. townsendi* from San Benitos Islands (all pictures taken by first author except d by Mario Salinas). Note the shorter muzzle in *A. galapagoensis*.

to La Paz, Baja California Sur, to be released at the southernmost sea lion rookery in Mexico, Los Islotes (24º36'N; 110º24'W; Figure 1). Upon inspection at the airport by the first author, the animal was identified as a Guadalupe fur seal (Aurioles-Gamboa *et al.*, 1999). The release plan was carried out because the animal had lost weight after 3 days of transport and because Guadalupe fur seals had been recorded at Los Islotes previously. After release, the animal was not seen again.

The second animal (#2 in figure 1; D in figure 2) was found in poor condition in the state of Chiapas (15º10'N; 92º52'W) on 13 January 1998, and taken to Mexico City where it was cared for at Atlantis Park, an oceanarium, ever since. We obtained photographs of both animals and compared these with photographs of Guadalupe and Galápagos fur seals. These examination revealed that the muzzle of both specimens were more similar in size and shape to Galápagos, rather than Guadalupe fur seals. To address the question further, we requested a skin sample to examine the taxonomic identity of the second animal.

A 425 base pair (bp) fragment of the hypervariable region I of the mitochondrial DNA control region was sequenced (Table 1) using standard molecular protocols (Schramm, 2002). A BLAST (Basic Local Alignment Search Tool) search was used to query the GenBank database (http://www.ncbi.nlm.nhi.gov). The target sequence showed affinity with seven fur seal species (*Arctocephalus galapagoensis, A. philippi, A. australis, A. gazella, A. forsteri, A. pusillus doriferus, A. townsendi*) and one sea lion (*Neophoca cinerea*) with varying degrees of similarity. The least number of base pair changes, 5 out of 222 variable sites, was found with the sequence of the Galápagos fur seal (*A. galapagoensis;* GenBank accession number AF384386). In contrast, there were 28 base pair differences between the target sequence and the Guadalupe fur seal sequence. The variable sites of the target sequence and the Galapagos and Guadalupe fur seal sequences are shown in Table 2.

The equator is believed to be a thermal barrier for bi-polar species such as fur seals and sea lions (Hubbs, 1952). During El Niño events, however, the population dynamics of pinnipeds on both sides of the equator may be strongly affected (Trillmich and Ono, 1991). Extralimital records of Galapagos sea lions and fur seals have also been documented recently along the coast of Colombia (Capella *et al.*, 2002). The distance between the Galapagos islands and the sites in Colombia is approximately 1320 to 1625km and to the two localities in Mexico the distance is approximately 1832 and 2240km. Eight of ten records on the Colombian coast, occurred during 1997-1998, and were thought to be related to El Niño phenomenon (Capella *et al.*, 2002). At least one of the two extralimital records presented here coincide in time with the highest sea surface temperatures recorded during the El Niño event of 1997-1998 (McPhaden, 1999) and both specimens were in poor body condition when stranded.

Drastic effects on pinniped populations in the eastern tropical and temperate Pacific, including the Galapagos Islands, are well documented during El Niño periods (Trillmich and Ono, 1991). High temperatures and a deepening thermocline during these warming events, decreases primary productivity with a subsequent depressing effect on higher trophic levels. As food for pinnipeds and other vertebrates becomes scarce, dispersal to more favorable conditions outside of the species' typical range, is a common response for many marine organisms (Radovich, 1961). The examples reported here, and those reported by Capella *et al.* (2002), provide evidence of dispersal of equatorial pinnipeds far into the northern hemisphere, suggesting that El Niño may work as a natural mechanism promoting the contact of bi-polar pinnipeds populations.

Table 1. Representative 425 bp target sequence from the hipervaribble region I of the control region of the mithocondrial DNA. Orientation is light strand 5' to 3' end. Site No. 1 is equivalent to site No. 16293 of the Harbor seal (*Phoca vitulina*) sequence by Árnason and Johnsson (1992), with a GenBank accession number NC 001325.

	TARGET SEQUENCE			
1	CCTCCCTAAG	ACTCAAGGAA	GAGGCAACAG	CCCCCCCATC
41	AACACCCAAA	GCTGACGTTT	TGATTAAACT	ATCCCCTGAC
81	ATACCAAACT	CCCCATATTC	ATATATATCA	CTACACCTAT
121	TGTGCCATCA	TAGTATCTCT	TTTTTTCCCC	CCCCATGTAC
161	ATCGTGCATT	AGTGGTTTGC	CCCATGCATA	TAAGCATGTA
201	CATACAGTGG	TTGATTTCAC	ATAATGACAT	GAACTTTAAC
241	GACTTAACTC	AAGCACTACA	AGTCCTCGAA	ATAAGTGCAA
281	CTCACTTAGC	CCACGAAGCT	TGATCACCAG	GCCTCGAGAA
321	ACCAGCAACC	CTTGTGAAAA	GTGTACCTCT	TCTCGCTCCG
361	GGCCCATCCC	AACGTGGGGG	TAGCTAAACT	GAATCTATAC
401	CTGGCATCTG	GTTCTTACTT	CAGGG	

Table 2. Fraction of the target sequence representing 35 variable sites compared to Galapagos and Guadalupe fur seals. The GenBank accession number is specified for each sequence and authority. The comparison was made between sequences with a total length of 222 bases; site No. 11 is equivalent to site No. 108 of the complete target sequence (Table 1). Each dot represents no change regarding the target sequence. Note the reduced number of changes (5) between the target sequence and the Galapagos fur seal sequence (*Arctocephalus galapagoensis*).

		Variable sites																													
Accession Number	Seq.	011	014	020	022	023	031	033	048	059	093	097	104	105	112	113	121	122	124	127	128	133	135	140	146	147	148	156	159	168	173
	TS	T	C	C	A	T	T	A	A	G	A	G	T	C	T	G	C	T	T	C	G	A	C	G	C	A	A	A	T	C	T
AF384386[1]	AG	•	•	•	•	•	•	G	•	A	•	•	C	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
AF384396[1]	AT1	C	T	T	G	C	C	•	G	•	G	•	•	T	C	C	T	C	C	T	A	G	T	A	T	C	•	G	C	T	C
AF384397[1]	AT2	C	T	T	G	C	C	•	G	•	G	A	•	T	C	C	•	C	C	T	A	G	T	A	T	T	G	G	C	•	C

(Seq.) seqüence, (1) Wynen *et al*., 2001, (TS) target sequence, (AG) *A. galapagoensis*, (AT1, AT2) *A. townsendi*.

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