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LONG-DISTANCE MOVEMENT OF A PINNIPED NEONATE

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Understanding long-distance dispersal patterns for wide-ranging species is critical to developing effective conservation strategies (Lockwood *et al.* 2002, Shanks *et al.* 2003, Gerber *et al.* 2005, Figueira and Crowder 2006). California sea lions (*Zalophus californianus*) in the Gulf of California (GoC) are thought to include distinct populations based on limited dispersal and resulting genetic population structure (Schramm-Urrutia 2002). Comparisons of mitochondrial DNA collected from pups located on seven GoC rookeries suggest three distinct populations occur within the GoC (Schramm-Urrutia 2002). Although marked 1-yr-old juveniles have been identified on islands far from their natal site (>600 km), these occurrences are uncommon (Hernandez-Camacho 2001). Here, we report a neonate (*i.e.*, a newborn <4 wk old) sea lion traveling >600 km during an 18-d period. Our observation represents the first published report of long-distance neonate movement among pinnipeds.

As part of a large-scale study on sea lion behavior and demography on islands in the GoC, we marked newborns with unique codes shaved into their back pelage at three rookeries (Fig. 1). On 25 June 2006, a male pup with a fresh umbilical cord (pup weight: 8.5 kg, length: 79.8 cm) was marked at Los Islotes Island (Fig. 1). This pup was not observed at Los Islotes again for the duration of the field season (field dates: 17–25 June, 7–15 July, 5–13 August 2006) but was next observed on 14 July 2006 on Granito Island, >600 km north of Los Islotes (Fig. 1). It is unlikely the neonate swam this distance on its own. Although the female was unmarked, we believe the pup traveled with its mother because the pup was observed nursing at Granito Island and alloparental care is rare in otariids (Boness 1990, Georges *et al.* 1999).

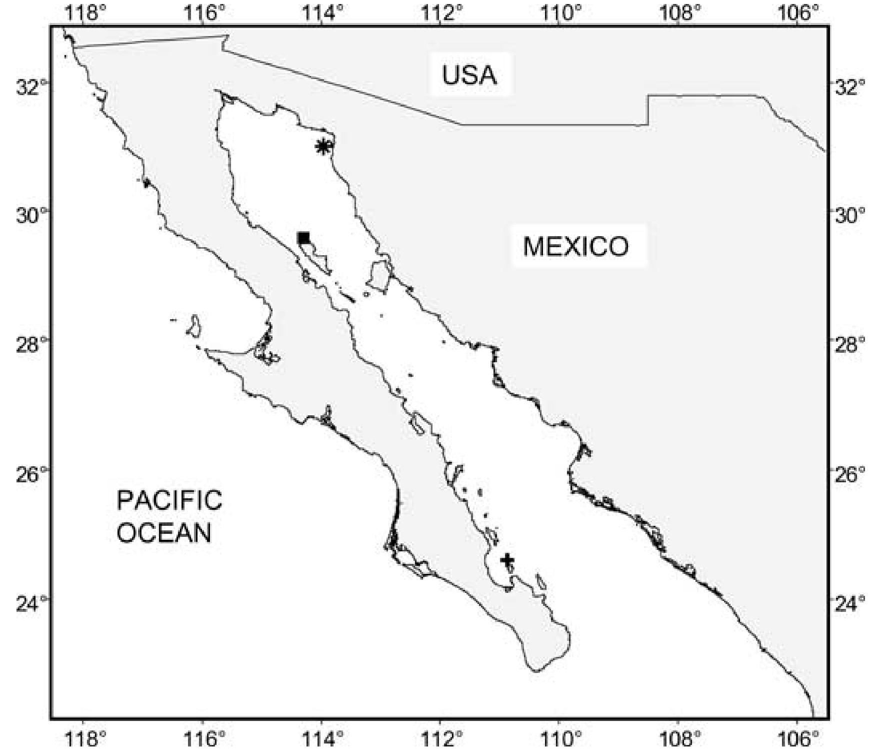

Figure 1. Baja and Gulf of California, Mexico. Sea lion pups were marked and resighted in 2006 at three rookeries: Los Islotes (+), Granito (■), and San Jorge (*).

Because pinniped neonates have limited motor skills and ability to thermoregulate (Baker and Donohue 2000, Donohue *et al.* 2000), it seems unlikely that a neonate could travel continuously for >600 km. Instead, it is likely that the female and pup made multiple stops en route to allow the pup to recover from the energy demands related to the journey and to increase its core body temperature. Given the distance traveled and time between sightings, we estimate that the pup traveled at a minimum rate of 1.4 km/h (600 km in 432 h). This appears to be a reasonable transit speed for a pup and female traveling together because females can swim up to 5.8 km/h (Feldkamp 1987). The pair could have rested for up to 18.3 h each day and still maintain travel speeds of 5.8 km/h. It is unclear why a female would move such a great distance with a neonate. Extralimital movement can occur for a number of complex reasons (*i.e.*, human disturbance, to decrease intraspecific competition; Raum-Suryan *et al.* 2004).

Female California sea lions rarely travel with neonates (Melin *et al.* 2000) and previous recorded incidents of long-distance movement in the GoC were for California sea lions >1 yr of age (Hernandez-Camacho 2001). Furthermore, the scale of movement that we observed has never been published for other otariids within the first 3 wk after birth. For example, Steller sea lion pups (*Eumetopias jubatus*) do not enter the

Table 1. Proportion of pups marked in June 2006 and either resighted on the island where first captured (same), found on other study islands (other), or undetected during visits to three islands in the Gulf of California in July and August 2006.

Island	*n*	Same	Other	Undetected
Granito	72	0.85	0.00	0.15
Los Islotes	68	0.91	0.02	0.07
San Jorge	60	0.88	0.00	0.12

water until they are 2–4 wk old (Sandegren 1970), and pups will only travel hundreds of kilometers with their mothers after they are 2–3 mo of age (Calkins and Pitcher 1982; Merrick *et al.* 1988; Raum-Suryan *et al.* 2002, 2004). Most Steller sea lion pups travel an average of 7.0 km per trip when they are <10 mo old (Loughlin *et al.* 2003) and remain within 500 km of their rookery until they are >1 yr old (Raum-Suryan *et al.* 2002, Rehberg 2005). Reports of Steller sea lions moving hundreds of kilometers are more common once the animals are around 1 yr old (Baba *et al.* 2000; Raum-Suryan *et al.* 2002, 2004). Similarly, northern fur seals (*Callorhinus ursinus*) do not typically enter the water until they are 13 d old (Baker and Donohue 2000), but older fur seal pups migrate approximately 400 km from their natal site (Ragen *et al.* 1995). These examples demonstrate that although older pups are capable of traveling great distances, this type of movement is rarely observed during the neonate stage.

Long-distance movement of neonates tends to be lacking from our understanding of mammalian spatial ecology because of the nature of most field studies (*i.e.*, most field studies mark individuals after postnatal dispersal; Johnson and Horvitz 2005). Although our observation may appear to be a rare event, our resighting efforts indicate that 10%–15% of the neonates could similarly disperse (Table 1). Even if only a small proportion of the population undertakes long-distance movement, such events may have important implications for population dynamics. Marking neonate pups and conducting spatially replicated behavioral observations during the same time period at multiple islands in the GoC (Gerber 2006) allowed us to observe a long-distance movement of a neonate pup. Although our observation is interesting from a purely behavioral ecology perspective, we believe it may also be relevant to conservation and management. Gonzalez-Suarez *et al.* (2006) found that movement between colonies dramatically reduces extinction risk for sea lions in the GoC. As little as one migrant per generation can override the effects of population structure (Wright 1965). Movement patterns thus may ultimately determine population structure (Cronin *et al.* 2006, Metcalfe 2006, Swartz *et al.* 2006), which is relevant to management decisions (*e.g.*, whether colonies should be measured as distinct units or as one population). Rare dispersal events are of similar importance to understanding population units and connectivity when developing management strategies. Because the development of conservation strategies for wide-ranging marine species necessitates an understanding of stage-specific movement patterns, we emphasize the importance of systematic long-term tagging studies.

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