## Short Note

## Potential Intersexual Altruistic Behavior in California Sea Lions (*Zalophus californianus*)

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The California sea lion (Zalophus californianus) (CSL) is a sexually dimorphic species from the Northeastern Pacific. Adult males are three to four times larger than females. Their breeding season extends from late May through August, and their polygynous mating system is a "moderate" lek (Heath & Francis, 1983), with reproductive territories formed by varying numbers of females (typically 10 to 15) and one dominant male that will eventually be ousted by another, more aggressive male (Peterson & Bartholomew, 1967). Because of the energetic demand throughout the breeding season, altruism is rare in these species, taking place in extraordinary occasions through alloparenting (i.e., females adopting orphaned pups) (e.g., Flatz & Gerber, 2010). Intersexual altruism between males and females had no precedent for CSLs until our findings herein.

Midway through the breeding season (5 July) of 2016, a survey of CSL health and trophic assessments were undertaken in "Los Machos" (29° 21' N, 113° 31' W), a small rookery located on the west coast of Angel de la Guarda Island at the Midriff Region of the Gulf of California. Mexico (Figure 1). As part of the survey, five adult females were captured using hoop nets based on standard protocols (Gales & Mattlin, 1997; Villegas-Amtmann et al., 2008). Once an animal was caught in the net, the ring was twisted several times to reduce the individual's mobility; then, it was taken a couple of meters from the capture site, when needed, to ensure a more convenient surface on which to work. Prior to capture, the animals were observed for at least 15 to 20 min to ensure they did not display any behavioral signs (e.g., evident erratic movements relative to other CSLs) that would suggest illness or weakness. The sampling protocol involved measuring total length

and obtaining fur for isotopic analysis, genital swabs, and blood samples as conducted previously (see Vera-Massieu et al., 2015; Barragán-Vargas et al., 2016). Briefly, genital swabs were collected with the use of a sterile speculum, and blood was collected from the caudal gluteal vein using sterile vacuum tubes and 18G, 1.5" needles (Bossart et al., 2001). The entire protocol took 5 to 10 min per individual, and containment was manual without the use of anesthesia. All samples were collected by a trained veterinarian, and a second veterinarian supervised the animal's vital signs during the entire procedure.

Upon being released from the net, one of the individuals, an adult female of 1.5 to 1.6 m length (ID #FZC-LM1), showed an evident lack of voluntary coordination, including gait abnormality, loose movements of her head, and occasional falling to the ground, showing a possible ataxia condition. She took approximately 15 min to get back to the sea as she stopped several times to rest. This was quite striking as the rest of the captured individuals got back to the water 5 to 10 s following release. Causes of sudden ataxia have been related to stress or extreme physical exhaustion (Blumenfeld, 2002). This is unlikely the case here since, as indicated above, our sampling protocol was not lengthy, and none of the other animals responded similarly. Typically, the moment they were released, they ran towards the water; however, we cannot discard that FZC-LM1 was particularly stressed since we did not conduct a stress hormone analysis. Ataxia in CSLs is normally related to intoxication by domoic acid (e.g., Gulland, 2000); however, none of the animals in the colony displayed any evident signs of domoic acid intoxication, although we cannot discard that the sea lion was affected by this neurotoxin as

we did not make a full evaluation searching for this condition, nor did we collect samples to this effect. To the best of our knowledge, this is the first report of handling-related ataxia of a freeranging CSL. As we did not undertake a full medical examination of FZC-LM1, abnormal conditions cannot be ruled out, but as indicated above, her pre-handling behavior was normal.

Once FZC-LM1 started to swim, her lack of coordination continued, rendering her breathing inefficient. She began to sink in an area where another group of adult females was floating and thermoregulating, roughly 15 to 20 m offshore. A patrolling territorial adult male approached FZC-LM1 and began to vocalize and swim repeatedly in close circles around the female (~8 to 10 vocalizations and circles every 10 s). An evident and frequent assistance took place—namely, the male placed itself beneath FZC-LM1 and pushed her back to the surface on several occasions, carrying FZC-LM1 on his back, thus making breathing possible for her (Figure 2). The male stopped

his behavior only long enough to breathe. This interaction continued for 15 to 20 min. After that, FZC-LM1 swam back to shore without assistance and remained there, in an apparent stable condition. We observed her for a further 30 min during which time she did not display any signs of ataxia. It was not possible to track her condition for a longer period because of logistic limitations.

*Altruism*, defined as that behavior that increases the fitness of another individual while decreasing the fitness of the actor (de Waal, 2008), is frequent in kin relationships such as parenting (Davies et al., 2012). Although less frequent, altruism between different species has recently been argued (Pitman et al., 2017). Alloparenting is considered a form of altruism and has been observed previously in other pinniped species, including CSLs from the Gulf of California (Flatz & Gerber, 2010), Antarctic fur seals (*Arctocephalus* gazella) from South Georgia (Hoffman & Amos, 2005), and Steller sea lions (*Eumetopias jubatus*) from the Western Gulf of Alaska (Maniscalco



Figure 1. Los Machos rookery, located at the Midriff Region of the Gulf of California, Mexico

et al., 2007). To the best of our knowledge, this is the first published source that describes a probable intersexual altruistic behavior in *Zalophus californianus*.

Behavior like the one described herein has been recorded in social cetaceans such as the bottlenose dolphin (*Tursiops truncatus*) (Siebenalar & Caldwell, 1956; Connor & Norris, 1982),



Figure 2. Assistance interaction between affected adult female FZC-LM1 (1) and territorial adult male (2)

common dolphins (Delphinus sp.) (Brown & Norris, 1956; Pilleri & Knuckey, 1969), pilot whales (Globlicephala macrorhynchus) (Caldwell et al., 1963), and rough-toothed dolphins (Steno bredanensis) (La Paz Stranding Network, unpub. data). In all reported cases, the behavior continued until recovery or death of the affected individual. This type of behavior is not necessarily related to kinship but, rather, to reciprocity or to establishing a mutual protective relationship within schools of dolphins (Connor & Norris, 1982). In this regard, Trivers (1971) argues that an individual "A" could perform an altruistic act for an individual "B" when it is possible to receive a future inclusive fitness through reciprocity of "B" that would exceed the cost of the initial altruism. This author also mentioned that reciprocal altruism might take place more often in scenarios for which there are many possibilities of reciprocation-through frequent proximity for instance. This is the case of dolphins and their large schools or, in our case, reproductive territories of CSLs. For a male CSL, the energetic cost of maintaining a territory is significantly high during the breeding season; there is an aggressive intrasexual competition along with prolonged fasting (Peterson & Bartholomew, 1967; Heath & Francis, 1983), which makes it unlikely that a territorial male would expend additional energy without the possibility of a short- to medium-term benefit. Hence, it is reasonable to assume that the altruistic behavior we observed could involve reproductive access to FZC-LM1, possibly within the same breeding season. However, without genetic data, kinship between FZC-LM1 and the male cannot be discarded as the explanation for the behavior. At this point, all possible explanations of the observed behavior are speculative.

In spite of the fact that our report consists of a single solid and prolonged observation, this kind of intersexual behavior might take place more often than previously thought. We were able to record this event because we tracked a female that displayed post-handling ataxia into the water, within a male territory, and paid attention to the behaviors exhibited. Multiple cryptic cases may occur involving sick or injured individuals that go unnoticed beneath the sea surface.

Our observations are interesting in the context of CSL behavior. Territorial males are typically associated to a lek mating system, which means they defend physical resources (territories on land or water) rather than females (Heath & Francis, 1983). The behavior reported herein, as well as other common behaviors such as territorial male CSLs that, occasionally, do not allow females to leave their territory or those that "appease" two females that are being agonistic to each other (personal observations by authors), indicate a "moderate" lek system within this species that should be further analyzed once more reports of this nature are compiled.

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