REPTILES & AMPHIBIANS

Mass Stranding of Pelagic Seasnakes, *Hydrophis platurus* (Squamata: Hydrophiidae), in Guanacaste, Costa Rica

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The Pelagic Seasnake (*Hydrophis platurus*) has the broadest natural distribution of any snake species (Heatwole 1999; Campbell and Lamar 2004; Boundy 2020) and is the only seasnake that occurs in tropical waters off the western coast of the Americas (Heatwole 1999; Campbell and Lamar 2004; Sheehy et al. 2012; Lillywhite et al. 2015). These snakes are abundant in gulfs and bays off the Pacific Coast of Costa Rica (Solórzano 2022) and are almost always encountered while drifting on the surface of moderately deep waters within slicks or drift lines, which locally are called "líneas de espuma" (literally "foam cords") (Kropach 1971). These patches are formed on the water surface by the combined effects of ocean currents, wind, and temperature fronts, and are sites where plant debris, garbage, and rubble accumulate (Kropach 1975).

Depending on the time of year, a few to hundreds of seasnakes can be observed in these environments (Lillywhite et al. 2015; Solórzano 2022). For example, during a research trip between the sectors of Ocotal-El Coco in the Gulf of Papagayo, Guanacaste, in December 2002, we counted 402 snakes in about three hours in a slick several kilometers long (unpubl. data). *Hydrophis platurus* is entirely aquatic and has lost the ability to crawl on land, even for short distances (Kropach 1975). However, they can occasionally be found stranded on beaches (Solórzano 2022). In Costa Rica, such encounters usually occur between mid-November and March during the dry season (Solórzano 2022). Strandings appear to be cyclical or seasonal events (especially toward northwestern Guanacaste Province). However, they differ in the number of snakes found and the frequency of strandings per season (Solórzano 2004, 2022). Kropach (1975) reported this same phenomenon in Panama during a similar period and pointed out that it was known by early researchers and was particularly noticeable after storms. Although the pelagic nature of this species allows it to congregate anywhere in its range, sightings of large numbers of snakes have most frequently been reported in Costa Rica, likely due to the topography of its Pacific Coast, which includes a considerable diversity of gulfs and bays and, together with the Gulf of Panama, probably is the coastal region where the greatest abundance of this species has been observed (Kropach 1975; Tu 1976; Solórzano 2004).

Figure 1. Some of the Pelagic Seasnakes (*Hydrophis platurus*) found dead on Brasilito Beach, Guanacaste Province, Costa Rica, after a strong storm. Photograph by Alejandro Solórzano.

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During the afternoon and evening of 29 January 2020, we found a large number of Pelagic Seasnakes (> 250) stranded along Brasilito Beach in Santa Cruz, south of the Gulf of Papagayo in Guanacaste Province (10.24261, -85.47482). A coastal storm generating powerful winds made landfall that day and dramatically increased the force of waves advancing toward the beach. The snakes were transported to a nearby firefighters' station and kept in a barrel of seawater (Fig. 1). We added some fresh water to the surface to hydrate the snakes. Unfortunately, only about 60 survived the night. At 0830 h the following morning, we encountered 38 additional living individuals stranded on the sand (Fig. 2) during a 30-minute walk along the beach. Later that day, we used a boat to release surviving snakes into the sea (Fig. 3). Most of the dead snakes probably died from exhaustion, dehydration, or stress.

Stranding might be a significant cause of mortality in coastal populations of *H. platurus* as no known marine predators prey on these snakes (Rubinoff and Kropach 1970; Kropach 1975). Laboratory experiments with predatory fish have shown that hungry fish recognize and avoid contact with these snakes (Rubinoff and Kropach 1970), reinforcing the idea that predation pressure on populations along the Pacific Coast is minimal or nonexistent. In contrast, predation may occur in other parts of the range of *H. platurus* (Kropach 1975). Once stranded, snakes are exposed to dehydration and high temperatures due to exposure to sunlight, and, as we have observed, they are vulnerable to some opportunistic predators, including birds (Solórzano and Kastiel 2015; Solórzano and Sasa 2017) and carnivorous mammals (Solórzano 2022). Moreover, because this species typically relies on the passive use of surface currents, Kropach (1975) suggested that it may not have developed the necessary mechanisms to selectively avoid certain currents that lead to the loss of individuals either by stranding on the shore or in populations at other latitudes by diverting them to drift toward lethally cold waters, since this species of sea snake rarely occurs in areas where the average temperature of surface waters is less than 20 °C (Dunson 1975).

Strandings of other marine vertebrates also have been associated with local meteorological conditions, especially currents and wind, but also water temperature and its effect on buoyancy (Norman et al. 2004). For example, Saavedra et al. (2017) found that wind direction, strength, and the number of days with strong winds explained the stranding of three species of cetaceans in northwestern Spain. In addition to the effects of storms, water temperatures might contribute to seasnake stranding events such as the one reported here. From late November

Figure 2. Pelagic Seasnakes (*Hydrophis platurus*) stranded on the sand the day after a storm at Brasilito Beach, Guanacaste Province, Costa Rica. Photograph by Alejandro Solórzano.

Figure 3. Pelagic Seasnakes (*Hydrophis platurus*) rescued after a storm at Brasilito Beach, Guanacaste Province, Costa Rica, and later released. Photograph by Alejandro Solórzano.

to February, the southward movement of the Intertropical Convergence Zone (ITCZ) intensifies the northeast trade winds, raising the thermocline and bringing colder waters to the surface due to coastal upwelling (Lizano 2016; Saravia-Arguedas et al. 2021). This could hinder the passive floating behavior of these snakes and facilitate movement toward the wave zone. Anecdotal evidence from local fishermen corroborates the idea that snakes come close to the coast or emerge on the beach during such periods. However, more longterm studies are required to understand better the complex movement patterns of this species and their relationships with surface currents.

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