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A female olive ridley returns to the sea in the early light of dawn after nesting in the Gulf of Fonseca, Honduras. See pages 1-4. Photo by Stephen G. Dunbar

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Marine Turtle Species of Pacific Honduras

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Understanding the distribution of marine turtles is key to the establishment of management measures that account for population size, direct conservation efforts, and increase public awareness. Without updated and accurate information on species presence at specific localities, an understanding of how species composition and relative abundances are changing may be greatly hampered.

Previous efforts have been made to describe the turtle species that inhabit the Gulf of Fonseca (GOF) along the coasts of El Salvador (Carr 1952; Hasbún & Vásquez 1999; Liles *et al.* 2011), and Nicaragua (Gaos *et al.* 2011; Gaos *et al.* 2012). However, in the country of Honduras, little information on the distribution of marine turtles has been documented in unpublished government reports, with even less in the published literature. Most of those studies have been undertaken in the Bay Islands of Honduras (Dunbar *et al.* 2008; Hayes *et al.* 2016; Baumbach *et al.* 2019) and along the north coast of the mainland (Dunbar *et al.* 2013). Efforts along the south coast of the country in the GOF have been minimal, mostly focused on the olive ridley (*Lepidochelys olivacea*) sea turtle, and mainly concentrating on tagging (Dunbar & Salinas 2008, 2013), genetics analyses of nesting turtles (Duran *et al.* 2014), and hatchery impact studies on hatchling behavior and condition (Duran & Dunbar 2015).

In this paper, we use visual observations to confirm the presence of sea turtles in the GOF along the Pacific coast of Honduras. We also discuss anecdotal reports that suggest which additional species may be found in that area, yet whose presence remains to be confirmed.

The GOF is a shallow inlet of the Eastern Pacific covering approximately 3,200 km^2 and surrounded by the coastal zones of El Salvador to the north, Honduras, and Nicaragua to the south (Fig. 1). Honduras presents the largest span of coastline (153 km), followed by Nicaragua (47 km) and El Salvador (29 km). Several islands are distributed throughout the Honduran portion of the Gulf, including Zacate Grande, San Carlos, and Amapala (Isla del Tigre). Coastal zones in this area consist of extensive estuaries, lagoon systems, mangrove forests, and long stretches of sand beaches.

Olive ridley (*Lepidochelys olivacea*). After visiting "Isla Ratones" (now, Punta Ratón) in the GOF, Carr (1948) was the first to report nesting by *Lepidochelys olivacea* on the beaches of Pacific Honduras. Essentially all of the turtles he observed nesting in the area were *L. olivacea*. In 1975, the Honduran government established the first 'veda' (prohibited period) restricting the personal collection of eggs for sale to public market vendors, and instead required all *L. olivacea* eggs collected during the first 25 days of September to be relocated into community managed hatcheries, as a means to promote conservation of the species. Cruz *et al.* (1987) visited the same area some 38 years after Carr and found this species continuing to nest on the beaches of the GOF from July to December. Several recent studies have documented regional increases in nests and nesting females (Dunbar & Salinas 2008; Dunbar *et al.* 2010, 2011, 2015), and suggested that the high degree of multiple paternity typical of large nesting populations, but found in this small nesting group, may indicate that *L. olivacea* nesting in the GOF may actually be part of the wider Eastern Pacific population (Duran *et al.* 2014).

The olive ridley is the most abundant sea turtle species both within the waters of the GOF and on the nesting beaches of the south coast of Honduras. It is unclear whether this species is locally abundant throughout the Gulf as a foraging population, or if individuals simply pass through these waters on their way to and from other, more prominent nesting grounds. Local fishers rarely report seeing or capturing *L. olivacea* throughout the year, although the species is anecdotally reported to nest to some extent throughout much of the year, from May to February.

Olive ridleys found along the GOF are within the size range of nesting females reported elsewhere along their East Pacific geographical range. During early nesting studies of *L. olivacea* on these beaches, Dunbar & Salinas (2008) found mean CCL = 65.9 cm ±0.5 SEM while mean CCW was 70.3 cm ±0.4 SEM (range CCL: 61.4-70.5 cm; n = 30; range CCW: 66.0-75.0 cm; n = 30). These measurements agree well with Carr (1986), who also noted that curved carapace measures for *L. olivacea* were greater in width than length. Despite both the harvest of essentially every nest throughout 340 days of the year (Dunbar & Salinas 2008), and a hatchery system during the 'veda' period that is essentially unguided by data collection and analysis (Duran 2015), *L. olivacea* nesting persists along the Honduran coast of the GOF. Untagged (mainly new) individuals continue to appear on the beaches of the region year after year, to which Dunbar *et al.* (2010, 2011) report applying new flipper tags.

Hawksbill (*Eretmochelys imbricata*). Hawksbills were at one time reported along the Eastern Pacific coast. However, much of this historical evidence was anecdotal with few personal observations (Carr 1952; Hasbún & Vásquez 1999) leading some to conclude that hawksbills had been extirpated from the Eastern Pacific. Recently, hawksbills have been found nesting in both Costa Rica (Gaos *et al.* 2006) and El Salvador (Gaos *et al.* 2011). Some El Salvador nesters were then satellite tracked to foraging areas within mangroves in other areas of El Salvador and the GOF where the authors hypothesized these turtles feed within mangrove areas (Gaos *et al.* 2010). Corresponding evidence was previously presented by Carr (1952) who found red mangrove fruit within the digestive tract of two dissected specimens. Gaos *et al.* (2012) used satellite data to confirm that post-nesting females moved into mangrove estuaries within the GOF where they established inshore or nearshore foraging home ranges. Dunbar *et al.* (2012) and Duran *et al.* (2016) were able to confirm the movement pattern reported by Gaos *et al.* (2012) through the direct observations of both juvenile and adult hawksbills within the Honduran portion of the GOF.

We confirmed the presence of juvenile hawksbills in the GOF during July 2011 when local fishermen presented us with a dead

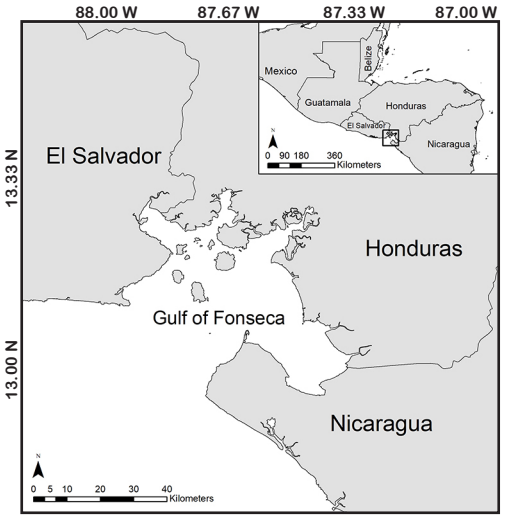

Figure 1. Map of the Gulf of Fonseca with coastal areas of El Salvador, Honduras, and Nicaragua. Inset map is of the Central America region showing the location of the Gulf of Fonseca.

turtle that was then frozen until a necropsy could be conducted, and another which was alive and in good health, with large barnacles and a layer of red algae on the carapace (CCL_{min} = 36.2 cm; CCL_{max} = 38.5 cm). We conducted surveys to determine where fishermen had seen these turtles, yet were unsuccessful in sighting any others until 9 September 2013, when local fishermen from El Venado brought us another juvenile that had been captured from the El Muerto estuary. In June 2015, seven more juveniles were collected by fishers in the San Lorenzo estuaries located in the northern part of the GOF (Duran *et al.* 2016). The following summer, fishers collected ten juveniles and one adult female. The female turtle had already been tagged on each front flipper while nesting in Estero Padre Ramos, Nicaragua. This adult female confirms the findings of Gaos *et al.* (2011) that *E. imbricata* nest in other countries, then navigate back to foraging areas within Honduran estuaries in the GOF.

Although many *E. imbricata* sightings were reported in our initial surveys, we found local fishermen readily confused large, adult *C. mydas agassizii* with *E. imbricata*. The potential for more and larger hawksbill adults in the estuaries, as found by Duran *et al.* (2016), may be the reason why fishermen confuse large *Chelonia mydas agassiziii* with *E. imbricata*. In El Salvador, Hasbún & Vásquez (1999) also found fishers confused *E. imbricata* with both *L. olivacea* and the freshwater turtle, *Trachemys scripta grayii*. These observations suggest that local fishers may not represent sources of reliable information on the abundance and distribution of these marine turtle species.

Hawksbill Hybrids. Hawksbill hybrids have been previously detailed by Seminoff *et al.* (2003), although no reliable observations had been documented from the GOF. We observed two hawksbill x green turtle hybrids in 2013: one presented to us after capture by fishermen near the Nicaraguan portion of the GOF in July (CCL_{min} = 45.5 cm; CCW = 37.5 cm) and the other captured by fishers in an estuary near the town of Guapiñol in November (CCL_{min} = 42.2 cm; approximate CCW = 31 cm). We determined that these were hybrid turtles from the presence of only two prefrontal scutes and a greater number of facial scales typically characteristic of green turtles. Seminoff *et al.* (2003) suggested that hybridization may occur because of the scarcity of hawksbill males along the Eastern Pacific, thus inducing hawksbill females to more readily accept heterospecific males during the breeding season.

Green (*Chelonia mydas*) and Black (*Chelonia mydas agassizii*). On visiting "Isla Ratones" in the GOF in 1947, Carr was surprised to find no nesting *C. mydas*, and that all of the nesting turtles he observed were *L. olivacea* (Carr 1948). Despite the lack of nesting green turtles, Carr noted that fishermen of the Gulf caught this species between January and June, but that none of the captured female turtles he examined were found to be with eggs at any advanced state of maturity (Carr 1952). Carr (1952) further noted that many local residents in the GOF readily confused the green turtle with *L. olivacea*. Although historically there has been some confusion as to whether the species in this area is *C. mydas* or *C. m. agassizii* (Carr 1952), both Carr (1952) and Pritchard *et al.* (1983) confirm that specimens they observed were *C. m. agassizii*. While black turtles have more recently been confirmed in the El Salvador portion of the GOF (Hasbún & Vásquez 1999), Cruz *et al.* (1987) have provided the only published report confirming that *C. m. agassizii* nested in Pacific Honduras. Our observations between 2009 and 2015 at nesting beaches and in coastal and estuary waterways around both Punta Ratón and El Venado confirm that low numbers of black turtles persist in feeding habitats along Pacific Honduras, but there is no documented nesting along this coast at the present time.

We confirmed the presence of a foraging black turtle in May 2013, when local fishers led us to an estuary opening at El Muerto where they had trapped a turtle they reported as *E. imbricata*, which we immediately recognized as *C. m. agassizii* based on its scute morphology, shell pattern, and color. Additionally, the size of the turtle (CCL_{min} = 80.4 cm, CCW = 67.7 cm) was characteristic of black turtles previously reported by Cruz *et al.* (1987) in the GOF area. On one other occasion (28 August 2013), local fishers brought us two black turtles from sites near the marine border between Honduras and Nicaragua. In both instances, fishers believed the turtles to be hawksbills. On inspection, we confirmed both were black turtles of CCL_{min} 45.5 cm and 81.5 cm, respectively and CCW 37.5 cm and 77.8 cm, respectively.

Additionally, there has been some history of confusion between the olive ridley (*L. olivacea*) and black (*C. m. agassizii*) turtles (Carr 1948, 1952). Commenting on field observations of turtles reported as *C. m. agassizii* during a 1984 nesting season on San Sabastian Island, El Salvador, just outside the GOF, Hasbún & Vásquez (1999) suggested that measurements of turtles reported as *C. m. agassizii* were more consistent with measurements of *L. olivacea*. Additionally, we have noted confusion persists among local community members on differences between *C. m. agassizii* and *E. imbricata* (Dunbar, pers. obs.).

Leatherback (*Dermochelys coriacea*). Although Hasbún & Vásquez (1993) report that sporadic nesting of leatherback turtles takes place in El Salvador between November and February, there are no published reports of leatherbacks either foraging or nesting along the south coast of Honduras. Descriptions of large, black turtles with different shells than other species of turtles have been provided by local fishers. However, a clear description of *D. coriacea* in this area has never, to our knowledge, been provided. Thus, we cannot confirm the presence or absence of leatherbacks along the south coast of Honduras at this time.

Loggerhead (*Caretta caretta*). While Benitez (1985) reports the presence and nesting of *C. caretta* in El Salvador, both Marquez (1990) and Hasbún & Vásquez (1999) are skeptical that there is good evidence to support that claim, and suggest that what Benitez reported were more likely to be olive ridley, rather than loggerhead turtles. Such misidentifications between *C. caretta* and *L. olivacea* have, according to Carr (1952) and Frazier (1985), had a long-standing history throughout the East Pacific region. Although it is possible that there is an occasional nesting event by this species along the Pacific coast of Honduras, to date, there is no historical or current evidence that *C. caretta* forages or nests in the GOF region.

Conclusion. We provide the first inventory report of sea turtle species on the south coast of Honduras along the Gulf of Fonseca. This report is of value as a benchmark for the species of turtles that have been confirmed in the area, as well as for those that have not, yet have been anecdotally reported. Additionally, we have provided substantial evidence that local fishers providing anecdotal reports have often misidentified sea turtle species, suggesting the need for ongoing capacity building in GOF communities to improve both species identification and proper conservation management. Finally, this work lends further support to the species inventories described in previous publications provided by local naturalists, as well as researchers in other countries of the GOF.

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