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Preface

Filling the gaps in sea turtle research and conservation in the region where it began: Latin America

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ABSTRACT. The first documented long-term sea turtle research and conservation project in the world was officially launched in Latin America (Tortuguero, Costa Rica) in 1955. Despite the enormous advances in research and conservation in the nearly seven decades since, many questions still remain unanswered about fundamental aspects of ecology and population dynamics that hinder the conservation of sea turtles in the region. To catalyze further dissemination of information and improvement of sea turtle conservation, this Special Issue presents 10 papers solely focused on studies conducted in Latin America. This Special Issue resulted from an initiative launched to celebrate the 36th Annual Symposium on Sea Turtle Biology and Conservation, held in Peru in March 2016 -the first time this event was held in South America. The articles featured present novel results for four of the five species of sea turtles present in this region, with data collected as far back as 1971 and as recent as 2016. The studies cover diverse subjects including the nesting ecology for the most endangered populations of sea turtles in the world -the Eastern Pacific hawksbill turtle (*Eretmochelys imbricata*) and leatherback turtle (*Dermochelys coriacea*); the origins and connectivity of nesting and foraging populations of hawksbills and green turtles (*Chelonia mydas*); the detection of a new foraging ground for hawksbills in the Eastern Pacific; and the pervasive occurrence of incidental capture as well as illegal retention of sea turtles. The recovery of these imperiled marine reptiles relies on information to design and implement sound conservation actions; in this regard, the papers in this Special Issue are making a vital contribution, following the initial efforts launched nearly 70 years ago.

Keywords: sea turtle research, nesting ecology, population genetics, bycatch, illegal take.

In the mid 1950's, Dr. Archie Carr, a young professor from the University of Florida, visited the remote black sand beaches of Costa Rica's Caribbean coast at a site that would soon host the first long-term sea turtle study in Latin America and perhaps the most famous sea turtle nesting beach in the world, Playa Tortuguero. Here, Dr. Carr started a pivotal long-term study to investigate basic aspects of the biology and ecology of the nesting population of green sea turtles (*Chelonia mydas*) (Carr & Ogren, 1960), thus setting the stage for future efforts in Latin America. Now, almost 70 years later, and with more than 50 organizations working in the region, the field of sea turtle biology and conser-

vation has matured tremendously. Indeed, Dr. Carr's original goal of protecting and recovering the imperiled populations of sea turtles of Latin America has continued thanks to the efforts of a cadre of passionate sea turtle researchers and conservationists throughout the region.

All five sea turtle species present in Latin America are listed, either at the species or population-level in a threatened category by the IUCN Red list (www.iucnredlist.org, Table 1). The populations of the leatherback turtle (*Dermochelys coriacea*), the hawksbill turtle (*Eretmochelys imbricata*), and the loggerhead turtle (*Caretta caretta*) are considered

Table 1. Overall and population-level classification of five sea turtle species by IUCN Red List of Endangered Species (www.iucnredlist.org). CR: critically endangered, EN: endangered, VU: vulnerable, LC: least concern. Red text indicates a classification in a threatened category.

Species/Populations	Overall	Latin America region ¹		
		East Pacific	Southwest Atlantic	Northwest Atlantic
<i>Dermochelys coriacea</i>	CR	CR	CR	LC
<i>Chelonia mydas</i>	EN	EN	EN	EN
<i>Caretta caretta</i>	VU	CR ¹	LC	LC
<i>Eretmochelys imbricata</i>	CR	CR	CR	CR
<i>Lepidochelys olivacea</i>	VU	VU	VU	VU

¹This classification applies only to the south Pacific populations.

Critically Endangered, while the populations of the green turtle and the olive ridley turtle (*Lepidochelys olivacea*) are considered Endangered and Vulnerable, respectively. The Eastern Pacific (EP) populations of leatherbacks and hawksbills are considered among the most endangered sea turtle populations in the world. Long-term studies have estimated a decline of more than 97% for the nesting population of the EP leatherback turtle, largely due to incidental capture and direct use of eggs (Wallace *et al.*, 2013). While contemporary nesting populations of hawksbill turtles were recently “rediscovered,” they are estimated to reflect a small fraction of the historic population (Gaos *et al.*, 2010). In contrast, there is encouraging evidence of recovery for other species. Many nesting populations of leatherback turtles in the Caribbean have experienced significant increases after years of conservation efforts and are considered as Least Concern by the Red List (Tiwari *et al.*, 2013), while EP green turtles and olive ridleys are also increasing in abundance following historic depletions (Plotkin *et al.*, 2012; Delgado-Trejo & Alvarado-Figueroa, 2012).

The sea turtles of Latin America tell contrasting stories, but also astounding ones. For example, regardless of the habitat they occupy -either Caribbean coral reefs or mangrove ecosystems in the EP- hawksbill turtles have a particular taste for sponges and in the EP they even devour mangrove shoots and seeds (Van Dam & Diez 1997; Carrión-Cortez *et al.*, 2013; A. Gaos, *unpublish. data*). Separate populations of loggerhead turtles traverse the Pacific Ocean during their life history, tracking oceanic gyres between nesting and foraging grounds in the North and South Pacific Oceans (Bowen *et al.*, 1995; Boyle *et al.*, 2009). But, despite the tremendous discoveries made since the first studies began many decades ago in Tortuguero and other Caribbean locations, many fundamental questions about sea turtle biology, ecology, life history, and population dynamics remain unanswered. One reason for this is the paucity of peer-reviewed publications

from Latin American scientists, a situation noted before (Nature Index, 2015) and that represents one of the main challenges to achieving a better understanding of sea turtles in Latin America and to effective conservation actions and policy. This disparity between the copious data being collected daily throughout the region and the data being published was one of the main motivations for launching this Special Issue “Sea turtle research and conservation in Latin America”.

The 36th Annual Symposium on Sea Turtle Biology and Conservation, held in Peru in March 2016, inspired this Special Issue. This was the first time the venue for this international event was in South America, and it attracted a remarkable number of researchers from throughout Latin America that arrived eager to share their most recent results. We conceived this Special Issue as a space to showcase the research conducted in the region. We invited manuscripts from research colleagues and groups engaged in long-term, multi-species, or multidisciplinary studies as these have demonstrated their utility to provide integrated perspectives and to aid management and conservation actions (*e.g.*, Wallace *et al.*, 2010; Raymond *et al.*, 2015; Chin *et al.*, 2017). We wanted the Special Issue to focus particularly on in-water studies and threats, quantification of threats by species and life stage; population connectivity at local and regional levels; and studies from understudied nesting beaches. The ten articles featured in this Special Issue comprise studies conducted in South and Central America and the Caribbean and present novel results covering as much as 45 years of data collection efforts.

We identified three main subject groups covered by the manuscripts presented here. The first group includes assessments of long-term nesting data for the two most threatened populations of sea turtles in the world. Two studies addressed important information gaps of nesting abundance from unreported and understudied beaches. Gaos *et al.* (2017) analyzed 33 years of nesting records for the hawksbill turtle from nine

sites along the eastern Pacific. They reported a larger number of deposited nests, contrasting with previous estimates that were based upon more limited information (Gaos *et al.*, 2010). Santidrian-Tomillo *et al.* (2017), on the other hand, looked towards secondary beaches for the eastern Pacific leatherback and analyzed nesting records from as far back as 1971. Secondary beaches are not usually considered when determining population trends, but for this species, these secondary beaches may represent higher-than-expected abundance relative to the entire population, as well as potential sources for the recolonization of index beaches that are near extirpation. Both studies valued every inch of beach in their efforts to identify opportunities for the recovery of depleted rookeries.

Foraging grounds are as important as nesting beaches for the conservation of sea turtles, if not more so. These areas, which can include neritic (*e.g.*, Velez-Zuazo *et al.*, 2014) and oceanic habitats (*e.g.*, Briscoe *et al.*, 2016), are pivotal for sea turtle development, recruitment, and population dynamics. The second group of manuscripts focused on these important areas, but approached their research questions from different angles. Two of the studies addressed open questions about the connections between feeding habitats and nesting beaches for the EP hawksbill and the Caribbean green turtle, respectively. Applying tools drawn from the field of molecular ecology, these studies provide further evidence of the large geographic areas sea turtles traverse during their ontogenic migrations and the regional perspective local initiatives should take when designing and implementing conservation actions. Zúñiga-Marroquín & Espinosa de los Monteros (2017) found that Eastern Pacific hawksbills establish local and trans-Pacific connections during their life history, while Patrício *et al.* (2017) filled a gap for understanding the complex spatial connections Caribbean green sea turtles establish as a result of their migratory behavior. Two studies revealed new foraging habitats. Llamas *et al.* (2017) confirmed the existence of a very important resident foraging aggregation of EP hawksbills in the protected waters of the Coiba Island National Park, Panama. Alvarez *et al.* (2017) determined that the southernmost foraging aggregation of green turtles -found in the waters off the coast of Chile- were from the Galapagos nesting rookery. And Jimenez *et al.* (2017) added to our knowledge of what green turtles eat in a tropical foraging habitat, but also reported a high occurrence of plastics in their diet, adding to the warning signs about the pervasive problem of plastics pollution in our oceans.

The third group of studies focused on several of the long-standing anthropogenic threats facing sea turtle: incidental catch (also known as bycatch) and illegal

take (Wallace *et al.*, 2011). Liles *et al.* (2017) investigated the impact of the lobster gillnet fishery in Central America and estimated one of the highest rates of gillnet bycatch and mortality for hawksbill turtles anywhere in the world. Likewise, Pingo *et al.* (2017) found high rates of bycatch of green sea turtles in gillnet fishery operations in northern Peru, with entanglements occurring in almost every observed fishing set. Bycatch may also lead to the illegal retention of the sea turtles, and according to Quiñones *et al.* (2017) this is not a rare event in the port of Pisco, in central Peru. In a period of six years, Quiñones *et al.* (2017) reported more than 900 sea turtle carapaces from four species with evident signs of slaughtering, most of which were observed at public dumpsites. Furthermore, the study detected an ongoing black market for sea turtle meat, despite the national regulations that prohibit its sale. The studies in this group serve as reminders that long-standing threats still jeopardize the recovery of sea turtle populations despite notable advances in sea turtle conservation.

Seventy years of sea turtle research and conservation in Latin America have yielded enormous amounts of information that have helped set and achieve conservation milestones throughout the region. These range from starting conservation programs in almost every country in the region to influencing government policies to protect sea turtles throughout their life histories. Thanks to these efforts, some sea turtle populations are showing undeniable signs of recovery. However, as the studies presented in this Special Issue demonstrate, conservation work is still required to sustain positive trends and to reverse ongoing declines, and more discoveries await. To these ends, this Special Issue conveys several important messages: 1) that every beach counts for female sea turtles and that it is important to monitor and protect these areas to help the recovery of depleted nesting populations; 2) that sea turtle foraging grounds await discovery and probably require immediate protection; 3) that concerted regional efforts are essential to secure the connectivity of populations; and 4) that we must continue to work toward reducing bycatch and any form of intentional harvest of sea turtles. This Special Issue helps fill information gaps and heightens global awareness for sea turtle conservation, especially in Latin America, the region where sea turtle conservation was born.

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