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Diversity, habitat distribution, and indigenous hunting of marine turtles in the Calamian Islands, Palawan, Republic of the Philippines

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ABSTRACT

All of the world's seven species of marine turtle are threatened by a multitude of anthropogenic pressures across all stages of their life history. The Calamian Islands, Palawan, Philippines provide important foraging and nesting grounds for four species: green turtles (*Chelonia mydas*), hawksbill turtles (*Eretmochelys imbricata*), loggerheads (*Caretta caretta*), and leatherbacks (*Dermochelys coriacea*). This work aimed to assess the relative importance of turtle nesting beaches and local threats using a combination of social science and ecological research approaches. Endangered green turtles and critically endangered hawksbills were found to nest in the Calamianes. The most important nesting sites were located on the islands off the west of Busuanga and Culion, particularly Pamalican and Galoc and along the north coast of Coron, particularly Linamodio Island. Opportunistic hunting and egg collection, conducted legally by indigenous communities, is the most significant threat to sea turtles in the area. Sites particularly vulnerable to hunting were found to be Galoc Island, Pamalican Island, and Panlaitan Island. Raising awareness, community engagement, and understanding of socio-cultural drivers of sea turtle exploitation, particularly among indigenous communities, are essential to gain support for any effective conservation program. Additionally, more effective enforcement of laws related to the trade in sea turtle products is required to close the commercial and export markets.

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Introduction

Owing to their longevity, slow maturation rates, and complex life histories, marine turtles are highly vulnerable to a multitude of anthropogenic threats operating across their life-history (Wallace et al 2011). They undertake large-scale migrations, utilizing a wide range of habitats but spending the majority of their lives in the deep oceans. Female turtles return annually to their natal beaches to nest (Lohmann et al 2013), allowing critical areas of the nesting habitat to be identified and providing a rare opportunity to evaluate populations and their distribution to inform conservation management. It is impossible to guard against all threats to a given population of marine turtles, or to protect every area of habitat they

utilize, so conservation efforts must therefore focus on life-history stages at which they are most vulnerable. Turtles are particularly vulnerable to human exploitation during nesting, when they are easily accessible to coastal populations, usually for subsistence purposes (Humber et al 2014).

Marine turtle populations worldwide are in urgent need of conservation action. Globally, the number of mature females nesting annually has diminished over the past three generations, by 84–97% for hawksbill turtles, *Eretmochelys imbricata* [listed on the International Union for the Conservation of Nature (IUCN) Red List as Critically Endangered; Mortimer and Donnelly 2008] and 48–67% for green turtles, *Chelonia mydas* (listed on the IUCN Red List as Endangered; Seminoff 2004). All seven of the world's species of marine turtle are included within the threatened categories of the IUCN Red List (IUCN 2014) and in Appendix I of the Convention on International Trade in Endangered Species, prohibiting international trade in these species and their products (UNEP-WCMC 2015).

There is a severe deficiency of current scientific research on marine turtles in the Philippines, as is the case for much of

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Southeast Asia (Gomez 1980; Shanker and Pilcher 2003), despite the fact that the country's waters are likely to harbor internationally significant populations. To date, the majority of research in the Philippines has focused on the Turtle Islands, Tawi Tawi, where over one million *C. mydas* eggs are laid each year (Cruz 2002; Lejano and Ingram 2007; Trono 1991). However, *C. mydas*, *E. imbricata*, and olive ridley (*Lepidochelys olivacea*) nesting sites are widespread throughout the Philippines (Cruz 2002; Ramirez-de Veyra 1994). Other sites with published data available include: Mindanao (Byrne and Hines 2005; Quimpo 2013); Northeastern Palawan (Ladra and Laguidao 1992); Panay and Guimaras Islands (Bagarinao 2011); Panikian Island, and Morong (Cruz 2002). Encouragingly, the *Pawikan* (marine turtle) Conservation Project, established in June 1979, has achieved much towards the sustainable management of turtles in the Philippines, including the development and implementation of conservation and protection policies, management and propagation schemes, and nationwide information and education programs (Ramirez-de Veyra 1994; Sagun 2003; Trono 1991).

The Calamian Islands (Figure 1) support a rich diversity of marine habitats including coral reefs, beaches, and seagrass beds (Garces et al 2013; Tupper et al 2015), providing important foraging and nesting grounds for marine turtles. At least four of the world's seven species of marine turtles have been historically reported in the islands' coastal waters (PCSDS 2006a,b,c,d): nesting populations of *C. mydas* and *E. imbricata*, occasional transient loggerheads (*Caretta caretta*; Sagun 2003) and leatherbacks (*Dermochelys coriacea*; Salinas et al 2009). Human exploitation for meat and eggs, combined with degradation of nesting and foraging sites and incidental capture in local fisheries, are major threats (PCSDS 2006a,b,c,d).

The Tagbanua of the Calamianes are one of the few indigenous tribes still practicing their traditional lifestyles in the Philippines. The Philippines' constitution guarantees the rights of indigenous communities to their ancestral land and sea resources (Capistrano 2010; Capistrano and Charles 2012). Fishing, hunting, and foraging define the Tagbanua people's identity and removing this component of their lives would endanger their culture (Dalabajan 2001). The Tagbanua people hunt marine turtles and collect their eggs according to traditional management practices such as cultural taboos and sacred areas (Guieb 2010; Sampang 2007). Additionally, the Philippines' National Protected Area System strongly promotes the inclusion of indigenous peoples and the integration of their traditional ecological knowledge in natural resource management strategies (Capistrano 2010).

Here we report on a rapid assessment of marine turtle populations in the Calamian Islands that combines social and ecological approaches, to provide information urgently required for conservation efforts including distribution of key nesting sites and patterns of exploitation.

Materials and methods

In order to rapidly develop a deeper understanding of marine turtle distribution, we carried out interviews in a total of 15 barangays located throughout the Calamianes (a barangay is the smallest administrative division in the Philippines; a village, district, or ward). Interview-based approaches have been employed in several studies of marine species globally (Moore et al 2010), providing a low-cost, rapid means of acquiring information over large areas. Barangays were selected based on a high occurrence of marine turtle sightings and locally known nesting sites (PCSDS

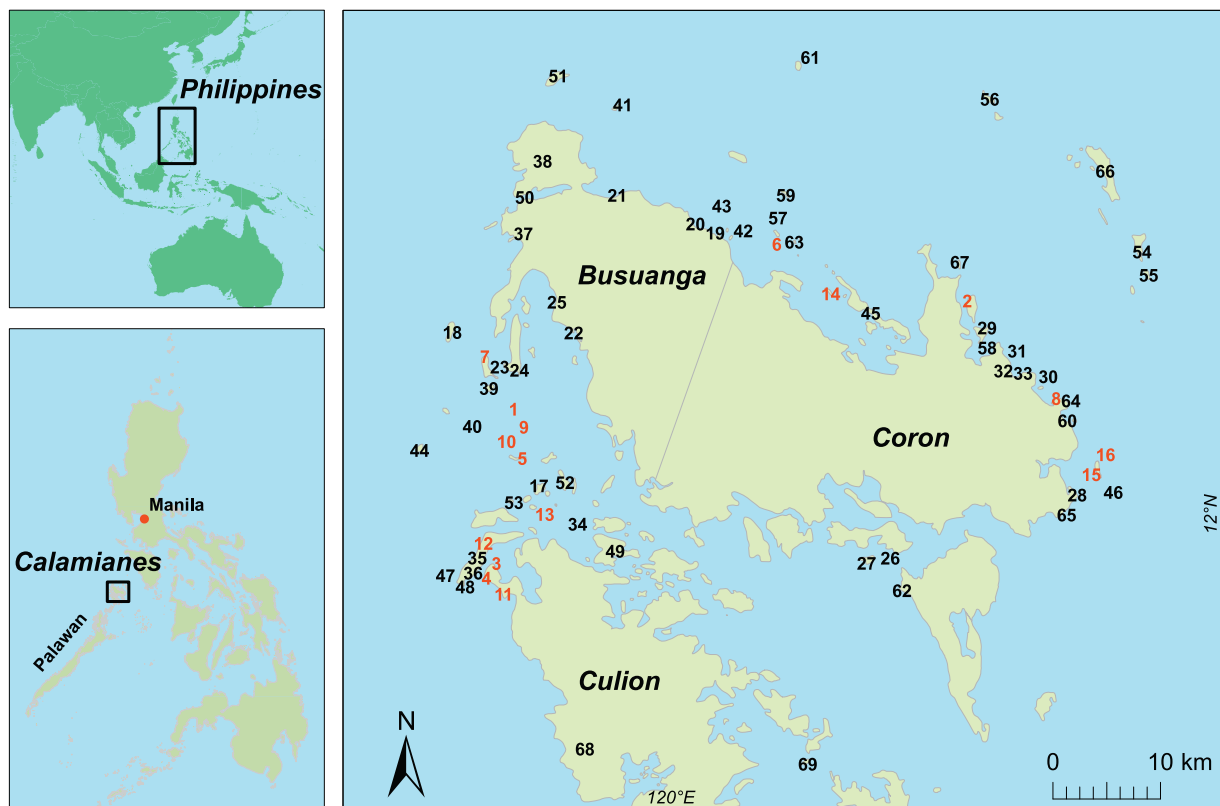


Figure 1. Location of the Calamian Islands showing marine turtle nesting sites identified during the current study, sites labeled in red indicate presence of body pits during surveys (for site names, see Tables 1 and A1).

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