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# Marine zoning in St. Kitts and Nevis: A design for sustainable management in the Caribbean

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ABSTRACT

Similar to many coastal or island countries, the waters around St. Kitts and Nevis, an island nation in the Eastern Caribbean, are home to multiple, cumulative, and often conflicting uses of the sea. Marine spatial planning and marine zoning hold great promises for addressing and balancing a number of marine management objectives in St. Kitts and Nevis under a common framework. We outline the key activities that led to the development of a draft marine zoning design for St. Kitts and Nevis, and discuss outcomes of the planning process and possible next steps towards implementation of a marine zoning plan. The key activities were focused around: 1) engaging stakeholders; 2) establishing clear objectives; 3) building an information base that spatially represents marine uses (i.e., a multi-objective geodatabase); 4) generating tools to assist stakeholders and decision makers in generating a zoning design and considering options and tradeoffs (i.e., decision support products); and 5) outlining the location of zones via a participatory process. The vision and foundation for marine zoning we outline here can continue to be leveraged by the citizen of St. Kitts and Nevis and serve as a model in other places engaged in similar efforts.



## 1. Introduction

A wide range of activities are placing increased and often conflicting demands on coastal and marine waters worldwide (Halpern et al., 2008). Future predictions indicate that many of these activities (e.g., coastal development, tourism, and fisheries) are likely to accelerate in the next few decades (Millenium Ecosystem Assessment, 2005). Consequently, we can expect pressures on important coastal and marine resources to continue to mount. This will threaten the biological diversity of a wide variety of marine habitats and the ecosystem services they provide (e.g., coastal protection, food security, tourism amenities, biodiversity protection, climate change adaptation) (Ruckelshaus et al., 2013).

Marine spatial planning (MSP) has emerged as an approach to help address multiple activities taking place in the ocean and attempt to combine marine management strategies (Agardy, 1999; Norse, 2005; Russ and Zeller, 2003; Sanchirico, 2004; Stelzenmüller et al., 2013). MSP refers to an extensive planning process required for equitable management of a marine area to accommodate multiple activities and objectives (i.e., multi-objective planning). MSP often serves as an integrative process in which decision makers acknowledge connections between multiple aspects of an ecosystem, and where it is a priority to balance relationships between land and sea, humans and nature, and ocean resource use and the ability of ecosystems to deliver important goods and services (Agardy, 2010; Lester et al., 2013). MSP can also provide a framework for conflict resolution, facilitating a balanced coexistence between marine sectors with competing interests within the same space, an objective deemed crucial for ocean management (Barale et al., 2009; Foley et al., 2013).

A marine zoning plan is one of the possible and often central outcomes of the MSP process (Ehler and Douvere, 2009; Agardy, 2010). In fact, MSP is the framework that is typically used to initiate comprehensive marine zoning (Foley, 2010). In the first phase, the boundaries in the marine space of zones are designed through an iterative process that involves stakeholder review and

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input. After the design has been accepted and translated into a zoning plan, management schemes are developed in an integrated fashion by including ecological, economic, and social considerations (Grantham et al., 2013; MacDonald, 2013). The final step involves implementing the marine zoning plan through a set of policies and/or regulations that specify allowable uses of the space in question.

To accommodate multiple uses including fisheries and manage cumulative effects across space in the marine environment, tools such as marine zoning are needed. Marine zoning is currently being applied worldwide and efforts span a range of spatial scales from large, integrated sea-use management projects to smaller scale initiatives (Ogden, 2010; Kenchington and Day, 2011; McGowan et al., 2013; Grantham et al., 2013; Baldwin and Oxenford, 2014). Each effort is motivated by different goals and outcomes. The case for marine zoning is particularly strong in the small island developing states (SIDS) of the Caribbean, one of the most complex political marine environments in the world. The economy and public health of the Caribbean is highly dependent on healthy marine and coastal ecosystems and the biodiversity they support (Heileman, 2005). Additionally, this area has been identified as one of the top five biodiversity hot spots in the world (Mittermeier et al., 2005; Shi et al., 2005; Myers et al., 2000), based primarily on the high number of globally important endemic species (Miloslavich et al., 2010). The Caribbean's large endowment of biodiversity-rich marine ecosystems is being lost at an increasing rate (Brown et al., 2007; Forster et al., 2011) largely due to high cumulative impact from humans on marine ecosystems (Halpern et al., 2008). Main threats to coastal marine areas include poorly planned coastal development, land-based pollution sources, over-exploitation of fisheries resources and global climate change. Consequently, important biological systems in the Caribbean are under increasing pressure, threatening the biological diversity of the region's beaches, coral reefs, wetlands, mangroves, and seagrass beds. These pressures have a damaging impact on the marine life reliant upon these habitats and the important ecosystem services they provide (Micheli et al., 2014). An integrated approach to balance and manage uses in the Caribbean will help address not only the mounting conflicts between users, but also benefit the biodiversity and natural resources that the uses, and people, depend on.

The few examples of marine zoning for small island states that exist are primary focused on marine protected area (MPAs) and MPA networks, and typically lack adequate documentation. While a number of publications have focused on “MSP best practices” to guide the development and implementation of marine zoning plans (e.g., Ehler and Douvere, 2009; Beck et al., 2009), few have discussed their application at particular sites, making an assessment of their effectiveness difficult. This paper is an attempt to begin to fill this void, detailing the MSP process to generate a national zoning design for Saint Kitts and Nevis, a small island developing state in the Caribbean. We do this by: 1) describing the local context; 2) outlining the key activities that led to the development of a draft marine zoning design (i.e., stakeholder engagement; strategic visioning; building a multi-objective spatial database; providing decision support products; and generating draft zones); and, 3) discussing outcomes of the planning process and possible next steps towards implementation of the zoning design.

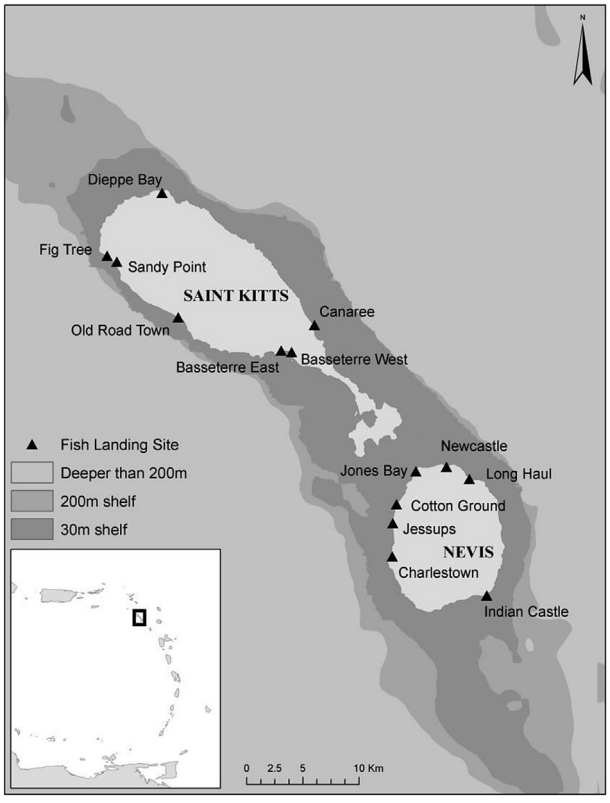


**Fig. 1. Map of St. Kitts and Nevis**. Map illustrates the coastal boundaries, the 30 and 200 m bathymetric shelf, and the major fish landing sites of St. Kitts and Nevis.

## 2. The context

The Federation of St. Kitts and Nevis is a two-island nation located in the West Indies of the Leeward Islands of the Caribbean (Fig. 1). St. Kitts covers a land area of 185 km$^2$ with a coastline of 108 km. Nevis, the smaller of the two islands, is 104 km$^2$ in area, with a coastline of 44 km. The total population is approximately 54,000; the population density is fairly high (164 people/km$^2$). The Federation's Exclusive Economic Zone (EEZ) waters covers 11,234 km$^2$ in area with a shelf area (<22 m depth) of 845 km$^2$. These islands are volcanic in origin, with large calderic peaks covered in tropical rainforest, and surrounding flatter coastal terrain in which the majority of the population resides.

St. Kitts and Nevis is characterized by a relatively small ocean shelf area that supports a number of critical habitats, with fringing reefs along much of the coastline and deeper submerged bank reef structures offshore (Wilson et al., 2012). A recent survey of reef communities found 29 species of coral with most sites having 6–13% live coral cover, and 88 species of ecologically and commercially important fishes (Bruckner and Williams, 2012). Arsenio (1981) suggests that the stable annual water temperature on the shelf limits the marine biological diversity on St. Kitts and Nevis. Additionally, low levels of cooler oceanic upwelling restrict nutrient supply and subsequently impact the offshore fisheries. Nearshore fisheries have declined sharply in recent years while increasing storms and anchoring have heavily damaged the reefs. Anecdotally, fishers have reported reduced catches of conch, lobster, and large pelagic and demersal fishes. Major threats to the area's marine ecology include coastal development, unsustainable fisheries practices, land-based sources of pollution, rising ocean temperatures, and the increasing intensity of hurricanes and other storm events (Bruckner, 2012).

The coastal and marine habitats of St. Kitts and Nevis support tourism and fisheries, the main sources of income on both islands. Tourism has replaced the sugar industry, which was the traditional mainstay of the economy until the 1970s. Large stretches of the coast are dominated by a growing tourism market that has attracted private yachts, cruise ships, and associated water