Assessing the Abundance, Distribution and Reproduction of the Florida Sea Cucumber (*Holothuria floridana*) for the Informed Management of a Growing Commercial Fishery

La Evaluación de la Abundancia, Distribución y Reproducción del Pepino de Mar de la Florida (*Holothuria floridana*) para la Gestión de la Información de una Pesquería Comercial en Crecimiento

Évaluation de L' Abondance, la Distribution et la Reproduction du Concombre de Mer en Floride (*Holothuria floridana*) pour la Gestion D'une Connaissance Croissante de la Pêche Commerciale

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EXTENDED ABSTRACT

Sea cucumbers, class Holothuroidea, are ecologically and socio-economically important components of many marine habitats. They play a crucial role in nutrient cycling in oligotrophic tropical reefs and oxygenate ocean sediments through their burrowing behavior. Sea cucumbers are also of high commercial importance in both the aquarium and consumptive trades, leading to overfished Holothurian populations around the globe. Due to recent, heightened demand for sea cucumbers in the Indo-Pacific, fishers have exploited new areas in the Caribbean and Florida, furthering the need for baseline studies to guide management of current and prospective sea cucumber fisheries.

The sea cucumber fishery in Florida was self-regulated due to low demand in the marine aquaria trade; however, in the absence of catch limitations, landings from 2012 to 2013 quadrupled when over 62,000 animals were harvested from state waters (Figure 1). In response to increasing harvests, the Florida Fish and Wildlife Conservation Commission imposed a quota of 200 individuals per day per vessel in June 2014. This implemented quota was effective at reducing sea cucumber landings in the state to pre-2013 levels prior to heightened fishery demand. Little is known about the size, stock structure, and ecological roles of holothurians in Florida - specifically, the species targeted by commercial fisherman, *Holothuria floridana*.

The goal of this study is to improve management of this emerging fishery by examining *H. floridana* abundance, distribution and reproductive potential in the Florida Keys. Utilizing a probabilistic sampling design, stratified by habitat and geographic region, the abundance, size, and distribution of *H. floridana* will be measured at > 200 sites throughout Florida Bay in the Florida Keys backcountry environment. Reproductive potential of *H. floridana* will be assessed using a gonadosomatic index via histological examinations to determine developmental phases and quantify reproductive output across the study area.

Pilot surveys from 2015 suggest that *H. floridana* prefers mixed seagrass and nearshore hardbottom habitats, with a tendency to gather in dense, spatially discrete aggregations around mangrove islands. *Holothuria floridana* was present at 58 of 73 sites surveyed from Marathon to Key West and found in densities ranging from 0.1 - 2.6 individuals/m^2.

Expanding upon the pilot work, surveys were conducted in the Marathon and Key West regions throughout 2016 and early 2017. The findings of these surveys are summarized in Table 1.

These preliminary results are consistent with the pilot study and suggest that *H. floridana* is more commonly found in seagrass habitats rather than hard- or sandy-bottom sites. Additionally, much higher densities of *H. floridana* were found in the Key West region where 60 times as many individuals were found than at the next most abundant site. To date, only a limited number of the proposed sites have been surveyed (40 out of 200+), leaving a wealth of information to be collected to complete the objectives of this study.

Table 1. Average density of *H. floridana* across various backcountry habitats from Marathon to Key West.

Region	Habitat Type	# of Sites Surveyed	# of Sites with *H. floridana* present	Average Density (# inds./m^2)
Marathon	Seagrass	19	9	0.00-0.10
Marathon	Hardbottom	11	1	0.00-0.02
Key West	Seagrass	8	3	0.00-1.18
Key West	Sand	1	0	N/A
Key West	Mixed Habitat	1	0	N/A

These surveys have uncovered other interesting aspects of *H. floridana's* life history that require additional research. Initial field observations found individuals were smaller in Marathon as compared to Key West, potentially suggesting that the two regions are utilized by *H. floridana* at different life stages. Also, individuals recorded in Marathon were lighter in color than those from the Key West, possibly denoting genetic differences between populations living in these two locations. Although the results are preliminary, they provide a positive outlook for developing adaptive management policies to allow the sustainable harvest of Florida's sea cucumbers.

KEYWORDS: Sea cucumber, abundance, fishery, distribution

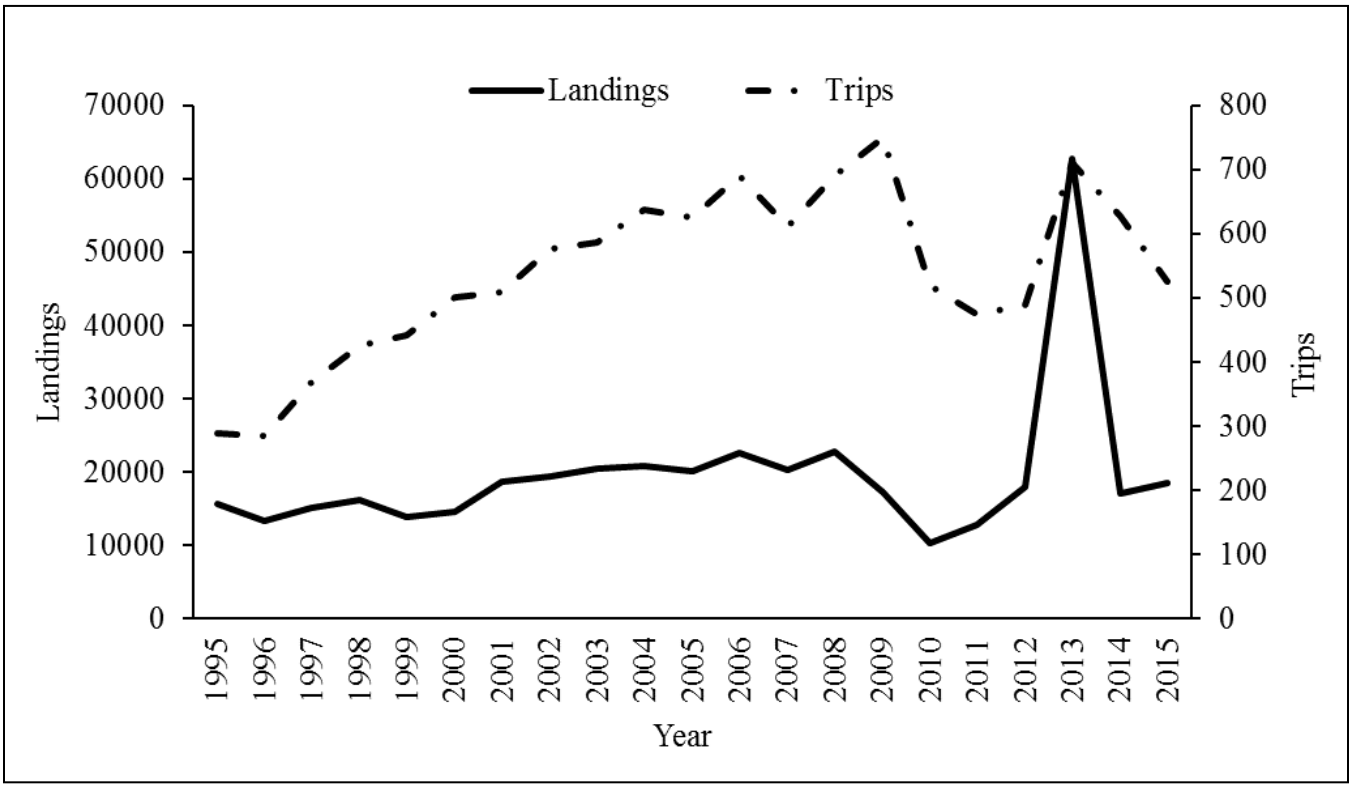

Figure 1. Number of trips targeting sea cucumbers and landings in Florida from 1995 - 2015.