

Monitoring Caribbean Spiny Lobsters in the Florida Keys National Marine Sanctuary, 1997-2002

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Goals

We have monitored spiny lobsters in selected FPMZs of the Florida Keys National Marine Sanctuary (FKNMS) since they were closed to exploitation in July 1997. Our goal is to determine if the FPMZs are effective in protecting this highly mobile species from human exploitation by comparing the size and abundance of lobsters between fully protected and exploited areas.

Methods

We sampled 13 FPMZs and paired reference areas twice a year from 1997 until 2001. A closed-season census was performed at the end of the closed fishing season each July, and an open-season census was completed each September/October after several months of the lobster fishing season (August-April each year). Results of this work have been previously reported (http://floridakeys.noaa.gov/research_monitoring/). In 2002, we focused on the Western Sambo Ecological Reserve (WES), because it has shown signs of effectiveness in protecting spiny lobsters from fishing. We discontinued sampling at all other FPMZs except Looe Key SPA (LKS) because it has been a lobster reserve for more than 20 years, and Eastern Sambo Research Only Area (ESB) because lobsters have been very abundant there and it is close to WES. We also reduced our sampling to a single census at each site during July (closed fishing season). In all years, sampling was stratified by habitat (fore reef, back reef, and offshore patch reef) in WES, and three sub-samples were taken within each habitat. One sample was taken in forereef habitat at the other sites. Samples consisted of a 60-minute timed search during which we counted and attempted to catch all lobsters observed. Size, sex, molt stage, reproductive state (females), den number, and depth were recorded for each lobster encountered. Data from LKS, ESB, and WES were treated separately and compared with data from their respective exploited reference areas.

Findings to Date

In 1997, there was little difference between the number of lobsters inside FPMZs and reference areas, but after five years of protection we found almost twice as many lobsters inside the three FPMZs as outside (Fig. 1). The total number of lobsters observed in FPMZs varied among years with a high in 1999 following a low in 1998. There usually were more lobsters in FPMZs than in reference areas during the closed fishing season, and the number of lobsters observed in reference areas always decreased dramatically during the fishing season. We found more lobsters in FPMZs during the fishing season than during the closed season in three of the five years for which we have data (Fig. 1).

Abundance of Legal-Sized Lobsters

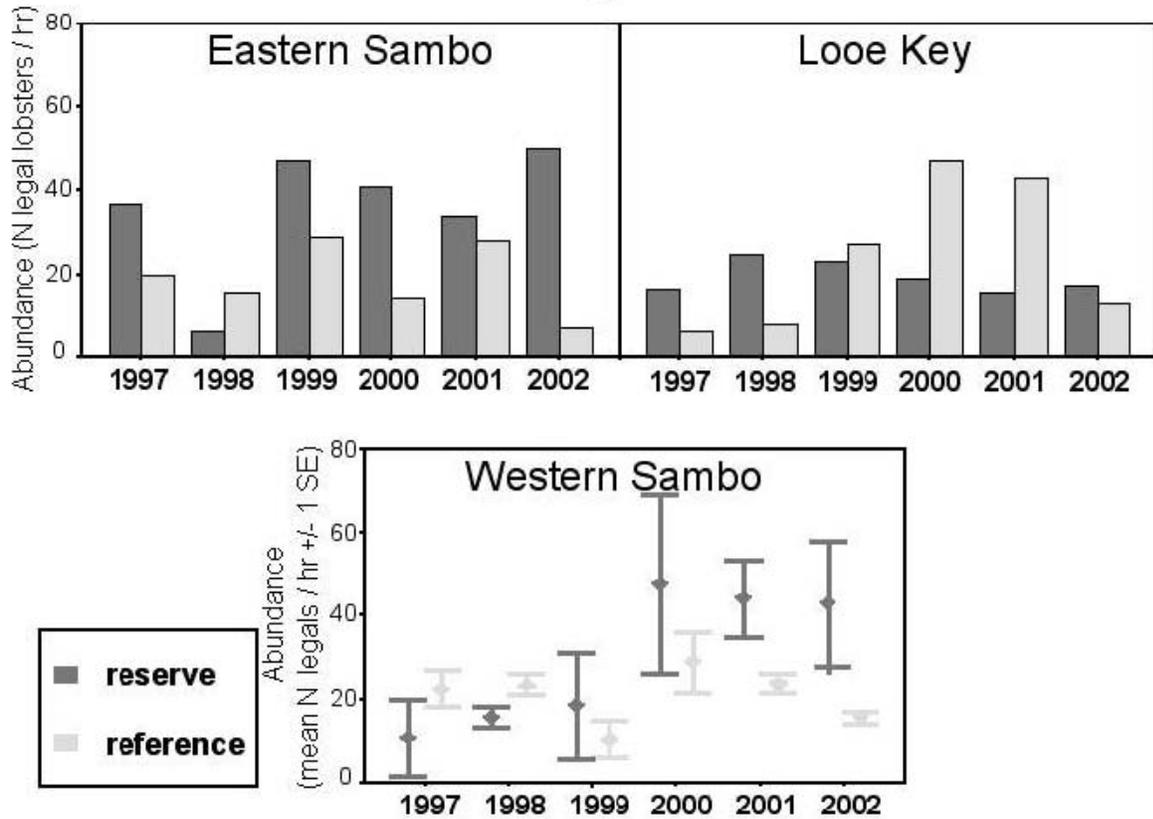


Figure 1. Total number of lobsters observed at Western Sambo Ecological Reserve, Eastern Sambo Research Only Area, Looe Key SPA, and adjacent reference areas during closed and open fishing seasons, 1997-2002. The FPMZs were implemented in 1997.

Legal-sized lobsters were very abundant on the fore reef at WES and ESB. Since 1999, abundance of legal-sized lobsters (n legal lobsters observed/hr) has always been greater in those FPMZs than in their reference areas (Fig. 2). Abundance of legal-sized lobsters at Looe Key SPA was higher on average than at many of the other FPMZs we sampled from 1997 until 2001. However, legal-sized lobster abundance was not higher in Looe Key SPA than in its reference area (Fig. 2) despite the fact that Looe Key has been a lobster reserve since 1981.

Efficacy of FPMZs will not be observed as absolute increases in lobster abundance inside the protected areas because lobster population abundance is cyclical. Rather, the important measure of abundance is increased abundance inside FPMZs relative to reference areas. We have observed this relative increase in abundance of legal-sized lobsters on the fore reef at WES (Fig. 3). There was no such trend observable at LKS, probably because the protected area is small compared to the home range of lobsters denning inside it. Though ESB is also small, there is a trend of increasing relative abundance of lobsters there that may be attributed in part to the proximity of the large Western Sambo Ecological Reserve.

In general, mean lobster size was below the legal limit (76 mm carapace length [CL]) in FPMZs and reference areas in 1997. LKS, ESB, and its reference area were notable exceptions with mean lobster size larger than the legal limit (Fig. 4). Since implementation of marine zoning in 1997, mean lobster size in FPMZs has been larger than legal size and comparatively larger than in reference areas. There were no differences in size of legal lobsters between Looe Key SPA and its reference area despite the longevity of protection at Looe Key. However, there has been a significant increase in the size of legal-sized lobsters in the large Western Sambo Ecological Reserve (Fig. 4). Mean size of male lobsters on offshore patch reefs in WES has increased 10 mm in five years (Fig. 5). Abundance of very large lobsters (≥ 100 mm CL) increased in WES relative to its reference area with males becoming larger as well as more abundant (Fig. 6).

Our data indicate that a resident population of spiny lobsters is becoming established within Western Sambo Ecological Reserve. The expansion of lobster size range in the WES suggests that some lobsters remain in the ecological reserve for an extended period. Habitat for all life stages of spiny lobsters is protected within it. Once adults establish residence, the ecological reserve is sufficiently large to protect a portion of the population as it travels to foraging grounds and between winter dens and spring spawning habitat.

Abundance of Legal-Sized Lobsters

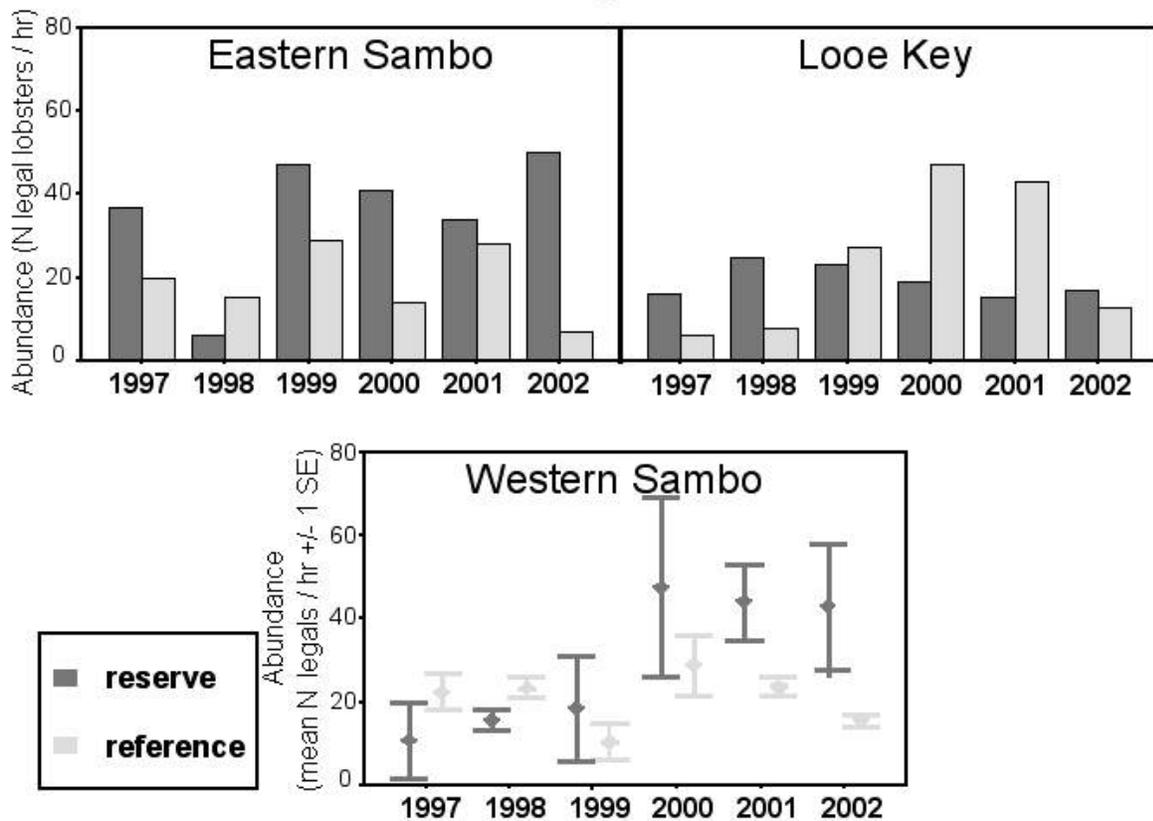


Figure 2. Abundance of legal-sized lobsters on the fore reef in FKNMS FPMZs and corresponding reference areas during the closed fishing season, 1997-2002.

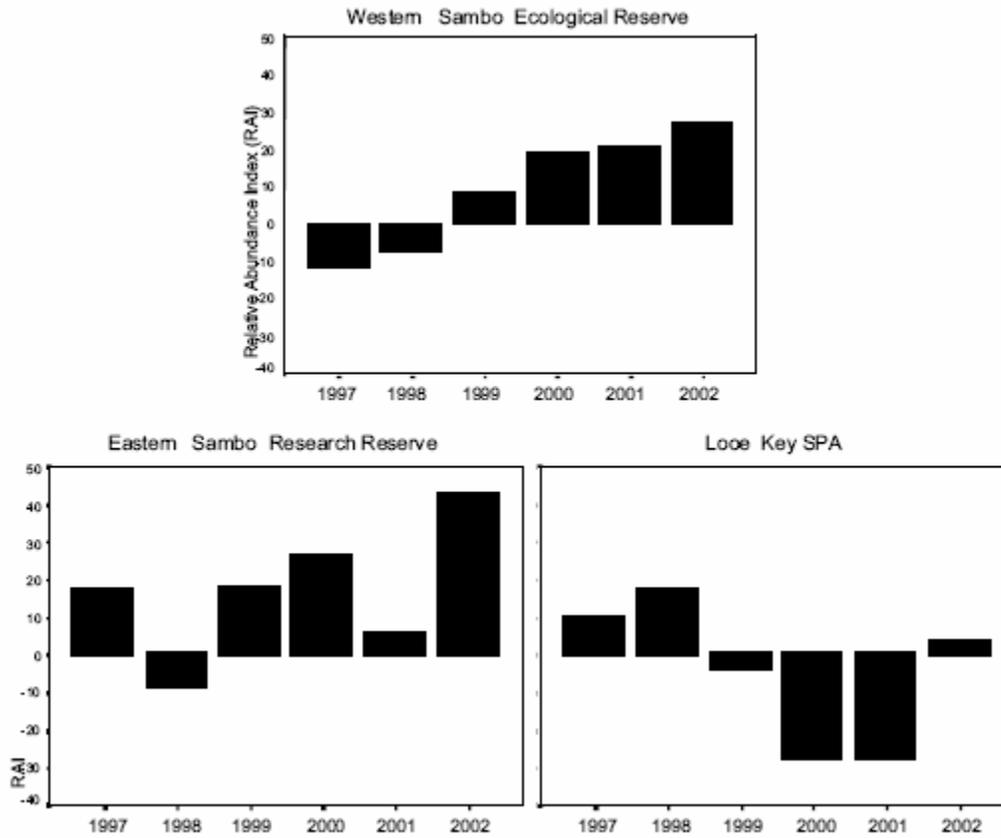


Figure 3. Relative abundance index (RAI) of legal-sized lobsters on fore reef habitat during the closed fishing season, 1997-2002. $RAI = [\text{mean abundance in FPMZ}] - [\text{mean abundance in reference area}]$.

Lobster Size

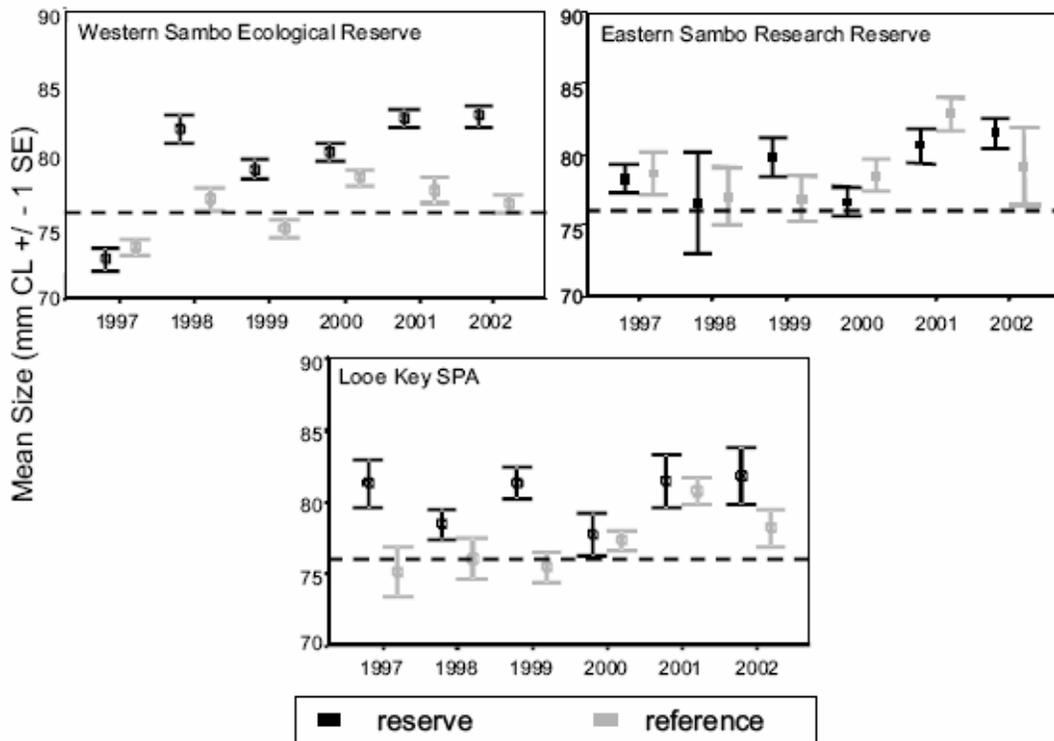


Figure 4. Size of spiny lobsters in FKNMS FPMZs during the closed fishing season, 1997-2002. Dashed line represents the minimum legal size (76 mm CL). Data for Western Sambo Ecological Reserve and its reference area include lobsters from forereef, backreef, and offshore patch reef habitats. Looe Key SPA and Eastern Sambo R-OA observations were made on the fore reef only.

Western Sambo - Size by Habitat

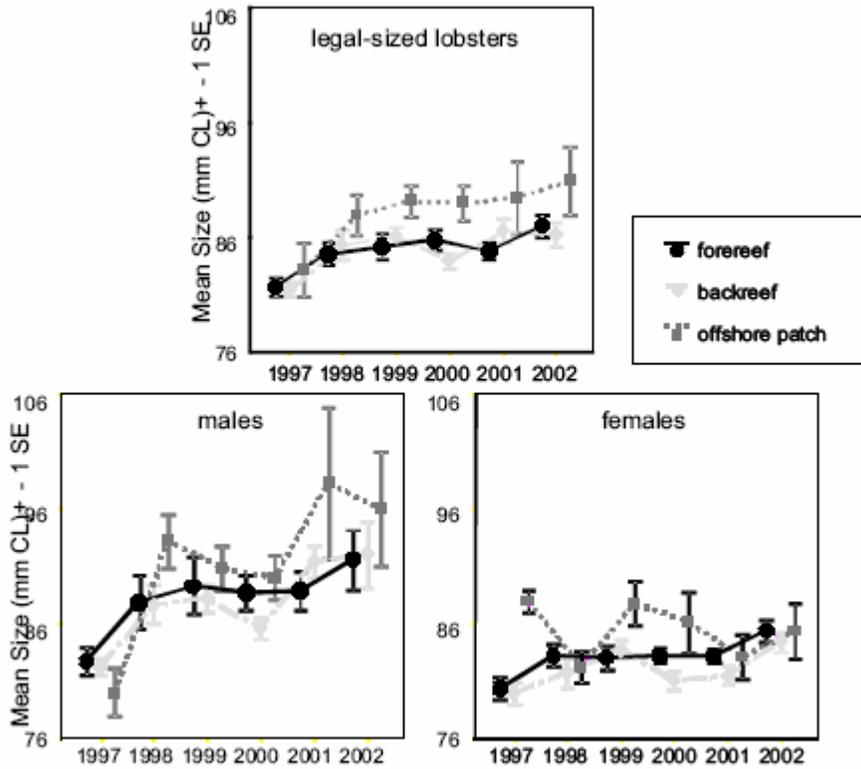


Figure 5. Mean size of male and female spiny lobster in Western Sambo Ecological Reserve by habitat during the closed fishing season, 1997-2002.

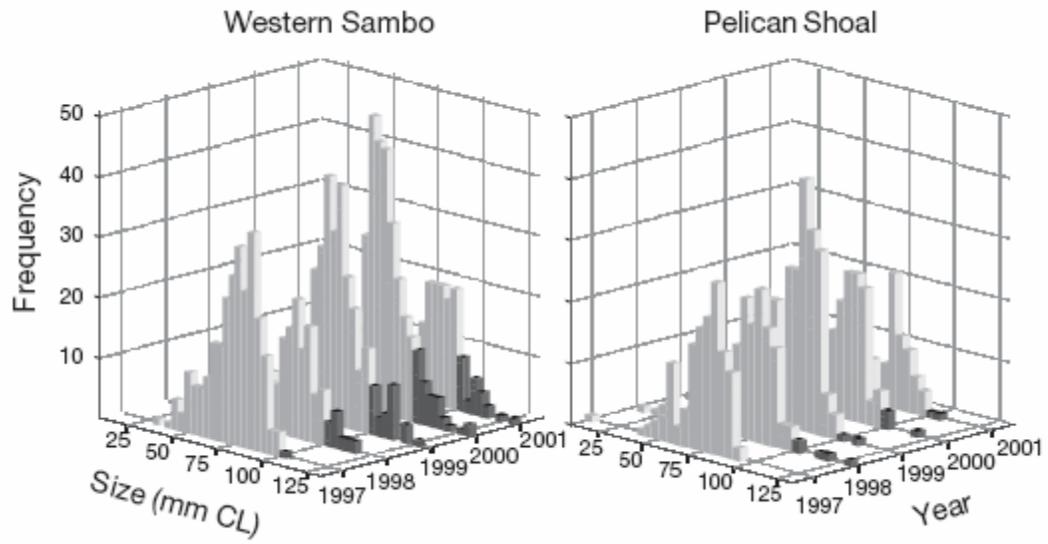


Figure 6. Size frequency of male spiny lobsters in Western Sambo Ecological Reserve and Pelican Shoal (reference area). Dark bars at 100-mm CL shown for comparison.

