Maturity of spiny lobsters in the US Caribbean

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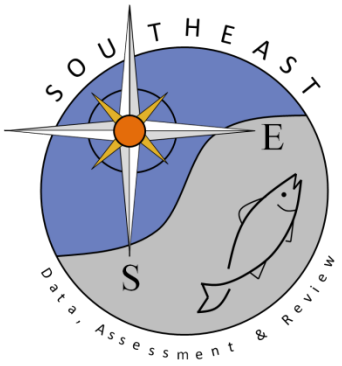

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The imposition of a prohibition of landing berried females has meant that for the last 15 years TIP data has not provided a reliable source of biological samples on lobster maturity. The data presently contained in the TIP database at NOAA SEFSC corresponds to the same data that was analyzed by Bohnsack et al (1992), who provided data on numbers of females with tar spots, egg bearing, and without signs of eggs or tar spots (immature).

This data was examined in more detail than was done by Bohnsack et al (1992), and logistic models were fitted to the proportion of mature females as a function of carapace length in order to estimate length at 50% maturity. Two models were fitted, Model A has two parameters and assumes that at certain size maturity reaches 100 percent, Model B has three parameters and allows for the asymptote of percent maturity been less than 100 percent.

Model A

$$m = \frac{1}{1+e^{-kL-\gamma}}$$

$$L_{50\%m} = \frac{\gamma}{k} - \frac{1}{k} Ln(1)$$

Model B

$$m = \frac{m_{\infty}}{1+e^{-kL-\gamma}}$$

$$L_{50\%m} = \frac{\gamma}{k} - \frac{1}{k} Ln(2\, m_{\infty} - 1)$$

Data available differs between islands. There is data for 10102 females lobsters in Puerto Rico, for 6864 for St. Thomas & St. John and 2,924 for St. Croix. The data for Puerto Rico and St. Thomas & St. John covers lengths from 70 mm to 135 mm whereas for St Croix it only ranges from 84 mm to 135 mm and there are no data for small lobsters between 70 and 83 mm.

Estimates of the proportion mature, (with tar spots and egg bearing as a proportion of the total number of females) were obtained by island and for each length class (in 1/5 inches intervals as measured) from Table 5 from Bohnsack et al 1992. Proportions mature suggest that the proportion mature was close to 100 percent for large lobsters (greater than four inches) in St Croix, but rarely reached 70 percent for Puerto Rico, and St. Thomas & St. John (Figure 1).

The data for St. Croix, as mentioned above, is much more limited than the data for the other two platforms and has very few observations at the lengths were there are significant numbers of immature lobsters. It was therefore decided to aggregate all the data for all islands prior to been fitted to the two models above. Model A did not fit the data as well as model B and a likelihood ratio suggests that the addition of a third parameter significantly improves the fit to the observed data (Figure 2). Estimates of length at 50% maturity however do not differ much between models, and was 92mm for model A and 91 mm for model B. These estimates correspond to 3.6 inches and closely coincide to the current minimum size of 3.5 inches.

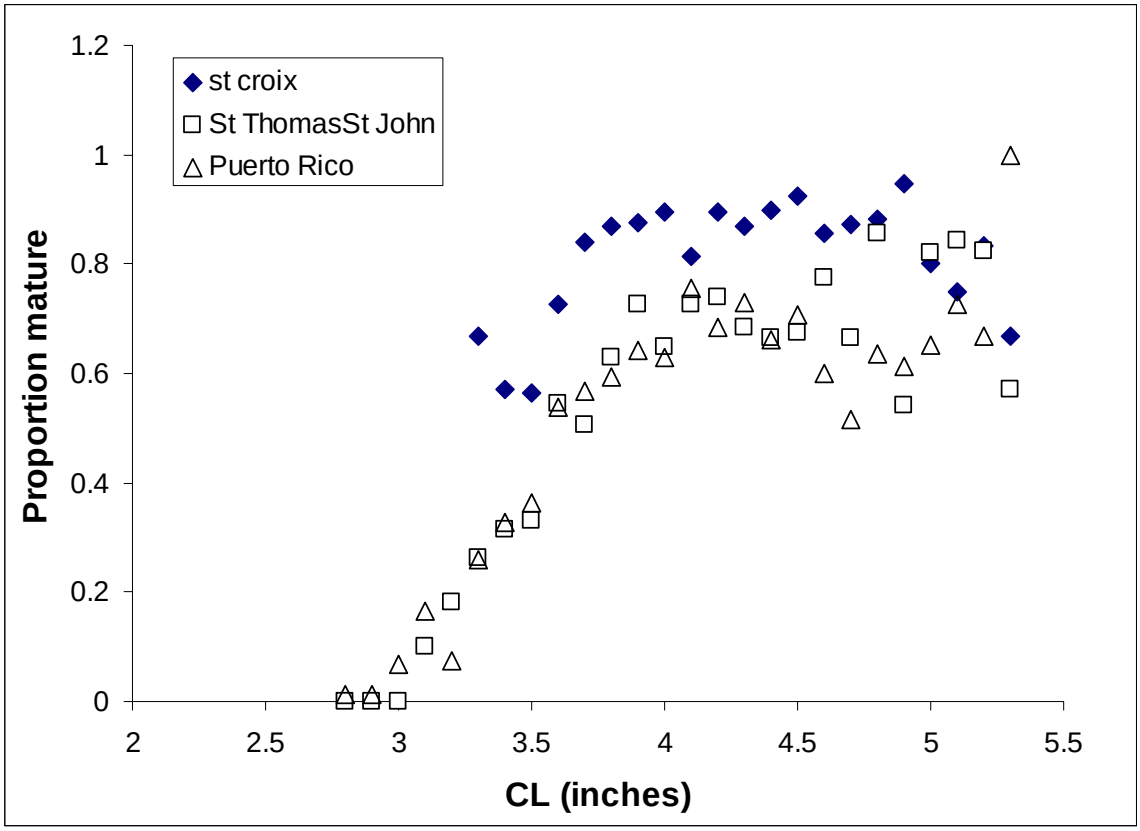

Figure 1: Proportion of mature female lobsters (with tar spots or egg bearing) as a function of carapace length for different island platforms in the US Caribbean.

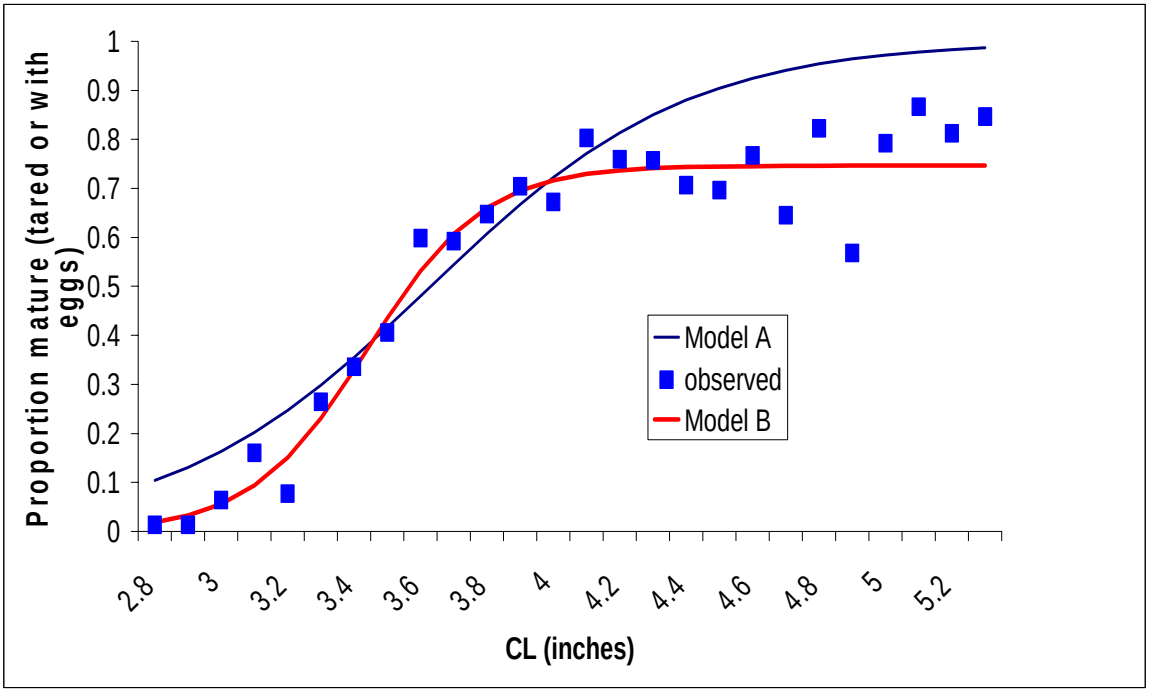

Figure 2: Observed proportion mature of female lobsters as a function of length for the US Caribbean and fits of logistic models to the data. Model A with asymptote equal to 100 percent and Model B with asymptote been estimated.

Table 1: Estimates of parameters for logistic models of proportion mature of female lobsters in the US Caribbean.

Model	k	λ	m_{oo}	SSQ
A	9.4	-2.59	n/a	103,610
B	19.58	-5.69	0.74	23,939