An Analysis of some Morphometric Characteristics of the Spiny Lobster, *Panulirus argus*, in St. Lucia

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ABSTRACT

This paper presents some morphometric relationships for the spiny lobster in St. Lucia, West Indies. The relationships were considered in the light of existing legal size restrictions for the fishery. Carapace length is related to total length by the equations: TL = 87.61 = (1.725 CL) for males and TL = 48.27 = (2.242 CL) for females. Carapace length is related to total weight by the equations: $Wt = 0.030\ CL^{2.216}$ for males and $Wt = 0.024\ CL^{2.270}$ for females. Total length is related to total weight by the equations $Wt = 0.013\ TL^{1.991}$ for males and $Wt = 0.001\ TL^{2.380}$ for females. The multiple regressions derives were Wt = -1341.622 g + (17.219 CL) + (1.6722 TL) (R=0.922) and Wt = -1572.659 g + (15.911 CL) + (3.1058 TL) (R=0.963) for males and females, respectively. It was, however, concluded that only carapace length should be used as the measure of legal size, since the variability of this measurement is less than that of others such as total length and total weight.

INTRODUCTION

Until recently, management of St. Lucia's lobster fishery was controlled by the provisions of the Fisheries (turtle, lobster, and fish protection) Regulations. Pursuant to those regulations, it was illegal to have, expose for sale, sell or purchase "any lobster that is undersized". "Undersized" being defined as (a) less than 25 cm in total length, (b) less than 9.5 cm in carapace length, (c) less than 680 g in weight, or (d) less than 340 g in tail weight. Murray and Jennings-Clark (in press) looked at the extent to which the existing closed season for spiny lobster, *Panulirus argus*, served to keep the fishery on a stable footing. Soares (1990) showed that the period of major reproductive activity for these lobsters, in the north of Brazil, was from January to April, with the months of March to April corresponding to the major occurence of egg-bearing females.

Goodwin *et al.* (1986) investigated various aspects of the biology, ecology, growth and exploitation of *P. argus* in St. Kitts. Gobert (1994) looked at aspects of the exploitation and status of lobster in Martinique and reported minimum legal sizes of 22 cm TL for both sexes, corresponding to 8.4 cm CL and 7.5 cm CL for males and females, respectively. Aiken (1983) considered the effects that lobster conservation laws, introduced in Jamaica in late 1976, had on lobster stocks. None of these studies considered the morphometric characteristics of the species in terms of the legal implications.

The assumptions that a lobster of total length 25 cm TL would have a carapace length of 9.5 cm CL, a total weight of 680 g and a tail weight of 340 g was the basis of the legal definition of undersized mentioned earlier. Among St. Lucia's fisheries biologists and fishermen, there was the intuitive feeling that this was not the case. New all-inclusive regulations were to be drafted, so it became necessary to derive morphometric relationships that would serve as the basis for size restrictions. Murray (1984) has suggested that leaving the legal limits set at levels relevant specifically to *P. argus* would ease the fishing pressure on the other common species: *P. guttatus*. This, it was believed existing regulations would allow for the latter species to serve as a "fall-back" if it ever became necessary to ease the pressure on *P. argus*. Most *P. guttatus* would legally be classed as undersized and, with fishermen adhering to the regulations, would mean that fishing pressure on the smaller species would be nil. This conclusion is subscribed to within the Department of Fisheries, hence, it is in this context that some of the morphometric relationships of *P. argus* are being considered.

METHODS

Lobsters of the species *P. argus*, landed at Savannes Bay in St. Lucia, were measured on the first buying day of the open season of 1990. Measurements of Total length (TL), Carapace length (CL) and Total weight (Wt) were taken. The lengths were measured to the nearest half-centimeters and converted to millimeters. Weights were measured in pounds on a digital scale and converted into grams. Data were inputted into LOTUS 123 version 2.2 and the regression of TL vs CL was calculated. LOTUS was also used to calculate the regressions of ln Wt vs ln CL and ln Wt vs ln TL.

Converted measurements were entered into the program MSTAT (Nissen *et al.*, 1987) and multiple regression analysis was by the routine MULTIREG, with weight as the dependent variable and, in the first instance, carapace length, total length, and sex as independent variables for all 181 observations (122 male and 59 female). The "dummy variables" (c.f. Zar, 1984) of 1 and 2 were used for males and females, respectively. The multiple regression was then repeated by excluding sex as one of the independent variables separately for the two sexes. Zar (1984) outlines a method for selecting the indenpendent variables of the final multiple regression. This involves calculating the regression with all the possible independent variables and then successively reducing their number such that the one with the lowest absolute value, less than the critical value, of the Student t-test parameter is removed. A new multiple regression is then fitted utilizing the remaining independent variables until the only ones left in the final regression have significant t-values; in other words all the partial regression coefficients in the equation are concluded to estimate Bs that are different from zero (Zar, 1984). This method resulted in CL and TL being left as the

independent variables for each of two multiple regressions with the lobsters separated by sex.

RESULTS

Table 1 shows the mean values of CL, TL and Wt for each sex. Carapace length is related to Total length by the equations:

$TL = 87.61 + (1.725\ CL)$ $(r^2 = 0.56)$ for males
and
$TL = 48.27 + (2.242\ CL)$ $(r^2 = 0.83)$ for females

Carapace length is related to Total weight by the equations:

$Wt = 0.030\ CL^{2.216}$ $(r^2 = 0.85)$ for males
and
$Wt = 0.024\ CL^{2.270}$ $(r^2 = 0.91)$ for females

Total length is related to Total weight by the equations:

$Wt = 0.013\ TL^{1.991}$ $(r^2 = 0.54)$ for males
and
$Wt = 0.001\ TL^{2.380}$ $(r^2 = 0.82)$ for females

Total length and weight differed significantly ($p<0.05$: ANOVA) when grouped by sex, but not when grouped by carapace length.

The multiple regressions derived were:

$Wt = -1341.622 + (17.219\ CL) + (1.6722\ TL)$ $(R = 0.922)$
and
$Wt = -1572.659 + (15.911\ CL) + (3.1058\ TL)$ $(R = 0.963)$

for males and females, respectively.

DISCUSSION

Male *P. argus* landed at Savannes Bay in St. Lucia had a larger mean carapace length than the females, but females were larger and heavier (Table 1). This justifies separating the two sexes for the derivation of morphometric relationships. These results also confirm the need to analyze the two sexes separately for growth parameter estimation, as has been done in other studies (*e. g.*, Cruz *et al.*, 1981; Goodwin *et al.*, 1986; Gobert, 1994; and others). However, morphometric relationships here were derived using relatively small numbers of

Table 1. Mean values for morphometric characteristics of male (n = 120) and female (n = 59) *P. argus* in St. Lucia.

SEX	MALE			FEMALE		
Measure	**CL (mm)**	**TL (mm)**	**Wt (g)**	**CL (mm)**	**TL (mm)**	**Wt (g)**
Mean	105.492	269.549	925.517	101.864	276.610	907.158
S. D.	10.629	24.646	233.684	15.422	37.857	369.539
S. E.	0.962	2.231	21.157	2.008	4.929	48.110

individuals within the exploited range of lobster sizes and should be viewed as being preliminary. This notwithstanding, the possibility of a multiple regression relationship between carapace length, total length and weight should be investigated further. Also notable, is the relatively high standard error of the mean for the total length and weight measurements as compared to carapace length. This indicates that the variability in carapace length measurements tend to be less, and is in keeping with Soares' (1990) suggestion that the rigidity of this part of the body makes measurements less prone to error. It would appear that carapace length should be the preferred measurement for the setting of legal size limits.

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