

ANALYSIS OF CARAPACE LENGTH MEASUREMENT AS AN INDICATOR OF SIZE-AT-
RECRUITMENT OF SCARLET KING CRABS *LITHODES COUESI* INTO THE
COMMERCIAL FISHERY IN WATERS ADJACENT TO THE ALASKA PENINSULA

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INTRODUCTION

The size-at-recruitment (or minimum legal retention size) of male scarlet king crabs *Lithodes couesi* into the commercial fishery in coastal waters of Alaska Peninsula is specified under the conditions of an Alaska Department of Fish and Game permit as 139.7mm (5.5 inches) in carapace width (CW) (D. Jackson ADF&G, Kodiak, personal communication). The objective of this investigation was to examine a relationship between carapace length (CL) and CW in a subsample of males observed during the 1996 commercial fishery, and estimate the true mean CL size-at-recruitment from the subsample data.

METHODS AND PROCEDURES

Carapace lengths and widths for male scarlet king crabs were measured in October 1996. Measurements of CW were taken to the nearest millimeter perpendicular to the medial axis at the point of maximum width (including any peripheral spines); CL was measured from the right eye orbit to the midpoint of the posterior margin. A total of 75 male crabs between 96mm and 156mm CL (114mm to 172mm CW) were randomly selected from pots fished by two vessels during the commercial fishery.

A normal distribution of CL and CW was assumed and linear regression using the ordinary least-squares fit (Neter et al. 1983) was used to examine the corresponding relationship between the two variables. The linear model $CL = \beta_0 + \beta_1(CW) + \epsilon$ ($E(\epsilon)=0$) was fit to estimate the true regression line and predict an expected size at recruitment CL.

A probability statement concerning the $100(1-\alpha)\%$ confidence interval (CI) was applied to examine the extent of variability in the linear model at of the expected size-at-recruitment of CL

$$\beta_0 + \beta_1(CW) \pm t_{\alpha/n-2} S_{\beta_0 + \beta_1}$$

where,

β_0 = the estimated intercept of the linear regression model;

β_1 = the estimated line slope of the linear regression model;

CW = 139.7mm (size-at-recruitment);

$t_{\alpha/n-2}$ = critical value of the t distribution at α and $n-2$ degrees of freedom, and;

$S_{\beta_0 + \beta_1}$ = the standard error of the unbiased estimator.

RESULTS AND DISCUSSION

Figure 1 shows a positive linear relationship between male scarlet king crab CW and CL with a .80 correlation coefficient (r). A residual plot of observed versus predicted carapace length also supports application of the linear model (Figure 2). Statistics from the regression analysis are given in Table 1. Based on the model output, the expected male scarlet king crab size-at-recruitment CL equaled 116.7mm at 139.7mm CW with a 95% CI of 114.8 to 118.6mm. The results of the analysis indicates that although a significant relationship of male scarlet king crab CL to CW can be demonstrated, the relatively large confidence interval about the expected mean size-at-recruitment CL suggests that a point estimate of this value would be inappropriate for use in determining the stock component available for commercial harvest.

LITERATURE CITED

Neter, J., W. Wasserman and M. H. Kutner. 1983. Applied Linear Regression Models. Richard D. Irwin Inc., Illinois. 537p.

Table 1. Least Squares Regression Analysis of carapace length and greatest carapace width in male scarlet king crabs sampled during the 1996 Alaska Peninsula commercial fishery.

Regression Statistics	
Correlation coefficient (r)	.80
Coefficient of determination (r^2)	.64
Adjusted r^2	.64
Standard Error	8.0mm
mean carapace length (CL)	119.7
mean carapace width (CW)	143.5
Sample size (n)	75

Linear model output					
	<i>Coefficients</i>	<i>Standard Error</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	7.95	9.83	0.42	-11.64	27.54
Carapace width	0.78	0.07	6.69E-18	0.64	0.91

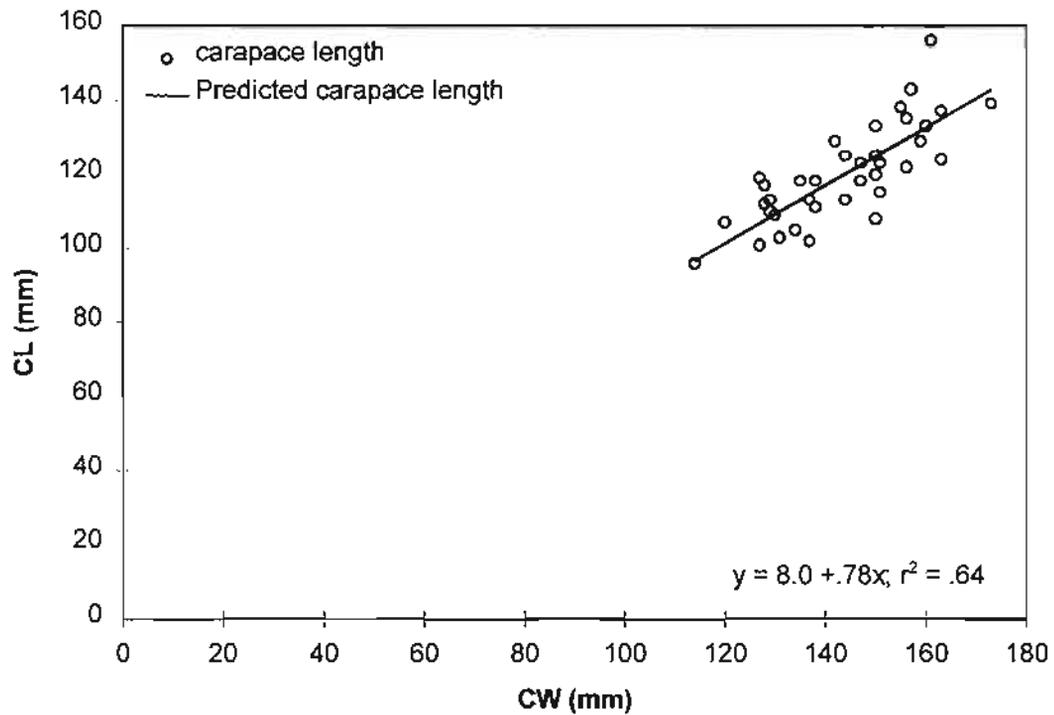


Figure 1. Observed and predicted carapace length correlated to carapace width in male scarlet king crabs sampled during the 1996 Alaska Peninsula commercial fishery.

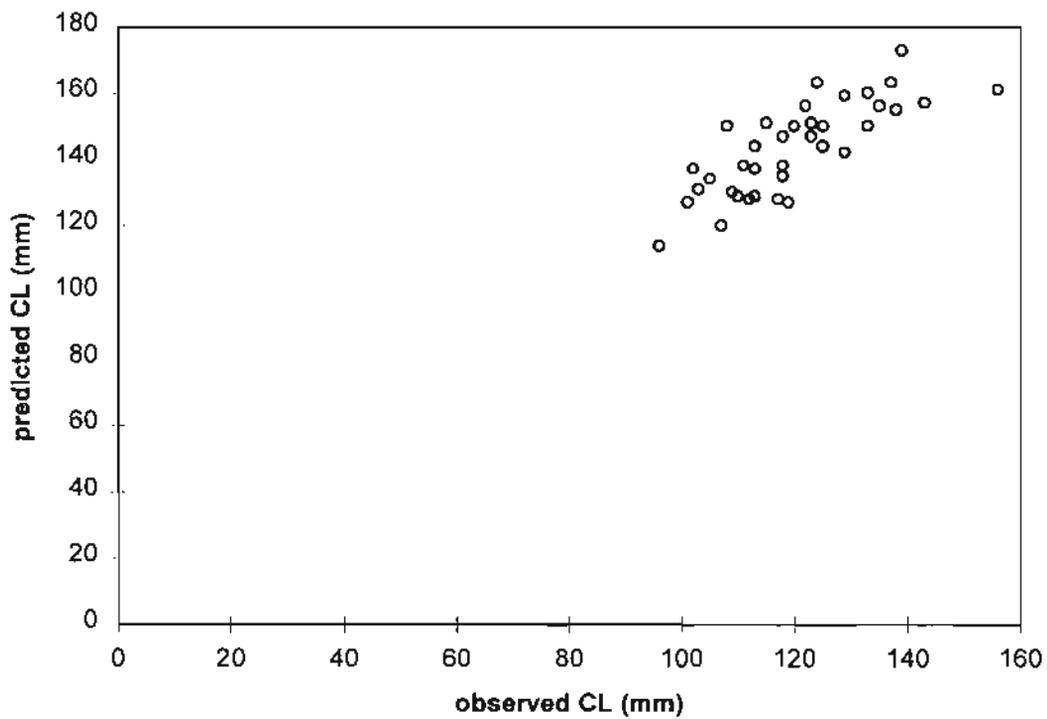


Figure 2. Predicted versus observed carapace length of male scarlet king crabs sampled during the 1996 Alaska Peninsula commercial fishery.

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