A CARAPACE LENGTH MEASUREMENT OF BROWN KING CRABS *LITHODES AEQUISPINA* FOR SIZE-AT-RECRUITMENT INTO THE COMMERCIAL FISHERY IN WATERS ADJACENT TO THE ALEUTIAN ISLANDS, ALASKA

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INTRODUCTION

The size-at-recruitment or minimum legal retention size for male brown king crabs *Lithodes Aequispina* into the commercial fishery in coastal waters of the Aleutian Islands, Alaska is described as 152.4mm (6 inches) in carapace width (CW) in Alaska Department of Fish and Game Commercial Shellfish Regulations (ADF&G 1997). The objective of this investigation was to examine a relationship between carapace length (CL) and CW in a subsample of brown king crab males observed during the 1996/97 commercial fishery, and estimate the true mean CL size-at-recruitment from the subsample data.

METHODS AND PROCEDURES

Carapace lengths and carapace widths for male brown king crabs were measured in April through June 1997. Measurements of CW were taken to the nearest millimeter perpendicular to the medial axis at the point of maximum width (including laterally protruding spines); CL was measured from the right eye orbit to the midpoint of the posterior margin. A total of 249 male crabs between 92 and 179mm CL (and 100 to 202mm CW) were randomly selected from pots fished by several 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 $Y = \beta_o + \beta_1 X + \varepsilon$ ($E(\varepsilon) = 0$) fit an estimated true regression line and predicted 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 CL

$$\beta_o + \beta_1 X^* \pm t_{\alpha/n-2}\, S_{\beta o + \beta 1}$$

where,
β_o = the estimated γ intercept of the linear regression model;
β_1 = the estimated line slope of the linear regression model;
X^* = 152.4 CW (size-at-recruitment);
$t_{\alpha/n-2}$ = critical value of the t distribution at α and n-2 degrees of freedom, and;
$S_{\beta o + \beta 1}$ = the standard error of the unbiased estimator $\beta_o + \beta_1 \chi^*$.

RESULTS AND DISCUSSION

Figure 1 shows a strong linear relationship between male brown king crab CW and CL with a .963 coefficient of determination (r^2). 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 brown king crab size-at-recruitment CL equaled 135.2mm at 152.4mm CW. The application of a 95%CI to the sample data revealed the true mean size-at -recruitment CL within an interval of 134.7 mm to 135.7 mm. The results of the analysis indicates that a very significant relationship of male brown king crab CL to CW can be demonstrated, and that the expected mean size-at-recruitment CL is an appropriate value for use in determining the stock component available for commercial harvest.

LITERATURE CITED

ADF&G (Alaska Department of Fish and Game). Commercial Shellfish Fishing Regulations, 1997-98 edition. Commercial Fisheries Management and Development Division, Juneau.

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 blue king crabs sampled during the 1996 St. Matthew Island fishery.

Regression Statistics	
Correlation coefficient (r)	.97
Coefficient of determination (r^2)	.94
Adjusted r^2	.94
Standard Error	3.9mm
mean carapace length (CL)	136.1mm
mean carapace width (CW)	153.4mm
Sample size (N)	249

Linear model output					
	Coefficients	*Standard Error*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	5.60	2.02	0.01	1.61	9.59
Carapace width	0.85	0.01	3.23E-157	0.82	0.88

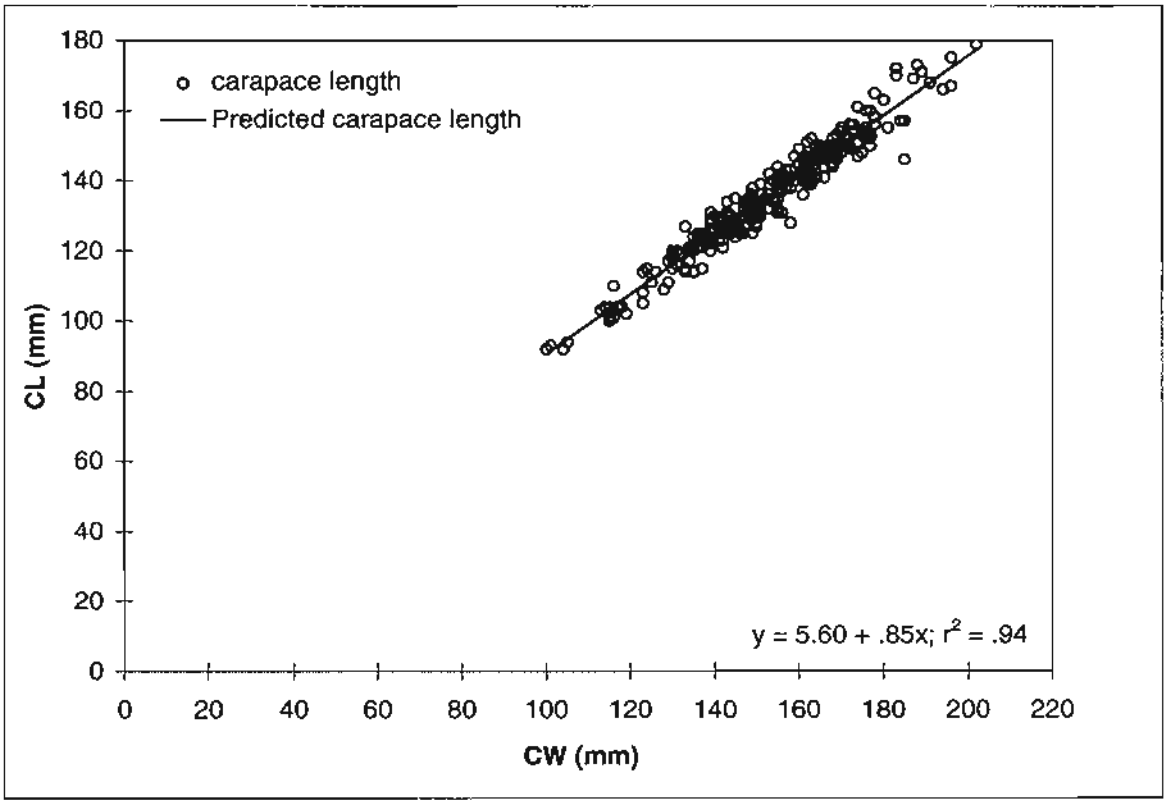

Figure 1. Observed and predicted carapace length correlated to carapace width in brown king crab males sampled during the 1996/97 Aleutian Islands commercial fishery.

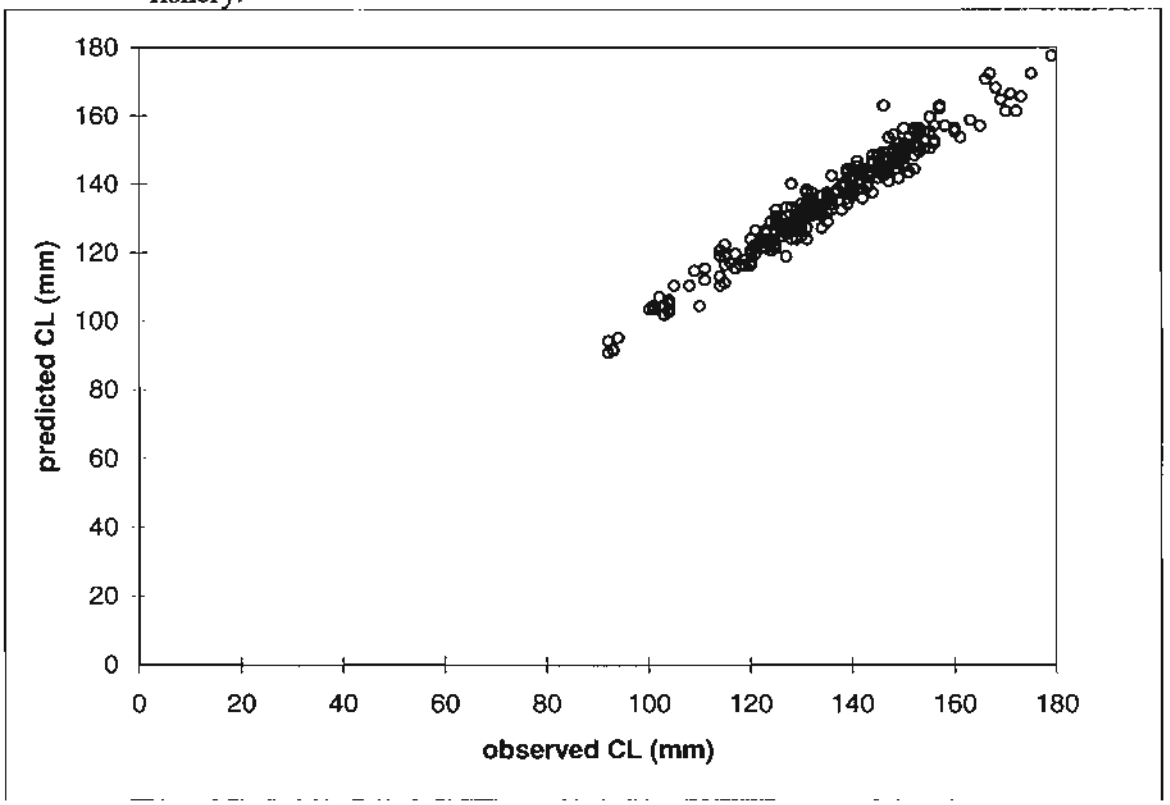

Figure 2. Predicted versus observed carapace length of brown king crab males sampled during the 1996/97 Aleutian Islands commercial fishery.