ESTIMATED MEAN CARAPACE LENGTH AT MINIMUM LEGAL SIZE OF BLUE KING CRABS *PARALITHODES PLATYPUS* IN WATERS ADJACENT TO ST. MATTHEW ISLAND, ALASKA

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INTRODUCTION

The minimum legal retention size of male blue king crabs *Paralithodes platypus* commercially fished in coastal waters of St. Matthew Island in the Bering Sea is described as 5.5 inches (139.7mm) in carapace width (CW) in Alaska Department of Fish and Game Commercial Shellfish Fishing Regulations (ADF&G 1997) and 120mm carapace length (CL) in annual population survey results (Otto et al. 1998). The objective of this investigation was to examine a relationship between CL and CW in a subsample of males observed during the 1996 commercial fishery, and estimate the true mean CL at minimum legal size from the subsample data.

METHODS AND PROCEDURES

Carapace lengths and carapace widths for male blue king crabs were measured in September 1996. Measurements of CW were taken to the nearest millimeter perpendicular to the medial axis at the point of maximum width; CL was measured from the right eye orbit to the midpoint of the posterior margin. A total of 275 male crabs between 69 and 151mm CL (and 79 to 172mm CW) were randomly selected from pots fished by several vessels during the commercial fishery. Linear regression using the ordinary least-squares (Neter et al. 1983) was used to fit the linear model

$$CL = \beta_o + \beta_1(CW) + \varepsilon$$

where ε are assumed normally distributed and independent with $E(\varepsilon) = 0$.

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

$$\beta_o + \beta_1(139.7) \pm t_{\alpha/n-2} S_{\beta o + \beta 1}$$

where,

β_o = the estimated γ intercept of the linear regression model;
β_1 = the estimated line slope of the linear regression model;
CW = 139.7mm (minimum legal size);
$t_{\alpha/n-2}$ = 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 $\beta_o + \beta_1 \chi(139.7)$.

RESULTS AND DISCUSSION

Figure 1 shows a strong linear relationship between male blue king crab CW and CL with a .96 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 king crab size-at-recruitment CL equaled 121.1mm at 139.7mm CW. The application of a 95%CI to the sample data revealed a true mean CL at minimum legal size within an interval of 120.7 mm to 121.5 mm. The results of the analysis indicates that very significant relationship of male blue king crab CL to CW can be demonstrated, and that the expected mean CL at minimum legal size 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.

Otto R. S., J.A. Haaga and R.A. Macintosh. 1998. Report to Industry on the 1997 Eastern Bering Sea Crab Survey. National Marine Fisheries Service, Alaska Fisheries Science Center, Processed Report 98-02, Kodiak.

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 commercial fishery.

Regression Statistics	
Correlation coefficient (r)	.98
Coefficient of determination (r^2)	.96
Adjusted r^2	.96
Standard Error	3.2mm
mean carapace length (CL)	113.4mm
mean carapace width (CW)	130.3mm
Sample size (n)	275

Linear model output					
	Coefficients	*Standard Error*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	6.60	1.28	5.10E-07	4.08	9.13
Carapace width	0.82	0.01	2.57E-197	0.80	0.84

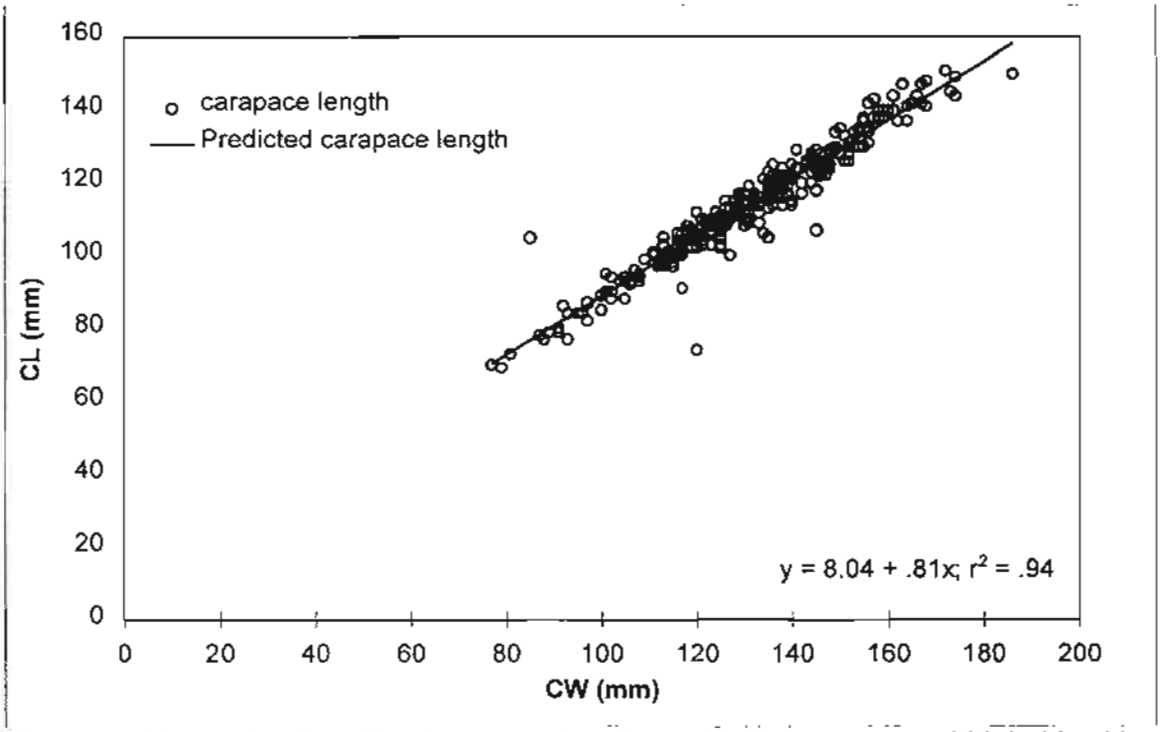

Figure 1. Observed and predicted carapace length correlated to carapace width in blue king crab males sampled during the 1996 St. Matthew Island commercial fishery.

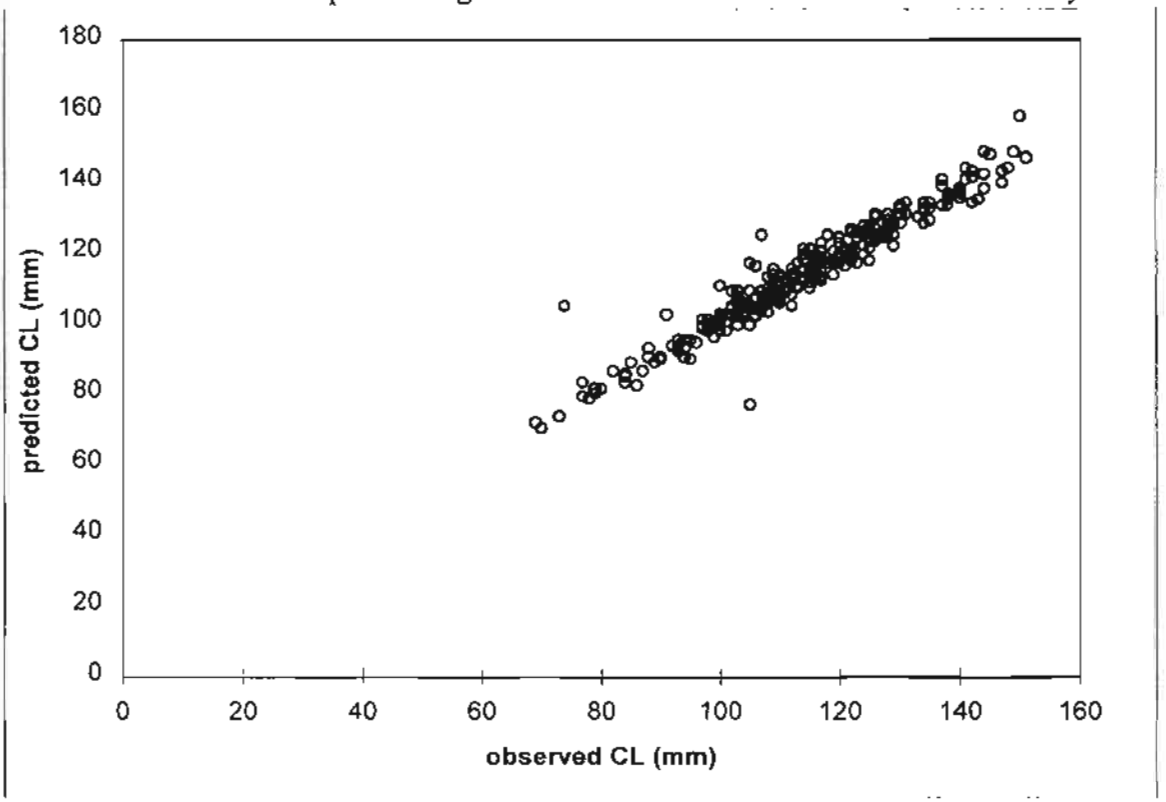

Figure 2. Predicted versus observed carapace length of blue king crab males sampled during the 1996 St. Matthew Islands commercial fishery.

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