

A CARAPACE LENGTH MEASUREMENT OF KOREAN HAIR CRABS *ERIMACRUS*  
*ISEBENCKII* FOR SIZE-AT-RECRUITMENT INTO THE COMMERCIAL FISHERY IN  
WATERS ADJACENT TO THE PRIBILOF ISLANDS, ALASKA

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## INTRODUCTION

The size-at-recruitment or minimum legal size for male Korean hair crabs *Erimacrus isenbeckii* commercially fished in coastal waters of the Pribilof Islands in the Bering Sea is specified under the conditions of an Alaska Department of Fish and Game permit as 82.6mm (3.25 inches) in carapace width (CW) (ADF&G 1993) and 83mm 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 size-at-recruitment from the subsample data.

## METHODS AND PROCEDURES

Carapace lengths and carapace widths for male Korean hair crabs were measured in November 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 303 male crabs between 38 and 109mm CL (and 43 to 119mm CW) were randomly selected from pots fished by a single vessel 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  $Y = \beta_0 + \beta_1 X + \epsilon$  ( $E(\epsilon) = 0$ ) 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

$$\beta_0 + \beta_1 X^* \pm t_{\alpha/n-2} S_{\beta_0 + \beta_1}$$

where,

$\beta_0$  = the estimated  $\gamma$  intercept of the linear regression model;

$\beta_1$  = the estimated line slope of the linear regression model;

$X^*$  = 82.6mm CW (size-at-recruitment);

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

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

## RESULTS AND DISCUSSION

Figure 1 shows a strong linear relationship between male Korean hair crab CW and CL with a .98 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 Korean hair crab size-at-recruitment CL equaled 76.7mm at 82.6mm CW. The application of a 95%CI to the sample data revealed the true mean size-at-recruitment CL within an interval of 76.4 mm to 77.0 mm. The results of the analysis indicates that a significant relationship of male Korean hair crab CL to CW can be demonstrated. Also, the expected size-at-recruitment of 76.7mm CL differs notably from that previously estimated at 83mm CL for this species by Otto and others.

## LITERATURE CITED

- Alaska Department of Fish and Game (ADF&G) 1993. Alaska Department of Fish and Game News Release, Division of Commercial Fisheries Management and Development Division, (unpublished manuscript), Kodiak.
- 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. McIntosh. 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 Korean hair crabs sampled during the 1996 Pribilof Islands commercial fishery.

Regression Statistics					
Correlation coefficient ( $r$ )					.99
Coefficient of determination ( $r^2$ )					.98
Adjusted $r^2$					.98
Standard Error					2.0mm
mean carapace length (CL)					85.3mm
mean carapace width (CW)					91.7mm
Sample size (n)					303
Linear model output					
	<i>Coefficients</i>	<i>Standard Error</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	-1.90	0.77	0.01	-3.41	-0.38
Carapace width	0.95	0.01	2.21E-251	0.94	0.97

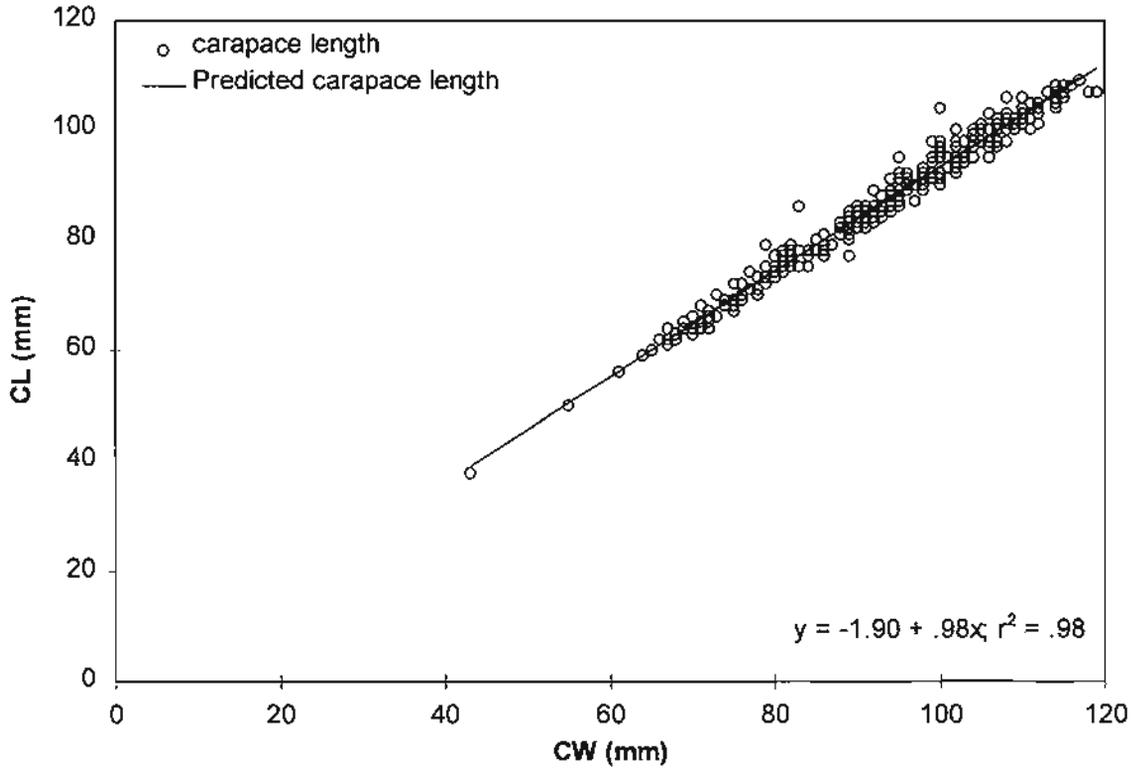


Figure 1. Observed and predicted carapace length correlated to carapace width in Korean hair crab males sampled during the 1996 Pribilof Islands commercial fishery.

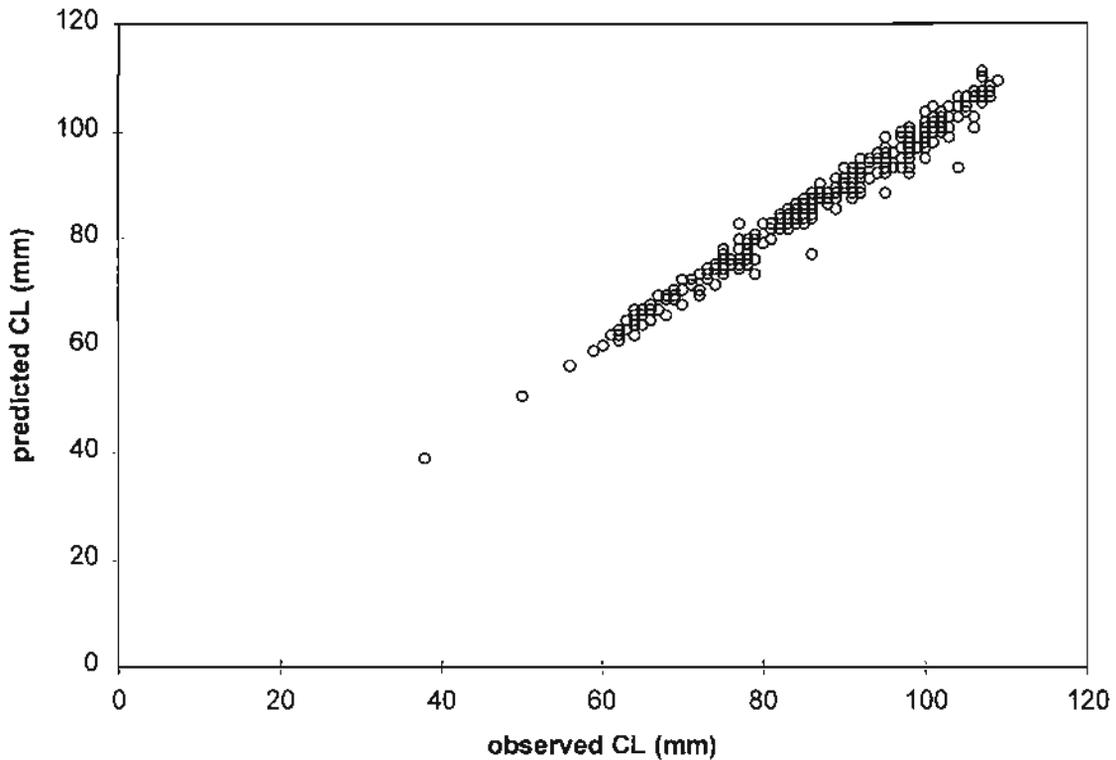


Figure 2. Predicted versus observed carapace length of Korean hair crab males sampled during the 1996 Pribilof Islands commercial fishery.

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