

ESTIMATED MEAN CARAPACE WIDTH AT MINIMUM LEGAL SIZE OF DEEP
SEA TANNER CRABS *CHIONOCETES TANNERI* IN WATERS ADJACENT TO THE
ALASKA PENINSULA

by
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INTRODUCTION

The minimum legal retention size (or size-at-recruitment) of male deep sea Tanner crabs *Chionocetes tanneri* commercially fished in coastal waters of the Alaska Peninsula is 139.7mm (5.5 inches) in greatest carapace width (GCW), which includes all protruding lateral spines (Pengilly and Jackson, ADF&G Kodiak 1997). The objective of this investigation was to examine the relationship between GCW and “biological” carapace width (CW), which excludes measurement of any lateral spines, in a sample of males observed during the 1996 commercial fishery, and estimate the true mean CW at minimum legal size.

METHODS AND PROCEDURES

Biological and greatest carapace widths for male deep sea Tanner crabs were sampled in October 1996 from the commercial catch Southern District of the Alaska Peninsula commercial fishery. Measurements of GCW were taken to the nearest millimeter perpendicular to the medial axis at the point of maximum width, including any spines at the periphery; CW was measured to the nearest millimeter perpendicular to the medial axis at the point of maximum width, not including spines at the periphery. A total of 314 male crabs between 28 and 172mm CW (and 40 to 188mm GCW) were randomly selected from pots fished by two vessels during the commercial fishery. Linear regression using the ordinary least-squares (Neter et al. 1983) was used to fit the linear model

$$CW = \beta_0 + \beta_1(GCW) + \epsilon$$

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

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 minimum legal size CW

$$\beta_0 + \beta_1(139.7) \pm t_{\alpha/n-2} S_{\beta_0 + \beta_1}$$

where,

β_0 = the estimated intercept of the linear regression model;

β_1 = the estimated line slope of the linear regression model

GCW = 139.7mm (minimum legal size);

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

$S_{\beta_0 + \beta_1}$ = the standard error of the unbiased estimator $\beta_0 + \beta_1(139.7)$.

RESULTS AND DISCUSSION

Figure 1 shows a strong linear relationship between male deep sea Tanner crab GCW and CW with a .98 coefficient of determination (r^2). A plot of jittered residuals (Cleveland 1943) and predicted CW 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 deep sea Tanner crab size-at-recruitment CW equaled 133.8mm at 139.7mm GCW. The application of a 95%CI to the sample data revealed the true mean size-at-recruitment CW within an interval of 133.5 mm to 134.1 mm. The results of the analysis indicates that a very significant relationship of male deep sea Tanner crab CW to GCW can be demonstrated, and that the expected mean size-at-recruitment CW is an appropriate value for use in determining the stock component available for commercial harvest.

LITERATURE CITED

- Cleveland, W., 1943. Visualizing Data. Hobart Press, New Jersey. 360p.
- Neter, J., W. Wasserman and M. H. Kutner. 1983. Applied Linear Regression Models. Richard D. Irwin Inc., Illinois. 537p.
- Pengilly, D., D. Jackson 1997. Proposed allowable harvest levels in for the Westward Region *Chionocetes tanneri* fisheries in 1997. Alaska Department of Fish and Game memorandum, Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development Division, (unpublished manuscript), Kodiak.

Table 1. Least Squares Regression Analysis of biological carapace width and greatest carapace width in male deep sea Tanner crabs sampled during the 1996 Alaska Peninsula commercial fishery.

Regression Statistics	
Correlation coefficient (r)	.99
Coefficient of determination (r^2)	.98
Adjusted r^2	.98
Standard Error	2.6mm
mean biological carapace width (CW)	127.6mm
mean greatest carapace width (GCW)	133.3mm
Sample size (n)	314

Linear model output					
	<i>Coefficients</i>	<i>Standard Error</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	-0.27	0.96	0.78	-2.17	1.62
Carapace width	0.96	0.01	5.73E-278	0.95	0.97

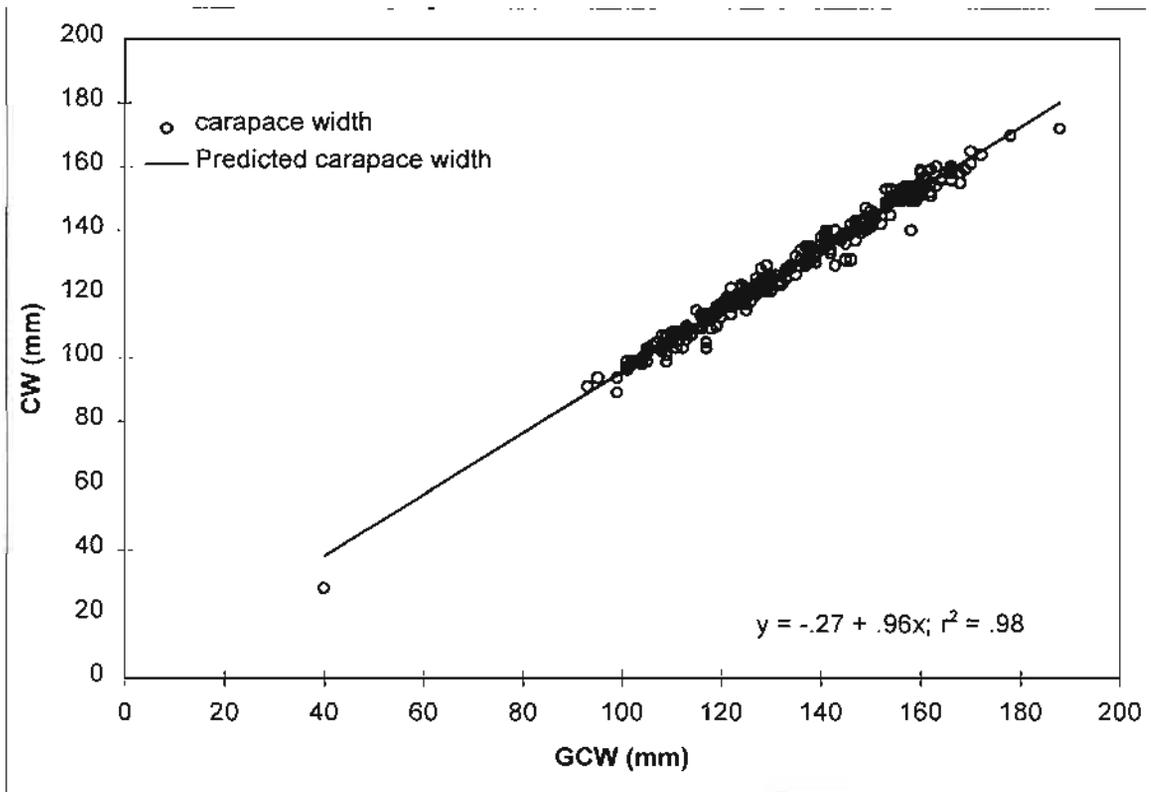


Figure 1. Observed and predicted biological carapace width correlated to greatest carapace width in deep sea Tanner crab males sampled during the 1996 Alaska Peninsula commercial fishery.

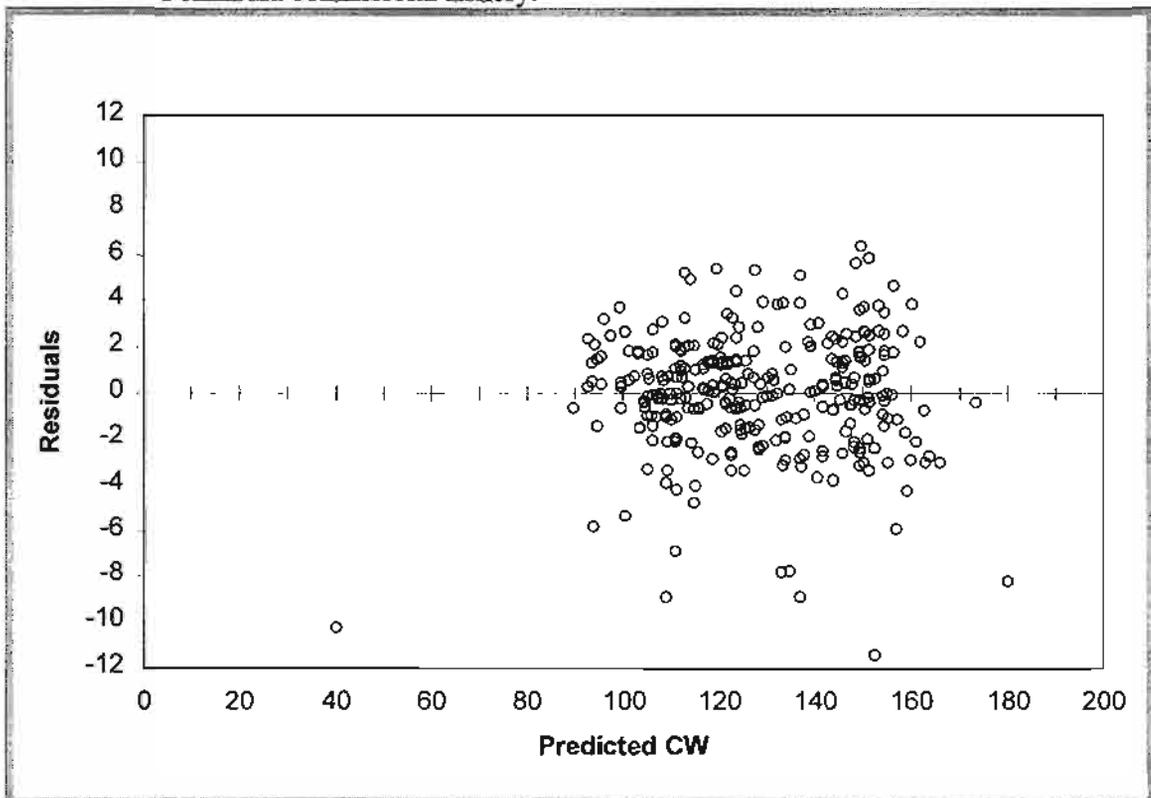


Figure 2. Residual values from linear regression analysis of carapace width in male deep sea Tanner crabs sampled during the 1996 Alaska Peninsula commercial fishery.

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