Informational Leaflet 2

LENGTH-WIDTH RELATIONSHIPS OF CARAPACE MEASUREMENTS OF THE KING CRAB (Paralithodes camtschatica)

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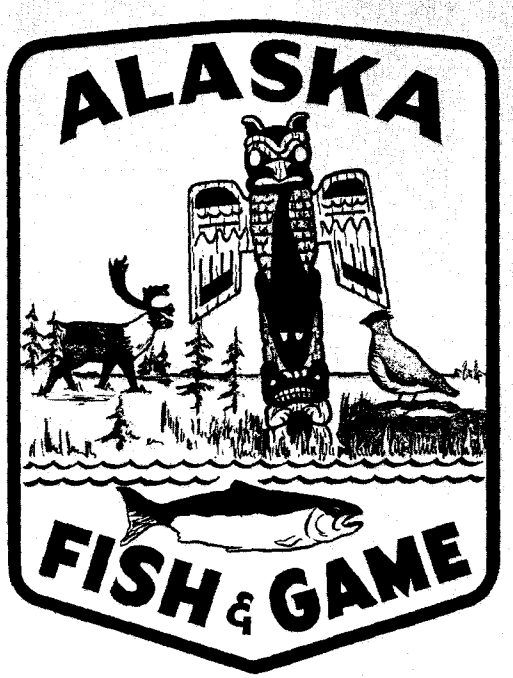
October, 1961



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Length-Width Relationships of Carapace Measurements of the King Crab

(Paralithodes camtschatica)

By

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INTRODUCTION

Gathering biological data such as length and width measurements of individuals in an animal population is a time-consuming and therefore expensive task. Any approach which would expedite such work is welcomed, provided the validity of the data is not impaired. In the following pages are statistics reckoned from field data gathered on king crabs both in the fishery and on research expeditions. The primary objective in this treatment was to eliminate one measurement, that of width of carapace, in the recording of data in the field. The difficulty involved in measuring carapace width is evident upon examination of the compressibility of the shell in the area of width measurements. The flexibility of the sides of the shell leaves to judgment of the individual the degree of pressure to apply in closing the jaws of the vernier calipers. This, of course, is undesirable as it would introduce another variable to be considered in any application of the data. It was felt that carapace widths could be computed from data previously recorded if a mathematical relationship could be proven.

Inspection of data taken on male king crabs in the Chiniak Bay area on Kodiak Island suggested that a lineal relationship does exist. A lineal regression of width on length was computed and a least squares line fitted to a scatter diagram. The fit is reflected by a correlation coefficient of $r = .9992$.

Data from two other king crab fishing areas of Alaska were available and the same statistics were derived from them.

This information is being circulated to individuals involved in king crab research and management in hopes that it may contribute as an aid in the gathering of data.

LENGTH-WIDTH RELATIONSHIPS

Carapace length-width data were analyzed for three areas. Data from Chiniak Bay is from the male king crabs measured and tagged by Alaska Department of Fish and Game personnel in June, 1958. Data from southeastern Bering Sea is from Wallace (1949) and data from Kachemak Bay, Bright (1960).

Data from all three areas were refined by taking the average of several width measurements for each 1 mm increment in length. Basic statistics appear in Table 1.

Table 1. Basic statistics for analysis of male king crab length-width data from Chiniak Bay, Kachemak Bay, and southeastern Bering Sea.

Area	N	Slope b	Intercept a	Correlation coefficient r^1	Equation
Chiniak	106	1.2623	-14.34	0.9992	y = -14.34 + 1.2623x
Kachemak	86	1.2714	-15.12	0.9956	y = -15.12 + 1.2714x
SE Bering Sea	89	1.2698	-14.11	0.9599	y = -14.11 + 1.2698x

[1] $p < 0.001$

Data were tested at the 99% confidence level for a significant difference between slopes (b values). There is no significant difference; (Figure 1); however, it is of interest to note the wide confidence limits for Kachemak Bay data. This implies a difference in accuracy of measurements or perhaps a mixing of stocks.

Finally, Chiniak data (Figure 2) were tested for significance of regression, hypothesis $\beta = 0$). Since ratio of mean square for regression on length and mean square for residual (Table 2) furnish an F value that is significant beyond the 1% confidence level, the hypothesis $\beta = 0$ is rejected.

Table 2. Analysis of variance, Chiniak data.

	d.f.	S.S.	M.S.
Regression on length	1	162,421	162,420
Residual	104	237	2.278846
TOTAL	105	162,658	

The other two areas were tested in the same manner and also found to be significant at the 1% level.

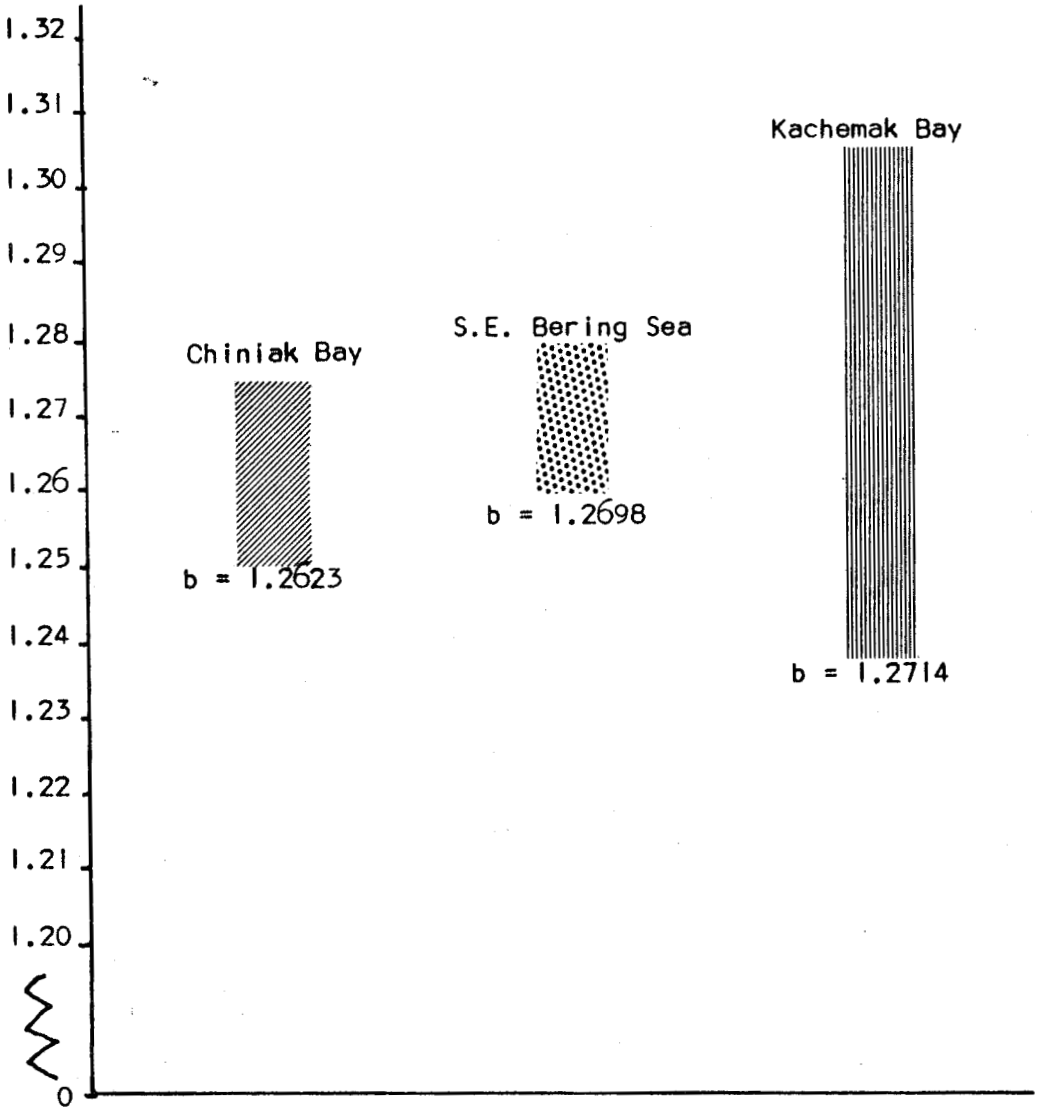

Figure 1. 99% confidence limits for slopes of regression of carapace width on carapace length of male king crabs from three different areas.

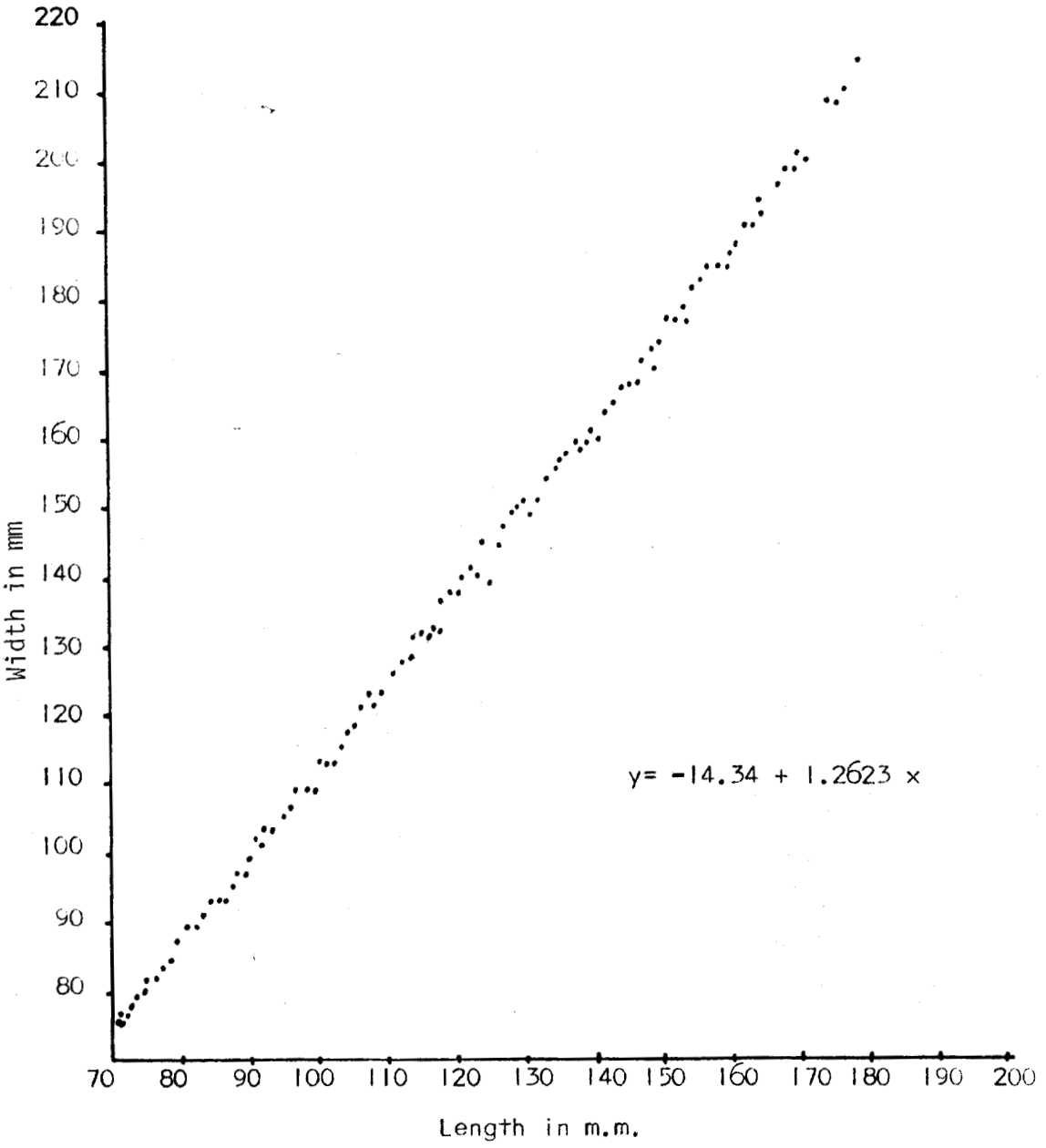

Figure 2. Regression of carapace width on carapace length of male king crabs measured in Chiniak Bay in 1958.

CONCLUSIONS

Based on the foregoing analysis we conclude:

1. It is valid to construct a length-width conversion table from measurements of king crab in Chiniak Bay. This conversion appears in Table 3.

2. There is no significant difference between slopes of regression lines for data from Chiniak Bay (1958), southeastern Bering Sea (Wallace 1949) and Kachemak Bay (Bright 1960). Kachemak Bay confidence limits (99%) are wider than those for the other two areas.

3. Regression for carapace width on carapace length of male king crabs in three areas is definitely linear.

SUMMARY

Because taking both carapace length and carapace width measurements of male king crabs requires more time than taking only the length measurement, and because width measurements are subject to greater error, a (calculated width) was developed and is presented.

Data from male king crabs measured in Chiniak Bay (Kodiak Island), southeastern Bering Sea and Kachemak Bay (Cook Inlet) are analyzed and compared. We found no significant difference between slopes of the carapace width-length relationship lines from the three areas. Tests also showed that the length-width relationship for Chiniak Bay data was definitely linear.

Hence validity of the conversion (carapace length to width) is well established.

ACKNOWLEDGMENTS

We wish to thank Guy C. Powell, shellfish biologist, for contributing unanalyzed data from Chiniak Bay, and Donald B. Siniff, biometrician, for helpful suggestions in statistical analysis of data. Both are with Alaska Department of Fish and Game.

TABLE 3

CONVERSION, LENGTH-WIDTH
IN MILLIMETERS
CHINIAK BAY DATA

L	W	L	W	L	W	L	W
70	74.0	105	118.2	141	163.6	177	209.1
71	75.3	106	119.5	142	164.9	178	210.4
72	76.6	107	120.7	143	166.2	179	211.6
73	77.8	108	122.0	144	167.4	180	212.9
74	79.1	109	123.2	145	168.7	181	214.1
75	80.3	110	124.5	146	170.0	182	215.4
76	81.6	111	125.8	147	171.2	183	216.7
77	82.9	112	127.0	148	172.5	184	217.9
78	84.1	113	128.3	149	173.8	185	219.2
79	85.4	114	129.6	150	175.0	186	220.4
80	86.6	115	130.8	151	176.3	187	221.7
81	87.9	116	132.1	152	177.5	188	223.0
82	89.2	117	133.4	153	178.8	189	224.2
83	90.4	118	134.6	154	180.1	190	225.5
84	91.7	119	135.9	155	181.3	191	226.8
85	93.0	120	137.1	156	182.6	192	228.0
86	94.2	121	138.4	157	183.8	193	229.3
87	95.5	122	139.7	158	185.1	194	230.6
88	96.7	123	140.9	159	186.4	195	231.8
89	98.0	124	142.2	160	187.6	196	233.1
90	99.3	125	143.4	161	188.9	197	234.3
91	100.5	126	144.7	162	190.2	198	235.6
92	101.8	127	146.0	163	191.4	199	236.9
93	103.1	128	147.2	164	192.7	200	238.1
94	104.3	129	148.5	165	194.0	201	239.4
95	105.6	130	149.8	166	195.2		
96	106.8	131	151.0	167	196.5		
97	108.1	132	152.3	168	197.7		
98	109.4	133	153.6	169	199.0		
99	110.6	134	154.8	170	200.3		
100	111.9	135	156.1	171	201.5		
101	113.2	136	157.3	172	202.8		
102	114.4	137	158.6	173	204.0		
103	115.7	138	159.9	174	205.3		
104	116.9	139	161.1	175	206.6		
		140	162.4	176	207.8		

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