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CARAPACE WIDTH - MERUS LENGTH RELATIONSHIP FOR BRISTOL BAY RED KING CRAB AND A MINIMUM SIZE LIMIT BASED ON MERUS LENGTH

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INTRODUCTION

Legal minimum size limits for all species of crab commercially harvested in Alaska are currently defined in terms of carapace width. Enforcement of size limits is determined by measuring widths from samples of commercially captured crab at unloading facilities. Recently there has been an increase in the number of catcher-processor vessels that have the capability to process their catch into frozen sections at sea. Since this method of processing results in carapaces being discarded before vessels return to port, there is at present no way to insure that catcher-processor vessels are complying with minimum size limits except through observers. It has been suggested that compliance with legal size limits be enforced through the use of some measurement that can be readily taken on frozen leg sections. One measurement which may be appropriate for this is the length of the largest leg section, or merus of the second walking leg (Figure 1).

OBJECTIVE

Somerton (1979), discussed the merus length - carapace width relationships of Tanner crabs, *Chionoecetes bairdi* and *C.opilio* and the blue king crab *Paralithodes platypus*, from the eastern Bering Sea. The objective of this study was to describe the merus length - carapace width relationship for male red king crab, *Paralithodes camtschatica*, of the Bristol Bay population.

METHODOLOGY

Male king crab were collected during the Bristol Bay test fishery during January 1988. The crab were delivered alive to a processing facility at Dutch Harbor. Individually numbered tags were attached to the right merus of the second walking leg of each crab. Carapace width (including spines) and the right merus length from the second walking leg were obtained with calipers to the nearest millimeter from 181 individuals (Appendix A.1) and recorded by tag number. Cannery personnel butchered each crab and cooked each section. Sections were then frozen for a 24 hour period. Merus lengths were again obtained after cooking and after freezing and recorded by tag number.

Maximum carapace width - merus length measurements were plotted for live, cooked and frozen crab. A regression line was fitted to each data set with 95 and 99 percent confidence intervals calculated.

RESULTS AND DISCUSSION

Maximum carapace width - merus length relationships for live, cooked and frozen samples are depicted in Figures 2-4 respectively. Ninety-five and 99 percent of

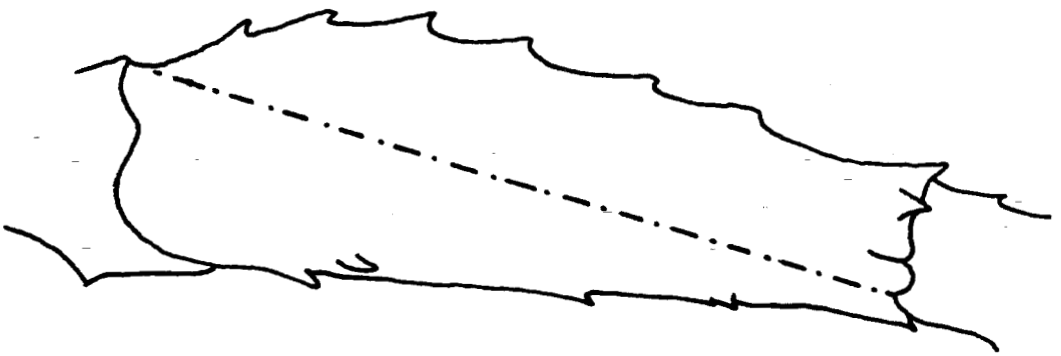

Figure 1. Merus length measurement for *P. camtschatica*.

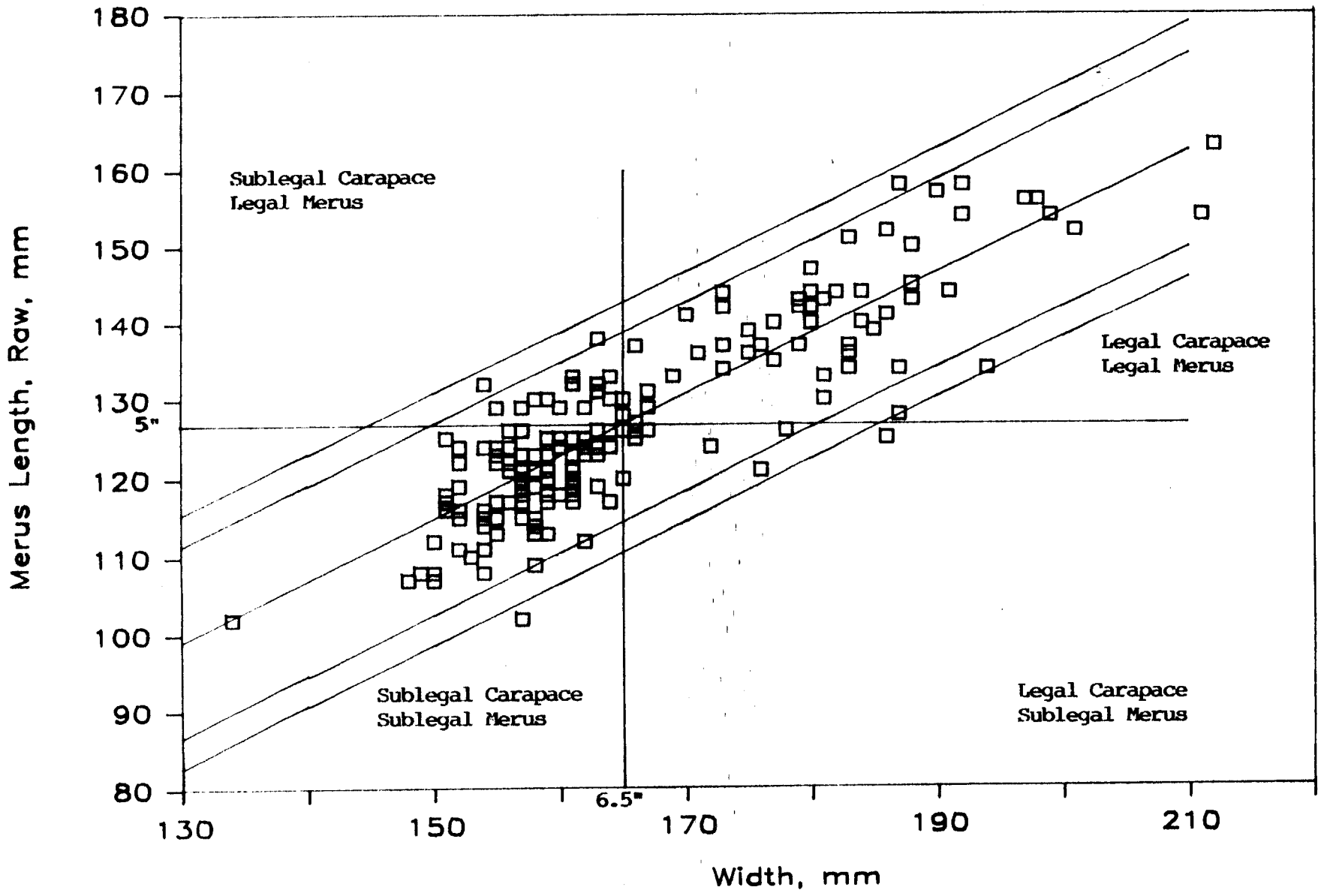

Figure 2. Merus length - maximum carapace width relationship for live (raw) male king crab P. camtschatca. Shown are estimated regression line, 95 and 99% confidence intervals and legal width measurement.

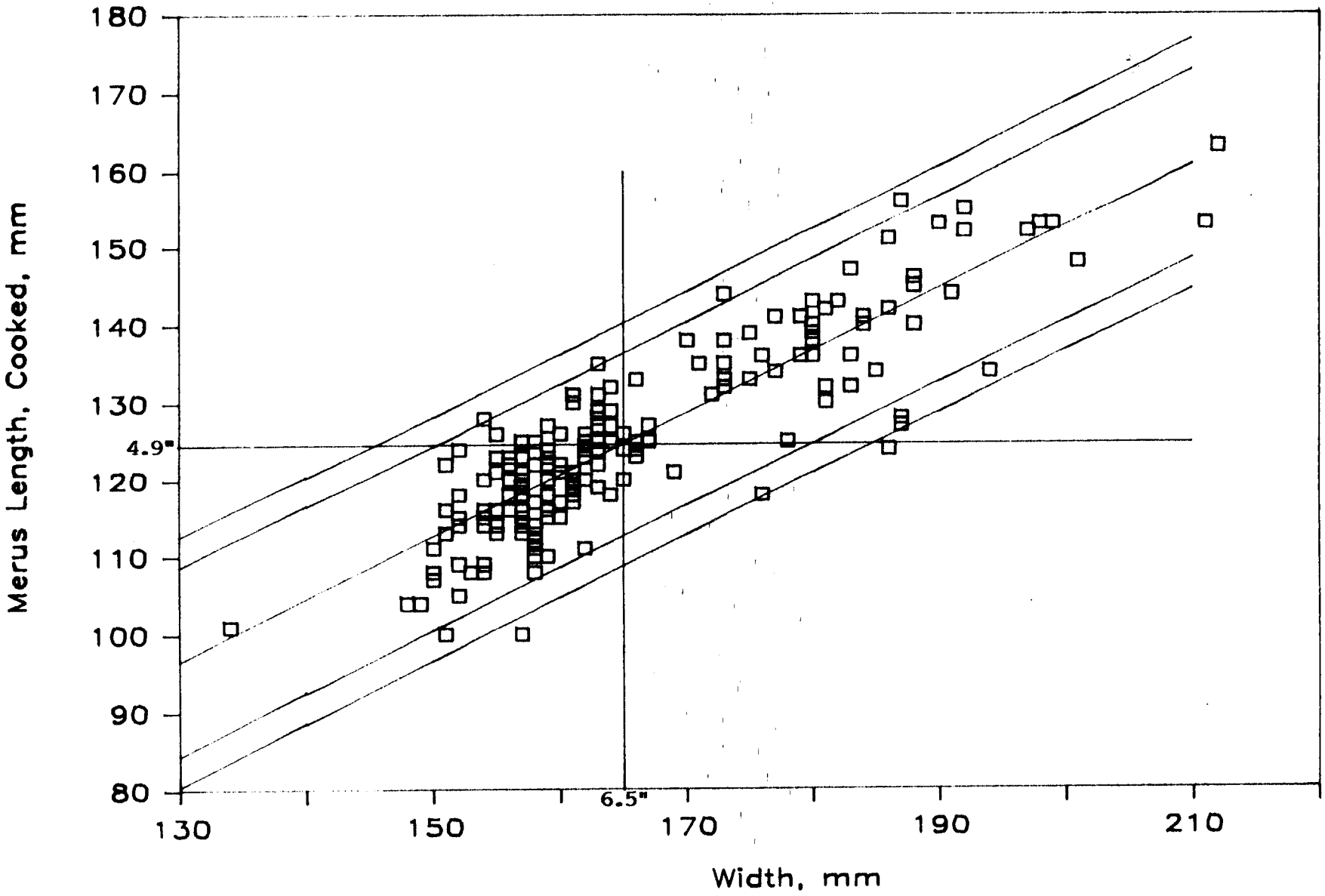

Figure 3. Merus length - maximum carapace width relationship for cooked male king crab P. camtschatica. Shown are estimated regression line, 95 and 99% confidence intervals and legal width measurement.

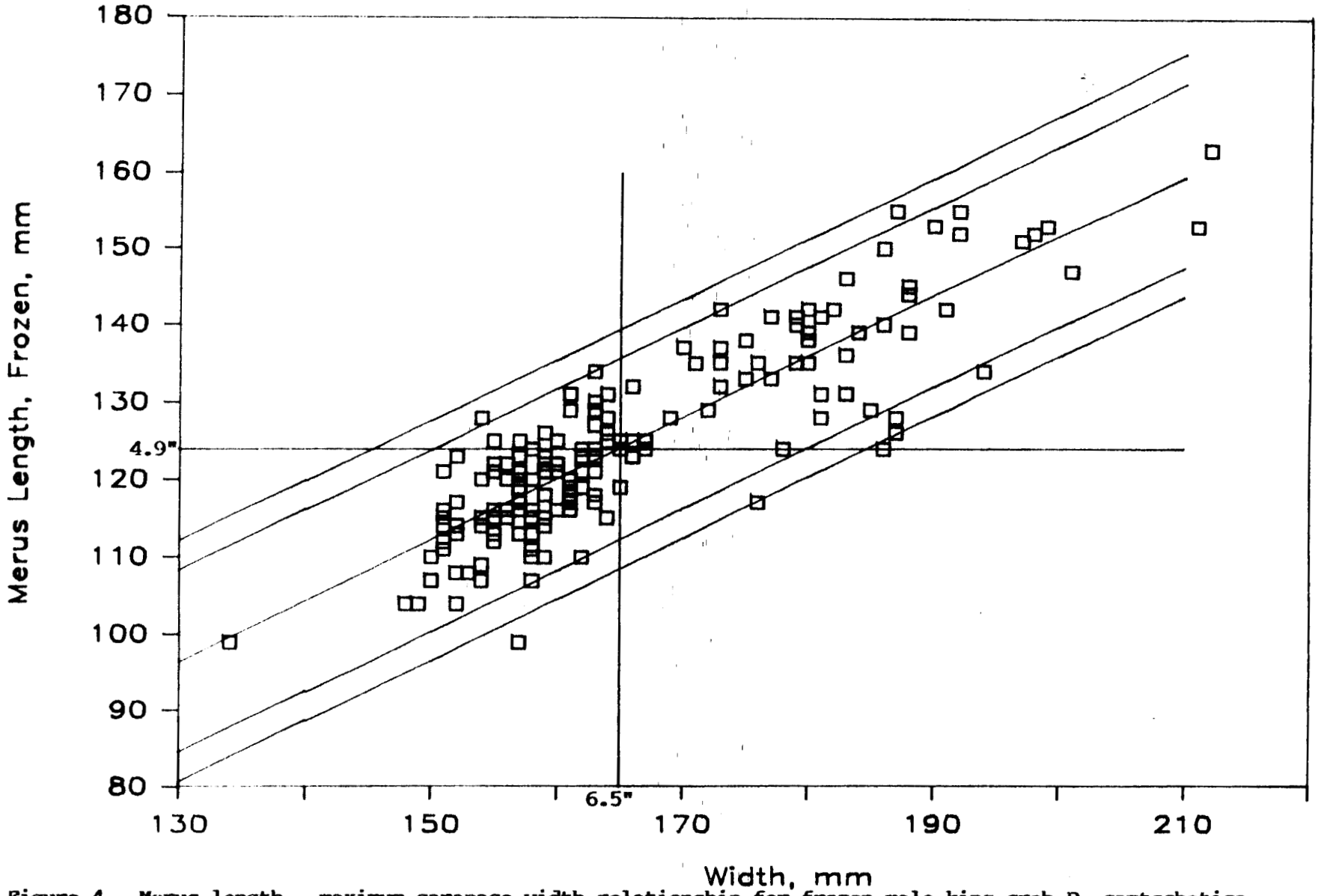

Figure 4. Merus length - maximum carapace width relationship for frozen male king crab P. camtschatica. Shown are estimated regression line, 95 and 99% confidence intervals and legal width measurement.

the crabs at a carapace width have merus lengths that are within the specified confidence interval. The legal minimum carapace width of 165 mm is equal to the following merus lengths: 126.7 mm live, 124.6 mm cooked, 124.0 mm frozen. It is apparent from the data that shrinkage usually occurs to the exoskeleton of the merus during processing and that there is variability associated with the carapace width - merus length relationship. As an example, if a merus length of 127 mm is chosen as the legal minimum based on the intersection of 165 mm carapace width line with the regression line on figure 2, then a cooked merus would be legal size down to 125 mm and a frozen merus would be legal down to 124 mm. Figure 2 provides a means of assessing management options utilizing a merus length size limit. The current 6.5 inch minimum size is depicted by the solid vertical line. If there were negligible variability about the merus length - carapace width relationship, then the appropriate minimum merus length would be read off the left hand scale at the same level as the intersection between the current size limit line and the regression line. However, the variability is large enough to introduce several potential management problems as discussed by Somerton (1979).

LITERATURE CITED

Somerton, David 1979. Several options for using leg measurements on frozen crab sections to determine compliance with minimum size regulations for Tanner crab (*Chionoecetes bairdi* and *C. opilio*) and blue king crab (*Paralithodes platypus*) in the eastern Bering Sea. Norfish tech. rpt. 93, Washington sea grant program.

Appendix A.1. Red king crab data from the 1988 Bristol Bay test fish program.

	CARAPACE		MERUS LENGTH (mm)		
	Width (mm)[1]	Length (mm)[2]	Raw	Cooked	Frozen
1	154	128	124	120	120
2	157	132	126	125	125
3	158	139	109	108	107
4	160	134	121	122	122
5	187	154	158	156	155
6	164	142	130	129	128
7	154	123	111	109	109
8	162	132	123	123	121
9	156	133	124	122	122
10	159	130	123	122	121
11	163	133	131	129	129
12	134	113	102	101	99
13	158	132	114	113	113
14	150	125	112	111	110
15	163	135	132	131	130
16	192	156	158	155	155
17	157	129	119	119	119
18	161	131	119	118	116
19	157	132	117	114	113
20	155	128	113	113	112
21	165	133	120	120	119
22	164	139	126	125	125
23	159	131	120	120	118
24	163	137	124	124	123
25	157	127	120	120	119
26	157	131	118	118	117
27	156	132	117	116	115
28	162	136	124	123	123
29	155	129	124	123	122
30	155	125	117	116	115
31	158	130	115	114	113
32	199	163	154	153	153
33	161	133	118	118	117
34	152	130	124	124	123
35	164	136	133	132	131
36	154	127	115	115	115
37	155	135	122	121	121
38	163	136	131	129	129
39	157	133	121	121	120
40	162	134	112	111	110
41	154	128	114	114	114

-Continued-

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	CARAPACE		MERUS LENGTH (mm)		
	Width (mm)[1]	Length (mm)[2]	Raw	Cooked	Frozen
42	158	131	123	122	120
43	161	136	132	131	131
44	152	129	115	115	113
45	181	150	130	130	128
46	159	134	125	122	121
47	161	131	120	120	119
48	158	130	113	111	111
49	155	130	123	123	121
50	152	124	115	114	113
51	157	135	117	116	116
52	160	132	118	117	116
53	151	130	116	116	115
54	159	132	123	123	122
55	156	131	121	120	120
56	181	145	133	132	131
57	162	134	125	125	123
58	154	130	116	116	115
59	150	126	108	107	107
60	161	132	117	117	116
61	161	136	120	120	118
62	166	135	126	125	125
63	155	128	115	114	113
64	159	129	117	116	115
65	171	142	136	135	135
66	162	133	125	124	123
67	150	129	107	108	107
68	177	142	135	134	133
69	163	139	119	119	117
70	194	158	134	134	134
71	212	172	163	163	163
72	159	132	125	124	123
73	197	161	156	152	151
74	156	128	126	123	122
75	160	133	129	126	125
76	159	132	121	118	118
77	176	136	121	118	117
78	151	130	118	100	114
79	198	156	156	153	152
80	165	135	128	124	124
81	157	131	121	118	116
82	163	138	138	135	134
83	154	125	111	108	107

-Continued-

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	CARAPACE		MERUS LENGTH (mm)		
	Width (mm)[1]	Length (mm)[2]	Raw	Cooked	Frozen
84	184	149	144	140	139
85	163	136	124	122	121
86	159	132	130	127	126
87	151	126	116	113	111
88	187	157	134	128	128
89	152	126	111	109	108
90	161	134	123	121	120
91	183	155	151	147	146
92	157	132	123	119	119
93	155	127	117	116	116
94	154	129	132	128	128
95	151	124	117	116	116
96	153	125	110	108	108
97	152	133	119	115	114
98	166	135	127	123	123
99	188	151	150	146	145
100	151	131	125	122	121
101	159	133	113	110	110
102	180	149	147	143	142
103	163	137	132	128	127
104	166	140	137	133	132
105	167	134	129	127	125
106	160	133	125	115	122
107	180	148	140	136	135
108	211	175	154	153	153
109	167	141	126	125	124
110	183	150	137	136	136
111	186	153	152	151	150
112	180	149	144	140	139
113	186	148	125	124	124
114	192	157	154	152	152
115	170	141	141	138	137
116	179	149	142	141	140
117	188	151	143	140	139
118	173	144	137	135	135
119	183	147	134	132	131
120	179	145	137	136	135
121	180	143	140	138	138
122	175	143	144	144	142
123	180	155	142	139	138
124	187	154	128	127	126
125	176	143	137	136	135

-Continued-

Appendix A.1. (page 4 of 5)

	CARAPACE		MERUS LENGTH (mm)		
	Width (mm)[1]	Length (mm)[2]	Raw	Cooked	Frozen
126	191	157	144	144	142
127	186	151	141	142	140
128	179	144	143	141	141
129	184	150	140	141	139
130	182	152	144	143	142
131	148	127	107	104	104
132	163	138	126	125	124
133	163	139	131	127	127
134	160	131	124	121	121
135	161	135	125	121	120
136	149	126	108	104	104
137	151	131	117	113	112
138	155	130	129	126	125
139	161	132	121	118	117
140	164	134	117	118	115
141	162	132	129	126	126
142	175	142	136	133	133
143	158	131	119	117	115
144	157	128	102	100	99
145	159	128	118	115	114
146	158	128	113	110	110
147	173	145	137	132	132
148	165	137	130	124	125
149	161	135	133	130	129
150	157	134	126	113	121
151	161	157	121	119	118
152	166	139	125	124	123
153	173	144	134	133	132
154	175	146	139	139	138
155	161	139	132	131	131
156	181	149	143	142	141
157	188	153	145	145	144
158	152	131	116	105	104
159	157	133	121	123	123
160	154	127	108	109	109
161	162	134	124	120	119
162	152	129	122	118	117
163	183	147	136	132	131
164	167	136	131	125	125
165	158	130	121	112	116
166	158	134	130	125	124
167	163	133	123	119	118

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	CARAPACE		MERUS LENGTH (mm)		
	Width (mm)[1]	Length (mm)[2]	Raw	Cooked	Frozen
168	178	147	126	125	124
169	165	137	126	126	125
170	172	132	124	131	129
171	157	131	129	125	123
172	187	157	134	128	128
173	164	134	124	127	126
174	173	143	142	138	137
175	185	152	139	134	129
176	201	148	152	148	147
177	190	155	157	153	153
178	169	136	133	121	128
179	157	132	123	118	117
180	156	128	122	118	116
181	177	145	140	141	141

[1] Including spine.

[2] Biological measurement.

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