

Norton Sound Winter Red King Crab Studies, 1998

by

Elisabeth L. Brennan

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Alaska Department of Fish & Game
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INTRODUCTION

Red king crab, *Paralithodes camtschaticus*, support both commercial and subsistence harvests in the Norton Sound area. The greatest area of effort is concentrated in the vicinity of Nome. Commercial fisheries occur during the winter and summer months, with the majority of the commercial catch occurring in the summer. Subsistence fisheries occur primarily in winter months and sporadically in summer months. The king crab population is concentrated closer to shore from December through April, and shore fast ice allows subsistence fishers easy access. A winter king crab test-fishing project began in February of 1982 in an attempt to monitor the nearshore distribution, abundance, life history and biological data of red king crab. Sampling procedures were standardized in 1983. Results of prior studies were reported by Schwarz and Lean (1982, 1983, 1984), Lean and Brannian (1987), Lean (1987), Bue and Lean (1989), Knuepfer and Gebhard (1990), Brennan and Anderson (1993), Brennan (1993), Brennan and LaFlamme (1995), Rob (1996), and Rob and Fair (1997).

Shorefast and sea ice conditions constantly change. From 1982 until 1987, test fishing stations were restricted to a single transect of shorefast ice extending ½ to 2 miles directly offshore from the Nome Post Office. Poor ice conditions precluded any test fishing in 1988. During the 1989 and 1990 seasons, the study area was expanded 6 miles to the west of Nome, in the vicinity of gold dredging activity, and 6 miles to the east of Nome, where less subsistence activity occurs. Test fishing effort was reduced in 1991 and 1993 due to poor ice condition and budget constraints. In 1992 and 1994, test fishing was not funded. In 1996 test fishing was expanded to the vicinity of Bluff, 50 miles east of Nome. In 1997 the active ice edge was closer to shore, and sea ice conditions were quite rough. Pots were established in more shallow water than in the past, and due to unstable ice, no pots were fished in the vicinity of Bluff.

Objectives for the 1998 winter field season were:

1. Monitor the catch of sublegal and legal male red king crab and the shell age of each age class to evaluate recruitment into legal population prior to the summer fishery.
2. Monitor the catch and distribution of red king crab accessible to winter users in the Nome area.
3. Monitor intensity and distribution of the winter fishing effort in the Nome area.
4. Tag all male new shell red king crab with carapace length ≤ 100 mm, as part of ongoing studies to estimate the growth of tagged crab recaptured in summer and winter fisheries.
5. Monitor the size and number of female red king crab and estimate egg development and clutch size.
6. Monitor other life history and biological data such as disease, parasitism, and the incidence of competing species.

METHODS

Eight test fishing stations were established in an area spanning from 7 miles west of Nome to 5 miles east of Nome (Table 1, Figure 1). All stations were located as close as possible to historical sites. Each station was located in water ranging from 35 feet to 55 feet deep and from approximately ½ mile to 1 ½ miles offshore. Travel to and from stations was by snowmachines towing sleds to carry supplies and equipment.

Station locations were established by locating the approximate historical site with a Garmin GPS (Global Positioning System) 45². A test hole was drilled using gasoline powered auger and water depth was checked using a weighted string. When the appropriate water depth was found, a square hole about five feet long on each side was cut in the ice using ice augers. Other tools used include ice chisels or “tooks”, axes, shovels, ice picks and long poles. Conical, four foot diameter “Japanese style” king crab pots were baited with chopped herring in two one quart bait containers and one string of 10 whole saffron cod. Each pot was deployed and attached to a tethered line at the surface of the ice. Each hole was covered with styrofoam and plywood to reduce refreezing of the hole. All holes were marked per regulation. The GPS was used to record all station locations.

Once pots were deployed, each pot was checked and rebaited twice per week (weather permitting). When pots were checked, they were brought to the surface and suspended so that all crab in the pot remained immersed in water. Crab were removed one at a time and legal and biological measurements were made to the nearest millimeter. Shell age was determined. Egg development on female crab was noted. New shell and old shell crab with a carapace length of 100mm or less were tagged with hog rings. Any prior injuries on all crab caught were noted. All crab were released into the same hole that the pot was suspended in. Catch per unit effort (CPUE) was calculated as the catch per pot lift.

RESULTS

Stations were deployed beginning on February 18, 1998. Ice conditions in the Nome area were good in regard to traveling. There was ice movement beginning between February 21 and February 24. Stations at West 1 and West 2 were lost at some point during this time period when ice moved offshore. As a result, station West 1 and West 2 were never checked. The station at West 4 was destroyed due to ice fracturing and movement during the period of February 27 and March 2. A dangerous crack in the ice developed on March 3 on the shore side of station West 3. This pot was pulled on March 4 due to the risk of losing it. On March 9, this station was reestablished in the same place. Pot locations, distances from Nome, and distance offshore were computed and recorded using the *GPS* (Table 1).

A total of 882 male and 38 female red king crab were captured and sampled at 5 stations between February 20 and April 22, 1998. A total of 84 pot lifts were made for an overall CPUE of 10.5 male and 0.5 female red king crab (Table 2). The CPUE for all crab caught at each station is presented in Figure 1. Daily catch information is presented in Table 3. A total

² Use of vendor name does not imply endorsement.

of 633 male crab were tagged. Other species captured include Arctic Lyre crab *Hyas coarctatus*, Soft crab *Hapalogaster grebnitzkii*, Flatbottom sea star *Asterias*, sea urchins of the genus *Strongylocentrotus*, *Pandalus* (sp.) shrimp, unidentified sculpins and jellyfish.

Carapace length measurements and shell age were taken from 882 male crab. Of the total male crab caught, 721 or 81.7% were prerecruit, 77 or 8.7% were recruit, and 84 or 9.5% postrecruit (Table 4). Prerecruit threes (carapace length <76mm) were 0.8% of the total male crab catch. Prerecruit twos (carapace length 76 to 89 mm) were 36.6% of the total male crab catch. Prerecruit ones (carapace length >89 mm) were 44.3 % of the total male crab catch (Table 11). The average length of all male king crab captured was 94.4 mm (Table 5). The length distribution of all male crab captured during the winter pot study ranged from 72 mm to 140 mm (Table 5, Figure 2).

Legal male crab were 18.2% of the total male crab catch. The average carapace length of the 161 legal crab caught was 113.2 mm (Table 6). Legal new shell male crab had an average carapace length of 109.0 mm and were 57.8% of the legal crab catch. Legal old shell male crab had an average carapace length of 119.1 mm and were 42.2 % of the legal crab catch. Recruits (legal new shell male crab with carapace length \leq 115 mm) were 47.8% and postrecruits (legal new shell male crab with carapace length \geq 116 mm and all legal old shell males) were 52.2% of the legal male catch (Table 6).

Sublegal male crab were 81.7 % of the total male crab catch (Table 4). The mean carapace length of the 721 sublegal male crab caught was 90.1 mm. New shell sublegal male crab had a mean carapace length of 90.0 mm and were 97.2% of the sublegal male catch. Old shell sublegal male crab had a mean carapace length of 94.3 mm and were 2.8% of the sublegal male catch (Table 7).

A total of 38 female crab were caught, 4 juvenile (carapace length < 72mm, no eggs) and 34 adults. The average carapace length was 68.5 mm for juvenile female crab, and was 77.5 mm for adult female crab (Table 8). Eleven adults had full egg clutches and 14 adults had high egg clutches. Nine adults had no egg clutches. Egg color varied from purple to brown to yellow with eyes throughout the winter pot study.

DISCUSSION

The red king crab winter pot survey has been conducted in the Nome area during thirteen of the fifteen years since sampling procedures were standardized in 1983. The winter survey has provided opportunities to collect and interpret valuable information on the crab population immediately available to the residents of Nome during the winter subsistence and commercial fisheries. This information is used as an indicator for the potential of the summer commercial fishery.

During 1998 the sea ice was stable in most of the historic study area throughout the season. The exception being the area between two and seven miles west of Nome where three pots were lost. The active ice edge was approximately 1 ½ mile offshore in most areas. Weather conditions were only severe enough to prevent travel a few times throughout the season.

Travel from shore to pots on the sea ice was very good due to lack of large pressure ridges. Travel conditions along the beach line were good all season.

Subsistence fishing effort was concentrated in front of Nome within two miles east and west. The subsistence effort was greater in comparison to the past two winter seasons. This was due to the good condition of sea ice and greater abundance of crab nearshore. Ninety-three subsistence permits were issued in 1998, compared to 38 in 1997, 85 in 1996 and 166 in 1995 (Table 9).

Commercial fishing effort extended about 20 miles west of town and east toward Cape Nome. Unstable ice two to seven miles west of Nome caused many commercial pots to be lost in mid to late February. This slowed commercial fishing because some fishers lost all pots they had deployed. Five fishers registered for the commercial fishery. This compares to 3 fishers in 1997, 9 fishers in 1996, and 42 fishers in 1995 (Table 9).

The 1998 winter pot survey had the second highest total catch since 1993. The total male crab catch was the second highest for the most recent survey years 1993 to 1998. Male CPUE (10.9 crab/pot) was the highest for this same time period (Table 10, Figure 3). The total number of female crab caught was the second greatest for the years 1993 to 1998. Female CPUE (0.5) was the highest for winter crab projects between 1986 and 1998.

The 1998 sublegal catch proportion (82 % of the total male catch) was the highest since 1983 (Table 11). Prerecruit threes and twos combined made up 37 % and prerecruit ones made up 44 % of all male crab sampled. These are well above the average percentages for the years 1983 to 1997. The legal crab catch proportion of 18 % was the lowest since 1983. This compares to the average of 50 % for the years 1983 to 1997. Recruit crab made up only 9% of all male crab captured. Postrecruit crab made up only 9 % of all male crab captured. Recruit and postrecruit percentages were the lowest for the years 1983 to 1998. This trend of high sublegal catch rates and low legal catch rates were also reported by subsistence and commercial fishers in the Nome area.

The composition of the male catch of red king crab in the 1998 pot survey changed dramatically from the 1997 survey. Only 18% of the 1998 male catch were legal compared to 36% in 1997. In 1998, 82% of the total catch were sublegal male, compared to 64% in 1997. The average length of legal male crab in 1998 was only 113 mm compared to 118 mm in 1997. Comparisons of the length frequency distribution of all male red king crab captured during the winter and summer pot and trawl surveys between 1995 and 1998 are presented in Figure 4.

A total of 21 tagged crab captured during the 1998 winter fishery were returned by subsistence and commercial fishers to the Nome ADF&G office (Table 14). The returned crab had been tagged during the 1995, 1996, 1997 and 1998 winter pot surveys. Ten of the 11 returned crab tagged between 1995 to 1997 were used to calculate an average growth per molt of 13.2 mm.

ACKNOWLEDGEMENTS

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Table 1. Location of test fishing stations for the winter red king crab pot survey, Norton Sound, 1998.

Pot	Location from Town	Longitude	Latitude	Depth (ft)	Historical Station	Remarks
Nome 2	1.01 miles South	N 64.48368'	W 165.41322'	45 ft	yes	
Nome 3	1.31 miles South	N 64.47810'	W 165.40393'	50 ft	yes	
West 3	2.56 miles West	N 64.48846'	W 165.48270'	45 ft	yes	
West 4	2.78 miles West	N 64.47968'	W 165.48297'	55 ft	yes	lost 2/28/98
West 1	6.96 miles West	N 64.51363'	W 165.62917'	40 ft	yes	lost 2/23/98
West 2	6.84 miles West	N 64.50522'	W 165.62768'	55 ft	yes	lost 2/23/98
East 1	4.74 miles East	N 64.46755'	W 165.25540'	35 ft	yes	
East 2	5.31 miles East	N 64.46273'	W 165.23939'	45 ft	yes	

Table 2. Number of pot lifts and catch, by station, for all stations in the winter red king crab pot survey, Norton Sound, 1998.

Station	Dates Fished	Number of Pot Lifts	Number of Male Red King Crab Caught	CPUE for Male Red King Crab	Number of Female Red King Crab Caught	CPUE for Female Red King Crab
Nome 2	2/20 - 4/20/98	17	46	2.7	0	0.0
Nome 3	2/20 - 4/20/99	16	100	6.3	7	0.4
West 1		0	0		0	
West 2		0	0		0	
West 3	2/20 - 4/22/98	15	132	8.8	3	0.2
West 4	2/20 - 2/28/98	2	99	49.5	3	1.5
East 1	2/20 - 4/22/98	17	234	13.8	11	0.6
East 2	2/20 - 4/22/98	17	271	15.9	14	0.8
Total		84	882	10.5	38	0.5

Table 3. Daily catch of red king crab for all stations in the winter pot survey, Norton Sound, 1998.

Date	Vicinity	# of Pots Lifted	# of Males Captured	Male CPUE	Cumulative # of Males Captured	# of Females Captured
20-Feb	Nome & West	4	80	20.0	80	4
24-Feb	West & East	4	103	25.8	183	3
25-Feb	Nome	2	31	15.5	214	0
27-Feb	Nome, East & West	5	58	11.6	272	2
2-Mar	Nome, East & West	5	71	14.2	343	0
6-Mar	Nome & East	4	55	13.8	398	5
9-Mar	Nome, East	4	48	12.0	446	1
13-Mar	Nome, East & West	5	49	9.8	495	3
16-Mar	Nome, East & West	5	43	8.6	538	2
20-Mar	Nome, East & West	5	30	6.0	568	3
23-Mar	Nome, East & West	5	30	6.0	598	0
27-Mar	Nome, East & West	5	56	11.2	654	1
1-Apr	Nome, East & West	5	47	9.4	701	2
6-Apr	Nome, East & West	5	29	5.8	730	3
10-Apr	East & Nome	3	30	10.0	760	0
14-Apr	Nome, East & West	5	43	8.6	803	2
17-Apr	Nome, East & West	5	37	7.4	840	4
20-Apr	Nome, East & West	5	28	5.6	868	0
22-Apr	East & West	3	14	4.7	882	3
		84	882	10.5		38

Table 4. Summary of male red king crab data from the winter pot survey, Norton Sound, 1998.

	Number	Percent	Mean Length (mm)
Sublegal Male Crab			
New Shell	701	79.5%	90.0
Old Shell	20	2.3%	94.3
Legal Male Crab			
New Shell	93	10.5%	109.0
Old Shell	68	7.7%	119.1
<hr/>			
Totals	882	100%	94.4
<hr/>			
Prerecruit Males	721	81.7%	
Recruit Males	77	8.7%	
Postrecruit Males	84	9.5%	
<hr/>			
Total	882	100.0%	

Prerecruits are sublegale crab with a carapace length < 115 mm.

Recruit crab are new shell, legal crab with a carapace length \leq 115 mm.

Postrecruit crab are legal crab with a carapace length \geq 116 mm.

Table 5. Length frequency distribution of all male red king crab captured during the winter pot survey, Norton Sound, 1998.

Carapace Length (mm)	Prerecruits		Recruits		Postrecruits		Totals		%	Postrecruits (continued)				
	Number	Percent	Number	Percent	Number	Percent	Number	Percent		Number	Percent	Totals	%	
60	0	0.0%					0	0.0%						
61	0	0.0%					0	0.0%						
62	0	0.0%					0	0.0%						
63	0	0.0%					0	0.0%						
64	0	0.0%					0	0.0%						
65	0	0.0%					0	0.0%						
66	0	0.0%					0	0.0%						
67	0	0.0%					0	0.0%						
68	0	0.0%					0	0.0%						
69	0	0.0%					0	0.0%						
70	0	0.0%					0	0.0%						
71	0	0.0%					0	0.0%						
72	1	0.1%					1	0.1%						
73	0	0.0%					0	0.0%						
74	4	0.5%					4	0.5%						
75	2	0.2%					2	0.2%						
76	4	0.5%					4	0.5%						
77	5	0.6%					5	0.6%						
78	9	1.0%					9	1.0%						
79	11	1.2%					11	1.2%						
80	8	0.9%					8	0.9%						
81	20	2.3%					20	2.3%						
82	37	4.2%					37	4.2%						
83	23	2.6%					23	2.6%						
84	19	2.2%					19	2.2%						
85	26	2.9%					26	2.9%						
86	37	4.2%					37	4.2%						
87	48	5.4%					48	5.4%						
88	40	4.5%					40	4.5%						
89	36	4.1%					36	4.1%						
90	35	4.0%					35	4.0%						
91	43	4.9%					43	4.9%						
92	51	5.8%					51	5.8%						
93	36	4.1%					36	4.1%						
94	22	2.5%					22	2.5%						
95	43	4.9%					43	4.9%						
96	27	3.1%					27	3.1%						
97	33	3.7%					33	3.7%						
98	30	3.4%	0				30	3.4%						
99	23	2.6%	0				23	2.6%						
100	21	2.4%	1	0.1%			22	2.5%						
101	8	0.9%	5	0.6%			13	1.5%						
102	14	1.6%	10	1.1%			24	2.7%						
103	2	0.2%	8	0.9%	1	0.1%	11	1.2%						
104	2	0.2%	5	0.6%	2	0.2%	9	1.0%						
105	0	0.0%	9	1.0%	2	0.2%	11	1.2%						
106	0	0.0%	4	0.5%	1	0.1%	5	0.6%						
107	1	0.1%	8	0.9%	1	0.1%	10	1.1%						
108	0	0.0%	5	0.6%	2	0.2%	7	0.8%						
109	0	0.0%	3	0.3%	5	0.6%	8	0.9%						
110	0	0.0%	2	0.2%	3	0.3%	5	0.6%						
111			3	0.3%	2	0.2%	5	0.6%						
112			2	0.2%	7	0.8%	9	1.0%						
113			4	0.5%	3	0.3%	7	0.8%						
114			3	0.3%	2	0.2%	5	0.6%						
115			5	0.6%	0	0.0%	5	0.6%						
116			0		2	0.2%	2	0.2%						
117					7	0.8%	7	0.8%						
118					1	0.1%	1	0.1%						
119					2	0.2%	2	0.2%						
120					5	0.6%	5	0.6%						
Totals	721	81.7%	77	8.7%										
121										2	0.2%	2	0.2%	
122										6	0.7%	6	0.7%	
123										1	0.1%	1	0.1%	
124										3	0.3%	3	0.3%	
125										1	0.1%	1	0.1%	
126										2	0.2%	2	0.2%	
127										2	0.2%	2	0.2%	
128										2	0.2%	2	0.2%	
129										2	0.2%	2	0.2%	
130										3	0.3%	3	0.3%	
131										2	0.2%	2	0.2%	
132										1	0.1%	1	0.1%	
133										1	0.1%	1	0.1%	
134										3	0.3%	3	0.3%	
135										0	0.0%	0	0.0%	
136										1	0.1%	1	0.1%	
137										2	0.2%	2	0.2%	
138										1	0.1%	1	0.1%	
139										0	0.0%	0	0.0%	
140										1	0.1%	1	0.1%	
141										0	0.0%	0	0.0%	
142										0	0.0%	0	0.0%	
143										0	0.0%	0	0.0%	
144										0	0.0%	0	0.0%	
145										0	0.0%	0	0.0%	
146										0	0.0%	0	0.0%	
147										0	0.0%	0	0.0%	
148										0	0.0%	0	0.0%	
149										0	0.0%	0	0.0%	
150										0	0.0%	0	0.0%	
151										0	0.0%	0	0.0%	
152										0	0.0%	0	0.0%	
153										0	0.0%	0	0.0%	
154										0	0.0%	0	0.0%	
155										0	0.0%	0	0.0%	
156										0	0.0%	0	0.0%	
157										0	0.0%	0	0.0%	
158										0	0.0%	0	0.0%	
159										0	0.0%	0	0.0%	
160										0	0.0%	0	0.0%	
Totals										84	9.5%	882	100.0%	
										Number of Prerecruit threes (< 76mm)		7	0.8%	
										Number of Prerecruit twos (76 to 89 mm)		323	36.6%	
										Number of prerecruit ones (> 89mm)		391	44.3%	
										Average Length of all male crab captured =		94.4 mm		

Table 6. Length frequencies by shell age of all legal male red king crab captured in the winter pot survey, Norton Sound, 1998.

Carapace Length (mm)	Legal New Shell Males		Legal Old Shell Males		Total Legal Males	
	Number	Percent	Number	Percent	Number	Percent
100	1	0.6%	0	0.0%	1	0.6%
101	5	3.1%	0	0.0%	5	3.1%
102	10	6.2%	0	0.0%	10	6.2%
103	8	5.0%	1	0.6%	9	5.6%
104	5	3.1%	2	1.2%	7	4.3%
105	9	5.6%	2	1.2%	11	6.8%
106	4	2.5%	1	0.6%	5	3.1%
107	8	5.0%	1	0.6%	9	5.6%
108	5	3.1%	2	1.2%	7	4.3%
109	3	1.9%	5	3.1%	8	5.0%
110	2	1.2%	3	1.9%	5	3.1%
111	3	1.9%	2	1.2%	5	3.1%
112	2	1.2%	7	4.3%	9	5.6%
113	4	2.5%	3	1.9%	7	4.3%
114	3	1.9%	2	1.2%	5	3.1%
115	5	3.1%	0	0.0%	5	3.1%
116	1	0.6%	1	0.6%	2	1.2%
117	5	3.1%	2	1.2%	7	4.3%
118	0	0.0%	1	0.6%	1	0.6%
119	1	0.6%	1	0.6%	2	1.2%
120	2	1.2%	3	1.9%	5	3.1%
121	1	0.6%	1	0.6%	2	1.2%
122	3	1.9%	3	1.9%	6	3.7%
123	0	0.0%	1	0.6%	1	0.6%
124	0	0.0%	3	1.9%	3	1.9%
125	0	0.0%	1	0.6%	1	0.6%
126	1	0.6%	1	0.6%	2	1.2%
127	1	0.6%	1	0.6%	2	1.2%
128	0	0.0%	2	1.2%	2	1.2%
129	0	0.0%	2	1.2%	2	1.2%
130	1	0.6%	2	1.2%	3	1.9%
131	0	0.0%	2	1.2%	2	1.2%
132	0	0.0%	1	0.6%	1	0.6%
133	0	0.0%	1	0.6%	1	0.6%
134	0	0.0%	3	1.9%	3	1.9%
135	0	0.0%	0	0.0%	0	0.0%
136	0	0.0%	1	0.6%	1	0.6%
137	0	0.0%	2	1.2%	2	1.2%
138	0	0.0%	1	0.6%	1	0.6%
139	0	0.0%	0	0.0%	0	0.0%
140	0	0.0%	1	0.6%	1	0.6%
141	0	0.0%	0	0.0%	0	0.0%
142	0	0.0%	0	0.0%	0	0.0%
143	0	0.0%	0	0.0%	0	0.0%
144	0	0.0%	0	0.0%	0	0.0%
145	0	0.0%	0	0.0%	0	0.0%
146	0	0.0%	0	0.0%	0	0.0%
147	0	0.0%	0	0.0%	0	0.0%
148	0	0.0%	0	0.0%	0	0.0%
149	0	0.0%	0	0.0%	0	0.0%
150	0	0.0%	0	0.0%	0	0.0%
151	0	0.0%	0	0.0%	0	0.0%
152	0	0.0%	0	0.0%	0	0.0%
153	0	0.0%	0	0.0%	0	0.0%
154	0	0.0%	0	0.0%	0	0.0%
155	0	0.0%	0	0.0%	0	0.0%
156	0	0.0%	0	0.0%	0	0.0%
157	0	0.0%	0	0.0%	0	0.0%
158	0	0.0%	0	0.0%	0	0.0%
159	0	0.0%	0	0.0%	0	0.0%
160	0	0.0%	0	0.0%	0	0.0%
Totals	93	57.8%	68	42.2%	161	100.0%
Average Lengths	109.0		119.1		113.2	
Total Recruits			77	47.8%		
Total Postrecruits			84	52.2%		

Table 7. Length frequencies by shell age of all sublegal male red king crab captured in the winter pot survey, Norton Sound, 1998.

Carapace Length (mm)	Sublegal New Shell Males				Sublegal Old Shell Males				Total Sublegal Males	
	Threes (<76 mm)	Twos (76 to 89 mm)	Ones (>89 mm)	%	Threes (<76 mm)	Twos (76 to 89 mm)	Ones (>89 mm)	%	Males	%
60	0			0.0%	0			0.0%	0	0.0%
61	0			0.0%	0			0.0%	0	0.0%
62	0			0.0%	0			0.0%	0	0.0%
63	0			0.0%	0			0.0%	0	0.0%
64	0			0.0%	0			0.0%	0	0.0%
65	0			0.0%	0			0.0%	0	0.0%
66	0			0.0%	0			0.0%	0	0.0%
67	0			0.0%	0			0.0%	0	0.0%
68	0			0.0%	0			0.0%	0	0.0%
69	0			0.0%	0			0.0%	0	0.0%
70	0			0.0%	0			0.0%	0	0.0%
71	0			0.0%	0			0.0%	0	0.0%
72	1			0.1%	0			0.0%	1	0.1%
73	0			0.0%	0			0.0%	0	0.0%
74	4			0.6%	0			0.0%	4	0.6%
75	2			0.3%	0			0.0%	2	0.3%
76		4		0.6%		0		0.0%	4	0.6%
77		5		0.7%		0		0.0%	5	0.7%
78		9		1.3%		0		0.0%	9	1.3%
79		11		1.5%		0		0.0%	11	1.5%
80		8		1.1%		0		0.0%	8	1.1%
81		20		2.8%		0		0.0%	20	2.8%
82		36		5.0%		1		0.1%	37	5.1%
83		23		3.2%		0		0.0%	23	3.2%
84		19		2.6%		0		0.0%	19	2.6%
85		25		3.5%		1		0.1%	26	3.6%
86		37		5.1%		0		0.0%	37	5.1%
87		47		6.5%		1		0.1%	48	6.7%
88		39		5.4%		0		0.0%	39	5.4%
89		36		5.0%		0		0.0%	36	5.0%
90			35	4.9%			0	0.0%	35	4.9%
91			42	5.8%			1	0.1%	43	6.0%
92			48	6.7%			3	0.4%	51	7.1%
93			36	5.0%			0	0.0%	36	5.0%
94			22	3.1%			0	0.0%	22	3.1%
95			39	5.4%			4	0.6%	43	6.0%
96			26	3.6%			1	0.1%	27	3.8%
97			30	4.2%			3	0.4%	33	4.6%
98			28	3.9%			2	0.3%	30	4.2%
99			23	3.2%			0	0.0%	23	3.2%
100			19	2.6%			2	0.3%	21	2.9%
101			8	1.1%			0	0.0%	8	1.1%
102			13	1.8%			1	0.1%	14	1.9%
103			2	0.3%			0	0.0%	2	0.3%
104			2	0.3%			0	0.0%	2	0.3%
105			0	0.0%			0	0.0%	0	0.0%
106			0	0.0%			0	0.0%	0	0.0%
107			1	0.1%			0	0.0%	1	0.1%
108			0	0.0%			0	0.0%	0	0.0%
109			0	0.0%			0	0.0%	0	0.0%
110			0	0.0%			0	0.0%	0	0.0%
Totals	7	319	374	97.2%	0	3	17	2.8%	720	100.0%
Average Lengths (mm)	74.0	84.7	94.9		0.0	84.7	96.0		90.1	mm

Average Length of all sublegal new shell males = 90.0 mm

Average length of all sublegal old shell males = 94.3 mm

Table 8. Length frequencies and percent ovigerity of all female red king crab captured in the winter pot survey, Norton Sound, 1998.

Carapace Length (mm)	Percent Ovigerity					Total
	Full 90 - 100%	High 60 - 89%	Medium 30 - 59%	Low 1 - 29%	None 0%	
55	0	0	0	0	0	0
56	0	0	0	0	0	0
57	0	0	0	0	0	0
58	0	0	0	0	0	0
59	0	0	0	0	0	0
60	0	0	0	0	0	0
61	0	0	0	0	0	0
62	0	0	0	0	0	0
63	0	0	0	0	0	0
64	0	0	0	0	1	1
65	0	0	0	0	0	0
66	0	0	0	0	0	0
67	0	0	0	0	0	0
68	0	0	0	0	0	0
69	0	0	0	0	1	1
70	0	0	0	0	1	1
71	1	1	0	0	1	3
72	1	1	0	0	3	5
73	1	0	0	0	1	2
74	1	0	0	0	2	3
75	1	0	0	0	0	1
76	2	1	0	0	1	4
77	2	2	0	0	0	4
78	0	0	0	0	0	0
79	1	1	0	0	0	2
80	0	0	0	0	0	0
81	0	3	0	0	2	5
82	0	2	0	0	0	2
83	0	2	0	0	0	2
84	1	0	0	0	0	1
85	0	0	0	0	0	0
86	0	0	0	0	0	0
87	0	0	0	0	0	0
88	0	1	0	0	0	1
89	0	0	0	0	0	0
90	0	0	0	0	0	0
91	0	0	0	0	0	0
92	0	0	0	0	0	0
93	0	0	0	0	0	0
94	0	0	0	0	0	0
95	0	0	0	0	0	0
Totals =	11	14	0	0	13	38

Total number of juvenile females (<72mm) = 4
 Average length of juvenile females (<72mm) = 68.50 mm
 Average length of adult females (>=72mm) = 77.50 mm
 Average length of all females = 14 76.21 mm

Table 9. Subsistence and commercial king crab permits issued for winter fishing, Norton Sound, 1978 - 1998.

Winter	<u>Subsistence Fishery</u>		<u>Commercial Fishery^a</u>		
	Number of Permits Issued	Average Harvest/Fisher	Number of Registered Fishermen	Number of Crab Harvested	Average Harvest/Fisher
1977-1978	290	84	37	9,625	260
1978-1979	48	6	1	221	221
1979-1980	22	24	1	22	22
1980-1981	51	16	0	0	
1981-1982	101	24	1	17	17
1982-1983	172	123	5	549	110
1983-1984	222	78	8	856	107
1984-1985	203	63	9	1,168	130
1985-1986	136	66	5	2,168	434
1986-1987	138	59	7	1,040	149
1987-1988	71	68	10	425	43
1988-1989	139	65	5	403	81
1989-1990	136	114	13	3,626	279
1990-1991	119	93	11	3,800	345
1991-1992	158	112	13	7,478	575
1992-1993	88	30	8	1,788	224
1993-1994	118	58	25	5,753	230
1994-1995	166	56	42	7,538	179
1995-1996	85	48	9	1,778	198
1996-1997	38	71	3	83	28
1997-1998	93	135	5	984	197

^a Before 1985 the winter commercial fishery was open from 1 January through 30 April. After March 1985, the winter commercial fishery was/is open by regulation from 15 November through 15 May.

Table 10. Total catch of red king crab during the winter pot surveys, Norton Sound, 1983 - 1998.

Year	# of Pot Lifts	# of Males Captured	Male CPUE	# of Females Captured	Female CPUE
1983	107	2,586	24.2	236	2.2
1984	70	1,677	24.0	78	1.1
1985	31	760	24.5	14	0.5
1986	31	594	19.2	74	2.4
1987	26	151	5.8	6	0.2
1988 ^a					
1989	42	548	13.0	9	0.2
1990	99	2,076	21.0	18	0.2
1991	56	1,283	22.9	8	0.1
1992 ^b					
1993	33	181	5.5	1	0.0
1994 ^b					
1995	126	776	6.2	10	0.1
1996	159	1,582	9.9	26	0.2
1997	140	399	2.9	60	0.4
1998	84	882	10.9	38	0.5

^a No data collected in 1988 because of unstable ice conditions.

^b The project was not funded.

Table 11. Percent prerecruits, recruits and postrecruits in the catch of red king crab during the winter pot surveys, 1983 - 1998, and the summer pot survey, 1995, Norton Sound.

Year	Sublegal Prerecruits				Recruits	Legal		Total
	Threes ^{ab}	Twos ^{bc}	Ones ^d	Subtotal		Postrecruits	Subtotal	
1983		26.2%	38.0%	64.2%	26.1%	9.6%	35.7%	100%
1984		34.7%	31.0%	65.6%	18.6%	15.8%	34.4%	100%
1985		24.7%	45.1%	69.8%	20.4%	9.8%	30.2%	100%
1986		25.7%	35.0%	60.7%	21.7%	17.7%	39.3%	100%
1987		12.5%	31.3%	43.8%	10.4%	45.8%	56.3%	100%
1988 ^e								
1989		26.8%	15.4%	42.2%	27.3%	30.5%	57.8%	100%
1990		15.9%	33.5%	49.4%	24.7%	26.0%	50.6%	100%
1991	0.2%	4.8%	30.6%	35.6%	33.5%	30.9%	64.4%	100%
1992 ^f								
1993	0.0%	3.3%	8.8%	12.2%	17.1%	70.7%	87.9%	100%
1994 ^f								
1995 ^g	2.1%	9.8%	11.4%	23.3%	32.3%	44.4%	76.7%	100%
1996	9.2%	22.1%	33.1%	64.3%	10.1%	25.5%	35.7%	100%
1997	11.0%	32.3%	20.8%	64.2%	14.3%	21.6%	35.8%	100%
1998	0.8%	36.6%	44.3%	81.7%	8.7%	9.5%	18.3%	100%
Averages 1983 - 1997	Average of threes and twos combined =	21.8%	27.8%	49.6%	21.4%	29.0%	50.4%	

Year	Sublegal Prerecruits				Recruits	Legal		Total
	Threes ^a	Twos ^c	Ones ^d	Subtotal		Postrecruits	Subtotal	
Summer 1995	8.6%	12.4%	16.9%	37.9%	20.0%	42.1%	62.1%	100%

^a Prerecruit threes are all sublegal males with carapace length < 76 mm.

^b Prior to 1991 carapace lengths were consolidated in pairs so that prerecruit threes and twos cannot be accurately separated.

^c Prerecruit twos are all sublegal males with carapace length from 76 through 89 mm.

^d Prerecruit ones are all sublegal males with carapace length > 89 mm.

^e No data collected due to unstable ice conditions during the winter of 1988.

^f No data collected due to lack of funds.

^g Includes catch from 12 testfishing stations and from one commercial fisherman catch on 5 April.

Table 12. Average length frequencies of legal male and female red king crab captured during the winter pot surveys in the Nome area, Norton Sound, 1983 - 1998.

Year	Average Length (mm)	
	Legal Male Crab	Female Crab
1983	c	c
1984	c	c
1985	c	79
1986	c	70
1987	c	71
1988	a	
1989	c	79
1990	115	83
1991	114	75
1992	b	
1993	118	93 ^d
1994	b	
1995	117	77
1996	117	71
1997	118	74
1998	113	76

^a No data collected in 1988 due to unstable ice conditions.

^b No data collected in 1992 and 1994 due to a lack of funds.

^c Information not available.

^d Only one female crab captured during 1993.

Table 13. Recruit and postrecruit red king crab as a percentage of the legal catch sampled during the winter pot surveys and summer commercial fisheries in the Nome area, Norton Sound, 1983 - 1998.

Year	Winter Study		Summer Commercial	
	Recruits	Postrecruits	Recruits	Postrecruits
1983	73%	27%	55%	45%
1984	54%	46%	59%	41%
1985	68%	32%	45%	55%
1986	55%	45%	48%	52%
1987	20%	80%	22%	78%
1988	^a	^a	25%	75%
1989	47%	53%	23%	77%
1990	49%	51%	21%	79%
1991	52%	48%	^b	^b
1992	^c	^c	28%	72%
1993	20%	80%	31%	69%
1994	^c	^c	14%	86%
1995	42%	58%	36%	64%
1996	28%	72%	30%	70%
1997	40%	60%	49%	51%
1998	48%	52%		

^a No data collected in the winter of 1988 due to unstable ice conditions.

^b No data collected in the summer of 1991 due to closed fishery.

^c No data collected due to lack of funding.

Table 14. F Commercial & Subsistence red king crab harvest. g crab tag information recovered during the 1998 Norton Sound win

Tag Number	Capture Date	Stat. Area of Capture	Carapace Length (mm)	Shell Age	Tagging Date	Tagging Location ^b	Carapace Length (mm)	Growth (mm) ^c	No. of Molts ^a	Skip Molts	Average Growth per Molt (mm)
NZ2568	1/26/98	656403	102	new	3/4/96	W2	84	18	2	0	9.0
NZ2721	1/27/98	656403	104	new	3/28/96	W1	67	37	2	0	18.5
NX3902	1/7/98	656403	111	old	4/1/96	W2	99	12	1	1	12.0
NZ2930	2/9/98	656403	no data		3/28/97	N2	89				
NZ2946	2/18/98	656403	100	new	3/14/97	N3	84	16	1	0	16.0
NZ2521	2/24/98	656403	104	new	2/22/96	N2	72	32	2	0	16.0
NZ3537	3/3/98	656403	92	new	2/24/98	E1	93	-1			
NZ3014	3/3/98	656403	87	new	2/25/98	N3	82	5			
NZ3086	3/8/98	656403	90	new	2/27/98	E1	90	0			
NX3125	3/8/98	656403	118	old	3/27/95	W1	109	9	1	2	9.0
NZ3082	3/10/98	656403	no data		2/25/98	N3	96				
NZ3268	3/15/98	656403	97	new	3/9/98	E1	97	0			
NZ3275	3/14/98	656403	87	new	3/9/98	N3	87	0			
NZ2995	3/18/98	656403	100	new	4/14/97	W4	81	19	1	0	19.0
NZ3321	3/25/98	656403	no data		3/13/98	W3	99				
NZ3048	3/31/98	656403	97	new	2/20/98	N2	97	0			
NZ3057	4/10/98	656403	97	new	2/20/98	W3	98	-1			
NZ3044	2/1/98	656403	98	new	2/20/98	W4	98				
NZ2978	4/17/98	656403	107	new	3/10/97	W5	93	14	1		14.0
NX3710	2/25/98	656403	109	old	4/5/96	W10	95	14	2	1	7.0
NZ2779	2/25/98	656403	92	new	4/8/96	W10	70	22	2	2	11.0

Average Growth 13.2

^a Crab growth of 12 mm (+/- 5mm) per year is thought to be the average growth in one molting period.

^b B1= Bluff area, 45 miles east of Nome.
 B4=Bluff area, 50 miles east of Nome.
 E1=4.78 miles east of Nome
 E2=5.2 miles east of Nome
 E3=7.9 miles east of Nome.
 E4=9.5 miles east of Nome.
 N2=0.85 miles south of Nome.
 N3=1.34 miles south of Nome.
 W1=6.83 miles west of Nome
 W2=6.78 miles west of Nome
 W3=2.8 miles west of Nome
 W4=2.8 miles west of Nome.

^c Growth of + or - 5 mm are considered errors in measurement.

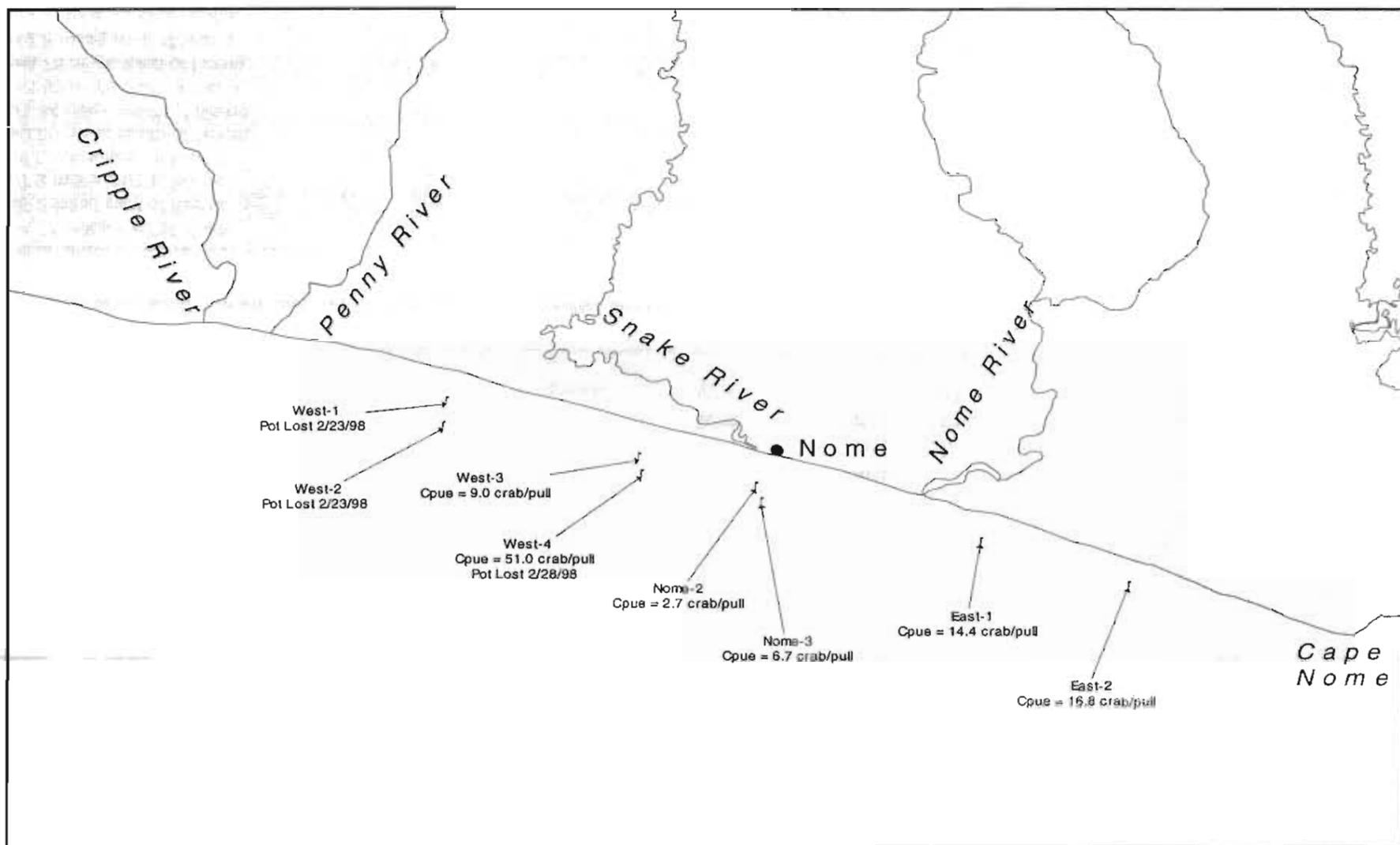


Figure 1. Detailed area location map for the red king crab winter pot survey, Norton Sound, 1998.

Norton Sound King Crab Winter 1998

20 February through 22 April, 1998

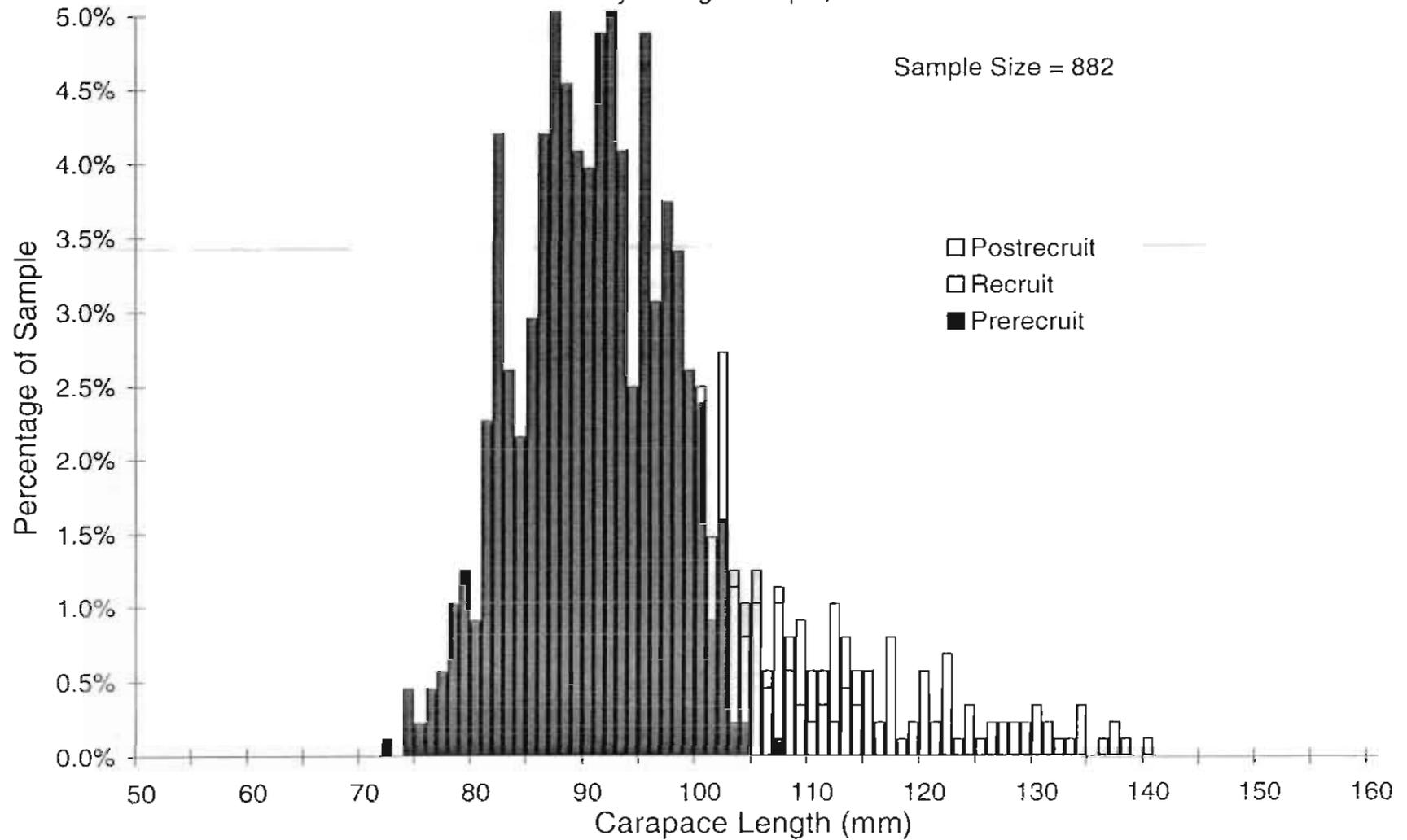


Figure 2. Length frequency distribution of all male red king crab captured during the winter pot survey, Norton Sound, 1998.

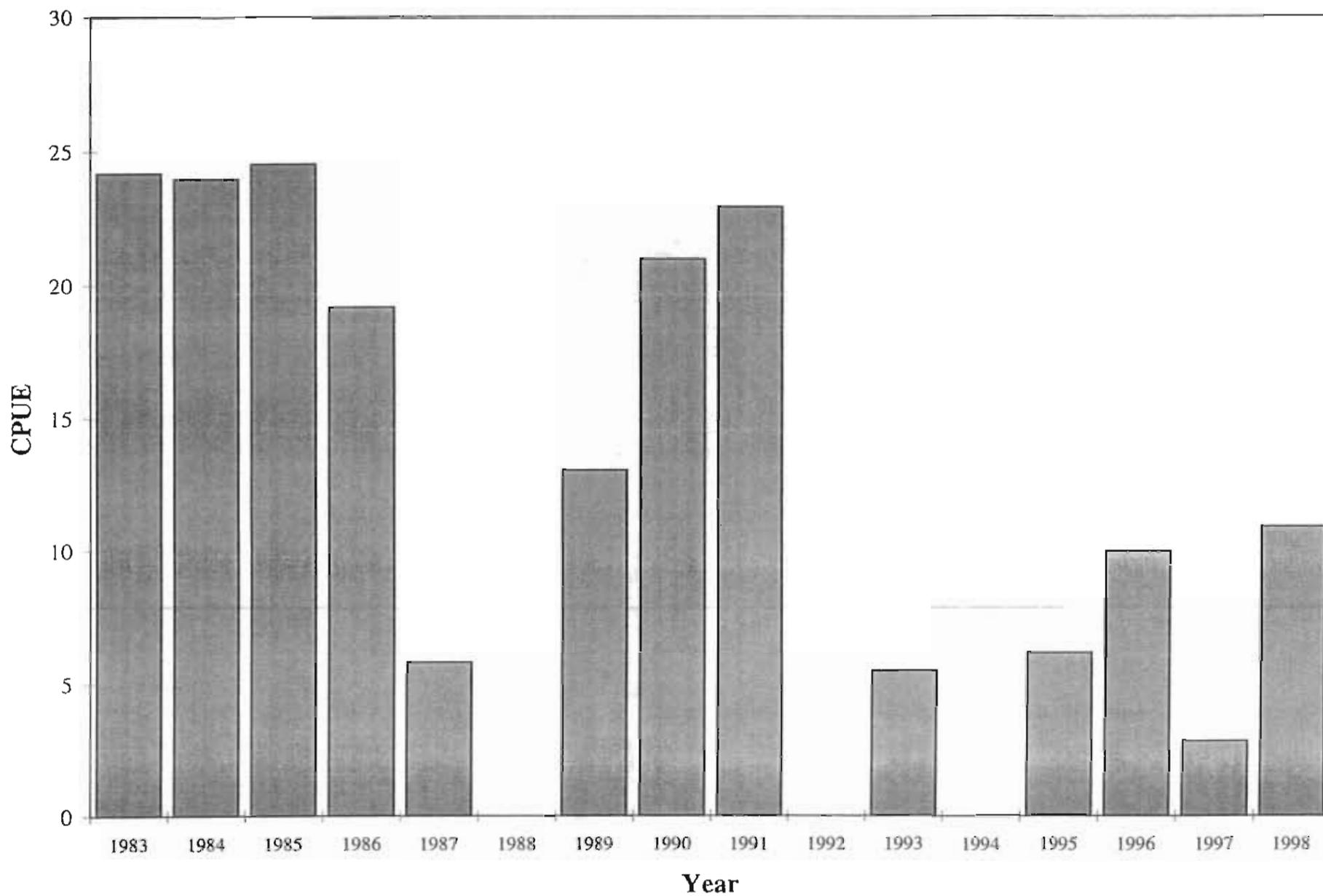
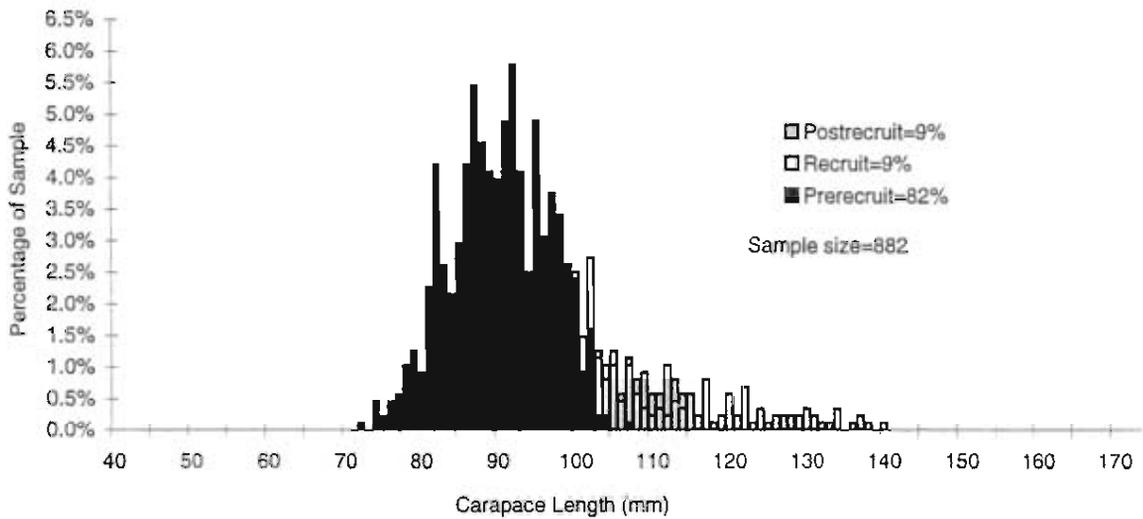


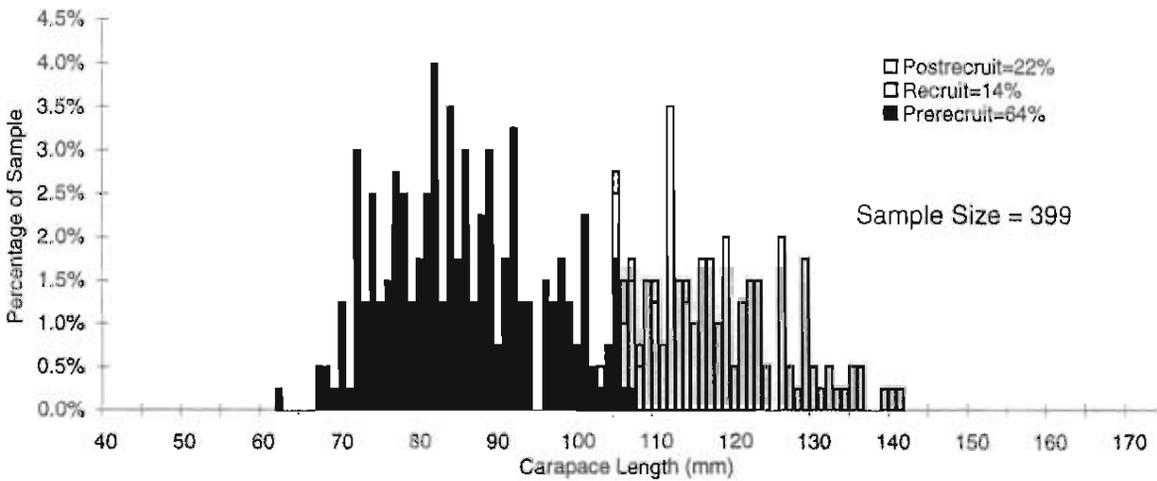
Figure 3. Annual catch per unit effort (CPUE) for male red king crab in the winter pot survey, Norton Sound, 1983 - 1998.

Figure 4. Comparison of the length frequency distribution of all male red king crab captured during the winter and summer pot and trawl surveys, Norton Sound, 1995 - 1998.

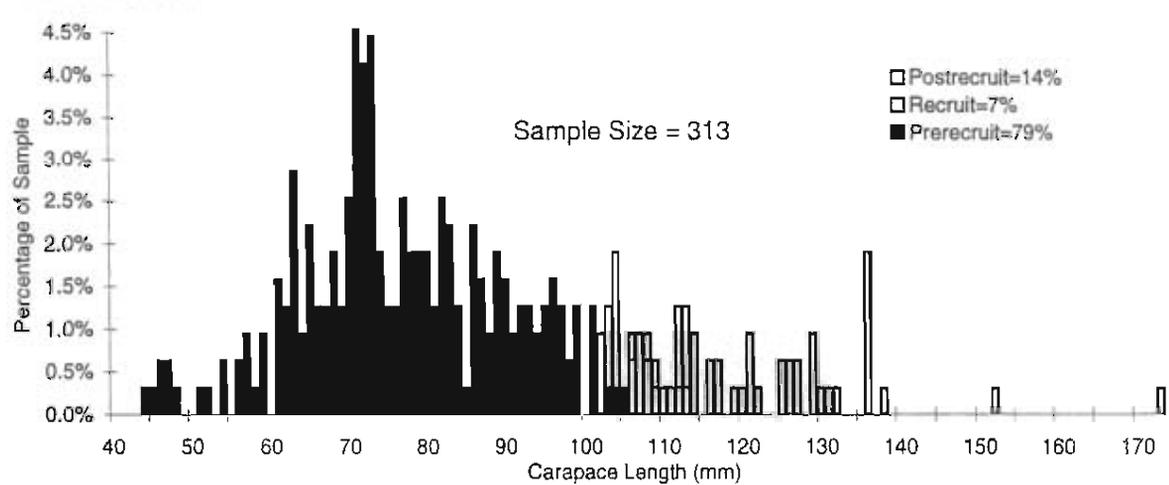
Length frequency distribution of all male red king crab captured during the winter pot survey, Norton Sound, 1998.



Length frequency distribution of all male red king crab captured during the winter pot survey, Norton Sound, 1997.



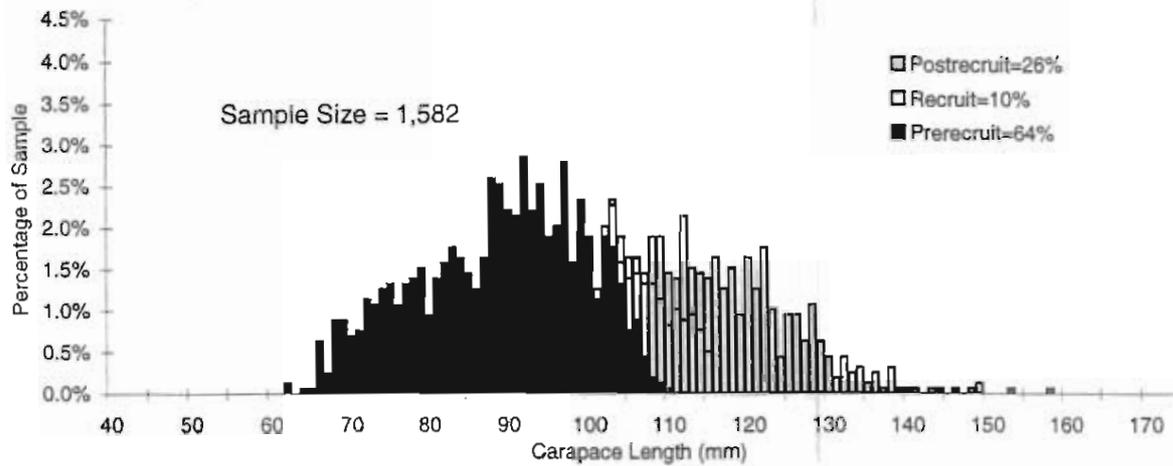
Length frequency distribution of all male red king crab captured during the summer trawl survey, Norton Sound, 1996.



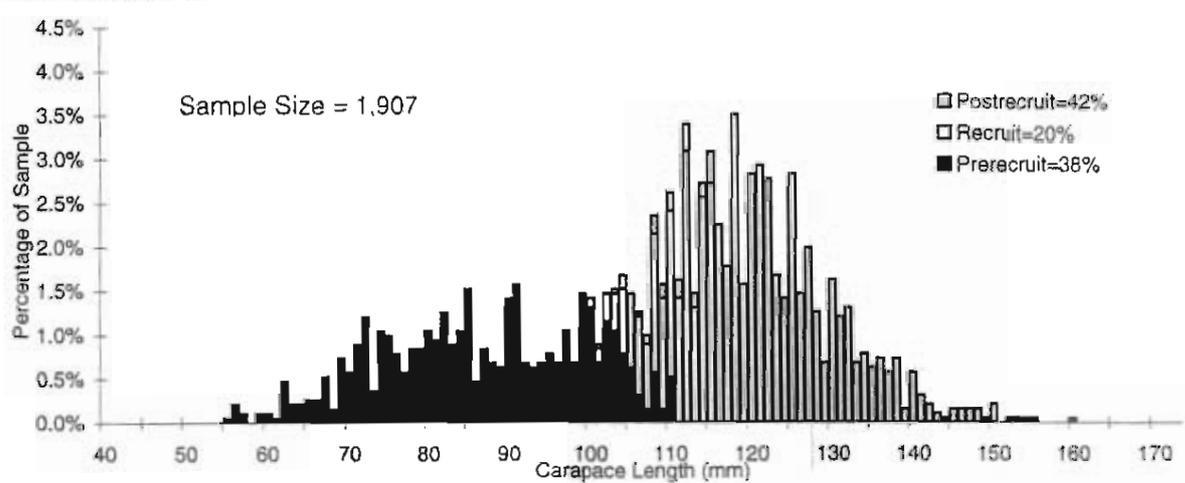
- Continued -

Figure 4. (Page 2 of 2).

Length frequency distribution of all male red king crab captured during the winter pot survey, Norton Sound, 1996.



Length frequency distribution of all male red king crab captured during the summer pot survey, Norton Sound, 1995.



Length frequency distribution of all male red king crab captured during the winter pot survey, Norton Sound, 1995.

