

1999  
NORTON SOUND DISTRICT  
SHELLFISH REPORT  
to the  
Alaska Board of Fisheries

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# TABLE OF CONTENTS

	<u>Page</u>
LIST OF TABLES .....	iv
LIST OF FIGURES .....	v
LIST OF APPENDICIES .....	vi
INTRODUCTION .....	1
Norton Sound .....	1
St. Lawrence Island .....	1
COMMERCIAL FISHERY .....	2
Norton Sound Summer Commercial Fishery .....	2
Statistical Summary .....	3
Commercial Catch Sampling .....	4
Tagged Crab .....	4
Enforcement .....	4
Norton Sound Winter Commercial Fishery .....	4
SUBSISTENCE FISHERY .....	5
STOCK STATUS/RESEARCH .....	5
FUTURE INVESTIGATIONS .....	7
OUTLOOK FOR 2000 .....	7

## LIST OF TABLES

<u>Table</u>	<u>Page</u>
1. Daily catch (using fish ticket data) for the commercial king crab harvest, Norton Sound Section, Eastern Bering Sea, July 1 – September 4, 1999 .....	8
2. Red king crab summer commercial harvest (from fish ticket reports) by statistical area for Norton Sound Section, Eastern Bering Sea, July 1 - September 4, 1999 .....	9
3. Carapace length measurement summary of sampled legal male red king crab captured during the commercial king crab harvest, July 1 – September 3, 1998 and during the 1999 Norton Sound king crab trawl survey .....	10
4. Red king crab tag information recovered during the Norton Sound commercial king crab harvest, July 1 – September 4, 1999 .....	11

## LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
1. King Crab fishing districts and sections of Statistical Area Q.....	12
2. Norton Sound red king crab statistical areas .....	13
3. Daily catch, daily CPUE, and cumulative daily catch, Norton Sound summer commercial red king crab fishery, July 1 –September 4, 1999.....	14
4. Length frequency distribution of new and old carapace age condition of legal male red king crab, Norton Sound summer commercial red king crab fishery, July 1, - September 4, 1999 and the 1999 Norton Sound king crab trawl survey .....	15

## LIST OF APPENDICES

<u>Table</u>		<u>Page</u>
1.	Historic commercial harvest of red king crab from Norton Sound Section, Eastern Bering Sea, by statistical areas, 1977-1999.....	16
2.	Historic summer commercial red king crab annual harvest, Norton Sound Section, Eastern Bering Sea, 1977 - 1999 .....	17
3.	Historic summer commercial red king crab economic performance Norton Sound Section, Eastern Bering Sea, 1977 - 1999.....	18
4.	A comparison of the proportion of recruit and postrecruit red king crab sampled from summer commercial harvest, Norton Sound Section, Eastern Bering Sea, 1983 - 1999 .....	19
5.	Standardized results from the population assessment surveys for red king crab in Norton Sound since 1976 .....	20
6.	Winter commercial and subsistence red king crab harvests, Norton Sound, Eastern Bering Sea, 1978-1999 .....	21

## INTRODUCTION

### Norton Sound

The Norton Sound Section of the Northern Bering Sea District consists of all waters in Registration Area Q that are north of the latitude of Cape Romanzof, east of 168 west longitude, and south of the latitude of Cape Prince of Wales (Figures 1 and 2). A large vessel summer commercial red king crab (*Paralithodes camtschatica*) fishery existed in the Norton Sound Section from 1977 through 1992 (Appendix Table 2). No summer commercial fishery occurred in 1991 due to a lack of staff necessary to manage the fishery. The budget had been cut the previous winter. In 1992, the large vessel summer commercial fishery resumed. Regulation changes adopted during the March 1993 Board of Fisheries meeting changed the character of the fishing fleet to that of a small boat fleet. A superexclusive designation went into effect for the Norton Sound commercial crab fishery June 27, 1994. A vessel registered for the Norton Sound crab fishery may not be used to take king crab in any other registration area during that registration year. A vessel moratorium was put into place prior to the 1996 season with the intention to create a license limitation in the near future.

The National Marine Fisheries Service (NMFS) conducted a trawl survey to examine the abundance of Norton Sound red king crab in late August 1991 (Appendix Table 5). The results of that survey as compared to the 6 previous trawl surveys show a gradual trend of increasing abundance since the low recorded in 1982. The 1991 survey estimated the total biomass of legal king crab (red king crab with carapace  $\geq 4.75$  inches) to be 3.4 million pounds present in the open commercial fishing area. The 1991 survey was the last survey conducted by the NMFS. The Alaska Department of Fish and Game (ADF&G) conducted a trawl survey to examine the abundance of Norton Sound red king crab from August 7 - 18, 1996. The estimated abundance of legal males was 534,446 red king crab with a biomass of approximately 1.6 million pounds (Appendix Table 5). This population estimate showed a 40% decline in the legal biomass of king crab since 1991. The results from the 1996 trawl survey prompted the fishery managers to reduce the harvest rate in the commercial fishery to five percent of the legal biomass and set the guideline harvest at 80,000 pounds. This is a significant reduction from the previous exploitation rate of ten percent and guideline harvest level of 340,000 pounds.

### St. Lawrence Island

The St. Lawrence Island Section lies immediately west and north of the Norton Sound Section. Because the Bering Sea crab fleet bases in Dutch Harbor, the St. Lawrence Island Section has been managed by ADF&G's Westward Region's Dutch Harbor office, until recently. The only reported commercial catches to date in the St. Lawrence Island Section were made in 1983 when 52,557 pounds of blue king crab were delivered from 13 landings; in 1989 when 3,603 pounds of red king crab and 984 pounds of blue king crab were delivered from 8 landings; in 1992 when 53 pounds of blue crab were landed; and in 1995 when 7,913 pounds were delivered from three landings.

In 1983, the commercial crab fleet concentrated near the southeast shore of St. Lawrence Island. The following year a regulation proposal to close the waters within 10 miles of all inhabited islands within the section was adopted in an attempt to protect stocks targeted by local fishermen and reduce impacts on marine mammal subsistence harvests during the winter. During the 1989 season, three fishing vessels prospecting in that section found relatively few blue king crab near rocks and shoals still open to commercial fishing, but red king crab were discovered in low densities near Kivalina, the northern

boundary of the section. The villagers of Little Diomed Island have also traded and sold winter caught blue king crab with residents of Nome and other villages for years. The Department has not been able to obtain an accurate estimate of the magnitude of this trade. The remoteness of this village is also a factor contributing to the lack of catch records. Current regulation allows the commercial harvest and sale of king crab near shore during the winter. The Board provided the same provisions in the regulation as are in effect for Norton Sound to allow a commercial winter fishery. However, local residents of St. Lawrence Island have decided not to export any of their winter catch for commercial sale.

## COMMERCIAL FISHERY

### Norton Sound Summer Commercial Fishery

The 1999 summer commercial red king crab fishery opened at 12 noon, July 1 in the Norton Sound Section. An emergency order relaxing the closure line described in regulation eastward to 161° 30' west longitude was announced June 19 to be effective at the fishery opening on noon July 1. Another emergency order was announced July 2 relaxing the nearshore closure line in the vicinity of Unalakleet eastward to 161° 15' west longitude effective noon July 3. Residents of eastern Norton Sound had requested that commercial fishing be allowed in areas more accessible to their communities. One commercial fisher had registered to fish in this eastern Norton Sound statistical area. Over the past year there has been some discussion of the impacts of relaxing the eastern Norton Sound line and changing the fishing season. Because there was only a limited market for king crab in Norton Sound during the 1999 season and because the timing of fish migrations had been delayed, there was an opportunity to gather information about the impacts of fishing early and nearer the eastern shore. A fishing vessel fishing in this open area was required to have an ADF&G observer on board to record size and health of the crab caught. The limited commercial effort was not expected to have a significant impact on the distribution of crab harvest between commercial and subsistence users of the resource.

The first fishers registered July 1, and the first delivery was not made until July 7. The fishery was closed by emergency order at 12 noon, September 4. The fishery had been extended 24 hours due to poor weather in order to provide fishers an opportunity to get all their pots out of the water in a safe and cost effective manner. The final delivery was made on September 7. Fishers had checked and pulled all fishing pots prior to the closure, but left a storage pot full of harvested crab out until they coordinated their market. A total of 10 fishing vessels and fishers were registered for the summer commercial crab season. All fishers were registered as catcher/sellers because no registered crab buyer was present in the ports of Nome or Unalakleet. Catcher/sellers coordinated flying live crab to buyers in Anchorage and sold live crab off the dock locally. One vessel over 32 feet participated in the 1999 summer season. This vessel was 45 feet in length and obtained an interim moratorium permit to participate in the 1999 crab fishery. No floating crab processors or catcher/processors operated in Norton Sound during the 1999 summer fishery, therefore no independent observers were placed on board commercial vessels. One fishing vessel based out of the Unalakleet area had an ADF&G observer on board for two of its trips to monitor crab catches. Port sampling in Nome was attempted at various times throughout the fishery. Because of the lack of a buying station in Nome, no commercial sampling was done due to erratic scheduled boat trips and problems with airline scheduling shipments of crab out of town. Fishers would hold their live crab in pots just offshore until they could schedule airline transport to haul live crab to Anchorage. Shipment would often be late at night as space allowed. Erratic scheduling also caused problems with fishers and their Anchorage markets.

Catch reporting logs were kept by buyers and by skippers of catcher vessels for each statistical area fished. Buyers verbal reports were relayed daily by 9:00 a.m. to the ADF&G office in Nome. Fish tickets were due in to the ADF&G office on Friday of each week throughout the duration of the fishery. Vessel reports from fishermen and Catcher/Seller fish tickets were required every Monday for the duration of the fishery. Compliance with reporting requirements was good. Daily catch statistics can be found in Table 1 and Figure 3

Of the ten vessels which made deliveries in the 1999 season six registered from Norton Sound, three from the Yukon Delta and one was Alaskan but from outside the section. Norton Sound fishers caught 35% of the total harvest, Yukon Delta fishers caught 27% of the harvest and other Alaskan residents harvested the remaining 38%.

Board of Fisheries regulations specific to the Norton Sound Section are:

- 1) 5AAC 34.915, which directs the Department to manage the Norton Sound summer king crab fishery for a harvest of one half the exploitation rate determined under 5AAC 34.080.
- 2) 5AAC 34.935, which established a closed area with a defined boundary approximating 15 miles from the beach in the Norton Sound section, to protect a long established winter subsistence fishery.
- 3) 5AAC 34.925 (i) and (j), requiring pot tags and limiting vessels of 125 feet in length or less to 40 pots each and larger vessels are limited to 50 pots.
- 4) 5AAC 34.906, designates the Norton Sound Section to be a superexclusive registration area..

### Statistical Summary

The total commercial catch was 8,734 crab (Table 1). A total of 23,553 pounds were harvested. Ten vessels made deliveries, and 9 permit holders fished. Average weight for commercially caught crab was 2.7 lb./crab. A total of 360 pots were registered and 1,630 pot pulls were recorded during the fishery. The average price/pound was \$3.08. The fishery value was approximately \$72,543. Daily catch statistics can be found in Table 1 and Figure 3.

Fish ticket reports document that 8 statistical areas were fished (Table 2, Figure 6). Statistical area 636401 had the highest catch with 14,201 pounds taken or approximately 60.3% of the entire harvest. The second highest catch came from statistical area 646330, which was 3,021lbs or 12.8% of the harvest. The overall CPUE for the 1999 fishery was 5.4 crab/pot (Table 1). Statistical area 646401 had the greatest CPUE with 17.5 crab/pot (Table 2).

### Commercial Catch Sampling

Carapace length measurements and shell age were collected from 561 legal male red king crab throughout the 1999 summer fishery and during the 1999 Norton Sound king crab trawl survey. Carapace age was classified as new (11 months old) or old (at least 23 months old) (Table 3, Figure 4). Overall mean carapace length of the legal male red king crab sampled was 118.1 mm (Table 3). Male crab with new shell carapaces made up 87.9% of the total legal male king crab sampled, and old shell

crab made up 12.1% of the sample (Table 3, Figure 4). Recruit crab made up 41.7% of all legal male crab sampled (Table 3). Postrecruit crab made up 58.3% of the legal crab sampled.

### Tagged Crab

Five male crab with tags were returned to the ADF&G office during the 1999 commercial fishery (Table 4). All but one of these five tagged crab had been tagged in 1999. The crab with tag number NX3017 was tagged March 9, 1995 and grew 37 mm. Three tags with no crab were also returned. These three tags provided no useful growth information.

### Enforcement

The Fish and Wildlife Protection officer was unable to patrol the fishery. No cases were filed during 1999.

### Norton Sound Winter Commercial Fishery

Regulation allows a winter commercial fishery in the Norton Sound Section from November 15 through May 15, the fishery typically takes place near Nome. The winter commercial fishery is required to take place from the ice, not from vessels. During the winter of 1998-1999, five commercial fishermen reported selling a total of 2,714 red king crab (Appendix Table 7). The villages east of Nome reported only limited harvests of crab. Ice conditions were generally unfavorable throughout Norton Sound, although the sea ice near Elim was fairly stable. Poor catch rates at Nome and unstable ice to the east kept king crab fishing to some of the lowest levels in recent years.

The harvest is divided between local residents who buy crab directly from the fishermen and other non-local markets such as Anchorage. Crab are sold in Nome for an average of ten dollars per crab, roughly \$3.69 per pound. The 1998-1999 winter catch of 7,041 pounds was estimated to be worth about \$25,981.

The winter crab fishermen generally use crab pots but some use handlines to "prospect". Deploying pots through sea ice is laborious, but hand lines can be dropped through a large ice auger hole in a short period of time. The other advantage of hand lines is that during periods of favorable weather hand lines may be deployed from new, less stable ice without the risk of losing more expensive crab pots. Most fishermen consider commercial crabbing a sideline and hold other jobs. Usually, two or three of the winter crab fishermen sell the majority of the crab. Because the volume of crab involved is low, no processor has found it profitable to operate locally. The crab sold locally are all sold fresh as are those shipped to Anchorage or other non-local markets. During the mid-winter months, fishermen find it difficult keeping the crab from freezing. Many Nome residents prefer to buy frozen crab since they are able to extract the meat prior to cooking. Fresh frozen crab are easily marketed in Nome, but are not accepted in Anchorage markets.

## SUBSISTENCE FISHERY

Red king crab are utilized by Norton Sound residents mainly during the winter. Fishing occurs through cracks or holes cut in the ice with the use of handlines and pots. In order to document trends in the subsistence harvest, the Board of Fisheries enacted a regulation in 1977 requiring subsistence fishermen in

Norton Sound to obtain a permit prior to fishing and to record daily effort and catches on these permits (Appendix Table 6).

The first year subsistence permits were required had the highest number of permits issued to date and a relatively high harvest rate were recorded. The fishery declined sharply the following year and remained at very depressed levels throughout the 1981-82 season. The lack of success in the winter crab fishery during some past years has been attributed to a declining crab population caused by the removal of crab in the summer commercial fishery together with low recruitment, low effort due to poor ice conditions, and changes in the nearshore winter distribution of crab. All these factors probably had some effect on the success of the winter fishery in varying degrees. During the 1978-79 winter fishery, the king crab population was still in relatively high abundance. Despite this relatively large population, winter catches were the poorest on record indicating that the major factors limiting winter catches were probably poor ice conditions and the distribution of crab. During the winter of 1981-82, poor winter catches could more reasonably be attributed to a declining crab population since the crab population was at a much lower level. Subsistence fishing success during the winters of 1982-83 through 1986-87 had improved due to a rebuilding of the population and increased use of more efficient gear (pots instead of handlines). Unstable ice conditions and record snowfalls adversely effected the 1987-88, 1988-89, and 1992-93 catches. During years of stable ice conditions, approximately 100 fishermen have averaged 100 crab each.

The 1998-1999 season had relatively stable ice conditions near Nome and Elim, however areas near Golovin Bay and Eastern Norton Sound were less stable. Subsistence fishers obtained 95 permits. Of the 44 permits returned, 41 reported fishing. Thirty-seven fishers reported using pots, three reported using handlines, and one reported using a combination of the two gears. Permit data indicates the subsistence harvest consisted of 3,427 male crab and 11 female crab. Those fishers reported harvesting 76% of the male crab they caught and 8% of the females caught.

## STOCK STATUS / RESEARCH

There has been a change in the character of the summer commercial fishery since 1993 due to regulation changes affecting pot limits, opening dates and a regulation making Norton Sound a superexclusive registration area. The quality and quantity of data collected since the 1993 summer crab fishery has differed greatly from previous years due to the nature of the small vessel fishery. No floating processor or catcher processor took part in the 1999 fishery, therefore no independent observers were onboard commercial vessels.

The ADF&G fishery monitor did not have the opportunity to make observations on small catcher vessels during the 1999 fishery. Only the observer on the vessel fishing in nearshore waters of eastern Norton Sound collected data on observed pot lifts, sublegal male and female length frequencies, and catch rates of legal and sublegal crab during the commercial fishery. This data may be of interest in considering proposals to open the season earlier or to allow fishing closer to shore.

In 1976, when monitoring of the Norton Sound king crab population first began, the population was mainly composed of prerecruit and recruit crab. The initial population assessment survey by the NMFS estimated the legal male king crab population at 8.1 million pounds (Appendix Table 5). The legal male crab population peaked in 1978 at an estimated 11 million pounds. During the 4 years following 1978, recruitment into the legal male crab population was very low. Subsequent NMFS surveys in 1979 and 1982 documented a population of predominantly postrecruit crab, and estimated the population had declined to 2.6 million pounds by 1982. Beginning in 1981, sublegal crab abundance began to increase, and by 1983 recruitment into the legal male population also began to increase. No assessment work was

conducted in 1983 or 1984. However, samples of the commercial catches indicated a significant increase of recruit crab into the legal male population; from a historic low of 10% in 1981 to 59% in 1984.

In 1985, both NMFS and ADF&G conducted population assessment surveys in Norton Sound (Appendix Table 5). After the commercial fishery in 1985, NMFS conducted a population assessment survey using trawl gear over a slightly larger area than that surveyed by the Department. Male king crab sampled in NMFS trawls were in the process of or had just molted with the result being that their estimate of 3.4 million pounds of legal male king crab included some recruitment. Adjusting this estimate for molting, and including the summer commercial harvest, an estimated three million pounds were present prior to the 1985 August fishery. Both surveys documented relatively substantial numbers of recruit crab and a healthy percentage of prerecruit crab.

During September of 1988 NMFS conducted a fifth population assessment with trawl gear. They sampled an area roughly the same size as in 1985, but increased sampling frequency in the proposed mineral lease area near Nome. The timing of the study, which occurred during the male molt, was almost a month earlier than similar surveys in the past. Nearly all the 1988 catch was in pre-molt condition. NMFS estimated 3.0 million pounds of legal male and 1.0 million pounds of prerecruit-one male red king crab; totaling 4.0 million pounds. Annual mortality was estimated at approximately 20% or 0.8 million pounds. Ignoring growth and the winter harvests, the population prior to the 1989 summer fishery would have been 3.2 million pounds, very close to the 1985 trawl estimate of 3.4 million pounds.

NMFS conducted a sixth trawl survey of Norton Sound during late August 1991 with a reduced number of tows. Each station had only a single sampling tow, as compared to each station having both a day and night tows during previous surveys. This reduction in sampling had the effect of introducing more variability into the estimate. The legal crab biomass in the summer fishing area was estimated to be 3,400,000 pounds and the total Norton Sound legal biomass was estimated to be 4,009,000 pounds. Since the survey occurred prior to the molt, a mortality of 10% was assumed for the year following the estimate. With no summer or winter fishery data to compare with the survey results, a conservative biomass of 3,400,000 pounds was used as the basis for the 1992-96 harvest guideline. The Norton Sound red king crab population was thought to be stable with harvest set near 10%.

NMFS has discontinued their trawl surveys of Norton Sound. The Department was able to utilize recently appropriated money for a trawl survey during August of 1996. The methodology used was very similar to that used by NMFS in previous surveys. The legal biomass was estimate to be 1,600,000 pounds. This is a significant decline from the previous survey. The Department decided that the population was far below its carrying capacity and was closely approaching the threshold below which a commercial harvest should not occur. There are indications that the sublegal portion of the population is relatively strong in comparison to the legal portion. It was decided that the exploitation rate would be reduced to five percent of the legal biomass. This reduced harvest rate and the expected strong recruitment allowed for a rapid recovery of the legal biomass.

The survey conducted during August of 1999 found a significant increase in the legal male population of red king crab. The population estimate is expected to be available by December 15.

## FUTURE INVESTIGATIONS

The trawl survey that occurred during the summers of 1996 and 1999 in Norton Sound was made possible by a budget increment passed by the legislature. This is to be a regularly scheduled survey rotating between districts. Both funding for a sustained winter research program and a triennial trawl survey to

evaluate Norton Sound crab populations were provided for in that legislation. A winter pot survey is planned during February, March, and April. The results of the recent trawl survey and the upcoming winter study will be used in a model to project the summer 2000 legal biomass and an appropriate harvest guideline.

### OUTLOOK FOR 2000

The outlook for 2000 is not yet complete. The winter pot survey will be used to refine the projections generated from the trawl survey and the Norton Sound crab population model. This calculation will not be completed until late April. At this time, the legal male biomass is expected to be found sufficient to provide for a summer harvest guideline greater than 250,000 pounds.

Table 1. Daily catch (using fish ticket data) for the commercial king crab harvest, Norton Sound Section, Eastern Bering Sea, July 1 - September 4, 1999\*

Date	Permits	Landings	Number of Crab	Lbs of Crab Harvested	Cumulative Total (lbs)	No. of Pits Pulled	Average Weight (lbs)	CPUE
7/1/99								
7/2/99								
7/3/99								
7/4/99								
7/5/99								
7/6/99								
7/7/99	1	1	310	1,050	1,050	40	3.4	7.8
7/8/99	1	1	35	123	1,173	2	3.5	17.5
7/9/99	2	5	370	1,171	2,344	90	3.2	4.1
7/10/99					2,344			
7/11/99	1	1	125	352	2,696	40	2.8	3.1
7/12/99	1	1	56	153	2,849	40	2.7	1.4
7/13/99					2,849			
7/14/99	2	2	99	271	3,120	34	2.7	2.9
7/15/99					3,120			
7/16/99					3,120			
7/17/99					3,120			
7/18/99	1	1	455	1,365	4,485	70	3.0	6.5
7/19/99					4,485			
7/20/99					4,485			
7/21/99	1	2	100	230	4,715	38	2.3	2.6
7/22/99	3	6	807	2,116	6,831	145	2.6	5.6
7/23/99	2	2	652	1,908	8,739	87	2.9	7.5
7/24/99					8,739			
7/25/99	1	1	52	150	8,889	19	2.9	2.7
7/26/99	1	2	154	385	9,274	19	2.5	8.1
7/27/99	2	2	270	812	10,086	47	3.0	5.7
7/28/99	1	1	2	8	10,094	14	4.0	0.1
7/29/99					10,094			
7/30/99					10,094			
7/31/99					10,094			
8/1/99	1	2	338	1,192	11,286	80	3.5	4.2
8/2/99	1	1	21	74	11,360	10	3.5	2.1
8/3/99					11,360			
8/4/99					11,360			
8/5/99	1	1	183	451	11,811	17	2.5	10.8
8/6/99	1	3	255	727	12,538	100	2.9	2.6
8/7/99					12,538			
8/8/99					12,538			
8/9/99	2	3	483	1,143	13,681	118	2.4	4.1
8/10/99					13,681			
8/11/99					13,681			
8/12/99	1	1	104	265	13,946	12	2.5	8.7
8/13/99	1	1	498	1,139	15,085	80	2.3	6.2
8/14/99					15,085			
8/15/99	1	1	84	245	15,330	13	2.9	6.5
8/16/99	1	1	107	313	15,643	20	2.9	5.4
8/17/99	1	1	167	461	16,104	30	2.8	8.4
8/18/99					16,104			
8/19/99					16,104			
8/20/99	1	1	950	1,324	17,928	85	1.9	11.2
8/21/99					17,928			
8/22/99					17,928			
8/23/99					17,928			
8/24/99					17,928			
8/25/99	2	2	1,052	2,690	20,618	114	2.6	9.2
8/26/99					20,618			
8/27/99	1	1	281	930	21,548	40	3.3	7.0
8/28/99	2	2	290	875	22,423	78	3.0	3.7
8/29/99					22,423			
8/30/99					22,423			
8/31/99	1	1	191	429	22,852	60	2.2	3.2
9/1/99					22,852			
9/2/99					22,852			
9/3/99					22,852			
9/4/99					22,852			
9/5/99					22,852			
9/6/99 <sup>b</sup>	2	2	218	632	23,484	78	2.9	2.8
9/7/99 <sup>b</sup>	1	1	25	69	23,553	20	2.8	1.3
Totals			8,734		23,553	1,670	2.7	5.4

\*The commercial season was extended 24 hours due to weather

<sup>b</sup> Season was closed 9/4/99, but crab was delivered and sold after this date

Table 2. Red king crab summer commercial harvest (from fish ticket reports) by statistical area for Norton Sound Section, Eastern Bering Sea, July 1 - September 4, 1999.

Statistical Area	Number	Pounds	Pots Pulled	CPUE	Average Weight (Lbs.)	Percent of Pots Pulled in Stat. Area (%)	Percent Harvest in Stat. Area (%)
616331	185	633	42	4.4	3.42	2.6	2.7
626401	150	508	20	7.5	3.39	1.2	2.2
636401	5,522	14,201	886	6.2	2.57	54.4	60.3
646330	1,027	3,021	182	5.6	2.94	11.2	12.8
646401	70	221	4	17.5	3.16	0.2	0.9
656330	509	1,300	88	5.8	2.55	5.4	5.5
656401	990	2,739	368	2.7	2.77	22.6	11.6
666401	281	930	40	7.0	3.31	2.5	3.9
Total:	8,734	23,553	1,630	5.4	2.70		

Table 3. Carapace length measurement summary of sampled legal male red king crab captured during the commercial king crab harvest, July 1 - September 4, 1999 and during the 1999 Norton Sound king crab trawl survey.

Carapace Length (mm)	New shell			Old shell			Total		
	No.	Ave Length Calc.	%	No.	Ave Length Calc.	%	No.	Ave Length Calc.	%
95	0	0.0	0.0%	0	0.0	0.0%	0	0.0	0.0%
96	1	0.2	0.2%	0	0.0	0.0%	1	0.2	0.2%
97	0	0.0	0.0%	0	0.0	0.0%	0	0.0	0.0%
98	1	0.2	0.2%	0	0.0	0.0%	1	0.2	0.2%
99	3	0.6	0.5%	0	0.0	0.0%	3	0.5	0.5%
100	6	1.2	1.1%	1	1.5	0.2%	7	1.2	1.3%
101	7	1.4	1.2%	0	0.0	0.0%	7	1.3	1.2%
102	11	2.3	2.0%	0	0.0	0.0%	11	2.0	2.0%
103	7	1.5	1.2%	0	0.0	0.0%	7	1.3	1.2%
104	17	3.6	3.0%	2	3.1	0.4%	19	3.5	3.4%
105	17	3.6	3.0%	2	3.1	0.4%	19	3.6	3.4%
106	14	3.0	2.5%	0	0.0	0.0%	14	2.6	2.5%
107	13	2.8	2.3%	3	4.7	0.5%	16	3.1	2.9%
108	11	2.4	2.0%	0	0.0	0.0%	11	2.1	2.0%
109	20	4.4	3.6%	0	0.0	0.0%	20	3.9	3.6%
110	30	6.7	5.3%	2	3.2	0.4%	32	6.3	5.7%
111	17	3.8	3.0%	1	1.6	0.2%	18	3.6	3.2%
112	14	3.2	2.5%	2	3.3	0.4%	16	3.2	2.9%
113	12	2.8	2.1%	1	1.7	0.2%	13	2.6	2.3%
114	14	3.2	2.5%	4	6.7	0.7%	18	3.7	3.2%
115	19	4.4	3.4%	1	1.7	0.2%	20	4.1	3.6%
116	11	2.6	2.0%	2	3.4	0.4%	13	2.7	2.3%
117	17	4.0	3.0%	5	8.6	0.9%	22	4.6	3.9%
118	9	2.2	1.6%	3	5.2	0.5%	12	2.5	2.1%
119	16	3.9	2.9%	4	7.0	0.7%	20	4.2	3.6%
120	15	3.7	2.7%	1	1.8	0.2%	16	3.4	2.9%
121	11	2.7	2.0%	0	0.0	0.0%	11	2.4	2.0%
122	12	3.0	2.1%	1	1.8	0.2%	13	2.8	2.3%
123	13	3.2	2.3%	6	10.9	1.1%	19	4.2	3.4%
124	11	2.8	2.0%	4	7.3	0.7%	15	3.3	2.7%
125	14	3.5	2.5%	3	5.5	0.5%	17	3.8	3.0%
126	9	2.3	1.6%	3	5.6	0.5%	12	2.7	2.1%
127	11	2.8	2.0%	6	11.2	1.1%	17	3.8	3.0%
128	15	3.9	2.7%	6	11.3	1.1%	21	4.8	3.7%
129	9	2.4	1.6%	0	0.0	0.0%	9	2.1	1.6%
130	11	2.9	2.0%	0	0.0	0.0%	11	2.5	2.0%
131	10	2.7	1.8%	1	1.9	0.2%	11	2.6	2.0%
132	9	2.4	1.6%	2	3.9	0.4%	11	2.6	2.0%
133	4	1.1	0.7%	0	0.0	0.0%	4	0.9	0.7%
134	9	2.4	1.6%	2	3.9	0.4%	11	2.6	2.0%
135	7	1.9	1.2%	0	0.0	0.0%	7	1.7	1.2%
136	9	2.5	1.6%	0	0.0	0.0%	9	2.2	1.6%
137	5	1.4	0.9%	0	0.0	0.0%	5	1.2	0.9%
138	7	2.0	1.2%	0	0.0	0.0%	7	1.7	1.2%
139	5	1.4	0.9%	0	0.0	0.0%	5	1.2	0.9%
140	3	0.9	0.5%	0	0.0	0.0%	3	0.7	0.5%
141	0	0.0	0.0%	0	0.0	0.0%	0	0.0	0.0%
142	3	0.9	0.5%	0	0.0	0.0%	3	0.8	0.5%
143	0	0.0	0.0%	0	0.0	0.0%	0	0.0	0.0%
144	2	0.6	0.4%	0	0.0	0.0%	2	0.5	0.4%
145	1	0.3	0.2%	0	0.0	0.0%	1	0.3	0.2%
146	1	0.3	0.2%	0	0.0	0.0%	1	0.3	0.2%
147	0	0.0	0.0%	0	0.0	0.0%	0	0.0	0.0%
148	0	0.0	0.0%	0	0.0	0.0%	0	0.0	0.0%
149	0	0.0	0.0%	0	0.0	0.0%	0	0.0	0.0%
150	0	0.0	0.0%	0	0.0	0.0%	0	0.0	0.0%
151	1	0.3	0.2%	0	0.0	0.0%	1	0.3	0.2%
Total No.	493		87.9%	68		12.1%	561		100.0%
Mean		117.8			119.8			118.1	
Total legal			561						
Total Recruits			234						
Percent			41.7%						
Total Post Recruits			327						
Percent			58.3%						

Table 4. Red king crab tag information recovered during the Norton Sound commercial red king crab harvest, July 1 - September 4, 1999.

Tag Number	Capture Date	Stat. Area of Capture	Carapace Length (mm)	Shell Age	Tagging Date	Tagging Location <sup>b</sup>	Carapace Length (mm)	Shell Age	Growth (mm)	No. of Molts <sup>a</sup>	Skip Molts	Average Growth per Molt (mm)
NZ3815	7/14/99	656403	93	New	3/11/99	W4	93	New	0			
NX3572	7/18/99	636401	no info		3/14/99	W5	98	New				
NZ3412	7/18/99	636401	no info		3/20/99	N3	97	New				
NZ4017	7/22/99	656403	98	New	4/7/99	W1	98	New	0			
NZ3973	7/22/99	656403	92	New	3/30/99	N3	92	New	0			
NX3685	7/26/99	656330	no info			no info found						
NZ4015	7/27/99	656403	92	New	3/22/99	N3	93	New	-1			
NX3017	8/16/99	656330	131	Old	3/9/95	W3	94	New	37	3	1	12.3
												12.3

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

<sup>b</sup> 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.

Figure 1. King crab fishing districts and sections of Statistical Areas E-Q

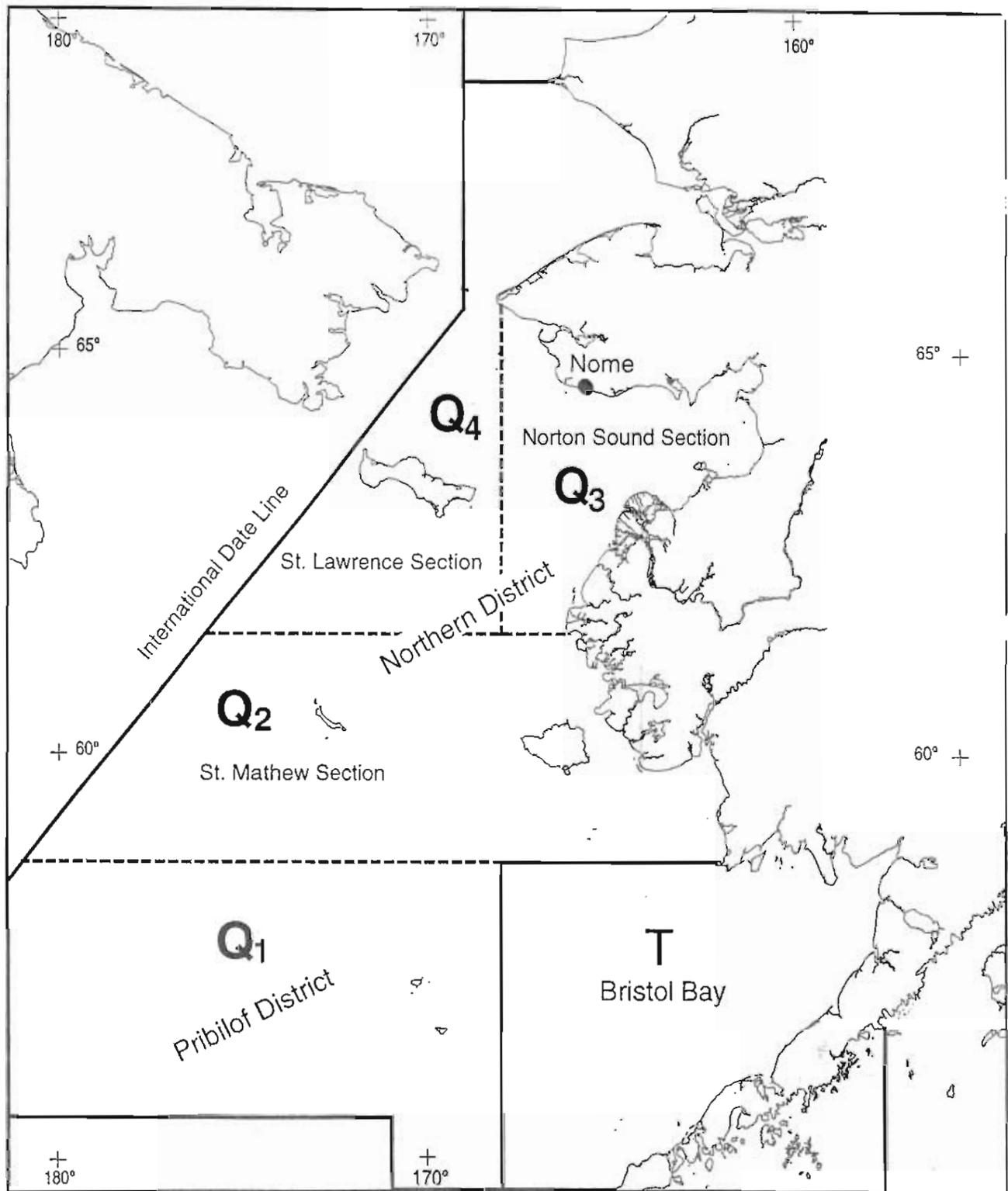
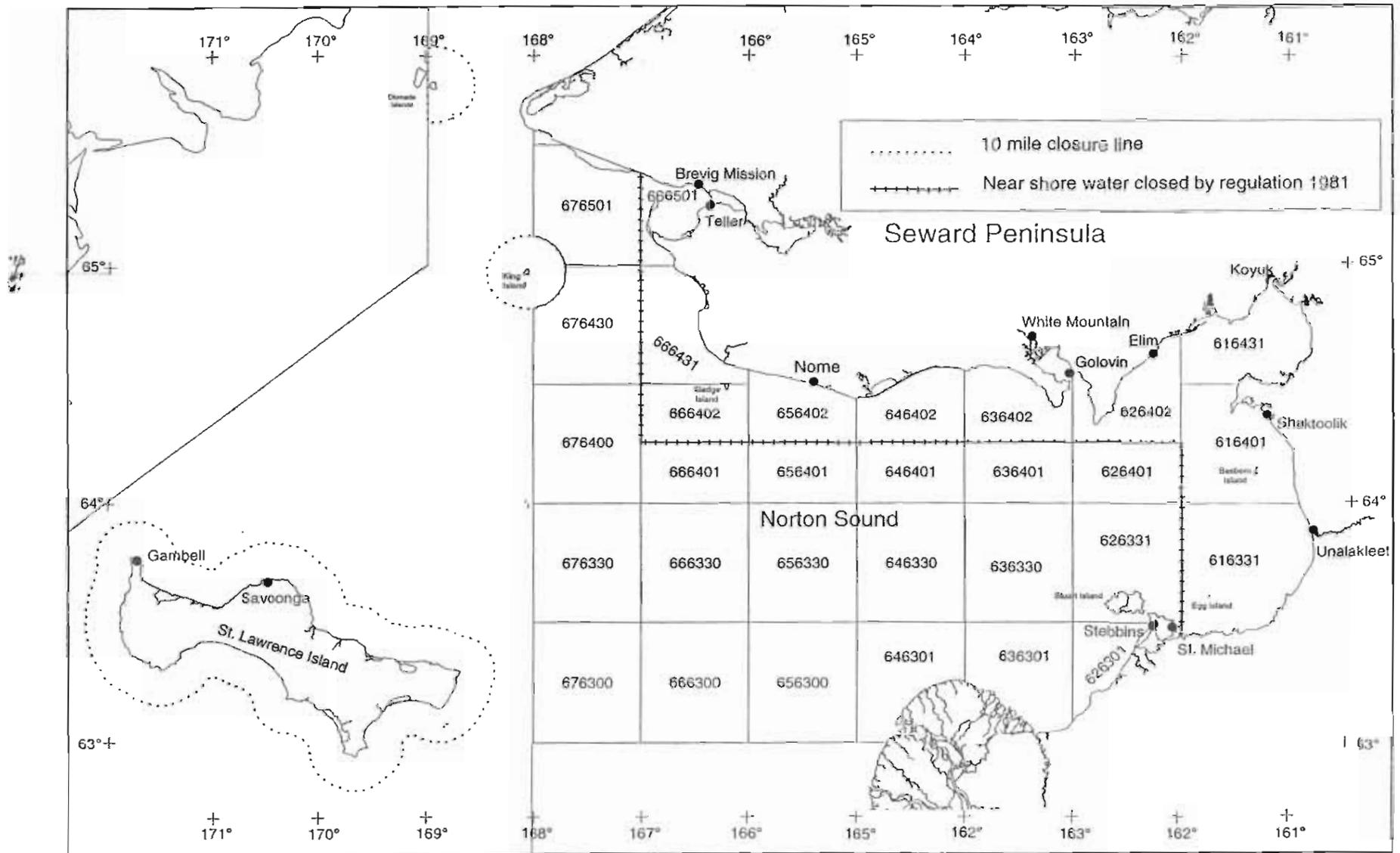


Figure 2. Norton Sound red king crab statistical areas.



# 1999 Norton Sound Red King Crab

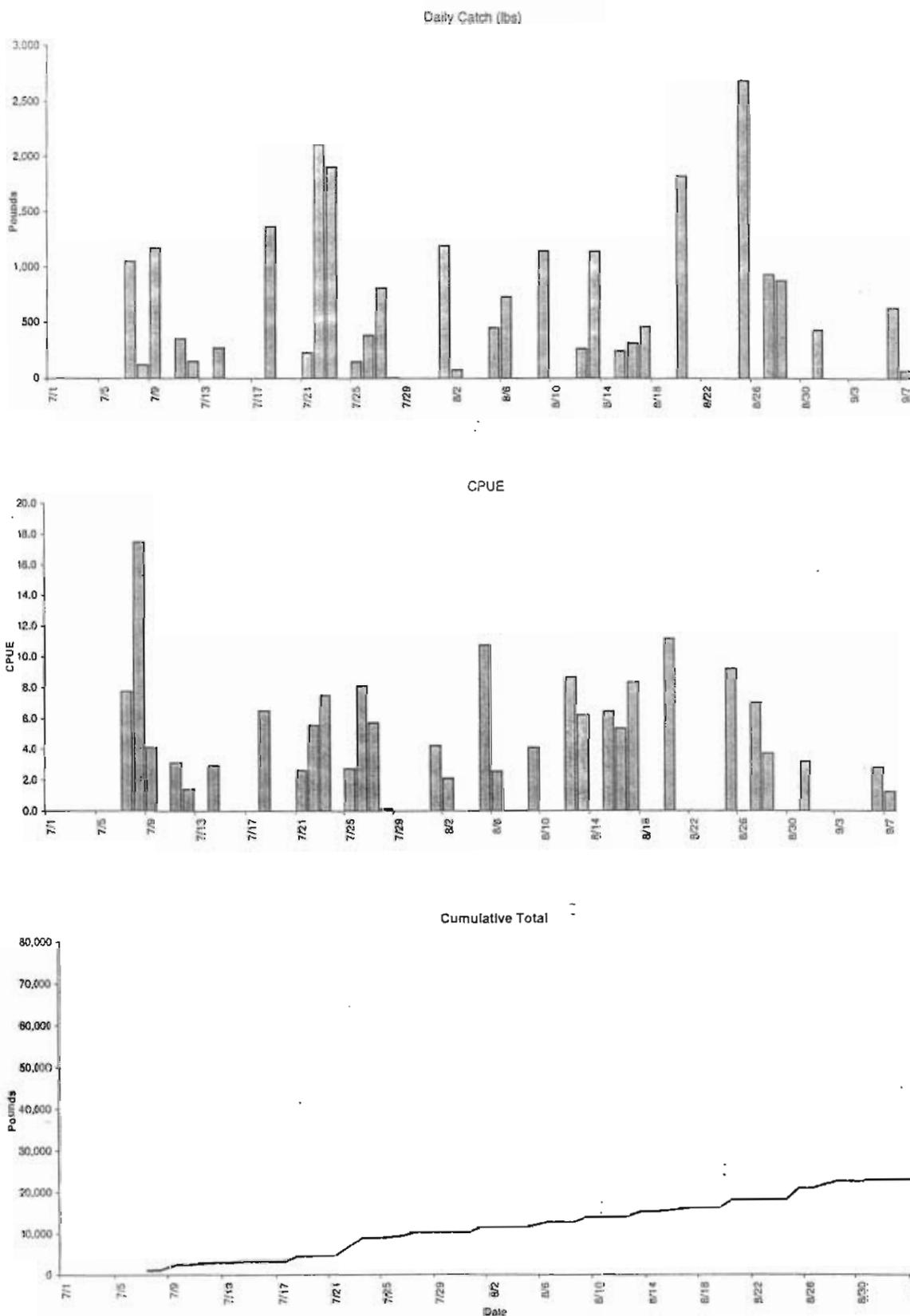


Figure 3. Daily catch, daily CPUE, and cumulative daily catch, Norton Sound summer commercial red king crab fishery, July 1 - September 4, 1999.

### Legal Male Red King Crab

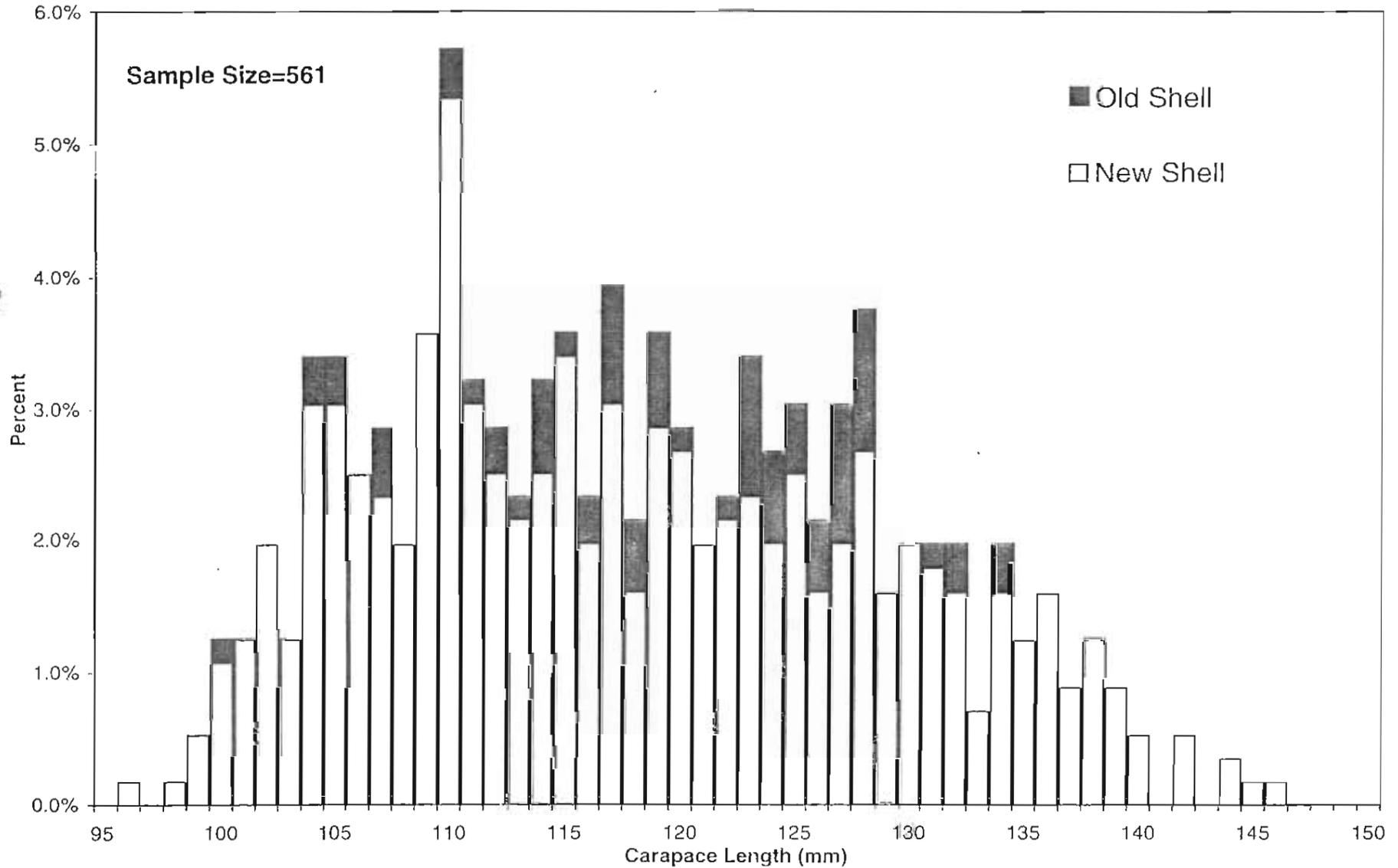


Figure 4. Length frequency distribution of new and old carapace age condition of legal male red king crab, Norton Sound summer commercial king crab fishery, July 1 - September 4, 1999 and the 1999 Norton Sound king crab trawl survey.

Appendix Table 1. Historic commercial harvest of red king crab from Norton Sound Section, Eastern Bering Sea, by statistical area, 1977-1999 (catch in pounds).<sup>a</sup>

Statistical Area	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1992	1993	1994	1995	1996 <sup>b</sup>	1997	1998	1999	Totals		
616331	7,893																48					633	7,941		
616401																		35						35	
626331	40,020					22													61					40,103	
626401	31,572			4,830	399													18,971	43,045	18,066	8,065	908		126,948	
626402	38,993																							38,993	
636330																			4,560	3,838	2,449			40,847	
636401				12,398	61,823	32,246	5,880	41	891				22,030		1,159	1,373	8,087	24,329	70,677	59,206	10,771	14,201		310,911	
636402																	1,734	3,466						5,220	
646301																			4,628	13,888					18,516
646330					4,716								5,212						1,491	2,894	314		3,621	14,626	
646401			155,972		1,319	17,532																		146,823	
646402	80,969					748												1,963	37,222	105,045	22,824	1,652	5,194	292,779	
656300			161,699		15,174												730	143,511	66,821					176,823	
656330				323,518	72,735	395,662	3,983	24,216	83,479	7,632		79,006	36,129	1,757					19,743	15,446	4,661	4,078	1,306	1,077,136	
656401				138,011	121,147	253,387	60,480	11,422	183,119	246,200		194,408	165,044	160,956	171	53,110	105,341	29,566	32,280	9,985	4,035	1,127	2,739	1,710,407	
656402	306,302	90,187	288,869	918	3,098	2,832			132,363								193,079	106,053	43,000					1,167,701	
666230		55,490			77																				55,567
666300		162,795	60,816	84,874	9,167	95		4,534																	347,800
666330		353,016	505,050	367,446	141,513	8,990	1,192		380	70,615	2,963	13,020	1,275	27,185	4,308	31,738			730						1,529,447
666401		179,212	486,047	205,400	381,510	79,580	325,045	116,254	5,341	408,848	50,744	23,895	113,257	162,263	16,672	746	396			3,001	1,816	930		2,554,887	
666402	12,036	515,778	534,938	183,581		17,585			32,992																1,298,666
666431			146,029																						147,153
676300		13,238		126,231															1,124						140,015
676330		51,304	81,798	6,762	18,734																				158,598
676400		667,130	33,856	274	92,026	1,315	247		32					3,212						9,775					807,867
676430		3,811	12,309		373	3,513			1,171																21,177
676501					36																				36
686330			1,860																						1,860
<b>Totals</b>	<b>517,787</b>	<b>2,091,961</b>	<b>2,931,672</b>	<b>1,186,596</b>	<b>1,379,014</b>	<b>228,921</b>	<b>368,032</b>	<b>1,387,427</b>	<b>427,011</b>	<b>479,463</b>	<b>327,121</b>	<b>236,088</b>	<b>246,487</b>	<b>193,831</b>	<b>74,029</b>	<b>335,790</b>	<b>327,858</b>	<b>322,676</b>	<b>224,231</b>	<b>92,988</b>	<b>29,684</b>	<b>23,553</b>		<b>12,481,834</b>	

<sup>a</sup> No commercial fishery occurred in 1993.

<sup>b</sup> Does not include approximately 2,490 lbs not reported as fish if/else.

Appendix Table 2. Historic summer commercial red king crab annual harvest, Norton Sound Section, Eastern Bering Sea, 1977 - 1999.

Year	Number of Vessels	Number of Permits	Number of Landings	Number of Crab	Harvest (lbs) <sup>a,b</sup>	Number of Pot Lifts	CPUE	Percent Old Shell	Average Weight (lbs)	Avg. Legal Mean Length (mm)
1977	7	7	13	195,877	0.52	5,457	36	<sup>d</sup>	2.7	113.4
1978	8	8	54	660,829	2.09	10,817	64	<sup>d</sup>	3.0	118.9
1979	34	34	76	970,962	2.93	34,773	28	<sup>d</sup>	3.0	119.8
1980	9	9	50	329,778	1.19	11,199	29	<sup>d</sup>	3.6	125.8
1981	36	36	108	376,313	1.38	33,745	11	<sup>d</sup>	3.7	128.5
1982	11	11	33	63,949	0.23	11,230	6	<sup>d</sup>	3.6	125.4
1983	23	23	26	132,205	0.37	11,195	12	<sup>d</sup>	2.8	115.2
1984	8	8	21	139,759	0.39	9,706	14	<sup>d</sup>	2.8	112.6
1985	6	6	72	146,669	0.43	13,209	11	<sup>d</sup>	2.9	115.8
1986	3	3	<sup>d</sup>	162,438	0.48	4,284	38	<sup>d</sup>	2.9	115.0
1987	9	9	<sup>d</sup>	103,338	0.33	10,258	10	13	3.2	121.7
1988	2	2	<sup>d</sup>	76,148	0.24	2,350	32	26	3.1	119.0
1989	10	10	<sup>d</sup>	79,116	0.25	5,149	15	29	3.1	119.8
1990	4	4	<sup>d</sup>	59,132	0.19	3,172	19	17	3.1	121.1
1991 <sup>c</sup>										
1992	27	27	<sup>d</sup>	24,902	0.07	5,746	4	29	3.0	119.7
1993	14	20	208	115,913	0.33	7,063	16	10	2.9	119.1
1994	34	52	407	108,824	0.32	11,729	9	71	3.0	118.8
1995	48	81	665	105,967	0.32	18,782	5.6	21	3.0	118.2
1996	41	50	264	74,752	0.22	10,453	7.1	36	3.0	117.1
1997	13	15	100	32,606	0.09	2,982	10.9	14	2.8	115.7
1998	8	11	50	10,661	0.03	1,639	6.5	39	2.8	116.9
1999	10	9	53	8,734	0.02	1,630	5.4	12	2.7	118.1

<sup>a</sup> Deadloss included in total.

<sup>b</sup> Millions of pounds.

<sup>c</sup> No summer commercial fishery.

<sup>d</sup> Information not available.

Appendix Table 3. Historic summer commercial red king crab fishery economic performance, Norton Sound Section, Eastern Bering Sea, 1977 - 1999.

Year	Guideline	Legal Male	Commercial	Number of			Number of Pots		Exvessel	Fishery Value	Season Length	
	Harvest Level (lbs) <sup>b</sup>	Pop. Est.(lbs) <sup>b</sup>	Harvest (lbs) <sup>a,b</sup>	Vessels	Permits	Landings	Registered	Pulls	Price/lb	(millions \$)	Days	Dates
1977	<sup>d</sup>	10.0	0.52	7	7	13	<sup>d</sup>	5,457	0.75	0.229	60	<sup>d</sup>
1978	3.00	11.0	2.09	8	8	54	<sup>d</sup>	10,817	0.95	1.897	60	6/7-8/15
1979	3.00	5.4	2.93	34	34	76	<sup>d</sup>	34,773	0.75	1.878	16	7/15-7/31
1980	1.00	6.6	1.19	9	9	50	<sup>d</sup>	11,199	0.75	0.890	16	7/15-7/31
1981	2.50	4.7	1.38	36	36	108	<sup>d</sup>	33,745	0.85	1.172	38	7/15-8/22
1982	0.50	1.3	0.23	11	11	33	<sup>d</sup>	11,230	2.00	0.405	23	8/9-9/1
1983	0.30	2.1	0.37	23	23	26	3,583	11,195	1.50	0.537	3.8	8/1-8/5
1984	0.40	2.7	0.39	8	8	21	1,245	9,706	1.02	0.395	13.6	8/1-8/15
1985	0.45	2.4	0.43	6	6	72	1,116	13,209	1.00	0.427	21.7	8/1-8/23
1986	0.42	2.8	0.48	3	3	<sup>d</sup>	578	4,284	1.25	0.600	13	8/1-8/25 <sup>e</sup>
1987	0.40	2.2	0.33	9	9	<sup>d</sup>	1,430	10,258	1.50	0.491	11	8/1-8/12
1988	0.20	3.2	0.24	2	2	<sup>d</sup>	360	2,350	<sup>d</sup>	<sup>d</sup>	9.9	8/1-8/11
1989	0.20	3.2	0.25	10	10	<sup>d</sup>	2,555	5,149	3.00	0.739	3	8/1-8/4
1990	0.20	3.2	0.19	4	4	<sup>d</sup>	1,388	3,172	<sup>d</sup>	<sup>d</sup>	4	8/1-8/5
1991 <sup>c</sup>	0.34	3.4										
1992	0.34	3.4	0.07	27	27	<sup>d</sup>	2,635	5,746	1.75	0.130	2	8/1-8/3
1993	0.34	3.4	0.33	14	20	208	560	7,063	1.28	0.430	52	7/1-8/28 <sup>f</sup>
1994	0.34	3.4	0.32	34	52	407	1,360	11,729	2.02	0.646	31	7/1-7/31
1995	0.34	3.4	0.32	48	81	665	1,900	18,782	2.87	0.926	67	7/1-9/5
1996	0.34	3.4	0.22	41	50	264	1,640	10,453	2.29	0.519	57	7/1-9/3 <sup>g</sup>
1997	0.08	1.6	0.09	13	15	100	520	2,982	1.98	0.184	44	7/1-8/13 <sup>h</sup>
1998	0.08	1.6	0.03	8	11	50	360	1,639	1.47	0.041	65	7/1-9/3 <sup>i</sup>
1999	0.08	1.6	0.02	10	9	53	360	1,630	3.08	0.073	66	7/1-9/4 <sup>j</sup>

<sup>a</sup> Deadloss included in total.

<sup>b</sup> Millions of pounds.

<sup>c</sup> No summer commercial fishery.

<sup>d</sup> Information not available.

<sup>e</sup> Fishing actually began 8/12.

<sup>f</sup> Fishing actually began 7/8.

<sup>g</sup> Fishing began 7/9 due to fishermen's strike.

<sup>h</sup> First delivery was made 7/10.

<sup>i</sup> First delivery was made 7/16.

<sup>j</sup> The season was extended 24 hours due to bad weather.

Appendix Table 4. A comparison of the proportion of recruit and postrecruit king crab sampled from summer commercial harvest, Norton Sound Section, Eastern Bering Sea, 1983 - 1999.

Year	Summer Commercial	
	Recruits (%)	Postrecruits (%)
1983	55	45
1984	59	41
1985	45	55
1986	48	52
1987	22	78
1988	25	75
1989	23	77
1990	21	79
1991 <sup>a</sup>		
1992	28	72
1993	31	69
1994	14	86
1995	36	64
1996	30	70
1997	49	51
1998	32	68
1999	42	58

<sup>a</sup> No data collected in summer 1991 due to closed fishery.

Appendix Table 5. Standardized results from population assessment surveys for red king crabs in Norton Sound since 1976.

Year	Date	Research Agency	Gear	Number of Red King Crabs Captured <sup>a,e</sup>				Population Abundance Estimates <sup>c</sup>			Standard Errors		
				Pre-2 Males	Pre-1 Males	Legal Males <sup>b</sup>	Females	Pre-2 Males	Pre-1 Males	Legal Males	Pre-2 Males	Pre-1 Males	Legal Males
1976 <sup>e</sup>	9/2 - 9/5, 9/16 - 10/7	NMFS	Trawl	58(38)	110(213)	180(614)	101(35)	331,555	808,091	1,742,755	44,653	70,094	104,941
1979 <sup>f</sup>	7/26 - 8/5	NMFS	Trawl	N/A	N/A	90(86)	N/A			809,799			61,176
1980 <sup>d</sup>	7/4 - 7/14	ADF&G	Pots			3,290	158			1,900,000			
1981	6/28 - 7/14	ADF&G	Pots			3,415	1,933			1,285,195			
1982	7/6 - 7/20	ADF&G	Pots			2,001	424			353,273			
1982	9/5 - 9/11	NMFS	Trawl	42	107	97	256	356,724	832,581	877,722	50,116	76,454	79,907
1985	7/1 - 7/14	ADF&G	Pots			4,645	181			907,579			
1985	9/16 - 10/1	NMFS	Trawl	63	94	139	139	466,858	707,140	1,051,857	58,598	71,999	87,931
1988	8/16 - 8/30	NMFS	Trawl	82(0)	69(1)	135(3)	212(2)	565,255	493,030	978,748	62,339	58,224	82,083
1991	8/22 - 8/30	NMFS	Trawl	39	42	166	105	294,801	303,682	1,287,486	46,648	46,960	98,101
1996 <sup>e</sup>	8/7 - 8/18	ADF&G	Trawl	39(36)	32(17)	53(14)	98(70)	452,580	325,699	536,235	52,324	47,338	69,647
1999 <sup>e</sup>	7/28 - 8/7	ADF&G	Trawl	9(3)	64(33)	106(63)	64(18)	103,832	940,198	1,594,341	40,841	120,449	129,864

<sup>a</sup> Number of crabs captured on ADF&G pot surveys represent data standardized for a 24-hour soak.

<sup>b</sup> Legal male red king crabs were defined as  $\geq 121.8$  mm (4.75 in) in carapace width for the pot surveys and the 1996 ADF&G trawl survey, and  $\geq 104$  mm for all of the NMFS trawl surveys except the 1979 survey which defined legal males as  $\geq 100$  mm.

<sup>c</sup> Population estimates are valid for the date of the survey (i.e., either before or after the summer commercial fishery).

<sup>d</sup> The 1980 pot survey estimate has been revised from the original estimate of 13.4 million pounds which was thought inaccurate due to an under-reporting of recovered tagged crabs.

<sup>e</sup> The 1976, 1979, 1996, and 1999 catches include resampled stations (in parenthesis). The 1979 and 1996 population estimates incorporated resampled stations by combining catches and tow distances for each station resampled.

<sup>f</sup> Pre-1 and pre-2 male, and female data is not available for the 1979 NMFS trawl survey and the legal male abundance estimate is fully standardized.

Appendix Table 6. Winter commercial and subsistence red king crab harvests, Norton Sound, Eastern Bering Sea, 1978 - 1998.

Commercial			Subsistence						
Year <sup>a</sup>	Fishers	# Crab Harvested	Winter <sup>b</sup>	Permits Issued	Permits Returned	Permits Fished	Total Crab Caught <sup>c</sup>	Total Crab Harvested <sup>d</sup>	Average Harvest/lm
1978	37	9,625	1977-78	290	206	149	<sup>e</sup>	12,506	84
1979	1	221	1978-79	48	43	38	<sup>e</sup>	224	6
1980	1	22	1979-80	22	14	9	<sup>e</sup>	213	24
1981	0	0	1980-81	51	39	23	<sup>e</sup>	360	16
1982	1	17	1981-82	101	76	54	<sup>e</sup>	1,288	24
1983	5	549	1982-83	172	106	85	<sup>e</sup>	10,432	123
1984	8	856	1983-84	222	183	143	15,923	11,220	78
1985	9	1,168	1984-85	203	166	132	10,757	8,377	63
1986	5	2,168	1985-86	136	133	107	10,751	7,052	66
1987	7	1,040	1986-87	138	134	98	7,406	5,772	59
1988	10	425	1987-88	71	58	40	3,573	2,724	68
1989	5	403	1988-89	139	115	94	7,945	6,126	65
1990	13	3,626	1989-90	136	118	107	16,635	12,152	114
1991	11	3,800	1990-91	119	104	79	9,295	7,366	93
1992	13	7,478	1991-92	158	105	105	15,051	11,736	112
1993	8	1,788	1992-93	88	79	37	1,193	1,097	30
1994	25	5,753	1993-94	118	95	71	4,894	4,113	58
1995	42	7,538	1994-95	167	71	57	5,918	4,059	71
1996	9	1,778	1995-96	84	44	35	2,936	1,679	48
1997	2	83	1996-97	38	22	13	1,617	745	57
1998	5	984	1997-98	94	73	64	20,327	8,622	135
1999	5	2,714	1998-99	95	44	41	4,686	3,438	84
Avg 1978-1998	10	2,349	Avg 1984-1998	127	100	79	8,948	6,189	74

<sup>a</sup> Prior to 1985 the winter commercial fishery occurred from January 1 - April 30; As of March 1985, the winter commercial harvest may occur from November 15 - May 15.

<sup>b</sup> The winter subsistence fishery occurs during months of two calendar years (as early as December, through May).

<sup>c</sup> The Number of crab actually caught; some may have been returned.

<sup>d</sup> The number of crab harvested is the number of crab caught and kept.

<sup>e</sup> Data unavailable.